GEOGRAPHY TEACHING NOTES 2017

O`LEVEL 2248

TOPICS

- Map work: Basic Techniques and Skills.
- Weather and Climate.
- Landform Studies.
- Biotic Studies.
- Natural Resources.
- Agricultural Studies.
- Industrial Studies.
- Population and Settlement Studies.
- Transport and Trade.
- Environmental Problems.

MAP WORK

BASIC TECHNIQUES AND SKILLS

A map

Is a diagrammatic representation of something e.g. the earth, stars or buildings e.t.c.

Uses of maps
- To locate places.
- To determine where you are going.
- To show distribution of features and type of materials.

Conventional sign

- Is a standard sign used on a map to indicate a particular feature. The conventional sign may be a letter of the alphabet or it may be a symbol.

Three Types of Symbols

- Point symbols - buildings, dipping tanks, trigonometrical stations.
- Line symbols - railways, roads, power lines, telephone lines.
- Area symbols - cultivation, orchards and vineyards, pans.

Six Colour Groups

1. Brown: land or earth features - contours, eroded areas, prominent rock outcrops, sand areas and dunes, secondary or gravel roads
2. Blue: water features - aqueducts, canals, furrows and siphons, coastlines, dams, lakes, marshes, swamps and vleis, pans, rivers, water-towers
3. Green: vegetation features - cultivated fields, golf courses, nature and game reserve boundaries, state forest boundaries, orchards and vineyards, recreation grounds, woodland
4. Black: construction features - roads, tracks, railways, buildings, bridges, cemeteries, communication towers, dam walls, excavations and mine dumps, telephone lines, power lines, wind pumps, wrecks, ruins, trigonometrical stations, boundaries
5. Grey: construction features - built-up areas, cadastral information.
6. Red: construction features - national, airdrome and main roads, lighthouses and marine lights; pink also shows international boundaries

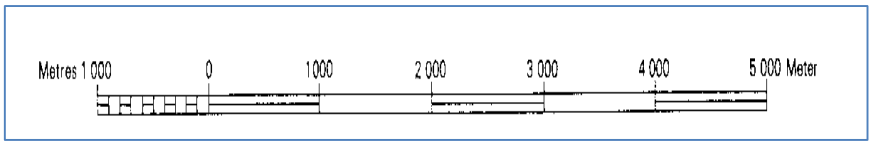
Five Elements

- Relief - contours, spot heights, trigonometrical stations.
- Water - lakes, rivers, waterholes, reservoirs.
- Vegetation - cultivation, orchards and vineyards, forests, plantations, woodland.
- Man-made - communication lines, settlements.
- Political – boundaries

Scale
- A scale is the ratio of a distance between two points on a map and the actual distance of the same two points on the ground.

1) The Linear Scale

This is a graphical representation of the amount by which the represented reality has been reduced.



2) Ratio scale

- Ratio – 1: 50 000.
- One unit on the map is equal to 50 000 units of the same size on the ground or 2cm to represent 1km.

3) Representative fraction – describe this type of scale.

Distance

Measuring distance using, a string, straight edge of paper and dividers.

- Measure the length between two points with a straight edge of paper.
- Place the dividers along the scale line with the right leg on a whole number, with the left leg falling on the subdivided part to the left of zero. In this way, fractions can be read off.

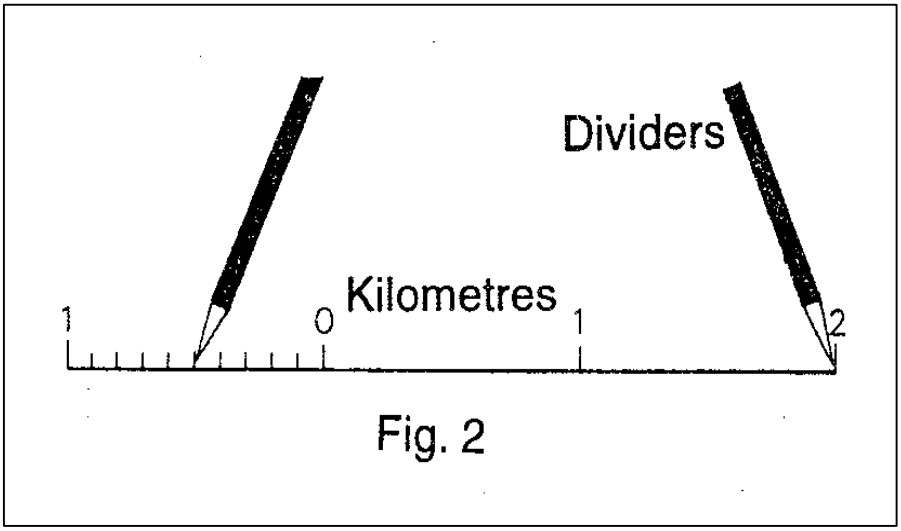
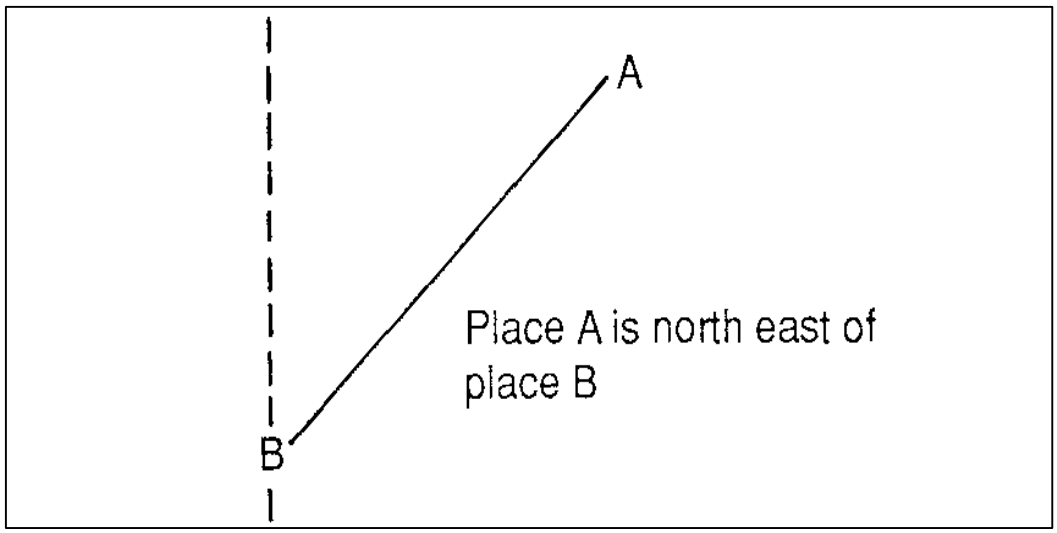


Fig. 2

Direction

- An approximate way of describing position of one place in relation to the direction makes use of 16 cardinal points, the four main ones being North, South, East and West
- Direction is a generalised method of showing the position of one place from another i.e. points of a compass.



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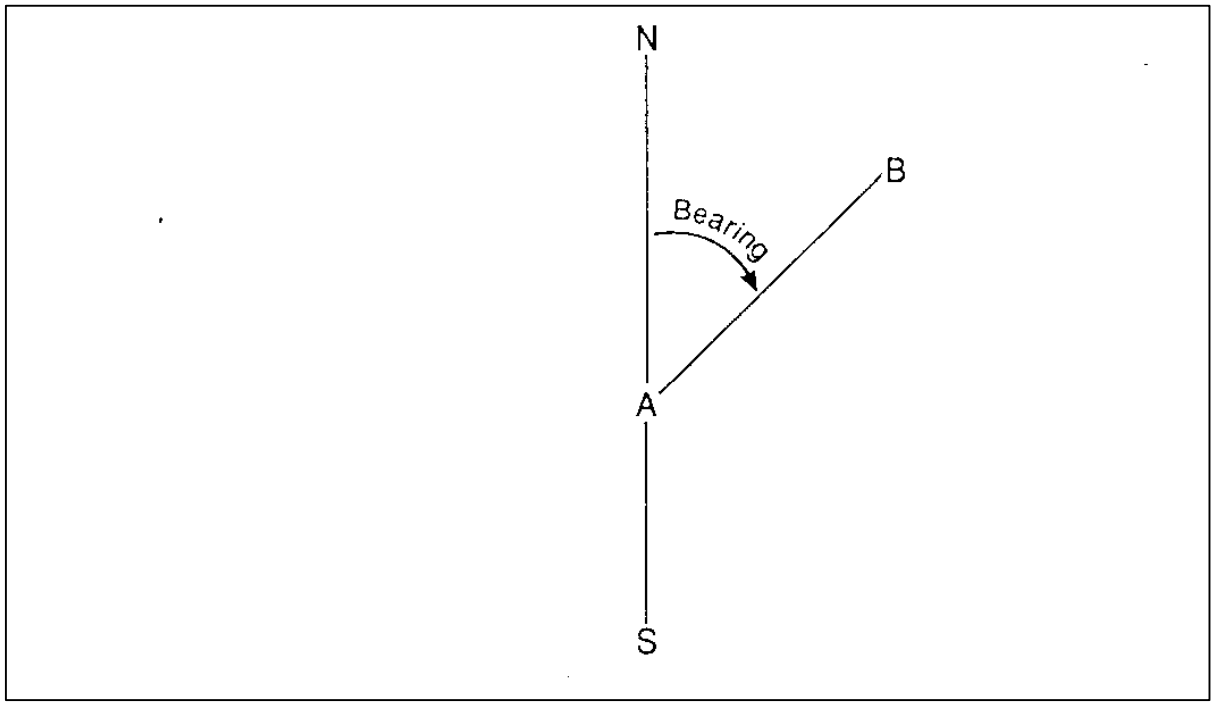
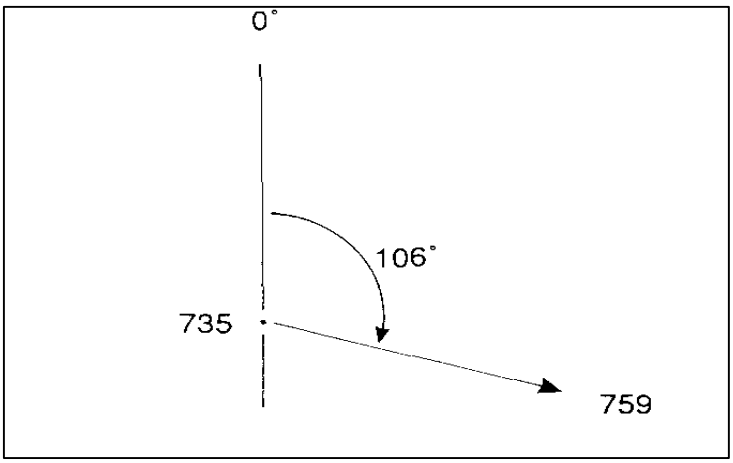
Bearing

- Bearing is the measurement of direction in degrees.
- True North is always at the top of the topographical map, but not always at the top of the photos.
- 0° is True North, bearings are always read in a clockwise direction from the North line through a full circle of 36Oº.



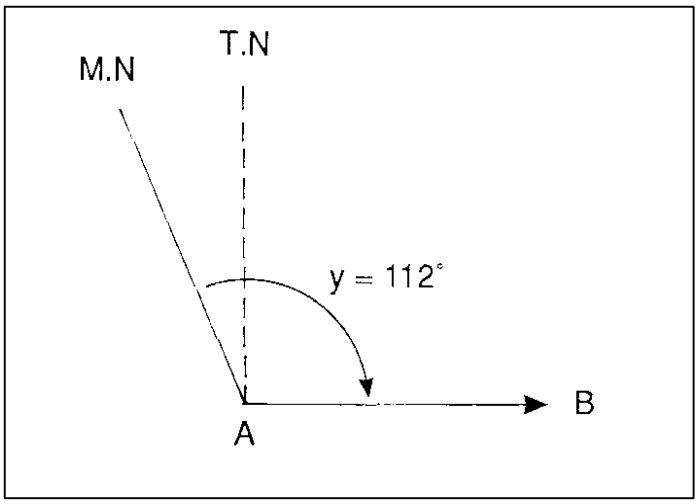
- Calculate the true bearing from spot height 735 to spot height 759.

a) With a pencil, draw a line parallel to the side of the map through spot height 735. (This is your True North line Oº).
b) Join the two spot heights with a pencil line.
c) Measure (with a protractor) the angle between True North, Oº (i.e. the line through spot height 735 and parallel to the side of the map) and line joining two spot heights.
d) The answer is 106°



Magnetic bearing

- Magnetic Bearing is the distance in degrees from Magnetic North (i.e. from where the compass points to North) to the position of the place.
- The magnetic bearing between A and B is angle y = 112º



Map Referencing / Co-ordinates

- This is the method of finding any point on the map.

Latitude and Longitude

- This is the method of finding the co-ordinates of a place.
- Latitude and Longitude are measured in degrees, minutes and tenths of a minute (or seconds).
- Latitudes are drawn parallel to each other running from west to east.
- Longitudes are drawn running north to south.

Four Figure Grid Reference

- Touch easting line and northing line.
- Move your hands until they join forming an L – pattern.
- Record eastings two digits then northings two digits.

Six Figure Grid Reference

- Touch easting line and northing line.
- Move your hands until they join forming an L – pattern.
- Record eastings two digits leave a box, then northings two digits, leave a box.
- Divide the box with the feature into tenths.
- Count small lines / boxes from the south to the feature and record the one digit on the first left box.
- Count small lines / boxes from the west to the feature and record the one digit on the last box.

Height

- Height on all maps and photos is shown in metres above sea level.
- On the topographical map, the contour interval i.e. the vertical distance between 2 contour lines is 20 metres.
- On the orthophoto map, the contour interval is 5 metres.
- Height is used to show the following:
  - Relief.
  - Intervisibility.
  - Gradient.
  - Cross-sections.
  - Vertical Exaggerations.
- Height is shown on maps in various ways – always in metres above sea level i.e. as altitude.
  - Contour lines.
  - Spot heights.
  - Trigonometrical beacons.
  - Bench marks

Gradient

- This is the steepness of a slope, and is represented as a ratio e.g. 1 : 50, 1 : 500.
- The smaller the number, the steeper the slope.

- Gradient = $\frac{\text{VI (Vertical Height)}}{\text{HE (Horizontal Equivalent)}}$

- VI = Highest height - Lowest height - always in metres

- HE = Measure the distance between the 2 points in cms, and convert to metres.

- Divide the top answer by itself, divide the bottom answer by the top. +The answer is a ratio i.e. no units must be given.

Example 1:
Calculate the average gradient from Trig Beacon 96 to Spot Height 447.

- Highest point = 544.3m (Height of Trig. Beacon).
- Minus 447m (Spot Height).
- Difference in height = 97,3m.
- Distance = 2,6cm
- Multiply by 500 to get m = 2,6 x 500m = 1300m.
- Gradient . = $\frac{H}{D}$

  = 97,3m ÷ 1300m

  = $\frac{97,3 \div 97,3}{1300m4 \div 97,3}$

= 1÷13,36
= 1:13,36

8. Intervisibility

- This is the concept of whether one place on a map can be seen from another.
- It is decided upon by studying the heights between the 2 places. Any ground which cannot be seen behind a higher height is known as dead ground.
- If a convex slope is between the two places, the second cannot be seen.
- A rough cross-section sketch shows this more easily.

Finding Area

Area of a regular shape

- The formula for the area of a rectangle is length x width (i.e. the length of one long side multiplied by the length of one short side).
- give your answer in either square metres (m2) or square kilometres (km2
- Remember to convert your map distances to real distances before you multiply.

L

W

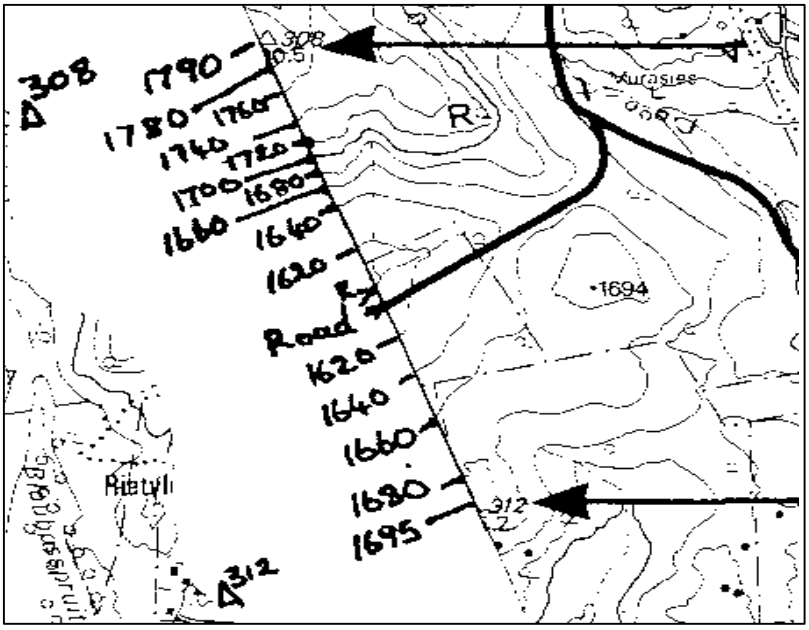
Area of irregular shape

- Follow the rule that parts of a square are to be counted if they are half or more than half occupied, but are to be ignored if less than half.
- Count the number of occupied squares and multiply the total by $1km^2$.

Cross-Sections

- It is a diagram showing change in height along a line drawn between two or more points on a map.

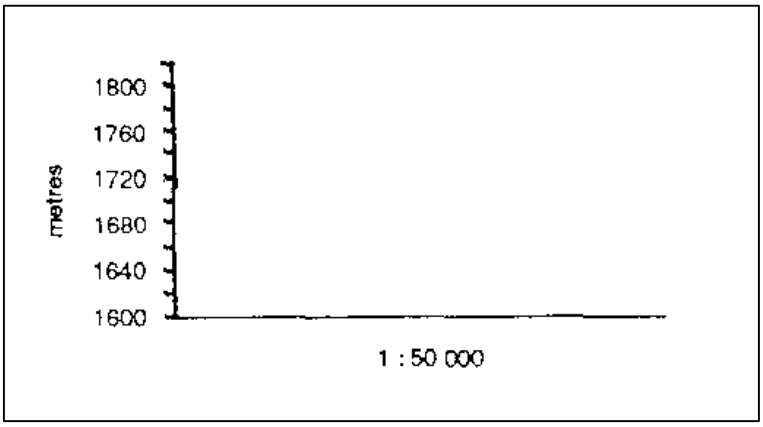
Procedure for drawing cross-sections
- Draw a straight line joining these two points.
- Put a piece of paper with a straight edge along this line.



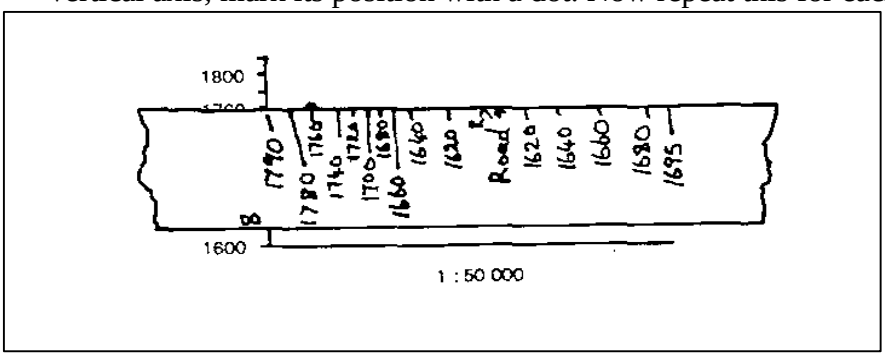
- On this strip of paper mark off each contour line you cross and indicate its height.

The positions of the two Trig. Beacons and any major features such as rivers should be noted.

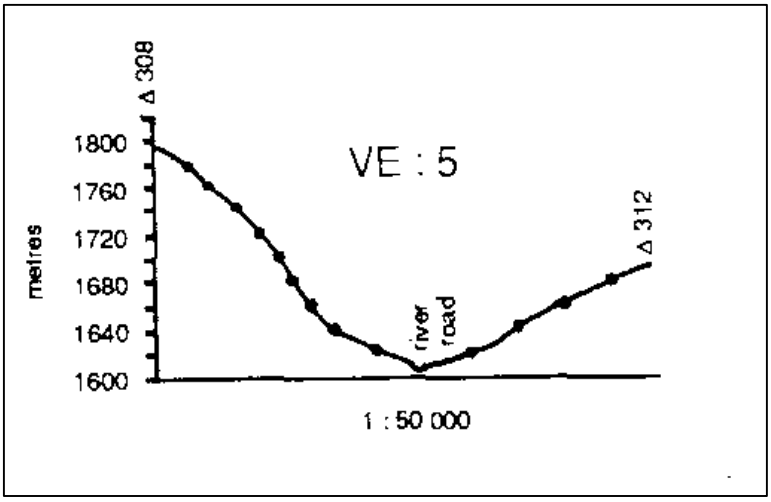
- Draw a horizontal and vertical axis and on the vertical axis put a scale of 1cm =20m.
- Make your bottom line one contour interval lower than the lowest height on your strip of paper, i.e. lowest height is 1620m, therefore your bottom point on your vertical scale is 1600m.



- Place your strip of paper along the bottom line and move it up keeping your starting point on the vertical axis. When the first height on your piece of paper corresponds with the same height on the vertical axis, mark its position with a dot. Now repeat this for each height on your strip of paper.



- Join these dots (by freehand) to complete your cross-section.



Vertical Exaggeration

- This is used as the vertical scale must be exaggerated because, if the horizontal scale were used for the vertical, the relief would show as an almost flat line on a cross-section.

- Vertical Exaggeration = Vertical Scale (Given on the cross-section)
  Horizontal Scale (1cm repr 50 metres)
- E.g. Vertical Scale = 1 cm representing 20 metres, convert to cms by multiplying by 100 i.e. 1 : 2 000.

- VE = 1: 2 000
  1: 50 000

- VE = $\frac{1}{2000} \div \frac{1}{50000}$

- VE = 25 times

SECTION A

WEATHER AND CLIMATE STUDIES

Weather

- The state of the atmosphere at a particular place and time as regards heat, cloudiness, dryness sunshine, wind and rain.

Climate

- The weather conditions prevailing in an area over a long period or long term weather pattern of a given area. It is measured by assessing patterns of variations in rainfall, temperature, humidity, etc.

Differences between weather and climate

Weather	Climate
Day to day temperature and rainfall activity	Describes average conditions expected at a specific place at a given time
Measured for short term e.g. day to day basis	Measured over a long period e.g. 30 yrs.
The study of weather is called meteorology	The study of climate is called climatology

Weather report

- Is a systematic statement of the existing and predicted meteorological conditions over a particular area e.g. Kutsaga.

Weather Focast

- Is a prediction of weather phenomena, trend and events.
- Is made through data collection on temperature, rainfall and humidity and use of complicated modelling and simulations to predict future weather.

Weather elements and instruments

- Temperature – six`s thermometer or max and min thermometer (Degrees Celsius).
- Humidity – hygrometer / psychrometer / satellites.
- Pressure – barometer and expressed in millibars.
- Wind direction – wind vane using the cardinal points of a campus.
- Wind speed – cup anemometer in knots.
- Sunshine – sunshine recorder in hours and minutes.
- Cloud cover – using eyes and measured in oktas.

Importance of weather

- People can be aware of weather hazards such as cyclones hence take precautions against.
- People will know the type of clothes to wear e.g. rain coats.
- Decision making on farming time and crop type.
- For aviation on taking off and landing time.
- Sporting calendars as some games can be affected by bad weather.

Air Masses

- Is a large body of air with uniform temperature, humidity and lapse rate.
- The region where air mass form is referred to as the source region.
- Air masses are classified according to temperature and moisture characteristics and source regions.
- In Zimbabwe, the continental air mass is resident while the polar maritime and tropical maritime also reach the country.

Types of air masses

a) Tropical continental
   - Originate over North Africa and the Sahara desert.
   - Is hot and very dry.
   - Very unstable, yet clear conditions predominate due to lack of water vapour.

b) Tropical maritime
   - Form over low latitude oceans and as such is very warm, humid and unstable.
   - It also reaches Zimbabwe in the NE trades coming from the Northern hemisphere subtropical anticyclone centred over Indian ocean.

c) Polar maritime
   - The SE trades originating from the southern hemisphere subtropical anticyclone cells and whose fetch begins from Antarctic , constitute the polar maritime
   - The SE trade winds are a winter feature in Zimbabwe.
   - They are cooler and moister than tropical continental.

Air masses affecting Zimbabwe

South East Trade Winds

- Are cool moist prevailing winds which blow throughout the year.
- Associated with light showers and drizzle and often give rise to guti after the rain season.
- In summer they blow strongly giving clear weather and cloudy weather in winter.

Zaire Air North West Monsoons

- They only blow in summer.
- Are the re-curved SE trade winds which approach Angola into Zimbabwe via DRC by the intense low pressure of the ITCZ.
- They bring a lot of rainfall to Zimbabwe and Central Africa because they collect moisture form the Atlantic ocean and Congo rainforest.

North East Monsoons

- Only blow in summer and cause rainfall in the Northern parts of Zimbabwe in December to January.
- They are not as moist as the North West Monsoons.

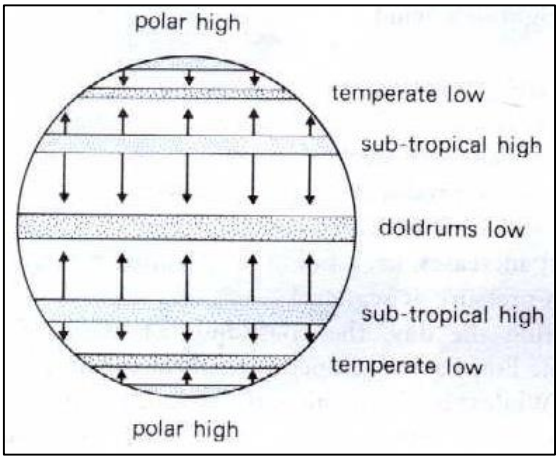
Pressure and winds

Pressure

- Air has weight therefore exerts pressure called atmospheric pressure.
- Altitude, temperature and earth`s rotation affects pressure.

Altitude – air pressure is higher at sea level than mountain tops. Pressure increases as air descends.
Temperature – the pressure increases as its temperature falls. North and South Poles have high pressure.

Pressure belts



- Low temperature at Poles cause air to contract and high pressure develops.
- Along the equator high temperature creates low pressure belts called doldrum low pressure / ITCZ.
- Air crossing Poles creates low pressure belts along 60°N and 60°S.
- Near 30°N and 30°S air begins to sink building sub-tropical high pressure belts called horse latitude.
- Some of the high pressure in latitude moves over the surface towards the equator and poles.
- There are three pressure systems: Polar High, Temperate Low and Sub-tropical High pressure.

Wind systems

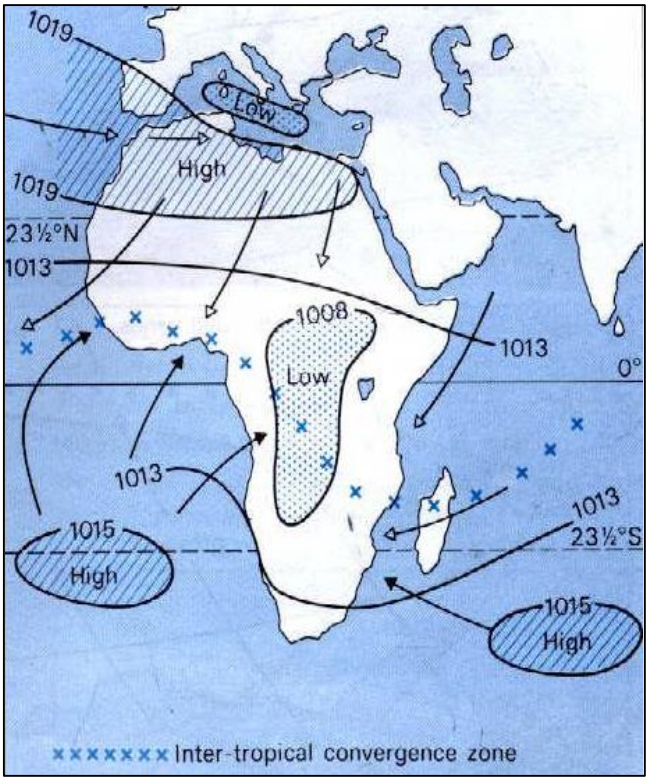
Northern hemisphere

1. North East Polar winds – blow from the polar high pressure towards the temperate low pressure in latitude 60°N.
2. South West winds – blow from sub-tropical high pressure in latitude 30°Nto low pressure zones.
3. North East Trade winds – blow from sub-tropical high pressure towards the doldrums along the equator.

Southern hemisphere

1. South East Polar winds – blow from high pressure towards low temperate regions in latitude 60°S.
2. North East winds – blow from the sub-tropical high in latitude 30°S towards the temperate low pressure.
3. South East Trade winds – blow from the sub-tropical high towards the doldrums.

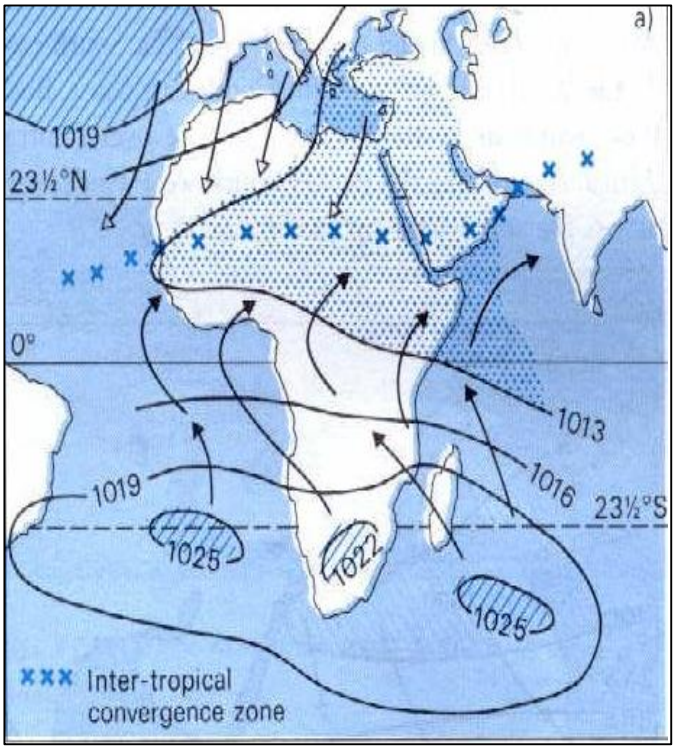
Conditions November to March



- High temperatures occur over Central and Southern Africa hence low pressure occurs.
- Temperatures are low over South Atlantic and Indian oceans hence high pressure.
- North Africa and becomes cooler than the rest of Africa.
- Winds blow from sub-tropical high to low to the south.
- Some winds come from desert and are dry and dusty - harmattan winds.
- North East and South East Trades winds affect east coast of Africa and south east coast respectively.

Both winds make for low pressure over Central Africa.

Conditions May to September



- High temperature over northern Africa hence low pressure.
- High pressure over southern Africa hence low temperatures.
- Tropical maritime air mass blows towards South Atlantic ocean towards the continental, west Africa towards Sahara low pressure.
- They now blow from south west and become south west monsoonal winds.
- They are warm and moist.
- Areas south of the Sahara are warm and dry.

Rainfall Types and Patterns

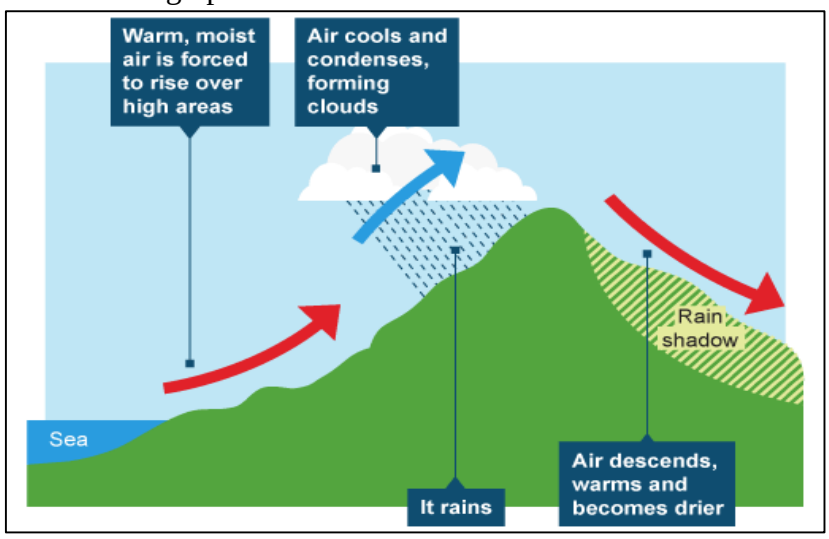
- Precipitation occurs when warm moist air rises.
- Water vapour cools and condenses to form clouds .
- Condensation produces small droplets which join together and grow to fall of their own weight.
- Types include relief, cyclonic and convectional rainfall.

Forms include sleet, hail, frost, fog, snow and others.

a. Sleet – a mixture of snow and rain formed by snow melting as it falls.
b. Hail – a solid form of precipitation comprising chunks of ice falling from the sky.
c. Dew – is snow droplets of water that appear on grass in the morning and evening due to condensation. This result when temperature of a surface cools down to a point below the dew point of air next to it.
d. Frost – is the deposit of ice that may form in humid air during the night or in winter especially in mountainous areas.
e. Fog – is a visible mass of cloud water droplets or ice crystals suspended in the air near the earth`s surface.
f. Rime – is a white ice due to water droplets in fog freezes to the outer surfaces of objects such as trees.
g. Snow – flakes of ice particles that fall from the clouds and does not occur in Zimbabwe but UK in winter.
h. Drizzle – very fine rain falling from stratus clouds.

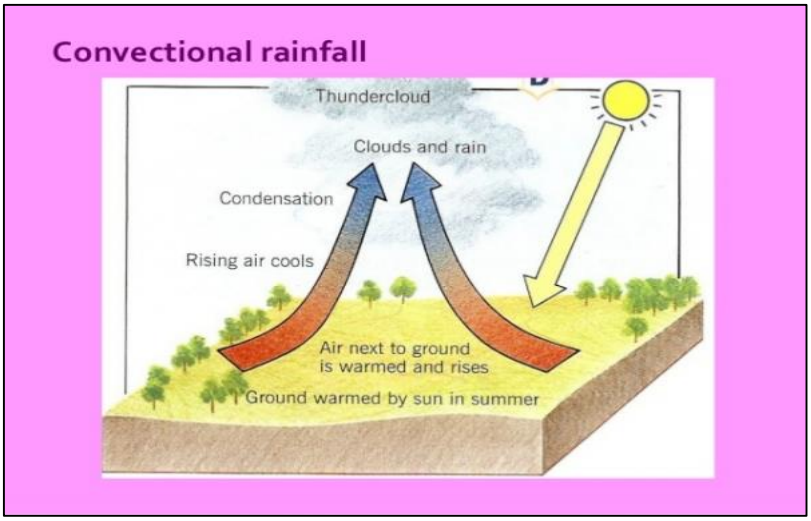
Types of rainfall

Relief or orographic



- ❖ Results when warm moist air rises over a barrier e.g. mountain.
- ❖ SE trade winds are forced over a barrier and rises, cools and condense and rain occurs on the windward side e.g. Chimanimani or Inyangani.
- ❖ Leeward side or rain shadow area is dry with little or no rainfall e.g the Save valley and Marange area.

Convectional



- ❖ Ground surface is overheated and air gets hot to generate convectional currents.
- ❖ Air is heated by conduction, absorbing more moisture, expands and rises.
- ❖ The ascending air remains warmer and hence become unstable.
- ❖ It cools and produces cumulonimbus clouds.
- ❖ Due to heat released by latent heat at condensation and freezing, thunderstorms are generated.
- ❖ Rainfall in West and Central Africa is convectional.

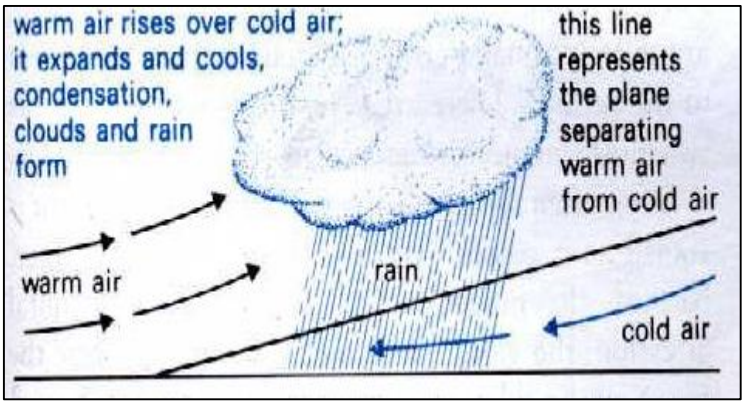
Hazards due convectional rainfall

- Lightning, fires, death, flooding, strong winds, Landslides, destruction of homes, crops, and property.

Measures

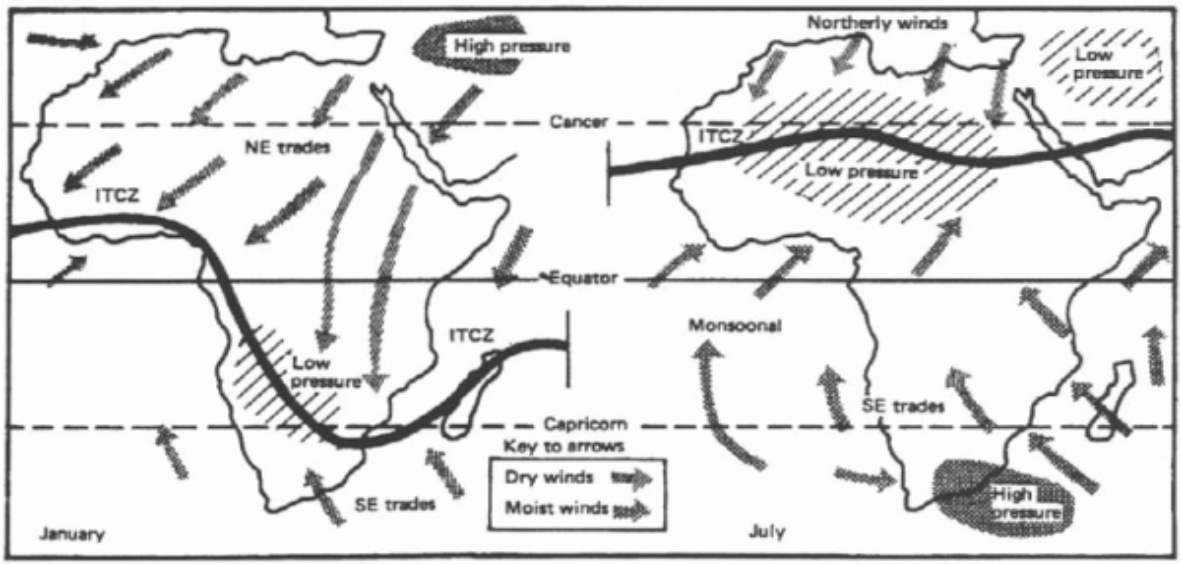
- Lighting conductors, early warning systems education, Cloud dissipation, afforestation/reforestation, resettlement, evacuation, settling on high ground and storm drains.

Frontal or cyclonic



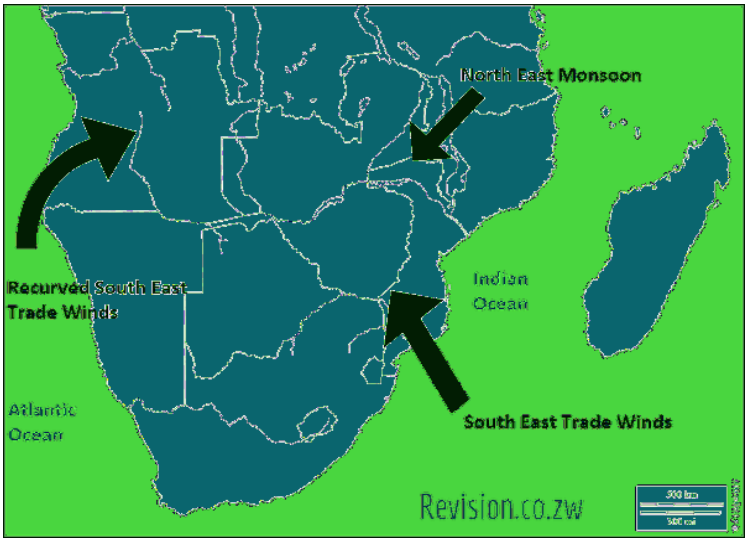
- ❖ Two or more winds with different temperatures meet for example in Southern Africa.
- ❖ The two air masses don't mix but form a front.
- ❖ The cold air mass is heavier than warmer air mass therefore, the light rises over the denser one.
- ❖ Warm air cools,
- ❖ Condensation and clouds form.
- ❖ Rain occurs along the front.

Inter – Tropical Convergence Zone (ITCZ)



- Is a zone that goes right round the earth and is roughly parallel to the equator.
- ITCZ brings about seasonal changes of winter and summer. It moves north and south following the sun with a lag of 4-6 weeks.
- The sun is overhead the equator on 21 March, Tropic of Cancer 21 June, equator again on 21 September and Tropic of Capricorn on 21 December.
- North and south of the ITCZ there are high pressure belts that encircle the earth.
- This forces air masses to converge within this zone as they move from north and south to meet within this zone.
- ITCZ brings cyclonic rainfall in Southern Africa including Zimbabwe and sometimes areas like Muzarabani and Tokwe-Mukosi affected by floods.
- However, some types of rainfall do occur e.g. relief.

Major winds of Southern Africa



- SE Trade winds – Are cool moist prevailing winds which blow throughout the year. Associated with light showers and drizzle and often give rise to guti after the rain season. In summer they blow strongly giving clear weather and cloudy weather in winter.

- Zaire /Congo air – They only blow in summer. Are the re-curved SE trade winds which approach Angola into Zimbabwe via DRC by the intense low pressure of the ITCZ. They bring a lot of rainfall to Zimbabwe and Central Africa because they collect moisture form the Atlantic Ocean and Congo rainforest.
- North East Monsoon – are seasonal winds which blow during summer and bring rainfall in northern parts of Zimbabwe.

Ocean currents – have an influence on weather and climate as well as human activities.

1. Warm Mozambican currents – the warm Mozambican currents flows parallel to the coast of Mozambique.
2. The Agulhas – flows parallel to the coast of Mozambique. Is made up of Mozambican current and Madagascar currents.
3. Benguela current – flows along the coast of Mozambique.
4. Angola current – flows along the coast of Angola.

Clouds

- Are the fractions of the sky obscured by clouds when observed from a particular location.
- Cloud cover is measured in oktas.
- Sky conditions are estimated in terms of how many eighths of the sky are covered in cloud, ranging from 0 oktas for clear skies to 8 oktas for overcast.

Cloud cover symbols and measurements

code no	symbol	description of cloud
0		clear sky
1		one-eighth cover
2		two-eighths cover
3		three-eighths cover
4		half of sky covered
5		five-eighths cover
6		three-quarters cover
7		seven-eighths cover
8		complete cloud cover
9		sky obscured, e.g. fog

Classification of clouds

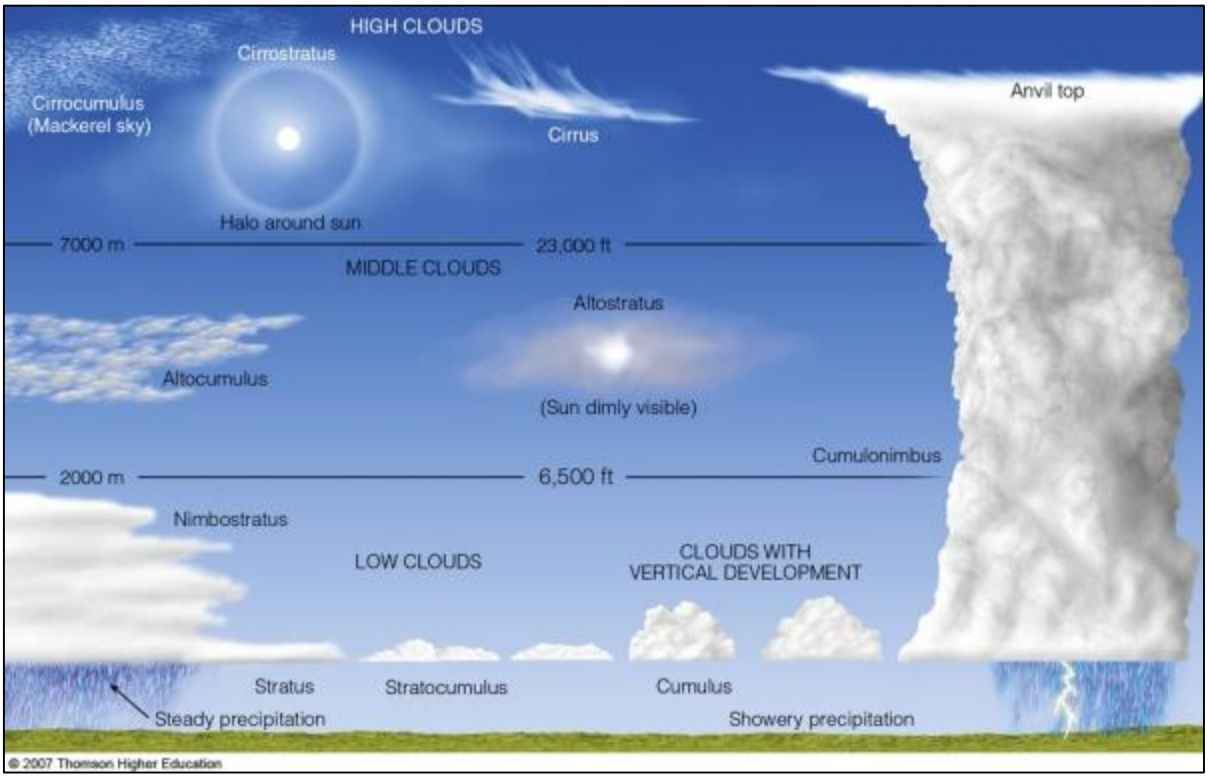
- Are classified according to height, form and appearance hence we have high, middle and low level clouds.

➢ High Level clouds – cirro is latin for high/crest and used for clouds found between 6000m to 12000m.
➢ Middle level clouds – Alto means middle. Thse clouds range between 2100m to 6000m for example alto-cumulus, altostratus and strato-cumulus.

- Lower Level clouds - Nimbus meaning water bearing and are below 2100m for example cumulonimbus, cumulus, nimbostratus and stratus clouds.

Home work
Qn: Define cumulus, stratus and cirrus (6)

Types of clouds



1. Cirrus clouds – are wispy white clouds with a feathery and patchy cover. Have a silky sheen appearance. Are made up of ice crystals and hardly block sunlight. They give the sun a red of yellow colour during sunset and sunrise.
2. Cumulonimbus – are anvil shaped at the top. They extend over great vertical distance. They are black or white heaped and are associated with heavy rainfalls and thunderstorms.
3. Nimbostratus clouds – are dark grey. They are dense and shapeless and associated with rain.
4. Altocumulus – white or grey and patched. Are made up of laminae or plates. When the sun passes over them, they form a corona.
5. Altostratus clouds – composed of water droplets forming sheets of grey clouds partly covering the sky.
6. Stratocumulus – large globular masses, bumpy-looking. They are grey in appearance forming a regular pattern.
7. Stratus clouds – are fog – like clouds forming a uniform layer. Bring dull weather accompanied by drizzle.
8. Cirrocumulus – composed of ice crystals and is like ripples in the sand on a sea shore. They form a thin cloud.
9. Cirrostratus – looks like a thin white transparent sheet that gives the sun and moon haloes.
10. Cumulus clouds – are round topped and flat – based forming a whitish-grey globular mass. Consist of individual cloud units.

Frontal Systems

Anticyclone

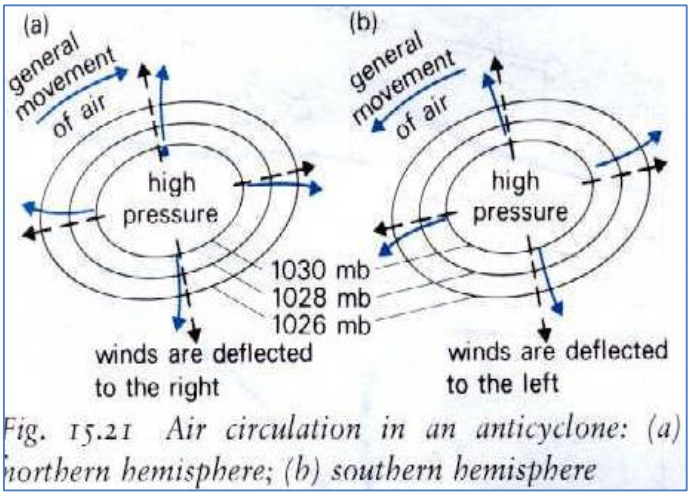


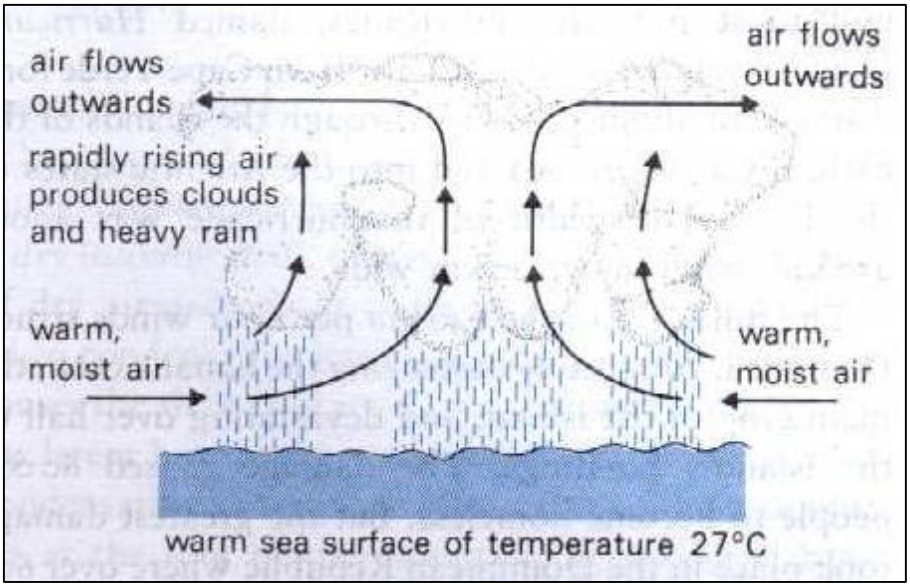
Fig. 15.21 Air circulation in an anticyclone: (a) northern hemisphere; (b) southern hemisphere

- Are areas of high pressure at the centre.
- Air is sinking in the midst not rising so no clouds or rain formed.
- Pressure from the centre decreases gradually resulting in gentle winds.
- Winds blow from high pressure at the centre to low pressure regions.
- In Northern hemisphere, winds blow in a clockwise direction and in the Southern hemisphere blow in an anti-clockwise direction.
- Anticyclones are associated with low or no rainfall, clear skies, low humidity, low wind speed, high pressure, low temperatures stratus clouds, fog or mist in highland and lowlands respectively.

Cyclones

- Are systems of intense low pressure.
- They form over warm oceans where sea temperature exceeds 26℃ and in the tropics latitude 5 and 20 north and south of the equator.
- Have lowest pressure at the centre.
- Strong winds are deflected to the left in the northern hemisphere and to the right in the southern hemisphere.
- They rush upwards with great force forming a vortex which is the area that surrounds the eye of the cyclone.
- Give rise to torrential rainfalls and strong winds.
- They occur in summer in southern hemisphere.
- Examples cyclone Eline and Japhet.

Weather associated with cyclones



- ❖ Prior to its arrival, air is still, humidity and temperature high.
- ❖ Gusty winds and thin clouds as the front of vortex arrives.
- ❖ Violent winds of high speed as vortex arrives, dense clouds and heavy rainfalls.
- ❖ Calm condition as the eye arrives and passes.

Effects

a. Heavy rainfall, landslides and mudflows.
b. Destruction of houses, dams and bridges.
c. Blockages of roads and power lines.
d. Death due to lightning

Mitigations

- ❖ Early warnings.
- ❖ Building strong houses.
- ❖ Afforestation as wind breaks.
- ❖ Evacuating people from affected areas.
- ❖ Relief and rescue operations.
- ❖ Provision of food and safe water to the affected.

Depression

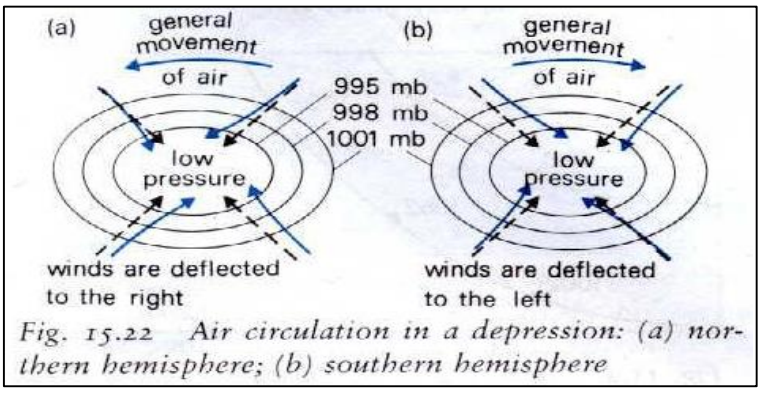
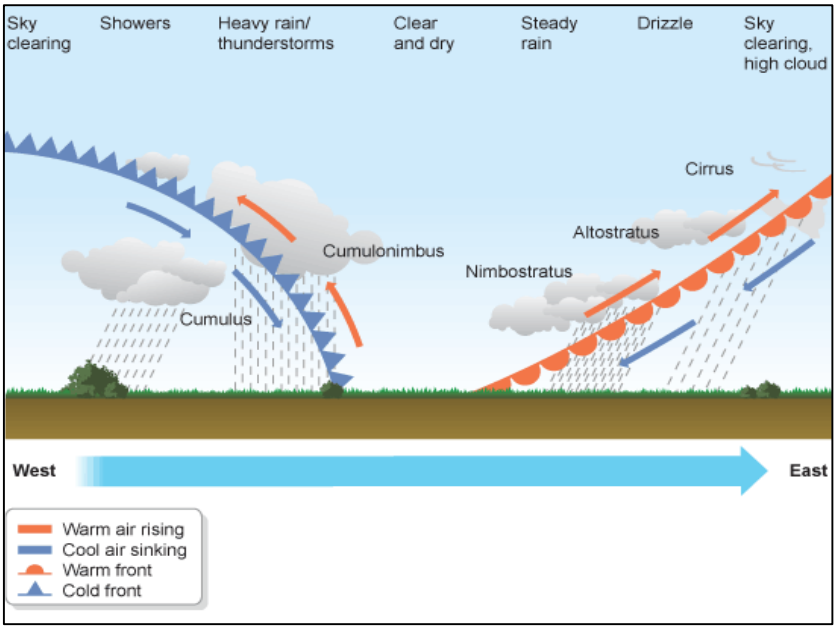


Fig. 15.22 Air circulation in a depression: (a) northern hemisphere; (b) southern hemisphere

- ❖ Is an area of low pressure with an oval shape on a map.

- Shown by closed isobars with low pressure at the centre.
- Air circulates in a clockwise direction in southern hemisphere and vice versa.
- Winds blow towards the centre.
- Are associated with unsettled weather hence are termed extra – tropical cyclones or lows.
- Rain occurs when warm moist tropical air is uplifted by the cold drier air.

Formation of a depression



- Formed in temperate latitudes when humid tropical air meets cold polar.
- Westerly winds meet polar winds.
- A depression is formed at the polar front.

Qn: Describe the main stages in the formation of a depression.

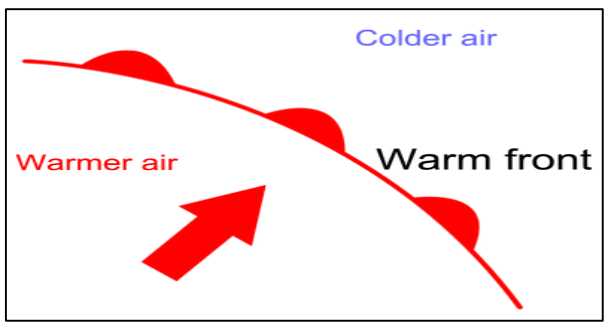
Weather associated with a depression

a. Passage of a warm front- clear skies with few cirrus clouds. Wind blows from SE for a while.
b. The warm sector – is the area between two fronts. Weather clears, temperature rises, and the air is humid. Wind blows from SE to SW.
c. Passage of cold front – temperature falls, heavy rain with cumulonimbus clouds. Wind blows from NW.
d. Passage of the depression – the sky clears and temperature remains cool.

Frontal systems

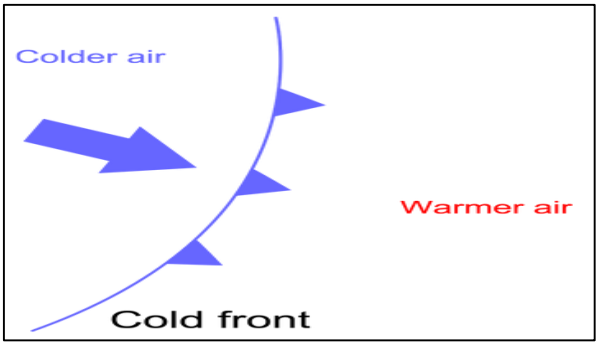
Front – is a boundary between two air masses and are named according to which air mass is replacing the other.

Warm Front



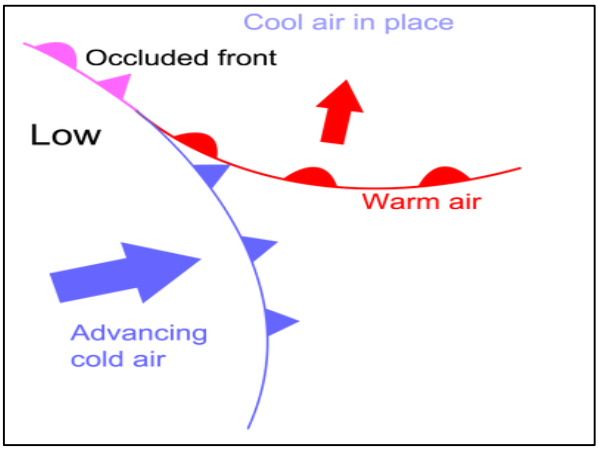
- Warm air displaces a cold air.
- Air behind the warm front is warm and moist and that ahead is cooler and less moist.
- Warm fronts have more gentle slopes than cold fronts hence leads to gradual air rise.
- Gradual rise of air initiates continuous precipitation along and ahead of the warm front.
- Are shown by a solid red line with semi – circles pointing the direction of its movement.

Cold front



- Cold air displaces warm air mass.
- Air behind a cold front is cooler and drier than that ahead which is warm and moist.
- Are associated with cirrus clouds along the front, strong thunderstorms ahead of the front.
- They usually bring cooler weather, clear skies and change in wind direction.
- Have a steep slope hence air is forced upward along its leading edges.
- Are shown by a solid line with tringles pointing in the direction of its movement.

Occluded



- Cold fronts move faster than warm front.
- The cold front will catch up to the warm front.
- Cold air behind the cold front meets the cold air ahead the warm front
- The coldest air undercuts the other.
- The boundary between the two cold air masses is called occluded front.
- Is shown by solid purple line with alternating triangles and semi – circles pointing in the direction of its movement.
- Are also linked with areas of low pressure called depressions.

Weather symbols and synoptic charts

Standard symbols used on weather charts

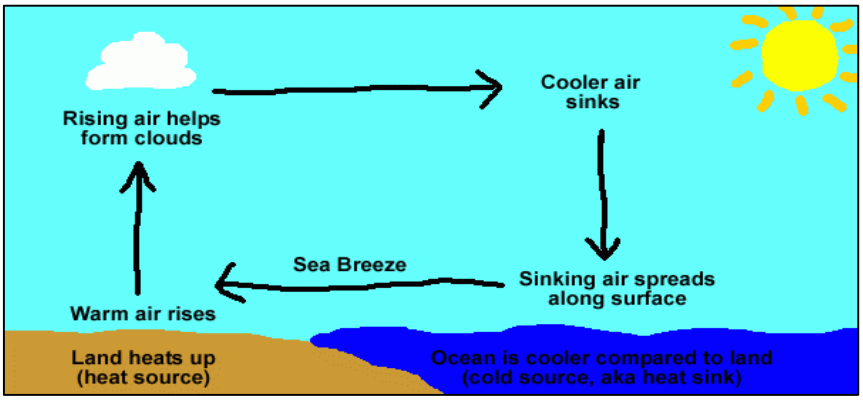
Symbol	Precipitation	Symbol	Cloud cover	Symbol	Wind speed
	Drizzle		Clear sky		Calm
	Shower		*One okta*		1-2 knots
	Rain		Two oktas		5 knots
	Snow		Three oktas		10 knots
	Hail		Four oktas		15 knots
	Thunderstorm		Five oktas		20 knots
	Heavy rain		Six oktas		50 knots or more
	Sleet		Seven oktas		
	Snow shower		Eight oktas		
	Mist		Sky obscured		
	Fog				

- A synoptic chart is any map that summaries atmospheric conditions or a chart that makes use of shorthand showing weather conditions of a place at a given time.

Land and Sea breezes

- A breeze is a cool and calm wind resulting due to heating and cooling between land and adjacent seas during day and night.

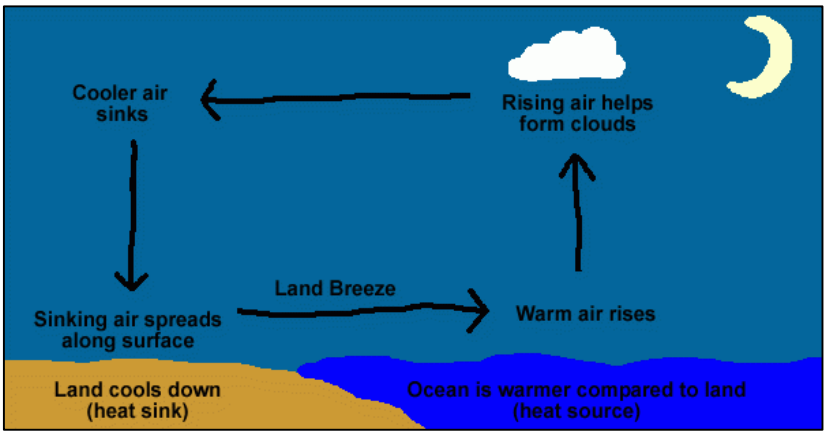
Sea breeze



- The air creates an area of high pressure over the sea and low pressure over the land since land is hotter than sea surfaces.
- The sea absorbs heat slowly during the day and remains cool.

- A cool sea breeze moves from the sea towards the land.
- The breeze reduces temperatures along coastal areas and may produce fogs.

Land breeze



- At night the reverse happens.
- Land quickly loses its heat than the ocean due to higher heat specific capacity of water.
- Air over the water is less dense and begins to rise creating low pressure above ocean surfaces.
- Cooler dense air from the land begins to move to the water surface to replace warm rising air.
- A gentle breeze blows towards the ocean.

People and weather

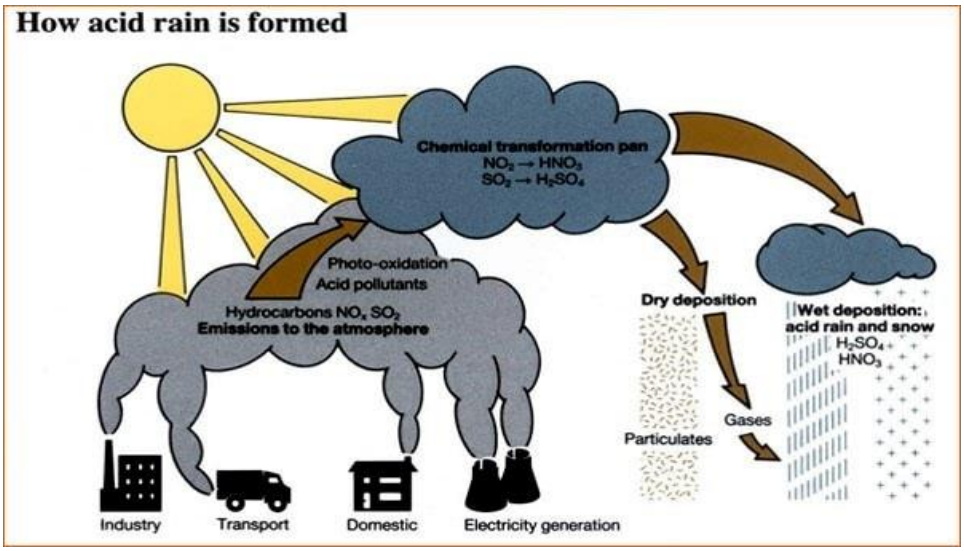
- Weather and climate has changed over time and continues to change.
- This has affected and is affecting human culture and activities.
- People are migrated to other regions due to climate changes.
- Weather affects our physical well-being e.g. harsh conditions in deserts and cold environments.
- People with their activities are changing weather e.g. use of greenhouse to prevent frost and dam construction, urbanisation leading to urban heat islands.
- Acid rain and global warming have negative effects.

Unintentional changes to weather

Acid Rain

- The smoke from burning fuels and chemical industries rises into the air and mixes with water vapour.
- When the rain falls down it becomes acidic.
- The acid rain is a weak acid made up of sulphuric and nitric acids.
- Over, a long time (years for example), the rain eats into limestone installations as well as natural landscapes, stone walks, statues and metals.
- It also destroys vegetation as it has done to entire forests in the Eastern countries like the Black Forest in Germany.
- Has negatively impacted on tree growth in Scandinavian countries.
- Since acids accrue in water they pose a health risk to humans and animals.

How Acid Rain is formed



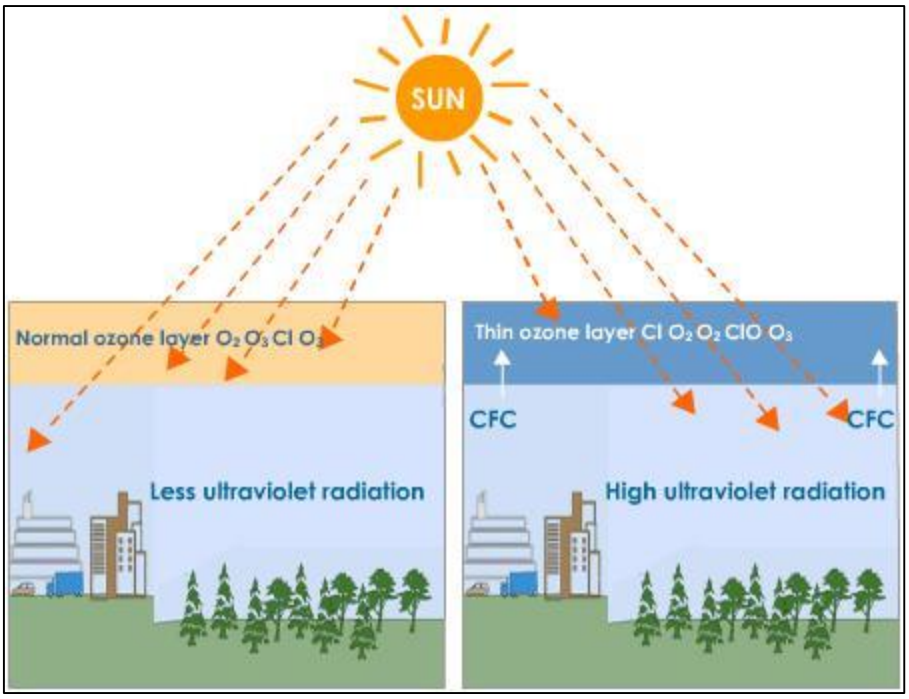
Carbon Dioxide and Global Warming
Global Warming

- Due an increasingly industrialised world a lot of Carbon Dioxide is being emitted into the atmosphere from industries, motor vehicles, machinery and other human activities.
- The solar irradiation from the sun comes mainly in the form of short UV radiation (light).
- These are converted into longer infra-red waves (heat) when it reaches the earth's surface.
- Some of the heat is radiated back into the atmosphere by the earth's surface.
- Due to increased carbon emissions the amount of carbon dioxide in the atmosphere has increased.
- This layer of Carbon Dioxide has an insular effect; it acts as a blanket preventing the longer waved infra-red waves from escaping back into space.
- The result is a general increase in the world's mean temperatures.
- This is known as global warming.
- The effects of global warming include a general increase in mean temperatures in some places, the melting of Polar ice resulting in sea level changes: this leads to flooding in low lying coastal areas, destruction of Polar ecosystems, persistent droughts in some areas, flooding and mudslides due to excessive rain in other areas for example Indonesia, freak weather storms and increasingly unpredictable weather, droughts and increased aridity in some areas.
- The effects of global warming are being compounded by deforestation.

Deforestation

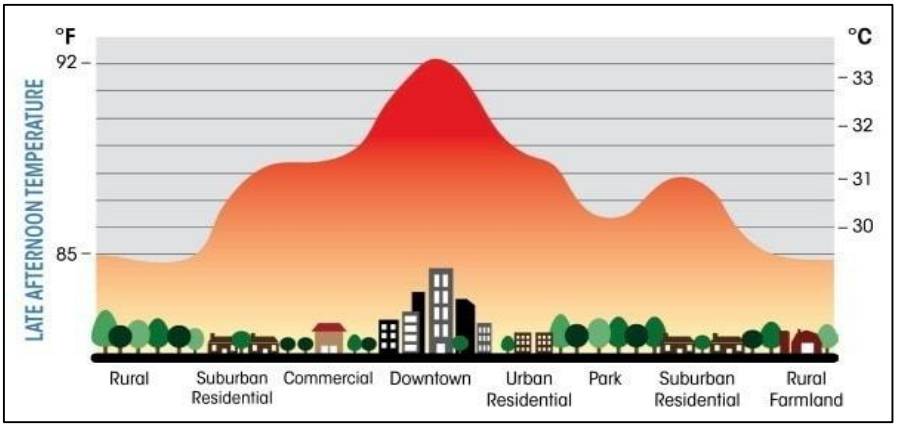
- Is the cutting down of trees without replacing them i.e. without reforesting.
- The high demand for timber, wood and land cultivation has led to the continuous clearance of forests.
- This reduces the humidity in the atmosphere and subsequently rainfall with long term effects of climate change and desertification.
- Deforestation also reduces the amount of trees which convert carbon dioxide back into oxygen resulting in a retrogression on the speed of global warming.

Ozone Layer depletion



- In the upper layers of the earth's atmosphere (between the stratosphere and the troposphere) there is a layer known as the Ozone Layer.
- It is composed of special bonds of Oxygen (O3) and about 30 km from the earth's surface.
- It acts a shield by blocking out the sun's dangerous UV radiation from reaching the earth.
- It is being depleted by chemicals from factories and some antiquated forms of aerosol sprays.
- These make emissions containing nitrous oxide compounds, bromine and chlorine compounds.
- These chemicals are often referred to as organohalogen, chloroflurocarbons (CFCs) and Bromoflurocarbons.
- They are depleting/reducing the Ozone layer by chemically breaking it down.
- This has resulted in Ozone holes in some places.
- This results in higher cases of non-melanoma skin cancer, eye cataracts and blindness and weakening of human immune systems (immuno-supression) to people living underneath these Ozone holes.
- Other effects include: reduced plant growth harming agricultural activities as well as natural vegetation, reduction in plankton populations (these is the major source of food for most fish and features prominently in marine ecosystems), loss of marine biodiversity, higher incidents of cancer in domestic animals, adverse effects on flowering and pollination of plants and damage to important synthetic materials like plastics and rubber.

Urban Heat Islands



- Due to a number of reasons the climate and weather of urban areas is different from the adjacent rural areas.

Temperature

- Although due to the presence of tall buildings light does not reach some areas especially alleyways and narrow streets,
- Normal buildings absorb heat during the day.
- Dark-coloured roofs, concrete blocks and bricks all have a high thermal capacity which means they are capable of absorbing heat energy during the day and releasing it slowly at night.
- Additional heat is yielded by car fumes, factories, power stations and the high population concert rations of people.
- All things being equal urban build up areas experience higher temperatures which is highest in the CBD and decreases gradually as one goes towards the edges.
- Daylight temperatures are on average higher than surrounding areas generally by about 0.6°C.
- Night temperatures are higher than surrounding areas due to the smoke and dust clouds over the city/town creating a blanket/insular effect.
- The mean winter temperature is also significantly higher as well as the summer temperature which might be as much as 5°C higher.

Sunlight

- Even though their temperature is higher, cities and towns receive less sunshine and more cloud cover than their adjacent rural areas.
- Dust and other particles over the build-up area absorb and reflect much of the sunlight preventing it from reaching the city/town below.

Wind

- Wind velocity is reduced by the buildings which create friction as well as act as windbreaks.
- Urban wind velocities are typically lower than that of surrounding rural areas.
- Sometimes however high rise building create wind tunnels which have streams of very high velocity winds which trouble pedestrians and can sometimes knock them over.
- There is reduced wind chill factor.
- Small scale turbulence and eddies can occur as a result in temperature differences with adjacent rural areas.

Relative Humidity

- Relative humidity is lower in urban areas where the warmer air can hold more moisture and there is lack of vegetation reducing the amount of evapotranspiration.

Clouds

- Urban areas appear to receive thicker and up to 10% more frequent clouds

Precipitation

- Towns and cities receive more rains and thunderstorms.
- This is a result of thermal currents within urban areas.
- Also greater chances of rain, snow and sleet in urban areas.

Weather Hazards

❖ Are conditions which are unfavourable to people and their activities

1. Drought

❖ Is a period of deficient rainfall leading to crop failure. Name areas more prone to drought in the world.

Causes - state and explain the causes.

- The most dominant theory is the El Nino effect with some experts even linking droughts to volcanic eruptions.
- El Nino is a band of water whose temperatures hardly changes for long periods of time that is found on the Western coast of the South American continent.
- The warming up of these waters is known in the local Spanish language as El Nino (the Child in reference to baby Jesus as it tends to occur around Christmas).
- The cooling of these waters is known as the La Nina (Little Girl).
- Both phases are known as the El Nino Southern Oscilation Cycle (ENSO)
- During an ENSO the waters in the Pacific Ocean get warmer.
- Normal airflow moves westward from the Pacific to the Indian Ocean, but during El Nino this movement is weakened or altered.
- This results in high rainfall in some parts of Latin America but low rainfall and even drought in southern Africa.
- During the 1991-1992 droughts, El Nino lasted until the end of February 1992.
- During a La Nina Zimbabwe receives extremely large amounts of rainfall.

Human causes

- Rapid population growth resulting in increased pressure on natural resources including water.
- Deforestation.
- Soil erosion.
- Overgrazing.
- Mono-culture.
- Falling water tables due to ground water being used for domestic and agricultural activities.
- Build-up of salts also known as salinision has destroyed a lot of land making it toxic to plants.

Effects

- Crops wilt and die there may be a significant reduction in yields.
- Animals die from dehydration and shortage of pastures.
- Shortage of drinking water.
- Dust storms.
- Death of people due to dehydration and starvation.
- Malnutrition and associated conditions like Kwashiorkor these are more pronounced in children.
- Poverty due to loss of livelihood.
- Famine
- Crops can become toxic due to an increase in aflatoxins especially to animals.
- Can lead to nitrate poisoning in animals which are fed drought affected crops such as maize.
- Wild fires become more frequent.

Mitigation

a) Insurance schemes by farmers.
b) Stockpiling food crops.
c) Cloud seeding.
d) Growing drought resistant crops.
e) Early planting.
f) Irrigation and Donor Aid.

2. Floods

❖ What are floods?

Causes

a) High rainfalls
b) Deforestation.
c) Siltation in rivers.
d) Melting of ice.
e) Concrete pavements in urban areas.

Mitigation

a) Widening and deepening river channels.
b) Straightening of river channels
c) Afforestation.
d) Use of check dams.
e) Early warnings.
f) Discourage settlements on low lying areas.
g) Relief and rescue schemes.

Lightning

❖ Is made up of huge static discharge that is a result of differences in charge between the ground and clouds.
❖ Thunder results when a lightning flash heats and expands the surrounding air during the discharge causing booming sound waves.

Effects

a. People die from lighting strikes.
b. Causes electrical surges in power grids and may damage unprotected electrical gadgets.
c. Damage buildings.

Mitigation

a. Lightning conductors.
b. Wear rubber shoes when going out during thunderstorms.
c. Don't walk on higher grounds.
d. Do not carry or touch metal objects.
e. Do not walk through water puddles.
f. Do not shelter under tall trees or isolated buildings.

Frost / snow

Effects of snow

- Flights are grounded when extreme.
- Hinders activities like sports.
- Buildings and equipments can be buried hence inaccessible.
- Roads are blocked.
- Vegetation and crops destroyed.

Mitigations

- Use of green houses.
- Use smudge pots to heat orchards and fields.
- Using heating systems in homes.
- Clearing snow from roads.
- Use of tires with grip to avoid slippery.

Hail

Effects

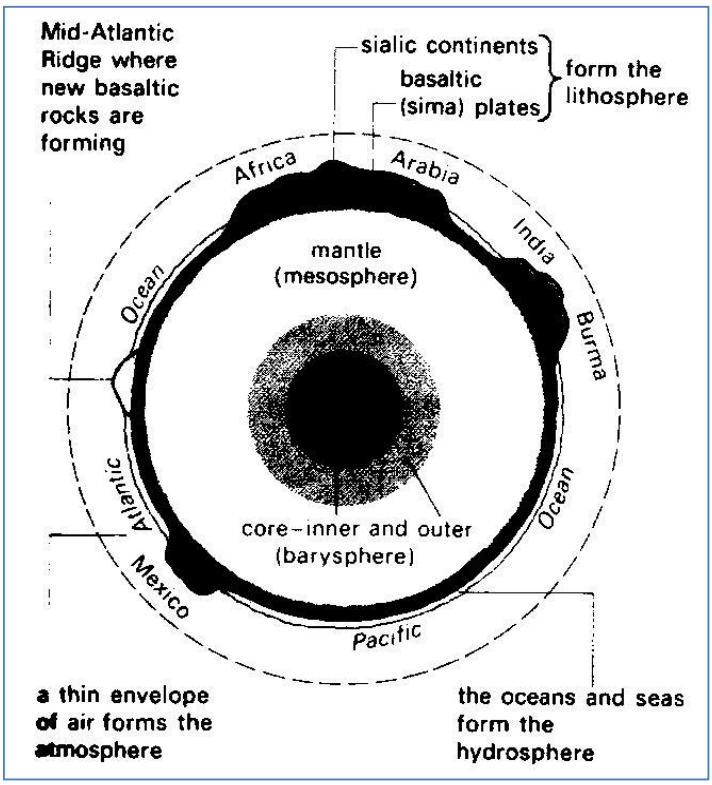
- Hail does extensive damage to crops like tobacco.

Solutions

- Growing crops in sheltered places like in green houses however it`s expensive.
- Use of agricultural shade cloth.
- Insurance schemes.

LANDFORM STUDIES

Internal Structure of the Earth



- Is the foundation upon which landforms on the earth`s surface stand.
- Drillings made into the earth during oil and mining are currently around 12. Km in depth offering an insight into the structure of the earth.
- Information collected from seismic activities such as earthquakes and tremors made scientists to conclude that three layers of different materials make up the earth.
- The layers are arranged from the surface going inwards and some discontinuity separating the layers as shall be seen below:

The Crust/Lithosphere

Thin layer forming the outer layer.
Made up of two rocks (Sail and Sima)

a) Sial
- Being the continental crust.
- The main rock being Silica and Aluminium.
- Material is less dense than most elements on the earth`s surface hence forms the earth`s upper crust.
- It has a maximum of 70 km in thickness in some places.
- It ranges between 5 – 70 km in thickness.

b) Sima
- Also known as the oceanic crust.
- It is denser / heavier than the Sial and is underneath the Sial and forms floor of oceans and seas.
- The main rocks are Silica and Magnesium.
- Sima averages about 6 – 10 km in thickness.
- Crust is separated by the Mohorovicic discontinuity.

- Mohorovicic is a boundary between the crust and mantle.

The Mantle / Mesosphere

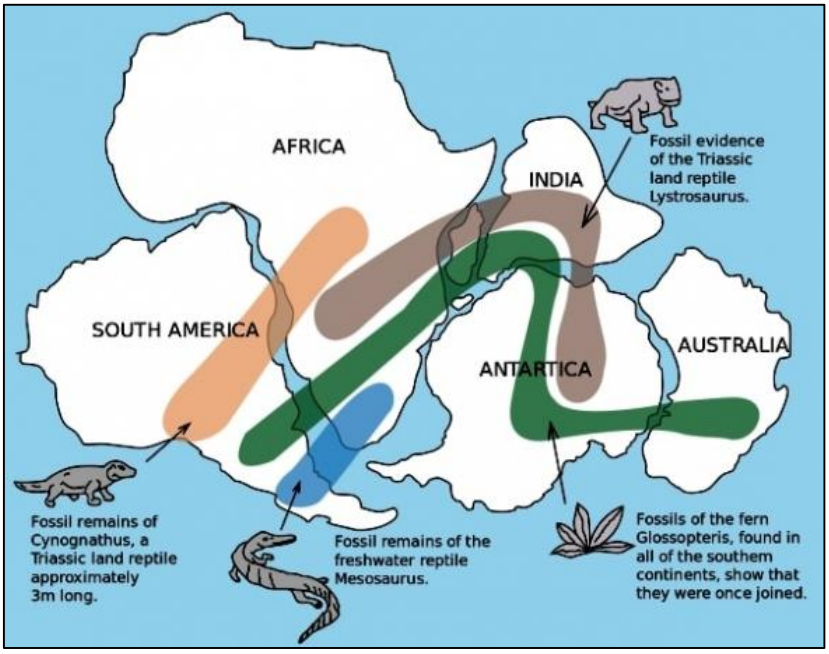
- Mainly composed of Sima and rocks rich in iron.
- The rock is also known as olivine rock.
- The rocks are solid in the top layer of the mantle.
- The lower layer rocks known as asthenosphere are in semi – molten state.
- It reaches a depth of about 2900 km into the earth.
- Temperature reaches as high as 5000℃ and can generate convection currents.
- Is separated by the Gutenberg discontinuity.
- Being a boundary between the earth`s core and mantle.

The Core

- Is made of two layers.
- Is the most dense and heaviest part of the earth.
- Comprises of metal nickel (Ni) and Iron (Fe) hence abbreviated NiFe.
- Temperatures are around 6 200℃.

Inner core is liquid, plastic or semi – plastic i.e semi – molten and outer core is solid due to pressure operating on it.

Continental Drift



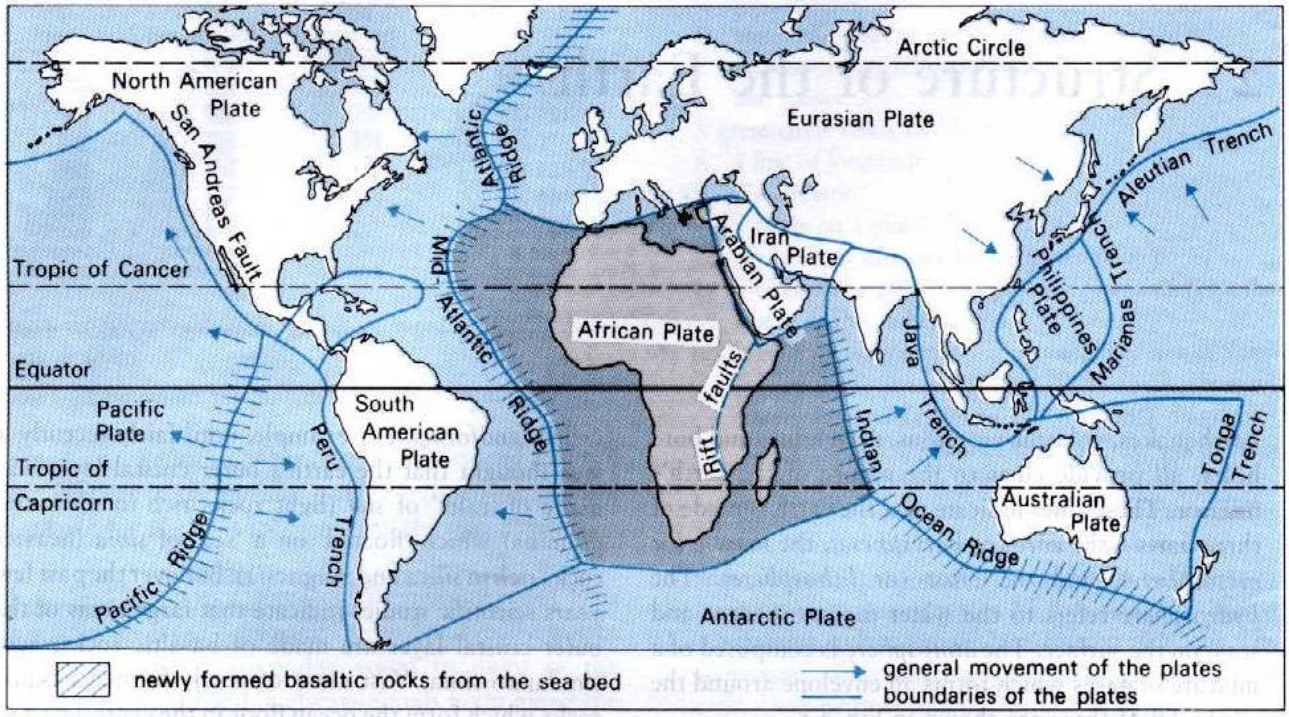
- Refers to the movements of continents.
- The idea was propounded by Alfred Wegner.
- The theory starts that present day continents were once one single continent.
- The theory says that continents have been moving for millions of years and still do so today.
- About 180 million years ago, the continent was only one super continent called Pangea.
- This later broke into two parts northern and southern blocks called Gondwanaland and Laurasia respectively.
- Laurasia divided to form North America and Europe and Gondwanaland formed South America, Africa, Australia and sub – continents.

- The sub-division of these two continents has resulted in the formation of present day continents.

Evidences on Continental Drift

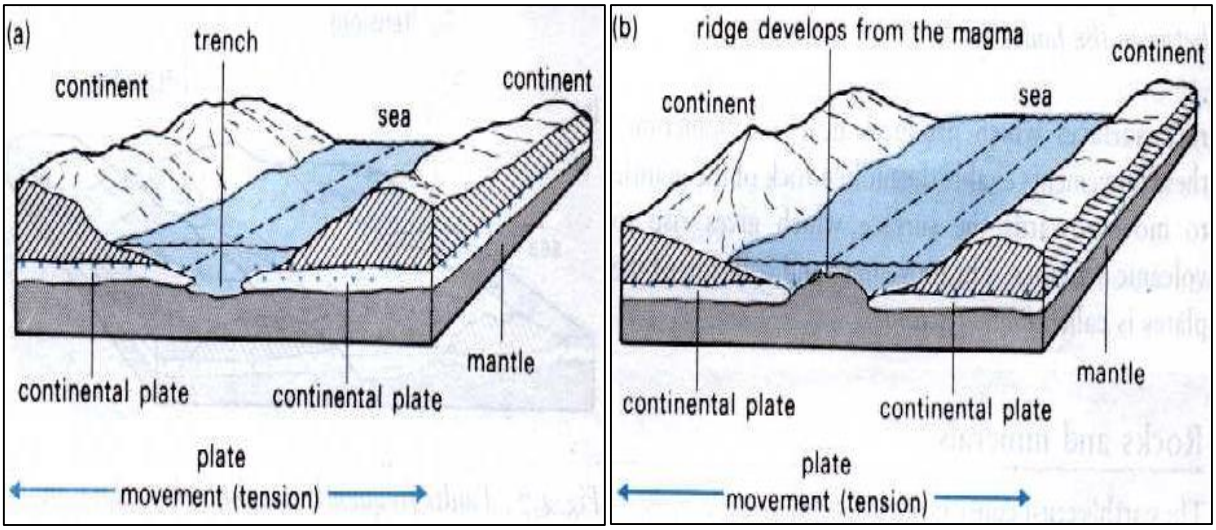
1. The jig saw shape of continents - If continents are pushed against each other like pieces of a jig saw they would fit well for example South America and Africa.
2. Fauna and flora - Animals and plants of Australia, South America and West coast of Africa suggest that they were one continent.
3. Similarities in geology.
4. Paleo magnetism evidence – this examines the age of rocks scientifically. Rocks are magnetized in the direction of compass north when they solidify. The study was able to tell the position of the rocks and when they were formed. Is the most convincing evidence.

Plate Tectonics



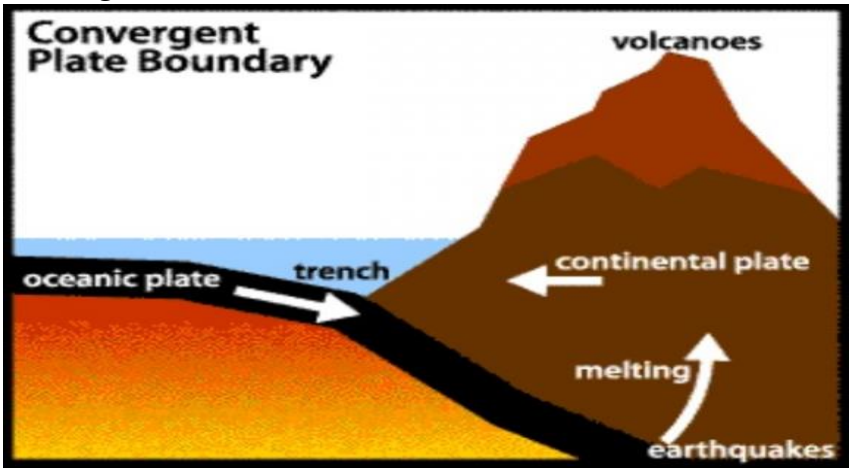
- The earth's crust is broken up into pieces.
- These pieces are called plates and are more than ten of these plates.
- Heat rising and falling inside the mantle creates convection currents.
- The convection currents move the plates.
- The movement of the plates, and the activity inside the earth, is called plate tectonics.
- Plate tectonics cause earthquakes and volcanoes.
- The point where two plates meet is called a plate boundary.
- Earthquakes and volcanoes are most likely to occur either on or near plate boundaries.

Divergent / Constructive Zone



- Plate move away from one another.
- Magma up-wells from the mantle to fill the gap left by diverging plates and provides new material forming new oceanic crust.
- Forming mid – oceanic ridge with volcanoes.
- For example the Mid – Atlantic Ridge was formed by diverging America and Eurasian and African plates.
- The East Pacific Rise was due to Nazca and Pacific plates moving apart.
- Divergent of continental plates forms volcanic mountains.
- The zone is marked by volcanoes, very young lithosphere, topographic ridge and shallow earthquakes.

Convergent Zone

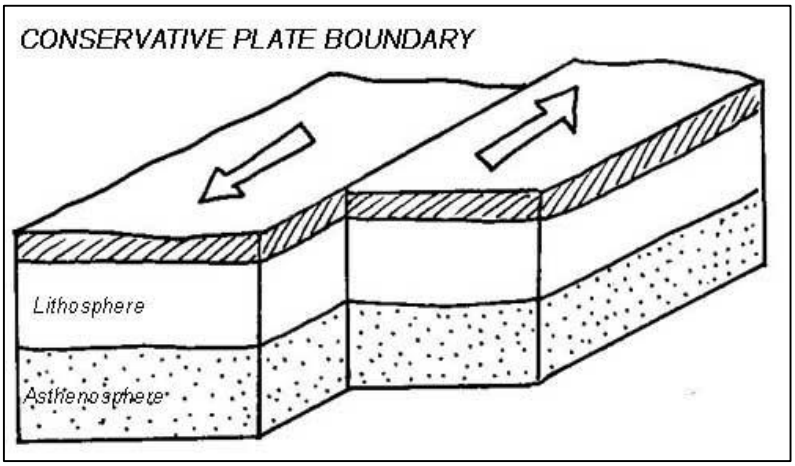


- Known as destructive of zone of subduction.
- Two plate move towards each other.
- An oceanic plate moves towards a continental plate but being heavier,
- The oceanic plate sinks or is subdued by the continental plate and is destroyed into the mantle giving rise to deep – sea trenches and island arcs with volcanoes.
- The oceanic plate and sediments are being destroyed, the zone termed zone of destructive.
- When plates move towards each other, their edges are destroyed as they collide and push one another.
- Nazca plate near Peru South America sinks under the South American plate (the Andes) and Juan de Fuca sinks under the North American plate (Rockiers) forming the island arcs of the West Indies.

Collision Zone

- This is when two continental crust collide and as neither can sink.
- They are formed into fold mountains.
- For example the Indian plate collided with the Eurasian plate form the Himalayas and African plate collided with the Eurasian plate forming the Alps.

Conservative / Transform Zone

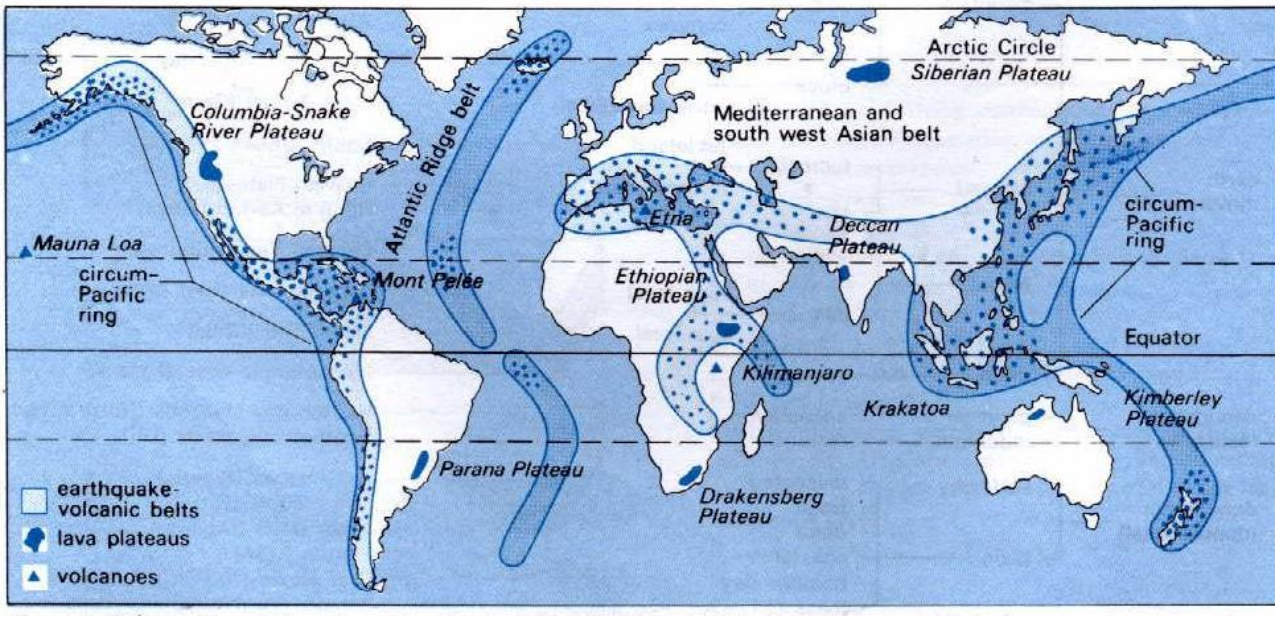


- At constructive zone plates slide sideways past each other.
- In opposite directions in a tear or shear fashion.
- The lithosphere or oceanic crust is neither created nor destroyed.
- Neither plate is constructed but are both conserved giving rise to the term conservative zones.
- Most transform zones are found on the sea floor where they connect segments of diverging mid – oceanic ridge.
- Examples include the San Andreas Fault in California.
- Landforms include rift valleys e.g Great African Rift Valley.
- Lakes also found e.g Lake Tanganyika in Tanzania.

Earthquakes and their Causes

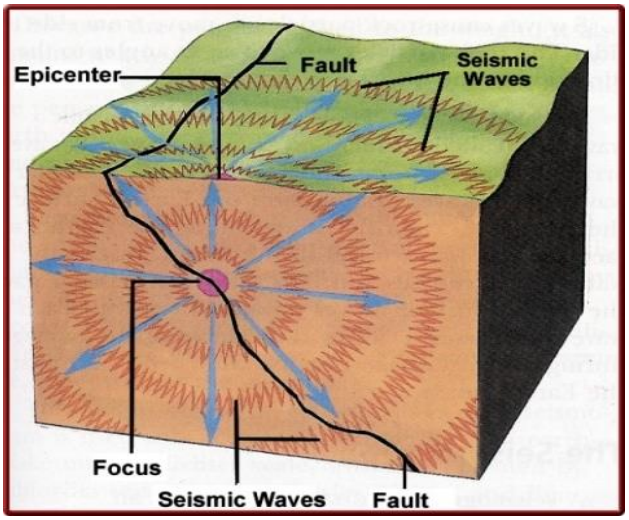
- Is a shaking, vibration, trembling or movement in the earth`s surface.
- They are due to one tectonic plate sliding over or past another plate along a fault line.
- May be due to volcanic eruptions when magma moves below or on the earth`s surface like the movement of plates.
- Building dams and Lakes may result in minor earthquakes and tremors.
- Zimbabwe, Zambia and Mozambique have experienced tremors due to weight of water building up in Lake Kariba and Cabora Bassa

Distribution of Earthquakes and volcanoes



- Most are along and within major plate boundaries.
- Occur near convergence, along conservative zone and transformational zones.
- Along or near ocean ridges, near volcanic islands, along the Pacific Ring of Fire.
- In Africa they are located in the Great Rift Valley and some parts of North West Africa.
- Serious earthquakes occurred in Malawi in 1989, El Asnam Algeria in 1980 and Orkney South Africa in 2014.

Earthquake terms



i. Focus – the point at which the earthquake originates and may be several kilometres below the surface.

ii. Epicenter – the point where the earthquake hits the surface a point directly above the focus. It is here the shock wave first hit which give rise to the earthquake. It is where the greatest impact falls and damage is suffered. Where most damage occurs and the spreads away from this zone.

There are two types of earthquake shocks

i. Body waves

➢ They travel through the earth`s crust in a vertical direction and are of two types.

- Primary – they cause the crust rock to move back and forth in the direction of the waves

- Secondary – these cause the crustal rock of the earth to move from side to side i.e. they operate at right angles with primary waves and direction of movement.

ii. Surface waves

- ➢ They travel through rock surfaces and are of two types.
- ➢ Cause most damage to infrastructures and loss of life.
- Love (L) waves – these cause the surface rocks to move from side to side at right angles to the direction of the wave movement.
- Rayleigh (R) waves – cause rock surfaces to have a vertical – circular movement.

Other Terms

1. Intensity – the degree or capacity of the earthquake to cause damage. It is measyred using the Mercali intensity scale.
2. Magnitude – is measured using a seismograph now known as seismometer. Known also as its scale being measured on a Ritcher scale ranges from 0 to 13.

- It is a logarithmic scale set to base 10 so a magnitude of 5 is ten times greater than that of 4 and 10 000 (1 followed by 5 zeros) greater than 1.

3. Aftershock – is an earthquake that occurs in the aftermath of a previous earthquake usually within days or hours of the main – quake in the main area of the same main quake. If it is large than the main shock it is known as foreshock. Most earthquake occur after periods of inactivity.

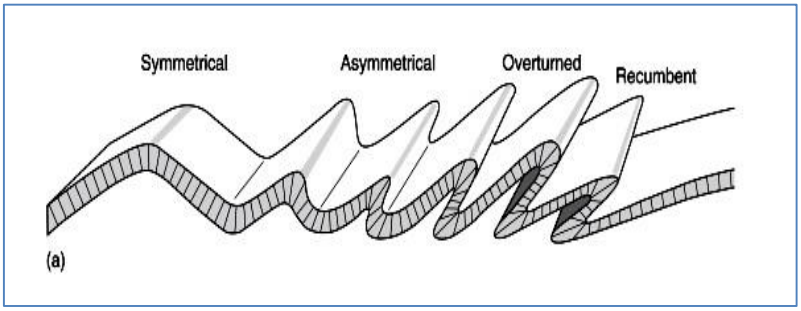
Factors affecting the impact of an earthquake

- Distance of concerned area from epicenter for example coastal areas are at risks from tsunami when it occurs at the sea.
- The magnitude.
- More developed countries are better equipped to predict and do rescue operation thereafter.
- Climate of an area and time of the year may increase diseases epidemics and mudslides.
- Time of the day especially the rush hour is more devastating.
- Relief such as Nepal impedes forms of rescue.

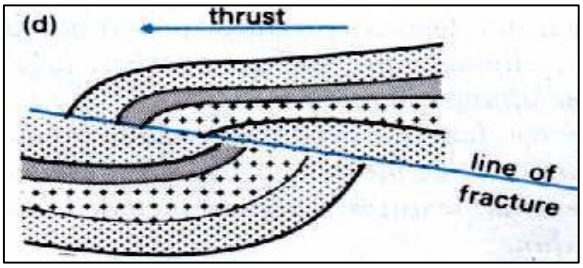
Folding

- ➢ Is the transformation of the earth`s structure into folded landforms as a result of compressional forces.
- ➢ Tectonic movement result due to earth`s internal forces.
- ➢ When forces move horizontally towards each other they are compressional forces.
- ➢ Rocks are subjected to this force in a process called folding.
- ➢ Rocks either fold or fault due to their brittleness or flexibility.
- ➢ In folding, some rock layers buckle and form folds.

Types of folding



- Symmetrical folds – is when both limbs are equal in steepness on both sides because the compressional sides are equal and opposite.
- Asymmetrical fold – occurs when one side is steeper than the other due to forces on one side which are more than the other force.
- Over-fold – results when one fold is pushed over the adjoining limb due to increasing compressional forces.
- Recumbent fold – occurs when the limbs are nearly parallel to each other and the axis of the fold is horizontal.
- Over – thrust fold



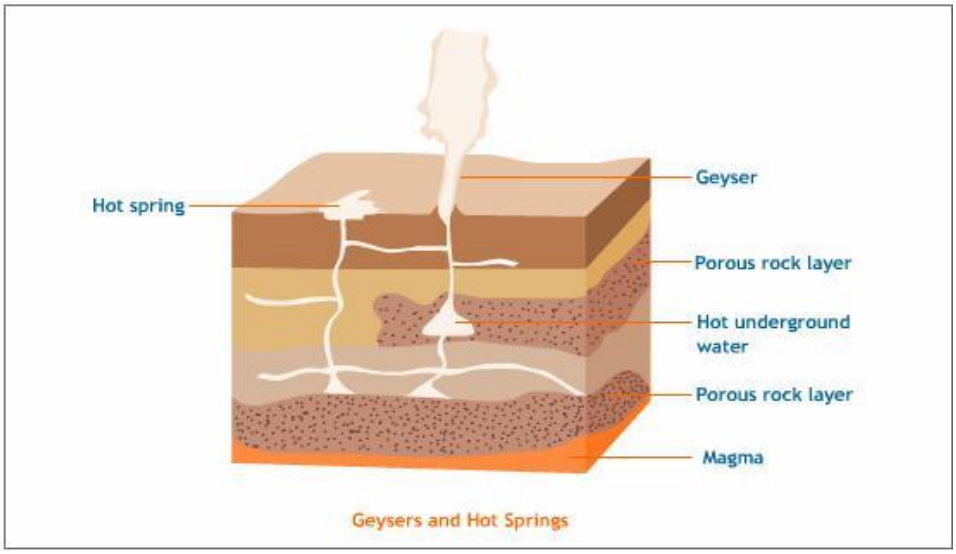
Occurs when the recumbent fold is acted upon by extreme powerful compressional forces which cause one of the limbs to fracture. The upper part of the recumbent fold is thrust forward along the fracture plane.

- Other landforms resulting from volcanic activities include hot springs and geysers.

Hot springs and Geysers

- Usually found near or on dormant volcanoes.

Hot spring and Geysers



- A spring is a point on the earth`s surface where water flows naturally from the ground.
- A hot spring is a stream of hot water flowing out of the ground.
- The water is heated when it comes into contact with molten hot rocks below the earth`s surface.
- The water then flows out as a spring naturally as a fountain e.g. Nyanyadzi and Rupisi near Mutare in the Eastern Highlands of Zimbabwe.

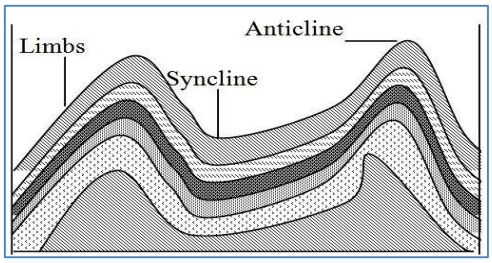
Geyser

- Is a hot spring that throws jets of hot water and steam into the air due to heating in the pipe of the geyser.
- The temperature of water rises resulting in pockets of steam trapped in the twisted portions of pipe.
- Eventually steam builds enough pressure and forces the water in the upper part of the pipe to be spouted and sprayed violently into the air.
- E.g is found in Yellowstone National Park in the USA.

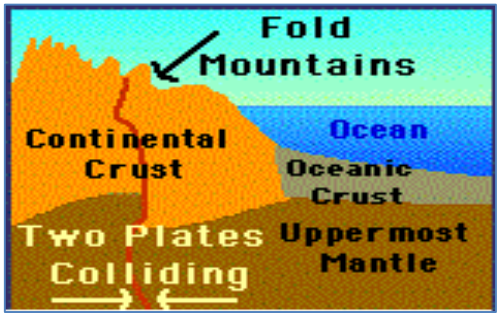
Landforms resulting from Folding

1. Anticlines, Nappe folds, Overthrust, Overfold, Recumbent, Fold mountains.

Anticline and Syncline



1. Anticline
   - Is a fold that is arched upwards to form a ridge of mountain.
   - It can be defined as a highland area or ridge formed due to compressional forces.
   - It is convex shaped and is formed out of rock units that are folded in the same pattern.
   - It results from a simple fold and each side of a fold is called a limb.
   - The topmost point is called a crest / axial line.
   - The crest acts as a line of symmetry between two limbs.
2. Syncline
   - Is a fold that arches downwards to form a fold.
   - Are made up of rocks units that are folded in the same pattern. Usually concave shaped.
   - Usually occur in conjunction with anticlines which is like the letter n.
3. Over thrust
   - If compression forces continue to act on the rock layers, a simple fold is formed; progresses into an asymmetrical fold, then an over fold and lastly into an over thrust which is actually a fault.
4. Over – fold
   - Occurs when one fold is pushed over the adjoining limb due to increasing compressional forces.
   - Also known as overturned fold.
5. Recumbent
   - Occurs when the limbs are nearly parallel to each other and the axis of the fold is horizontal.
6. Fold mountains



   - Result due to folding in the upper layers of the earth`s surface.

- Is a result of compressional forces when tectonic plates move against each other acting on flexible rock but not brittle.
- The movement of the two plates forces sedimentary rocks upwards into a series of folds.
- Fold Mountains are usually formed from sedimentary rocks and are usually found along the edges continents.
- This is because the thickest deposits of sedimentary rock generally accumulate along the edges of continents.
- When plates and the continents riding on them collide, the accumulated layers of rock crumple and fold like a table cloth that is pushed across a table.
- The process of mountain formation is orogenesis.
- Many fold mountains are formed in narrow elongated seas called geocynclines.
- Fold Mountains have a short width but are long extending to thousand killometres e.g. Rockies and Himalayas, Urals Mountains (in USA), the Cape Range and Mt Everest in Nepal.

Human activity in fold mountains - The Alps

- This region is based on the exploitation of the coniferous forest.
- Pasturing dairy cattle.
- Tourism.
- The combination of tectonic and glacial processes makes the area ideally suited for HEP schemes. HEP schemes often involve many different watersheds.

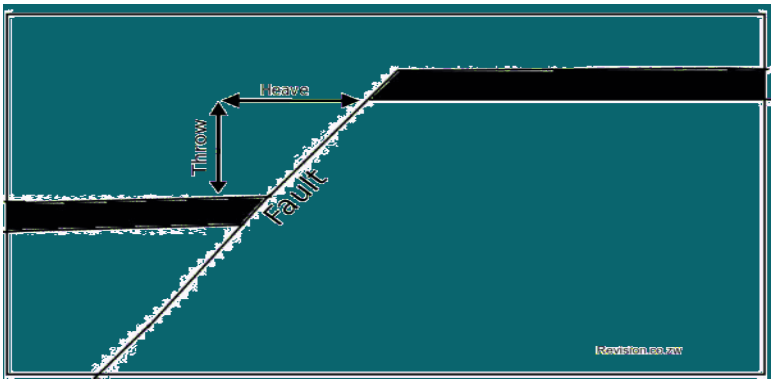
Problems

- Difficult to build in due to the steep sided valleys.
- Roads and other communications links have to snake their way up wherever they can, and often these roads are not big enough to adequately service a large community.
- The climate is very cold and wet, meaning that most industrial and agricultural activity is difficult. For farmers they have a very short growing season, and it is difficult to use machinery on the steep slopes.
- Avalanches are a constant threat, as was seen to devastating effect in Ranrahirca, Peru, in 1962. Huge amounts of money are spent each year to try and combat the avalanche threat, especially with the large amount of tourists using the mountains.

Faulting

- Refers to the fracturing of breaking of the earth`s crust due to both compression and tension forces as a result of tectonic movements.
- Lateral earth movements often produce very great stresses due to compressional forces and tensional forces.
- These forces can cause fractures or breaks in the earth`s crust forming joints.
- If the rocks are displaced on both side of the crack it is called a fault.
- Faulting normally displaces the crustal blocks along lines and eventually rocks are pushed above or dropped below the general level of land.

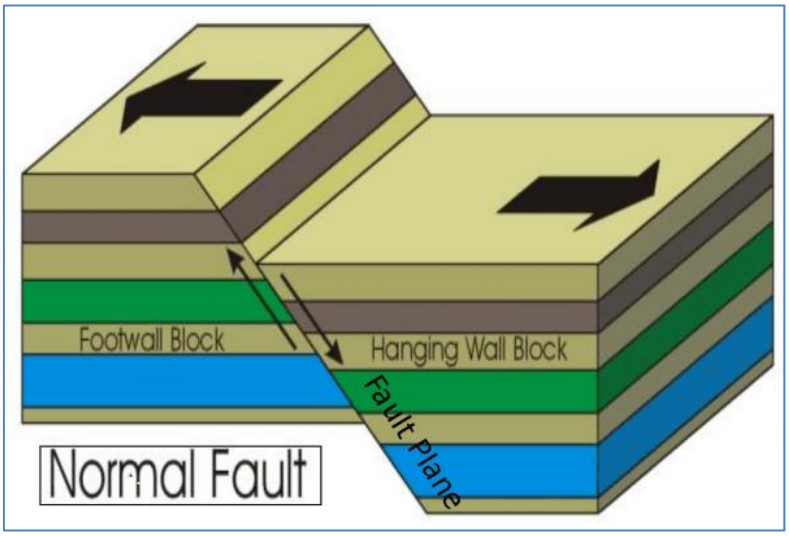
Features of a simple fault



- Heave – the forward horizontal displacement of the sediments.
- Throw – the vertical displacement of the sediments or strata / layer e.g. when rocks are folded and tilted they do this.
- Dip – refers to the direction the sediment tilts in.
- Bedding plane – are surfaces of plane that separates layers of sedimentary rocks i.e. a line that follows the weaknesses between sediment layers of different compositions.

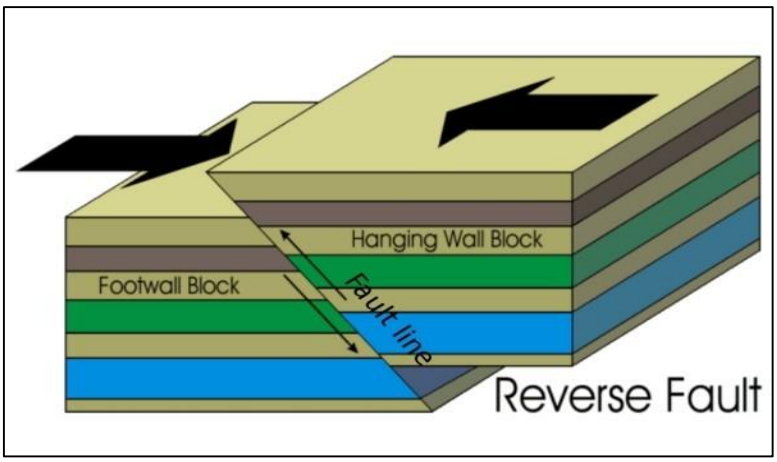
Types of faults

1. Normal fault



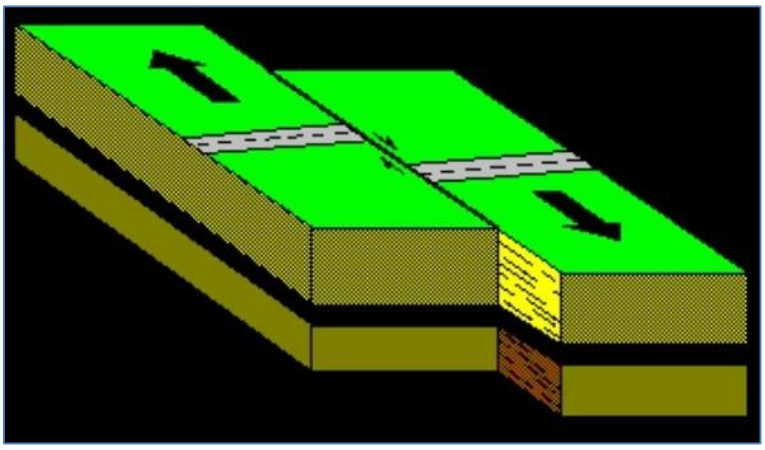
- Caused by tension forces which cause part of the earth to move downwards.
- The central block is a fault plane to the right of the central block is displaced downwards.

2. Reverse fault



- Are caused by compressional forces i.e. pushing towards each other.
- When rocks are subjected to compression, the central block is forced upwards (heaved upwards) relative to the level ground and adjoining blocks.
- The central block is displaced upwards.

3. Tear fault



- It is due to tear forces which are in opposite direction and this normally results in rift valleys.

Effects of Faults

- Producers of earthquake.
- Petroleum and oil deposits found in porous sedimentary rocks.
- Also give rise to underground ground water table along fault planes resulting in hot or cold springs.
- May also give rise to waterfalls.
- Difficult to build roads and railways.

Vulcanicity

- Refers to various ways by which molten rock and gases are forced into the the earth and onto its surface.
- Includes volcanic eruption forming volcanoes, lava plateaus and geysers.
- Also involves intrusive and extrusive features e.g. batholith and sills.
- When magma (molten rock) reaches the surface is known as lava.
- Vulcanicity occurs most at plate boundaries.
- Vulcanicity is divided into intrusive and extrusive vulcanicity.

Qn: What is intrusive and extrusive vulcanicity? (4)

A Volcano

- Is an opening in the earth`s surface through which magma is injected into the earth or ejected as lava onto the earth`s surface.
- Rocks below the earth`s crust have a very high temperature but the great pressure exerted on them by the earth`s crust keeps them in a semi – solid state.
- Friction at plate boundaries raises their temperature and fuelling great pressure due to faulting and folding hence rocks become molten and semi- fluid.
- It is this magma that flows up into cracks in the earth`s surface forming landforms like dykes, batholiths, sills and lapolith.
- Volcanoes erupt violently or quietly.

Types of Volcanoes

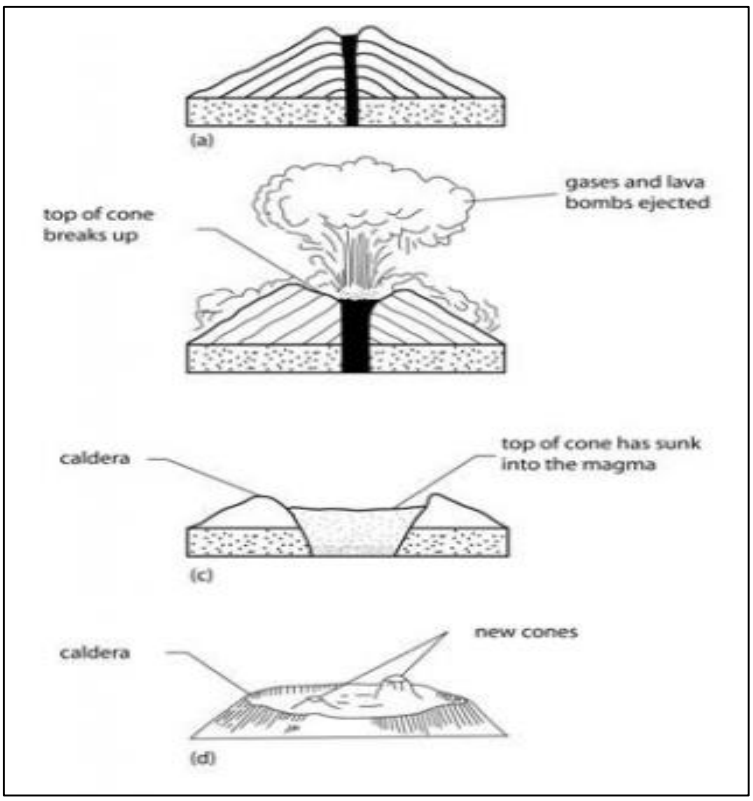
Volcanoes are classified as active, dormant and extinct.

1. Active volcano
   - ❖ It occurs or erupts either occasionally or periodically.
   - ❖ i.e. when it is currently erupting, is likely to erupt or is showing signs of unrest for example making gas emissions.
   - ❖ Most are found along the Pacific ring of Fire.
2. Dormant
   - ❖ The volcano is inactive and has not been known to erupt in recent times.
   - ❖ They are quiet but may erupt again because they are undergoing a recharge period which may take for tens of thousands but may erupt.
   - ❖ Mt Pinatubo erupted in 1991 and Mt Kilimanjaro in Tanzania are considered dormant.
3. Extinct
   - ❖ Are considered as being unlikely to erupt because they have exhausted their magma supply.
   - ❖ For example Hawaii`s Emperor sea mount chain.

Calderas

- ❖ Are large craters that form at the top of a volcano usually two or more killometres in diameter.
- ❖ They are deep and can extend downwards for some hundred meter with lakes as in active volcanoes e.g. Lake Bosumtwi in Ghana.

Formation



Violent eruption

- A composite volcano may explode violently that its top is blown off and disintegrates into rock masses and ashes. Thereby forming a crater at the top of the volcano.

Subsidence

- It may form due to block subsidence or downward displacement of the central block.
- After an eruption, the supply of magma is depleted causing a huge chasm to form beneath the volcano.
- The weight of the cone sometimes develops faults which may cause the cone to collapse into the chasm beneath e.g. Longonot in Kenya.

Meteor theory

- This suggests that solid objects from space fall by gravity and on impact with the volcanic cone.

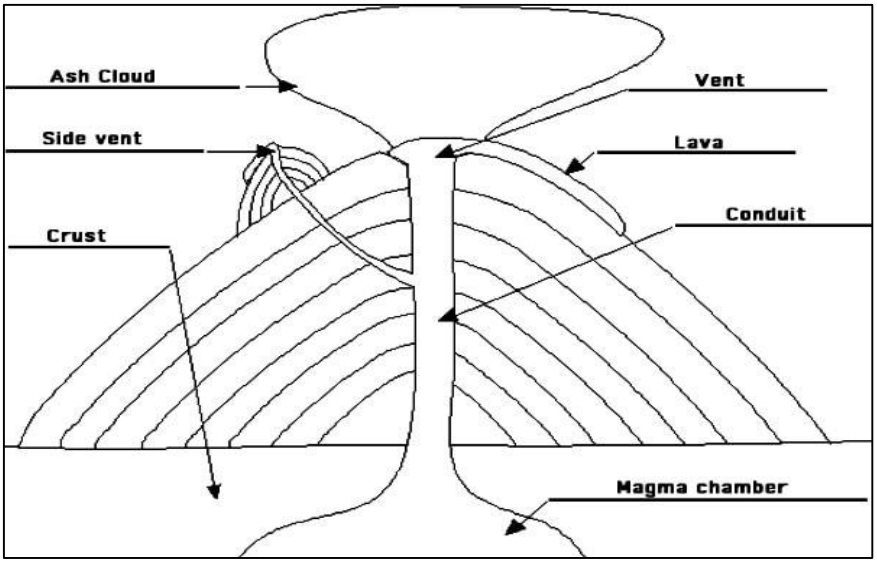
Mountain collapse

- A mountain may collapse if it has a large mass floating on a wetter surface resulting in a caldera.

Extrusive volcanic landforms

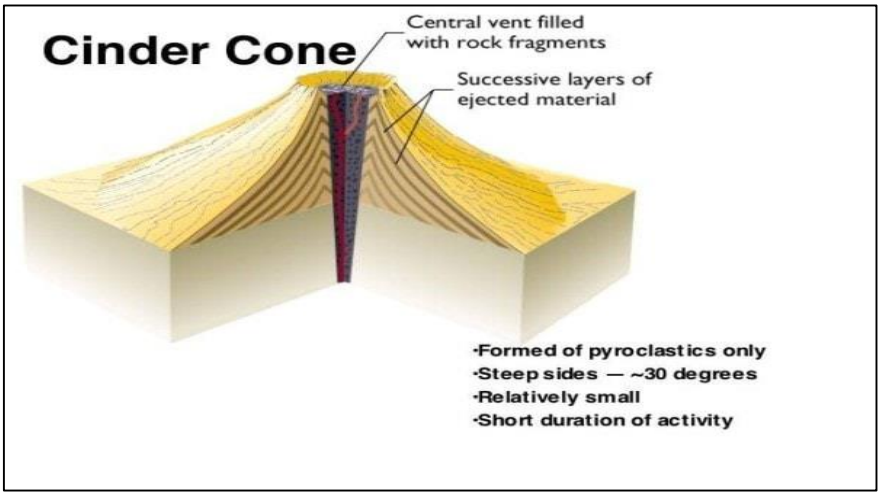
- Are those landforms resulting as a result of magma solidifying on reaching the earth`s surface e.g. cinder cone, acid cones, composite cones and plug cones.
- Magma sometimes reaches the earth`s surface through a vent, fissures and cracks (called lava).
- If the lava emerges from through the vent form a cone shaped mound called volcano.
- If it emerges out of a fissure it builds and forms a lava plain or plateau.

Volcanic cones



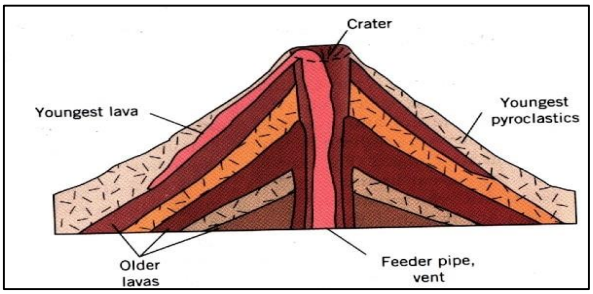
- The mount of a volcano is its cone.
- It is made up of lava or lava and rocks torn by molten magma.
- It may contain layers of ashes and small bits of lava known as cinders.
- The shape and size of the cone depends on the nature of materials and type of eruption.
- It has a pipe where the lava flows out and the exit of the pipe is the crater.

Cinder cone



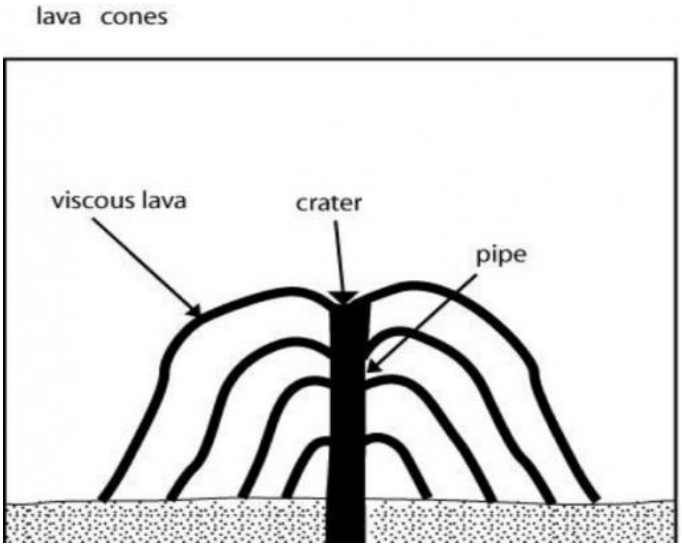
- Is made up of successive layers of ash deposited on each eruption.
- Lava is blown a great height when it is ejected i.e. pyroclastic eruption.
- It breaks into smaller fragments which fall back to the earth and form a cone.
- Has steeper sides and is small as to other volcanic cones.
- They are short lived due to processes of denudation. e.g. Jose Plateau in Nigeria and Likaiu and Teleki in Kenya.

Lava cone



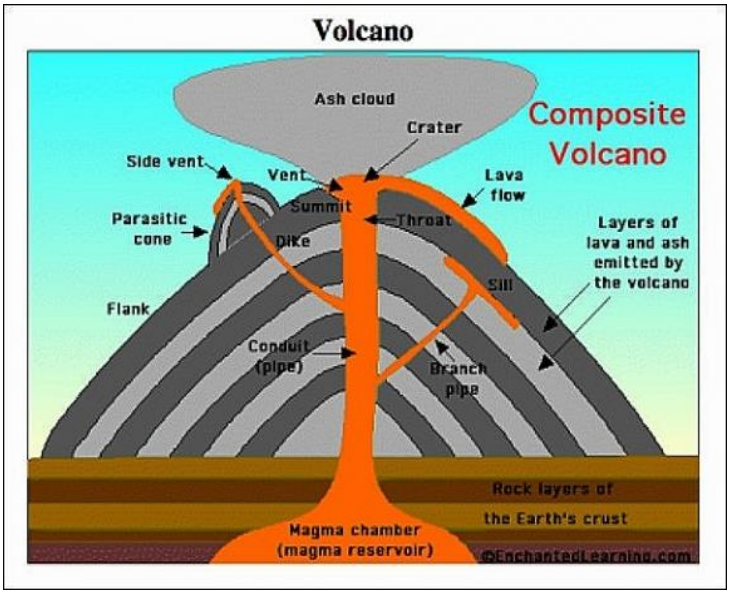
- The shape and slope depends on whether the lava is fluid or viscous.
- Basic / shield/ fluid lava is very fluid or mobile.
- It spreads over some distance and forms gentle slopes e.g. Nyamuragira in DRC and Mauna Loa in Hawaii with a diameter of 400km and a height of 9km from sea bed.

Basic lava cone



- Acid / viscous lava produces steeply sloping cones.
- Viscous lava contains a lot of silicates and is stick.
- It travels over a short distance before it cools.
- Sometime the viscous lava may form a plug dome that may block the vent e.g. Pico Cao Grande in Gulf Guinea.
- Examples of acid lava are the Hoggar Mountains in Algeria.

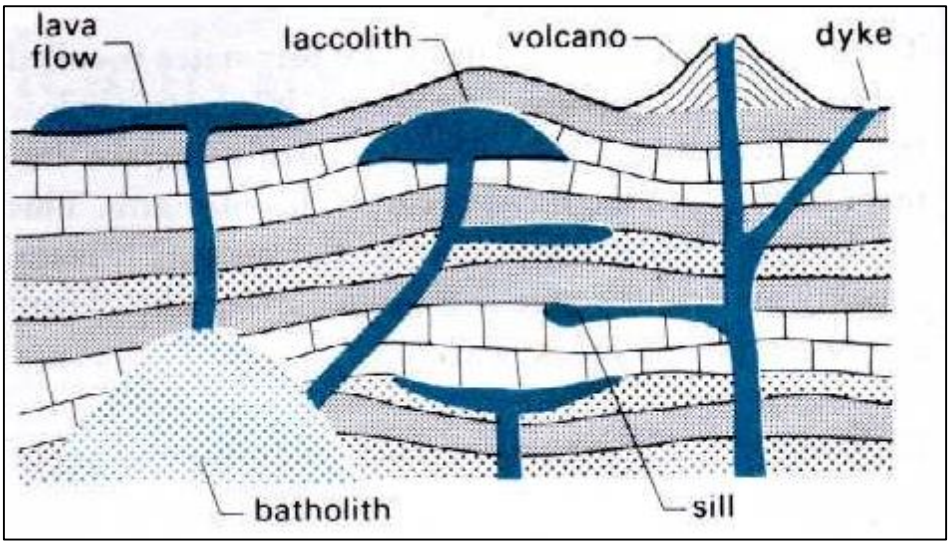
Composite cone



- As eruption continues lava pours out forming a layer on top of ash.
- Lava escapes from the sides of the main cone where it forms small conelets.
- Sometimes its features include dykes, conduits, ash and lava, a crater and a pipe.
- It's very high and it has alternate layers of cinder and lava and ash hence named stratovolcano i.e. layered volcano e.g. Mount Kilimanjaro in Tanzania and Mt Cameroon in Cameroon.

Landforms from intrusive vulcanicity

- Dykes, Sills, Batholith, Lopoliths, Laccoliths.



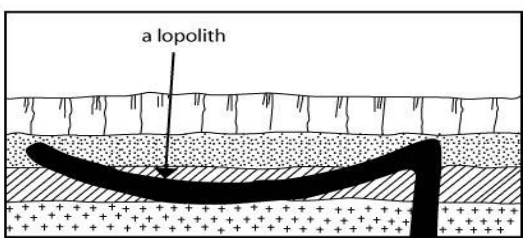
1. Dyke
- Is a sheet of magma that solidifies across bedding plane.
- It can be vertical or inclined.
- Dykes are easily eroded forming shallow trenches.
- Those that resist erosion form ridges.
- Dykes normally give rise to waterfalls for example Howick Falls in South Africa.
- Other examples are the Jos Plateau in Nigeria and Kaap in South Africa.

2. Sills
- A sheet of magma that lies along bedding planes.
- A sill is a body of tabular rock that solidifies along bedding planes sometime are igneous intrusions.
- Due to erosion they may form ridge like escarpments and others remain as caps on top of hills.
- They can be dissected by rivers forming isolated hills.
- The Three Sisters in Cape Province South Africa are buttes which have sills.

3. Batholith
- A deep-seated dome like igneous intrusion made up of granite.
- Is formed when a large mass of magma that accumulates in the earth`s crust which cools and solidifies within or near the earth`s crust.
- Sometimes they form the root or core of mountains.
- They form features like dwalas and low lying hills after denudation processes.
- They are essentially massive underground hills.
- Example is Domboshava near Harare.

4. Lopoliths

a lopolith

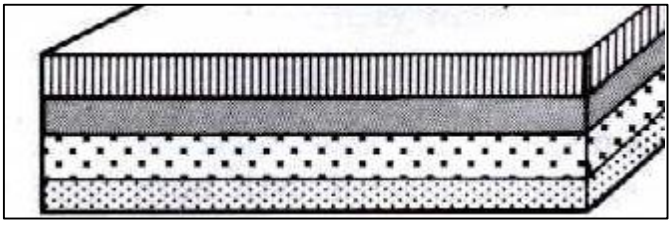


- A saucer concave shaped sheet of magma that solidifies in the earth`s crust.
- They form depression which holds water or form lakes.
- Example is the Great Dyke in Zimbabwe is not a dyke according to geological fact.

5. Laccolith

- Is convex shaped massive sheet of magma that solidifies within the earth`s crust and usually nea the earth`s surface.
- They are arch – like igneous intrusions as a result of magma solidifies within sediments.
- They have a pipe-like feeder coming from the magma pool very deep down.
- Laccolith forces sedimentary rock to curve up and when exposed to erosion and denudation, they form low lying hills.
- For example Mt Mlanje in Malawi.

Bedding planes



- Are layers of sedimentary rocks.
- They result from fossil deposits or layers of sedimentary materials.

Lava Plateau

- ✓ Lava eruption through cracks tends to be very quiet and subdued.
- ✓ The lava spreads out over the surrounding countryside causing layers of lava to build up.
- ✓ Eventually covers up the features of the surrounding area resulting in lava plateaus.
- ✓ Some lava plateaus are very extensive in size and cover thousands of killometres e.g. Haruj al Aswad Plateau in Libya, part of Drankensberg Mountains in South Africa and Mt Nyiragongo.
- ✓ Due to subsequent erosion by rivers the original surfaces may be exposed on the floor of deep valleys.
- ✓ Rivers crossing these plateaus often carve out deep gorges.
- ✓ Plateaus sometimes provide fertile soils.

Earthquakes

Short term Effects

- Loss of life.
- Destruction of homes.
- Landslides due to ground shaking.
- Destruction of transport and communication networks e.g. roads.

- Leads to nuclear disasters such as the Fukushima – Daichii in March 2011.
- Power failure leads to blackouts.
- Trade, commerce and industries are destroyed.
- Tsunamis can result especially in coastal areas and may cause damage.

Long Term Effects

- Spread of diseases such as cholera and dysentery due to unsanitary and shortage of clean water hence loss of life.
- Expensive rebuilding exercise e.g. in Nepal investments were directed towards repairs.
- Fall of standards of living due to loss of income and livelihood.
- Long term radiation effects including cancer, deformed births and cataracts.
- Damage from aftershocks.

Mitigation

- Disaster preparedness practice drills on dos and don`ts when an earthquake occurs.
- First aid kits in homes.
- Seismic studies to forecast the likelihood of an earthquake.
- Disaster relief operations such as medicines, clean water and food supplies.
- Provision of tents for shelter.
- Rescue operations using earth moving equipments.
- Donations towards reconstruction funds.
- Building strong and more earthquake resistant buildings.
- Communication methods e.g. radio to disseminate information.

Benefits and problems of Volcanoes
Benefits

- Lava and ash form fertile soils for agricultural activities.
- Geothermal electricity.
- Contain precious minerals such as Opals and obsidian.
- Tourist attraction.
- Habitable islands for example the Hawaii islands in the Pacific Ocean.
- Produce condensation nuclei.
- Igneous rocks for building.
- Caldera lakes as source of water.

Problems

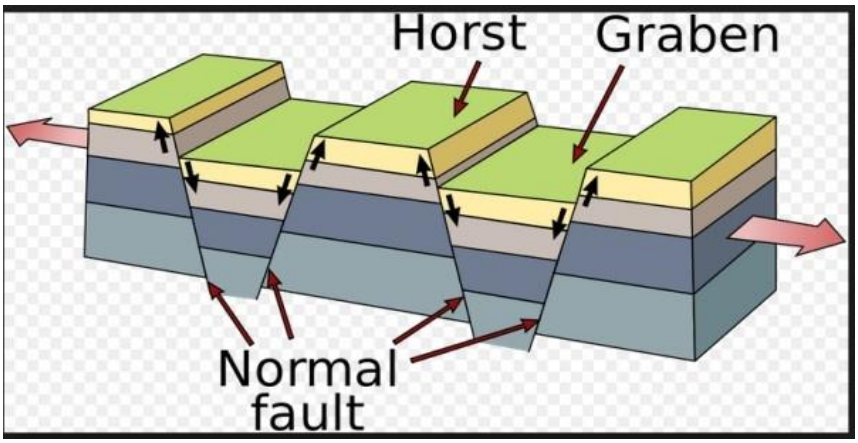
- Loss of life as in the Pombeii.
- Destruction of crops due to lava flow as in Hawaii.
- Loss of ecosystem and biodiversity.
- Leads to acid rain and natural fires.
- Settlement disruption and displacement of people.
- Can cause tsunamis. What are tsunamis?

Mitigation

- Rescue operation to affected areas.
- Dissemination of information through effective media when the eruption is predicted.
- Diverting lava flows using barriers.

- Monitoring volcanoes using latest seismic technology.
- Evacuation from affected areas prior to the eruption.

Block Mountains and rift valley



Advantages of Block Mountains

- Associated with relief rainfall.
- They have cooler environments which discourage diseases.
- Have pastures for animals.
- Firewood and fruits.
- Offered fortification during tribal wars.
- Minerals such as gold and diamonds found within their vicinity.
- Water can be obtained from springs.

Disadvantages of Block Mountains

- High erosion rates.
- Associated with dangerous wild animals.
- Rock falls can be fatal to humans and damage infrastructure
- Prone to volcanic activities and can lead to loss of life.
- Transport networks are difficult and expensive to construct.

Rift Valleys

Advantages of rift valleys

- Source of water for domestic and industrial use.
- Pastures for animals can be found in most valleys e.g. East Africa Rift Valley.
- Fertile soils.
- Alluvial deposits from which can be found precious minerals such as gold.
- Fishing provides livelihood to people for example Lake Malawi and Lake Tanganyika.
- Recreation activities and tourism.

Disadvantages of rift valleys

- Hot weather can be stiffing and enervating on valley floors.
- Diseases such as malaria, bilharzia and typhoid abound in within.
- Dangerous animals can be found in forests.
- Flood occurrence.

Weathering

- Is the disintegration of rocks into smaller particles which lie exposed to weather elements in situ.
- In situ meaning in its original place or stationary.

Importance of weathering

- Creates tourist attractions for example Epworth Kopje.
- Produces soils valuable for agriculture and vegetation development.
- Weathering helps in soil enrichment.
- Without weathering, the concentration of the same valuable material may not be sufficient and economically viable to exploit, process and refine.
- Prepares the way for formation of not only regolith and soils, but also erosion and mass movements.

QN 1. State the differences between weathering and erosion. (8)

Weathering	Soil erosion
Breaking down of rocks	Washing away of soil either by wind, water or ice
Happens in situ	Washing away of top soil
Produces inselbergs and karst landscapes	Produces gullies and dongas
Caused mostly by temperature changes and acid rain.	Caused by the movement of water, wind and ice.

Humans and weathering

- Increased motorization leads to emission of sulphur dioxide nitric oxide and carbon dioxide yielding acid rain which in turn accelerates chemical weathering and carbonation.
- Deforestation increases runoff and reduces moisture retention leading to decreased biological and chemical weathering and increasing physical weathering.
- Global warming influencing climatic conditions for weathering rates and types.
- Planting of trees can facilitate chemical weathering.
- Mining and quarrying creates fractures on rocks thereby exposing them to processes such as freeze thaw and crystallisation.

Factors affecting type and rate of weathering

- Rock type.
- Rock strength and hardness.
- Rock joints and bedding planes.
- Mineral composition of the rock.
- Climate.

QN: explain how the above mentioned factors affect weathering rates. (10)
Types of weathering

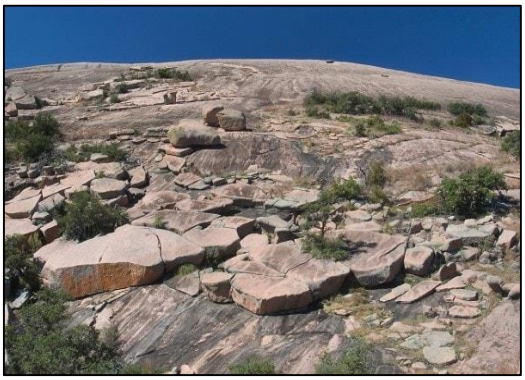
- Physical, chemical and biological / organic.

Physical weathering / mechanical

- Is the disintegration of rocks into smaller particles by mechanical processes without any changes in the chemical composition of the rock.

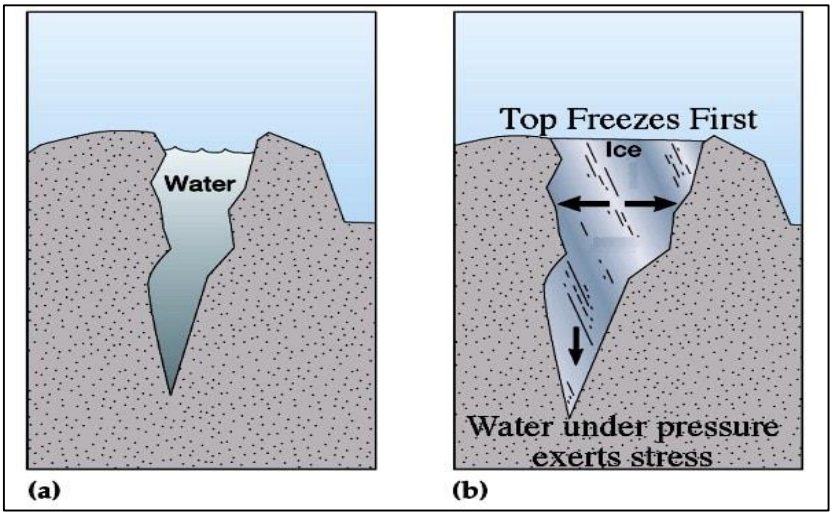
- Likely to occur in areas of arid climates such as deserts, arctic regions and some with little or no vegetation cover.
- Typically produces sand soils.
- Physical weathering processes include exfoliation, frost shattering, pressure release and thermal shattering.

Exfoliation



- Rocks expand when heated and contract when cooled similar to solid materials.
- In arid areas diurnal temperature can exceed 50℃.
- At night temperature falls and rock contacts and the outer layers cools faster than the inner parts.
- Stresses develop within the rock causing the outer layer to peel off like the rings of an onion (Onion weathering).
- Also several different minerals within the rock expand and contract at different rates and result in granular disintegration.
- The exfoliation domes like Domboshava have been formed due to exfoliation.
- It can be termed thermal expansion or insolation weathering.

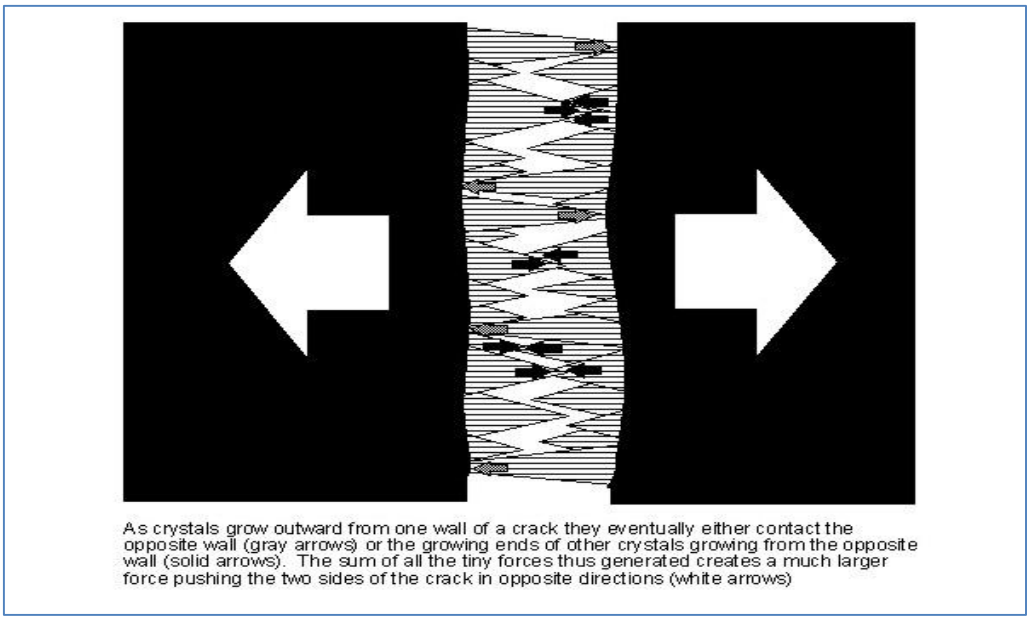
Frost Shattering



- It occurs in rocks with crevices and joints and where there is limited vegetation cover and temperatures fluctuate around 0℃.
- During the day water enters through the crevices or joints.
- When temperatures fall at night, water freezes leading to breakdown.
- Ice occupies more space than water hence rocks expand.

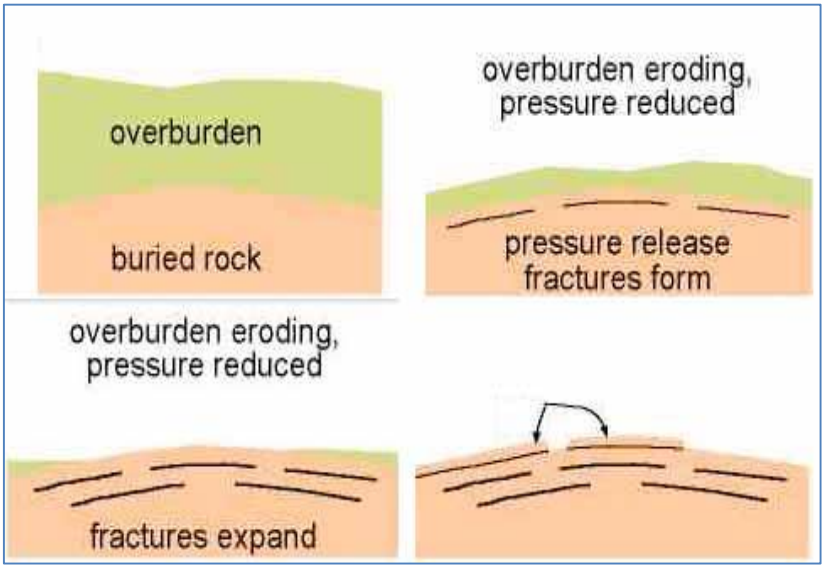
- As the water freezes within the rock it attracts more particles of water to form ice crystals which expands further.
- The rocks shatter and fall off the main rock as frost wedging.

Salt crystallisation



- Saline water with some salts enters rock cracks or pore spaces.
- Salt crystals form as evaporation takes places.
- As crystals become bigger, they exert stress upon the rocks causing granular disintegration.
- The process results in the development of weathering pits especially in deserts where water is drawn to the surface of rocks by capillary action.

Pressure release / dilatation



- Intrusive landforms as batholith are formed deep below the surface and under intense pressure due to the weight of the overlying overburden.
- The removal of the overburden results in reduction in pressure which causes fractures to develop on the top layers of the rock.
- Cracks develop parallel to the surface in a process called sheeting forming exfoliation domes.

Chemical weathering

- Refers to decomposition of rocks as a result of chemical processes and reactions altering the chemical components of the rock.
- Some rocks decompose when they get into contact with water, oxygen, carbon dioxide and some acids (carbonic, humic, acid rain and smog).
- Some minerals are susceptible to chemical weathering for example calcium.
- Most active in humid regions.
- Processes include oxidation, hydration, hydrolysis carbonation, organic wreathing and acid rain.

QN: Compare chemical and physical weathering. (8)

Oxidation

- Occurs when rocks are exposed to oxygen in air or water.
- Rocks containing iron react with oxygen as the rock transforms from ferrous state to ferric state
- During rusting, rocks change colour and become reddish – brown.
- This makes the rock easily crumble.
- Reduction (opposite to oxidation) also occurs in waterlogged areas through a process known as gleying.

Hydration

- Some rocks such as that have salt minerals have the capacity to absorb water hence swell and become susceptible to future breakdown.
- In hydration, rocks swell and exert pressure in addition to changing their chemical structure.
- The rock swells during wet periods and contract during dry periods causing them to fracture and breakdown.

Hydrolysis

- Hydrogen ions in water react with mineral ions in the rock.
- Water reacts with minerals in the rock instead of dissolving it forming compounds.
- Is common in granite areas where feldspar in granite or igneous reacts with hydrogen to form clay.
- Mica can also be affected by hydrogen ions in acidic water solutions.

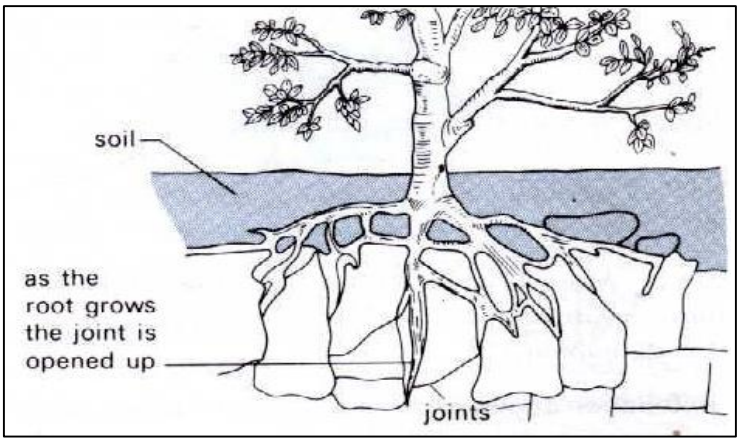
Carbonation

- Occurs when carbon dioxide dissolves with rain water to form carbonic acid.
- This weak acid reacts with rocks that are composed of calcium carbonate e.g. limestone.
- The calcium is dissolved and removed as a calcium bicarbonate solution by running water.
- This forms underground caves such as Chinhoyi caves and other limestone features such as stalagmites and stalactites.

Solution

- Some minerals like rock salt are soluble in water.
- When they come in contact with water they dissolve in situ.
- As the rocks dissolve in water they may form grikes/ grykes and clints which are known as limestone pavements.

Biological / Organic Weathering



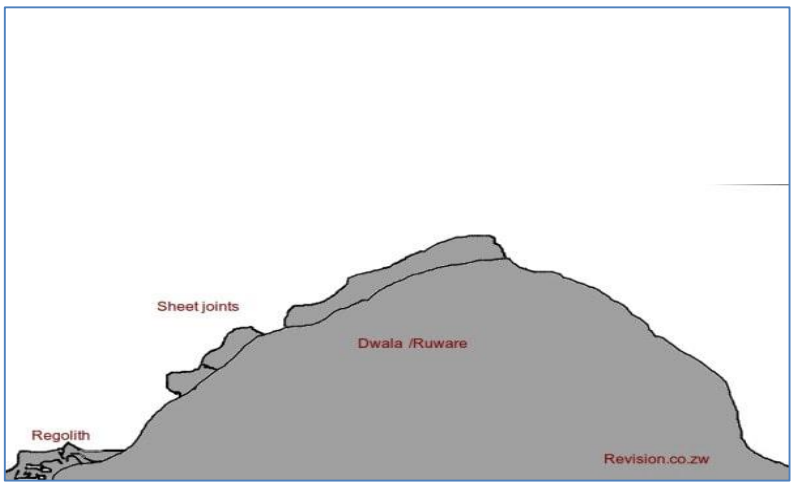
- Decomposing vegetation forms humus which releases humic acid which attacks rocks in the process called chelation.
- Respiration of bacteria and plants root increases carbon dioxide levels in the soil hence increasing carbonation.
- Lichen extracts iron from rocks via reduction.
- Burrowing and wedging by organisms like earthworms, rodents etc., help in exposing the new surfaces to chemical attack and assists in the penetration of moisture and air.
- Human beings by disturbing vegetation, ploughing and cultivating soils, also help in mixing and creating new contacts between air, water and minerals in the earth materials.

Acid rain

- Sulphur dioxide and nitric oxides react with water to form acid rain.
- Acid attacks and corrodes limestone and other rocks such as sandstones.
- Also, the acidic solutions tend to free up oxygen ions hence fueling hydrolysis.

Landforms resulting from Weathering

1. Dwalas

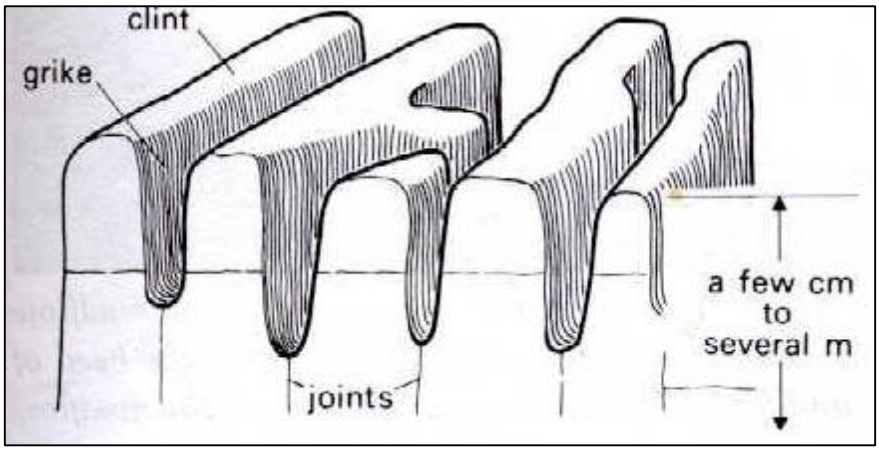


- Are known as ruware in Shona, dwala in Ndebele and whaleback in English.
- It is a hill or rock which is dome shaped and rises several metres from the ground about 2.5m in height.
- Have gentle slopes, are rounded or elongated hills and are found in low lying areas.
- Have convex / rectilinear and gentle slope.
- Might have vertical joints as a result of pressure release.
- They are surrounded by deeply weathered regolith.
- They are usually bare of vegetation but can be lightly populated by shrubs and bushes.

Formation of dwalas

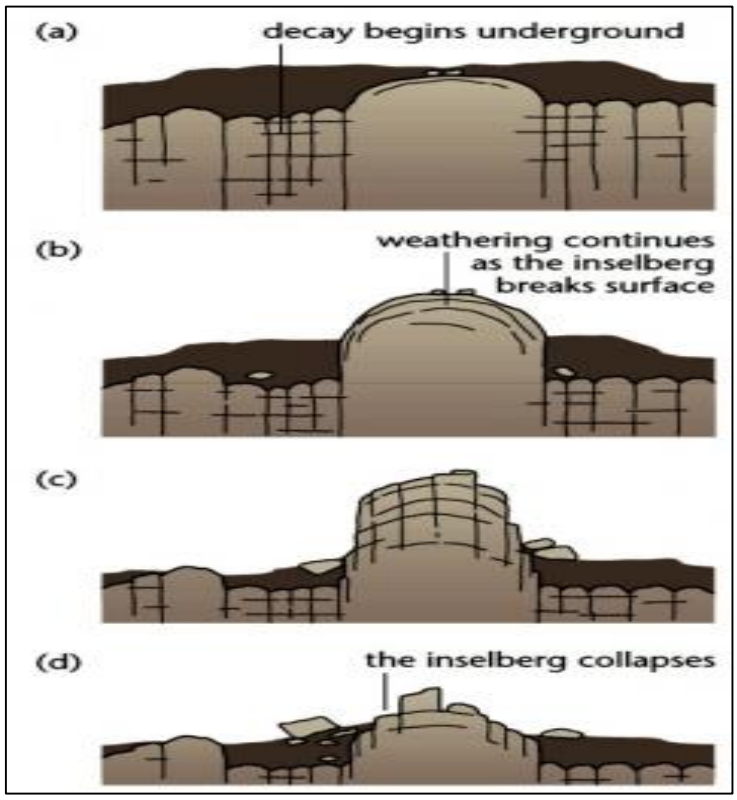
- An underground intrusion for example a batholith is exposed by denudation.
- The overburden is removed by denudation processes resulting in pressure release and the formation of a dwala.
- Denudation refers to process or forces that wear away the land surface for example weathering, erosion, transportation and mass wasting.

2. Limestone pavements



- Are flat areas of exposed limestone rocks.
- They are part of a dissolved bedding plane which may have exposed because the surface soil may have been removed by glacial and never replaced.
- Carbonation widens joints on the pavements.
- The widening of joints leaves deep incisions / gashes / fissures called grikes separated by the flat-topped dissected blocks called clints.
- These clints can be leveled by denudation and the grikes widened until a bedding plane is exposed.

3. Inselbergs

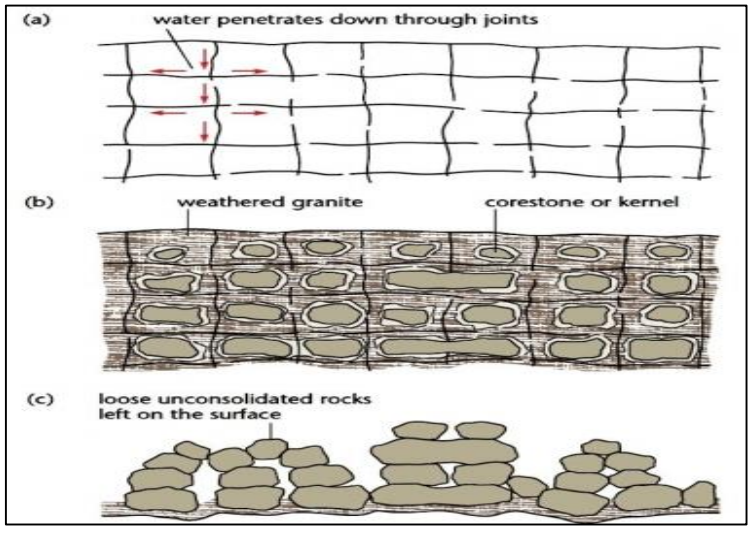


- Are Island Mountain and termed manadnock in West Indian meaning an isolated mountain.
- Is an isolated rock hill, knob, ridge or small mountain that rises abruptly from a gently sloping plain.
- Are made of rock piles or blocks of rocks that rise from an area of flat lower terrain.
- Are dome-shaped and formed from granite gneiss and are also called bornhardt.
- Common inselbergs include castle kopjes, tors, conical hills and balancing rocks.

Tors, kopjes or castle kopje

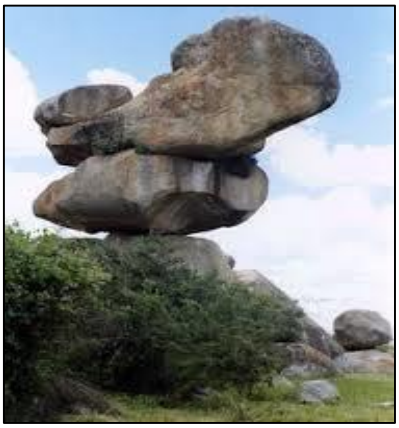
- Tor is a Scottish word meaning a hill.
- Kopje is an Afrikaans word meaning a small isolated hill made up of granite rock piles.
- They are rock features made from weathering.
- They are usually less than 5m in height.

Formation



- Result from subsurface weathering of domed landforms.
- Granite intrusions are weathered beneath the surface by chemical weathering processes.
- When rock is exposed the rotten parts are washed away by erosion.
- Weathering continues in form of physical and chemical due to rectangular joints on the rocks.
- If the joints are close together, the mass collapse and are washed away but if far away blocks of rocks fall away from the main rock forming tors/kopjes.

Balancing rocks



- Are a result of continued weathering of tors and kopjes.
- If the joints in the rocks that form kopjes and tors are further apart, massive chunks of rock may withstand the denudation processes to remain balancing one on top of another e.g. those in Epworth Harare.

4. Karst landscapes
5. Mountain peaks that are usually made up of rocks when the mountain core is exposed.

Rivers

Surface water flow and origin of rivers

- Rain falling down on land flows down the slope as sheet flow, rill flow and gully flow all of which contribute to stream discharge.
- Underground water oozes at certain points called springs and also contributes stream discharge.
- It is a type of overland flow or downslope movement of water which takes the form of a thin, continuous film over relatively smooth soil or rock surfaces is generated when rain falling onto the earth's surface flows over the whole surface as a thin layer of water.
- It commonly occurs at the head of the watershed where the slope is gentle and the surface flat e.g. artificial surfaces, rocks etc.

Rill flow

- Rills are shallow channels (no more than a few tens of centimetres deep) cut into soil by the erosive action of flowing water.
- As the slope steepens, the amount of water increases and sheet flow encounters surface irregularities sheet flow turns into small shallow channels or rivulets known as rills.
- Rills in turn join up with other rills and form gullies.
- A gully is a landform created by running water, eroding sharply into soil, typically on a hillside.
- Gullies resemble large ditches or small valleys, but are metres to tens of metres in depth and width.
- The process by which gullies are formed is called gullying.
- A gully may grow in length by means of headward erosion at a knickpoint.
- Gullies are sometimes known as dongas.
- Gullies empty into streams which are perennial rivers.

The results of water erosion

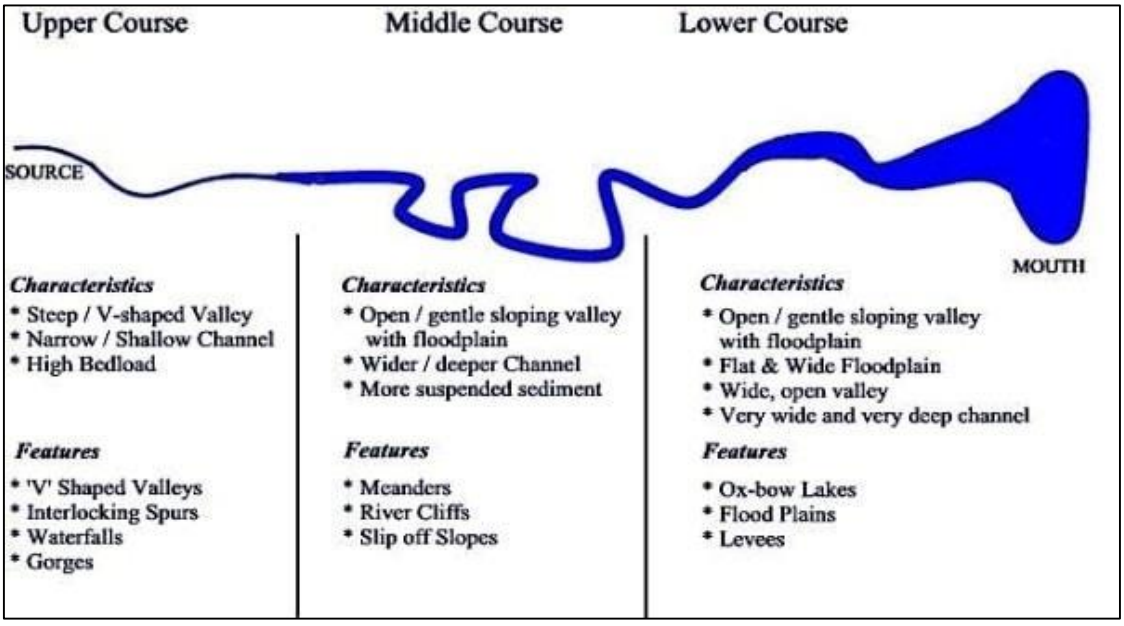
- Sheet flow results in sheet erosion.
- This results in the washing away of fertile top soils and shallow soils.
- Rock surfaces and plant roots are also exposed by sheet wash.
- Rill flow results in rill erosion.
- Gully flow results in gullies also known as dongas.
- Both Rill and gully erosions results in the formation of dongas and ravines.

The problems of dongas.

- Can lead to some areas becoming inaccessible as they are difficult to cross especially when it comes to carts and motor vehicles.
- Disrupts communication lines such as roads.
- Reduces the area available for crops pastures and settlements.
- Can lead to the uprooting of trees.
- Contribute to siltation.
- Humans and animals can fall into these ravines leading to injuries.

River profiles

- The long profile-this is the cross section along the river's entire length from its source to its mouth.
- The short profile-this is the cross section across a river's valley from the crest line(on one bank) to the channel to the other crest line. This is known as the river's valley.
- There is only one cross profile but an innumerable short profiles that can be taken at any point in a river's length.
- The short profile however tends to widen the further one moves downstream.
- The diagram above shows the three main sections of a river/stream's long profile and the diagram below show the corresponding typical short profiles at each stage.
- Short profiles that correspond to the long profile.
- A river's long profile can be divided into three sections viz: the upper course or headwater reaches, the middle course or middle reaches, the lower course or the lower reaches.
- The base level of a river is the lowest point a river can erode its channel, this is equal to the sea level of the ocean into which the river empties.



Upper course

- Common features include: V-shaped narrow valleys, potholes, interlocking spurs, waterfalls and rapids, gorges, strewn boulders.
- The most dominant form of erosion is vertical erosion and headward erosion also takes place.

Middle course

- It's less steep, has more water volume, a wider channel and more velocity due to reduced channel roughness.
- Common features include: Open V-shaped valleys, truncated spurs, meanders, ox-bow lakes and braids.
- Erosion is mostly in the form of lateral erosion.

Lower course

- Is flat and has a very wide channel with less energy.
- Common features include: bluffs and other flood plain features such as swamps, braiding, deltas, alluvial fans, deferred junctions and natural levees.
- These features are mostly due to deposition which is more dominant than erosion due to the reduced river energy due to the lower gradient and increased wetted perimeter.

River processes

- Rivers are perhaps the most important denudation agent.
- They carve channels, form valleys,transport and deposit regolith over great distances and other material to form other types of landforms.

Terms used in describing a river channel.

1. A channel is an area that contains flowing water confined by banks.
2. Channel width is the distance in meters across the surface of a river, it is the distance between the two banks i.e. the distance from bank to the other.
3. Depth is the distance in meters of the level of water down to the river bed. This is the vertical distance from the surface to the bed.
4. Gradient/Slope is the angle between the horizon and the river's surface.
5. Velocity is the speed at which the water flows through the channel. Speed is low at the sides near the banks and at the river bed due to friction and highest at the center.
6. The source is where the river begins.
7. The mouth is where a river empties/ends usually into a lake, sea or ocean.

Flow of water in streams

- Rivers always flow downstream because of the pull of gravity.
- A river's erosion, transport and deposition depends on the flow of water in its channel.
- This flow is determined by several factors viz:

a) The energy which is provided by gravity and is affected directly by they gradient of the river's bed the steeper the slope the more energy a river has.
b) Volume is the amount of water in a river's channel. Volume increases during the wet seasons when most of the precipitation occurs or if a river's course passes through a region experiencing wet climatic conditions
c) Conversely a river's volume falls during dry seasons such as winter and spring in Zimbabwe or if it passes through arid conditions/regions experiencing dry conditions.
d) The nature of flow also affects and channel shape also affects a river's energy.

River erosion

- River erosion involves the wearing away of rock and soil found along the river bed and banks.
- It also involves the breaking down of the rock particles being carried downstream by the river.
- There are four main processes of erosion (corrasion, attrition, hydraulic action and solution (also known as corrosion).

Corrasion

- Is the wearing down of the sides and bed of the river by the load as it is being transported by the river.
- Corrasion occurs when a river picks up material and rubs its bed and bank wear them away by abrasion like sandpaper.
- Corrasion therefore happens when the river's sides and bed are scrapped off by the material being transported by the river.
- This process is most pronounced during flooding.
- This is the major means of erosion by which a river extends both vertically and horizontally.
- If there are hollows in the river bed, pebbles can get trapped in these and whirled by turbulent eddies (in circular motion) to form potholes.
- When pebbles are trapped in existing potholes these are deepened further by the whirling pebbles.
- Corrasion wears away the channel's river bed and add more material to the river's load thus amplifying the processes as more load means more corrasion.

Attrition

- Is a process by which the river's own load is broken down from larger particles into smaller ones.
- This happens because the river's load which is made up of different sized particles which collide and knock into each other causing them to break into smaller fragments.
- As the load progresses downstream it gets smaller and smaller.
- Also angular rocks become increasingly rounded.

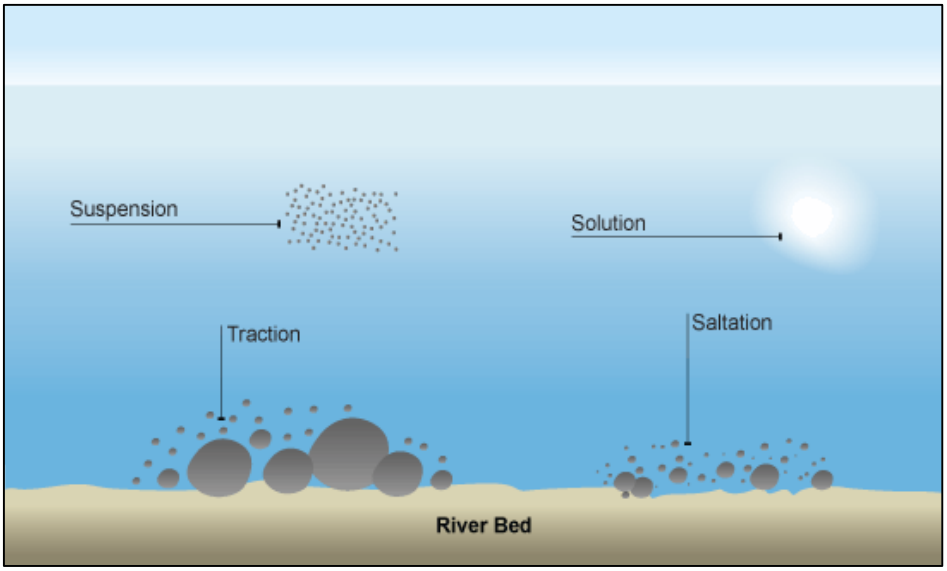
Hydraulic Action

- Refers to the sheer force and turbulence of the moving water which can be able to remove loose material such as gravel, sand and silt.
- This force can also weaken solid rocks by surging into cracks in the rock.
- This processes can be aided when there is air in the cracks which is compressed causing eventual bank collapse.
- Cavitation is a form of hydraulic action caused by bubbles of air collapsing and the resultant shock waves hit and weaken the banks of the river.
- Hydraulic action by itself is very effective if the river does not have some load to produce corrosive erosion/abrasive erosion.
- Hydraulic action is the weakest and least effective form of erosion.

Solution or Corrosion

- The water in the river dissolves some soluble rocks such as rock salt and sometimes limestone.
- This is most effective in areas where the stream bed and banks are composed of soluble rock for example in limestone regions

River transportation



- Any energy left after a river has overcome friction is used to transport sediment.
- This energy varies directly with a river's discharge, velocity and turbulence
- That is if they increase the amount of a river's energy to erode and transport also increases until a river reaches flooding level when deposition is likely to occur due to an increase in the wetted perimeter and thus friction.
- There are three main processes by which a river's load is transported: suspension, solution and bedload (sometimes divided into saltation and traction making them four methods instead of three in this case).

Suspension

- This is when light silt and mud floats along with the water.
- Very fine particles of silt and clay are dislodged and carried away in the turbulence of the flowing water.
- The greater the turbulence the greater larger the quantity and size of particles picked up by and carried away by the river.
- This partly explains why flooded river often have mud coloured water, it is due to the heavy amounts of suspended material with the water.
- The suspended material usually forms the largest part of a river's total load.
- It increases in amount towards a river's mouth also giving the black/brownish colour to the water that is similar to that of most rivers after a storm.

Solution/Dissolved Load

- Is when material dissolves in the water and is carried away in solution form for example rock salt.
- Flowing water within river channels almost always contain acids in the form carbonic and nitrous acids especially after a storm or due to pollution.
- This dissolves the bedrock especially if it is soluble for example limestone.
- It dissolves in water and is carried away in solution form.
- This is a very active form of transportation in limestone regions and in other regions it forms a comparatively small part of the load.

Bed load

- Is divided into two processes traction and saltation.
- Saltation is when smaller particles bounce along the bed of the river.
- Traction is when larger boulders and pebbles roll and are dragged along the river's bed.

- Since larger particles cannot be picked up by the current they are moved along the bed of the river in these two ways.
- Saltation happens when pebbles, sand and gravel are temporarily lifted up by the river's current and bounced along the bed of the river in a hopping motion.
- Traction occurs when the largest cobbles and boulders roll or slide along the bed of the river.
- The largest loads can only be moved in this way during flood periods for example after a storm.

River deposition

- Deposition occurs when a river no longer as sufficient energy to transport its load.
- When its velocity begins to fall and has less energy, a river's competence (maximum size of material which a river is capable of transporting) and capacity (maximum amount of load that a river is capable of transporting) falls and therefore deposition begins.
- Deposition occurs when:

a) Discharge is reduced after a period of low precipitation.
b) Velocity is reduced upon the river reaching the dam, lake,sea or ocean resulting in the formation of deltas.
c) Shallow water occurs on the inside section of a meander for example.
d) The load is suddenly increased for example in the event of a landslide for instance when a portion of bank collapses into the river.
e) When the river overflows its banks so that the velocity outside the channel is reduced resulting in the formation of a floodplain.
f) During floods, especially in the lower course rivers spread to the sides of the channel.
g) Frictional drag and the reduced gradient slow down the flowing water resulting in deposition.

Deposition occurs along the entire course of the river:

- On the channel bed.
- The river valley floor especially during floods.
- On the river's banks as in a meander.
- At the river's mouth when it empties into the sea.

NB Deposition occurs at any part of a river's course depending on a river's energy and velocity. The division of a river into stages is therefore useful but by no means conclusive.

Deposition

- When the river loses its energy to any of the reasons pointed out above the following happens.
- The heaviest material/load is deposited first this is why rivers are littered with boulders in the upper course.
- This is because traction load and siltation loads require more energy to transport.
- The finest material is deposited last and may reach the sea where it is deposited onto and to form deltas.
- The dissolved load which is in solution water is deposited at all but transported to the sea where it maintains the saltiness of oceans.
- The deposition of sand and silt leads to the development of a gently sloping plain known as a flood plain.
- Deposition can result in aggredation where the river's bed and gradient are increased. This can happen at deltas and on alluvial fans.

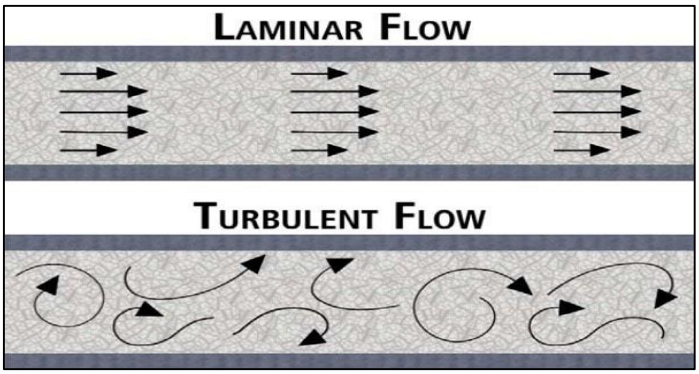
Factors affecting river processes

The following factors affect the river's energy and ability to erode, transport and deposit its load.

- Type of flow, gradient of channel, volume/discharge, cross-sectional channel shape, channel roughness
- When water flows downhill under gravity it follows the path of least resistance.

There are two patterns of flow: laminar and turbulent.

Laminar and turbulent



Laminar

- Is a horizontal movement of water in a river with minimal vertical mixing.
- The water is in layer; such a form of flow would result in minimal erosion and more deposition.
- In reality such a type of flow does not exist although something close to this can be observed in flat terrain when rivers are relatively calm during their flow.

Turbulent flow

- Consists of a series of vertical and horizontal eddies and a lot of vertical mixing of the water as it flows downhill.
- Turbulent flow results in more erosion and transportation and this form of flow increases with an increase in a river's energy.

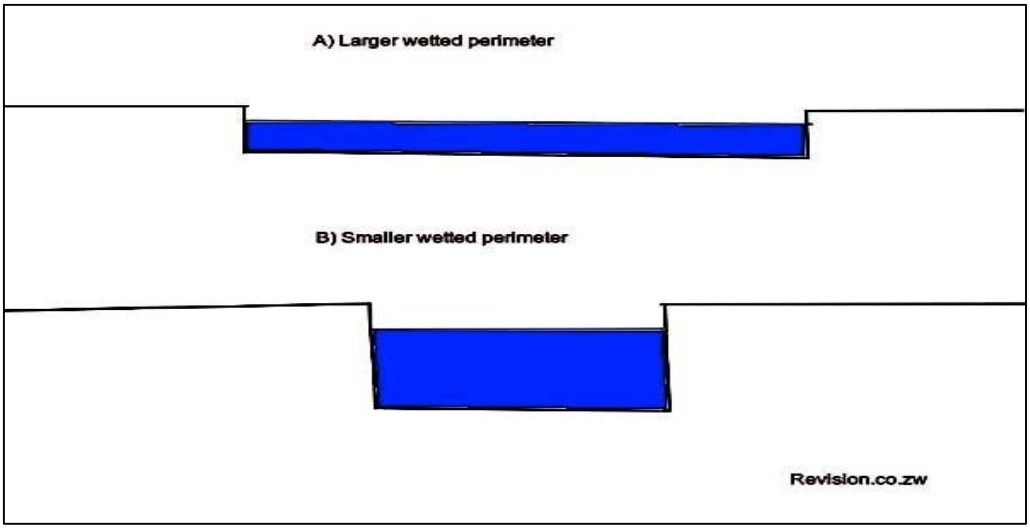
Gradient of the channel

- The gradient of the channel determines a river's ability to erode, transport and deposit its load.
- The upper course of a river is associated with steep gradients therefore a lot of velocity and energy and therefore river erosion and transportation takes place in the upper course.
- The middle and lower course have a much gentler gradient and therefore the slower moving waters have less erosive power and therefore more deposition takes place and less transportation and erosion.

Discharge/Volume

- As already said, water flows in response to the pull of gravity which is also determined by the mass and in turn the volume of the moving water.
- Rivers have less water in the upper course because of most have fewer tributaries at this stage therefore they have less energy to erode.
- Middle course and lower course river sections have higher volumes of water since they have more upstream tributaries at this stage resulting in more energy to transport and erode and transport in terms of water volume.

Cross Sectional Channel shape.



- Channel cross-section: A has less energy due to friction
- Channel A has a larger wetted perimeter which means more friction and leaves less energy to erode its bed and to transport load.
- Channel B has a smaller a smaller wetted perimeter resulting in more vertical erosion because it has more energy left over from overcoming friction.
- In terms of channel cross section upper course streams have more energy to erode when compared to lower and middle course streams.

Channel roughness

- Channel roughness channel A) is typical in the upper course streams and B) in the lower course streams.
- Upper course streams encounter more friction due to their rough channels which are a result of protruding boulders and rocky outlines. This means such channels will have less energy left over to erode and transport their load.
- Middle and Lower course streams have more energy to transport and erode since they have smooth channels resulting in less friction.

Conclusion

- More erosion takes place in the middle course since the channels are smooth, the gradient steeper than in the lower course, the wetted perimeter smaller than in the lower course and the volume of water is high.
- A lot of vertical erosion takes place in the upper course.
- Most deposition takes place in the lower course of the river since the gradient is smaller, the wetted perimeter larger, and the gradient considerably less steep when compared to the other two courses.

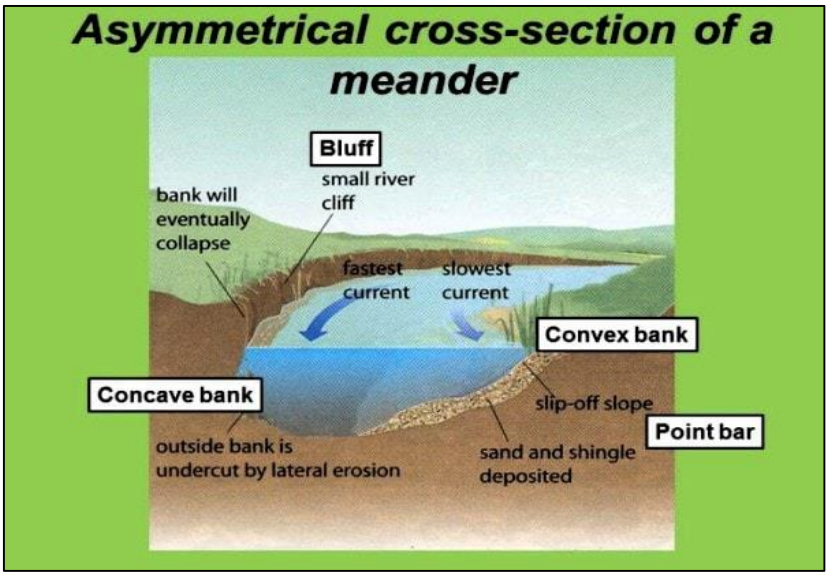
Landforms

- These can be broadly divided into those landforms resulting from erosion and deposition.
- Those from erosion include Narrow valleys, Interlocking spurs, Waterfalls and rapids, Pot holes, Gorges.
- Those resulting from mainly deposition include Flood Plains, Meanders, Ox-bow lakes, Braids, Levées, Deltas
- A lot of river features such as floodplains and meanders are formed by both erosion and deposition acting in tandem.

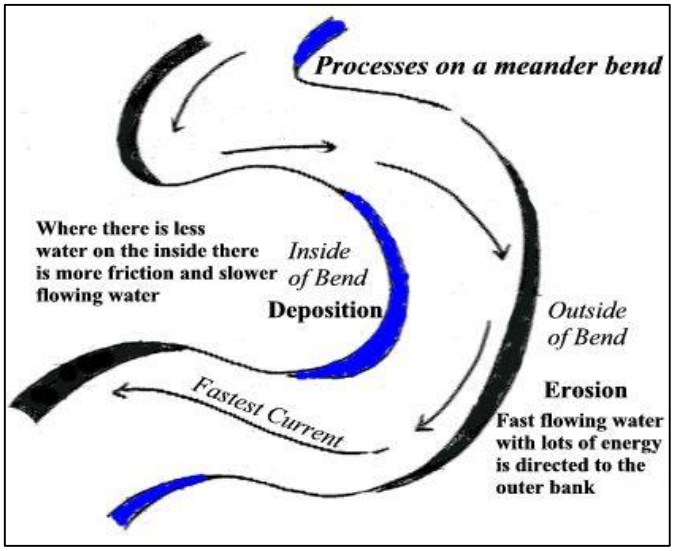
Interlocking spurs.

- Interlocking spurs occur mainly in the upper course section of streams and rivers as rivers have little energy to erode.
- Steep sided valleys
- Since water flows in small amounts and in predominantly steep areas in the upper course section vertical erosion is more dominant than lateral erosion.
- This also facilitated by the load which the river carries because it cannot reach the upper levels of the valley walls once they have been formed so much of corrasion processes are limited to the lower sections of the river and this tends to deepen the channel.
- The results are V-shaped steep sided valleys.

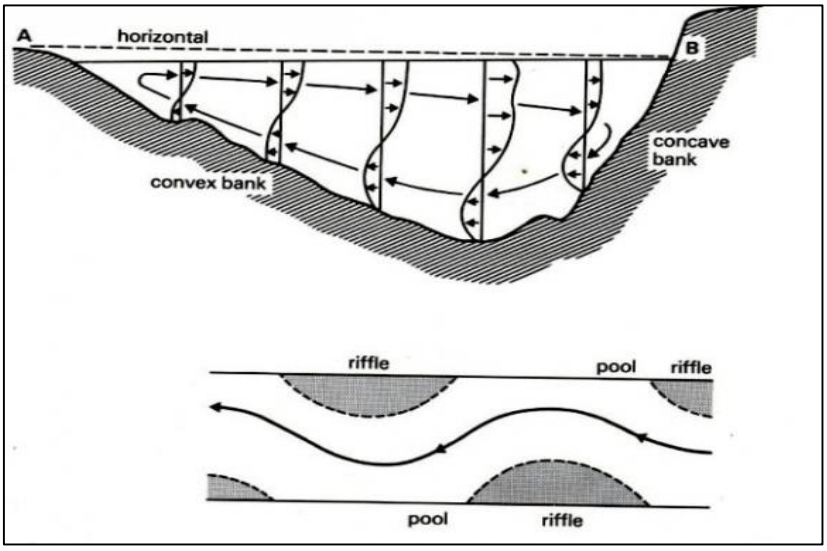
Meanders
Meander cross section



- Meanders are pronounced bends in a river's course
- They are formed when a river twists and turn in wide bends.
- They are common on the floodplain but can develop in any part of the river's course.
- Meandering is a common behaviour of fluids that avoid a straight path to flow in a twisting and turning path.
- It is believed that meandering is a thermodynamics behaviour that maximizes velocity and reduces friction.
- Other experts have theorized that meanders start when friction with the channel bed and banks causes turbulence in the water flow.
- This results helicoidal flow.



Helicoidal flow in a meander.



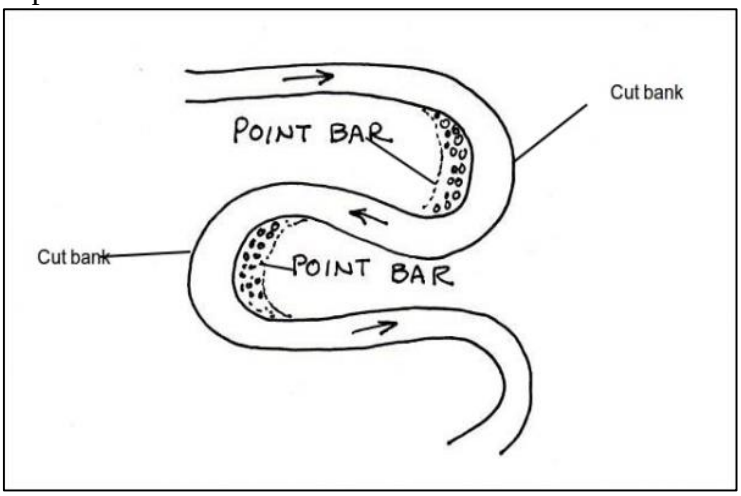
- This is a corkscrew like movement of the water as it spirals downstream from bank to bank as shown in the diagram above.
- This often occurs during floods and results in the formation of meanders and their associated features such as pools and riffles.

Pools and riffles

- Pool-this is a deep section in a meander where a lot of erosion takes place where the river's energy builds up due to reduced friction and the water has higher velocity.
- Riffle-this is a shallow section in a river where there is deposition due to reduced capacity in a river resulting from energy dissipation (reduction) in a river due to increased friction and a reduction in a river's velocity.
- The spacing of the pools and riffles are fairly regular in a river channel about six to five times the width of the channel.
- Helicoidal flow is responsible for the erosion on the outside bends and then depositing it into the inside bends of meanders.
- Water flows fastest on the outer bend (concave bank) of the river where the channel is deeper and there is less friction.
- It erodes this bank laterally by attrition and hydraulic action.
- There also vertical erosion which deepens the channel, which reduces friction and increases in energy results in further erosion.

- The lateral erosion results in undercutting of the river bank and the formation of a steep sided river cliff these cliffs are also known as bluffs. The inner bend water is slow flowing, due to it being a low energy zone, deposition occurs resulting in a shallower channel.
- This increased friction further reduces the velocity (thus further reducing energy), encouraging further deposition.
- Over time a small river beach or runoff slope builds up on the inner bend.
- The greater erosion of the concave bank occurs just downstream of the axis of the meander bend, because the course of the maximum velocity zone in the channel does not reflect the meander shape.
- This causes meander to migrate down the valley.
- The lateral erosion of the meanders and their migration widen the flood plain.

A point bar

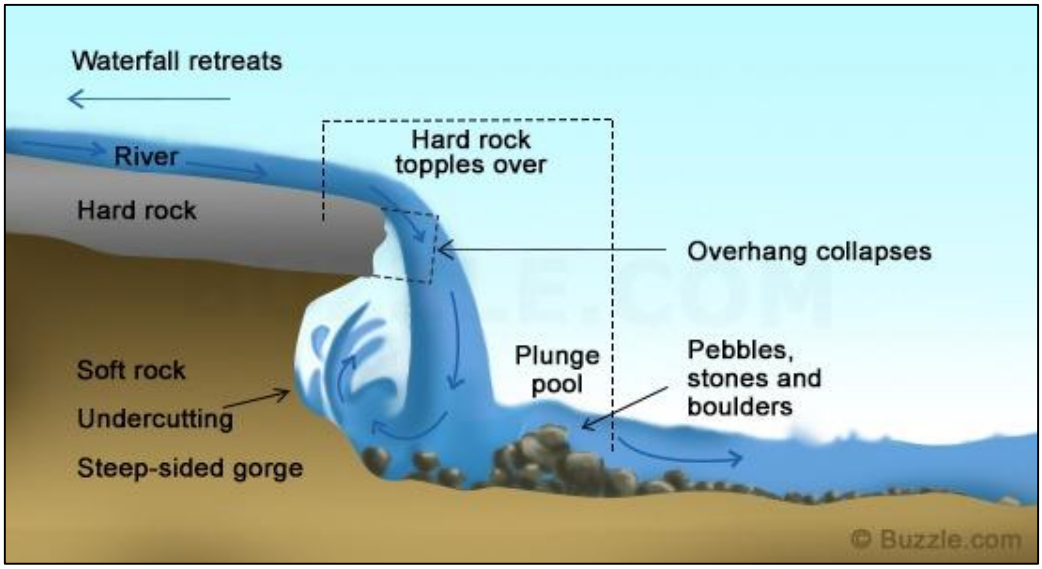


Is a depositional feature made of alluvium that accumulates on the inside bends of streams and rivers below the slip-off slope.

- They are crescent-shaped and located on the inside of a stream bend of meanders.
- They show the former positions of a meander during its downstream migration.
- The term is sometimes used synonymously with slip-0ff slopes although the term slip-off slope is used to refer to the cross section and the term point bar is used to refer to the aerial view.
- It is important to note again that meanders to not remain stationary but migrate downstream resulting in the widening of the flood plain.

Gorge

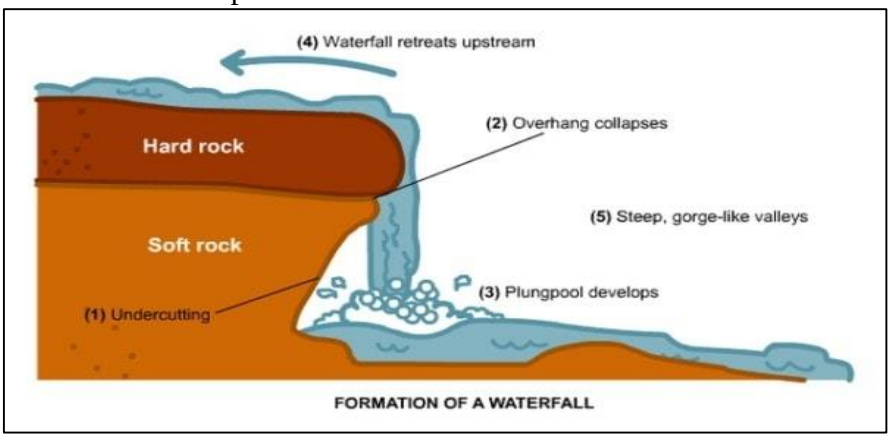
- Is a narrow valley between hills or mountains, typically with steep rocky walls and a river/stream running through it.



a) A gorge may develop if a river's course follows a line of weakness such as a fault line. For example the Kaduna river in Nigeria forming the Shiroro Gorge.
b) An actively flowing river may carve a gorge if it flows through a plateau which is made up of layers of resistant rock alternating with lays of less resistant rock.
c) If the region in which the plateau is found is arid or semi-arid there will be little weathering of the valley sides resulting in a narrow and deep gorge.
d) When the gorge is large it is sometimes referred to as a canyon for example the Fish River Canyon in Namibia and the Grand Canyon in the United States.
e) The later was formed in part by the process of river rejuvenation.
f) Gorges can be formed due to vertical erosion in areas of vertical uplift.
g) They can also result from the collapse of underground caves in limestone regions.
h) Vertical erosion into resistant rock can also result into the formation of a gorge as the valley walls on both sides of the river remain intact due to minimal weathering. For example the Lupata gorge was developed when the river incised into resistant rhyolite rock.
i) A gorge can also result from the upward migration of a waterfall for example the gorges at Victoria Falls.
j) Vertical erosion on a once buried hard rock layer by an existing stream in cases of superimposed drainage.
k) Down-cutting of the predator or victor stream in cases of river capture for example the Pungwe Gorge.

The diagram above shows a gorge being formed as a result of a waterfall migrating upstream
Note this is just one of many ways in which a waterfall can be formed.

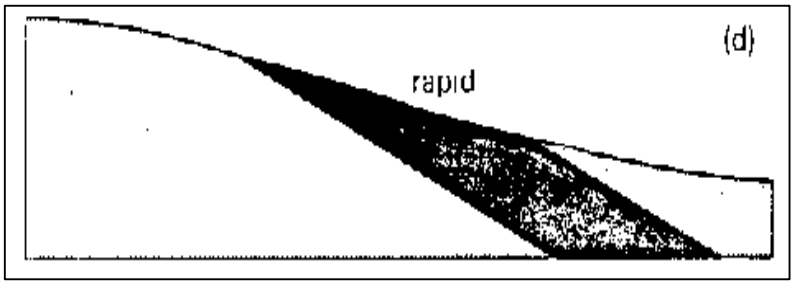
Waterfalls and Rapids



- Waterfalls commonly occur in the upper course section of the river although they can occur at any part in a river's course.
- There are various ways in which a waterfall/rapid can be formed.

a) A sharp break in the bed of a river produces a waterfall.
b) A band of resistant rock with a vertical face overlying less resistant rock produces a waterfall when it is exposed at the surface by river erosion can also result in the development of a waterfall.
c) A rapid is formed if the rock lies at a steep angle but is not vertical.
d) A waterfall can also develop when resistant rock overlies a less resistant is horizontal or dips gently up river.

Rapid



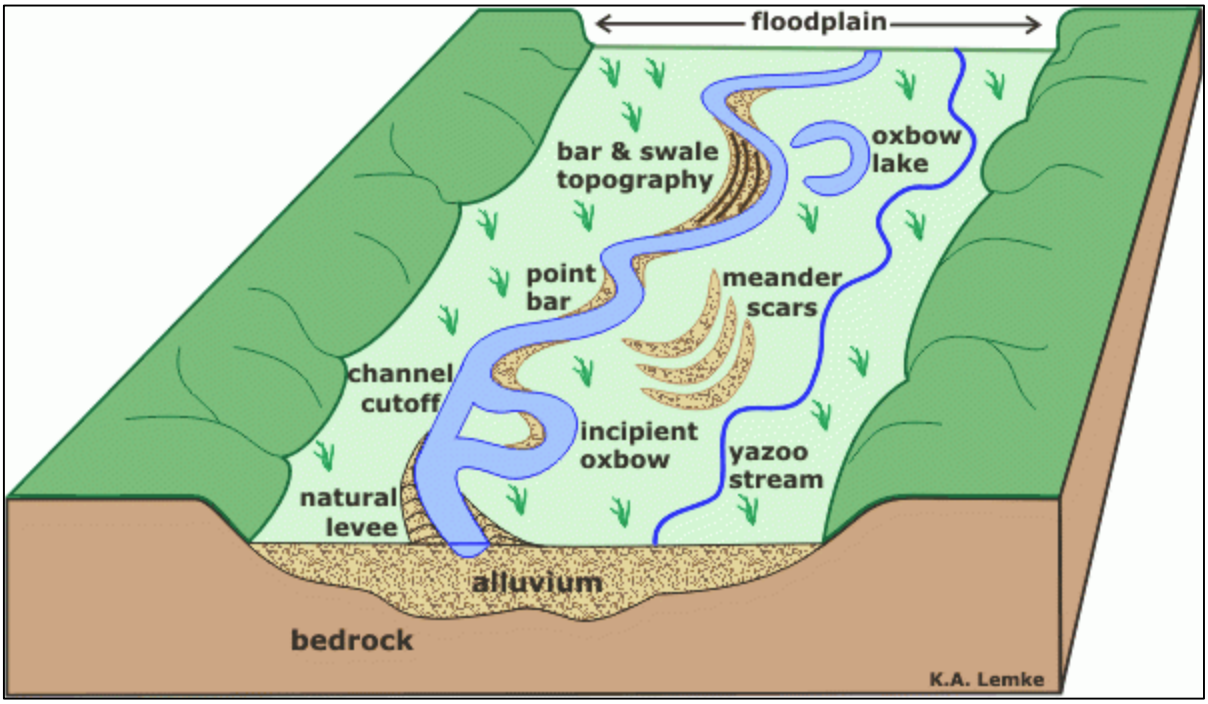
e) A rapid might be formed first in such instances but continued erosion at the base of the pool will resulting into the rapid developing into a waterfall.
f) A rapid develops when the resistant rock, overlying a less resistant rock dips gently down river.

- The Victoria Falls are the widest falls in the world.
- They may have developed as a result of the river Zambezi uplift of an almost horizontal basaltic plateau.
- Where a river flows across a line of weakness it erodes vertically to form a waterfall.

The Victoria Falls may also have been formed in this way.
- It has retreated upstream along fault lines and might cease to exist one day.
- A river might descend the scarp in areas of faulting resulting in a waterfall at the knickpoint.
- A waterfall may also be formed where a river descends from a highland area (for example a plateau) into a lowland area.
- A river might erode backwards to undercut and divert the water of a neighbouring stream and the point of capture is marked by a waterfall.
- An example is the Pungwe Falls which marks the point where the Pungwe River captured the waters of the Nyakupinga river which is a tributary of the river Odzi in the Eastern Highlands.

Plunge pool
- Is deep pool that is formed at the base of waterfalls due the swirling water eroding the base of the waterfall via hydraulic action and corrasion aided by bits of the hard rock that falls into the pool and becomes part of the load and the eddying and turbulent motion of the water at the base.
- As the undercutting continues the waterfalls migrate upstream.

Floodplain



- These are typically found in the middle and lower course sections of the river.
- They are gently sloping surfaces of alluvium that result from lateral erosion and material deposited onto the valley floor.
- A flood plain commonly has the following river features alluvium, marshes, meanders and ox-bow lakes which are remnants of cut off meanders.
- When a river is in flood it overflows its banks and covers the whole plain upon which it deposits some of its load.
- The continual deposition results in the formation of levees.

Leeves (see diagram above)

- These are ridge like features resulting from deposition.
- Flood plains may become so large and wide the the edges of the meanders may not be able to reach the sides of the valley for example the Nile River and the (Yellow River) Huang Ho.
- In meanders both lateral and vertical erosion takes place resulting in the removal of the original floodplain and the formation of a new one.
- The pieces that survive the erosion form terraces which have varying heights and often times the heights of terraces might not match those on the other side.
- This differentiates these terraces from the ones formed by river rejuvenation.
- The river Benue has a well-developed flood plain.
- It is important to note that floodplains are both a depositional and erosional feature.
- Natural terraces resulting from successive erosion of floodplains.

Levees and tributaries with deferred junctions

- Flooding causes deposition to take place on a river's banks because the water is slower there and therefore has less energy to transport the load.
- As already said above, continued flooding results in the formation of raised banks.

- These ridges are known as natural levees.
- Most flooding takes place at the edges of the channel since the water is slower
- The river then flows above the level of the floodplain which causes tributaries to defer joining with the main stream.
- Tributaries flow parallel to the river, with some flowing into depressions resulting into swamps, while others eventually join the main river further downstream forming what are known as deferred junctions.
- Rivers that flow above the flood plain present great risk of flooding to nearby settlements for example the (Yellow River) Huang Ho in China and the Mississippi in the United States.

Swamps/Marshes

- This is stagnant water that is clogged with water loving vegetation.
- They occur in the flood plain due to frequent flooding and where tributaries fail to enter the main stream (i.e. deferred junctions where a tributary flows over a depression).

Bluffs (see diagram on flood plain)

- This is a prominent slope that mark the edge of a floodplain.
- These steep promontory cliffs are sometimes found on the outside bend of a meander.

Oxbow lakes

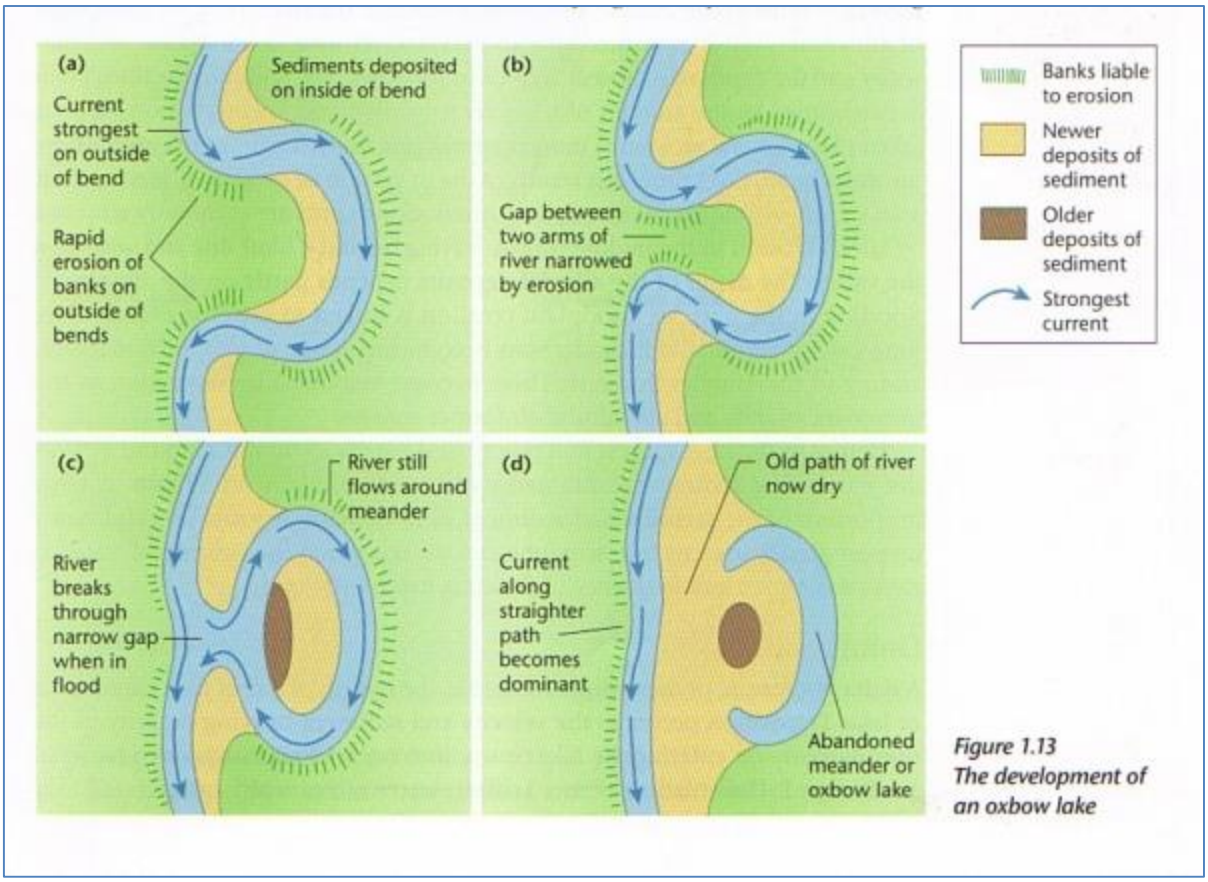


Figure 1.13 The development of an oxbow lake

- An oxbow lake is a U-shaped body of water that forms when a wide meander from the main stem of a river is cut off, creating a free-standing body of water.
- This landform is so named for its distinctive curved shape, resembling the bow pin of an oxbow. Development of Ox-bow lakes.
- Ox-bow lakes form when an acute meander leaves a narrow neck separating the two ends of a meander.

- Active lateral erosion takes place on the outside bends and break through this neck especially during floods.
- In flood the cut ends are sealed off by deposition and the meaner becomes an ox-bow lake.
- The banks are steadily raised by depositions resulting tin the river lying above the level of the lake.
- The lakes gradually lose water as vegetation and sediment fill them up.

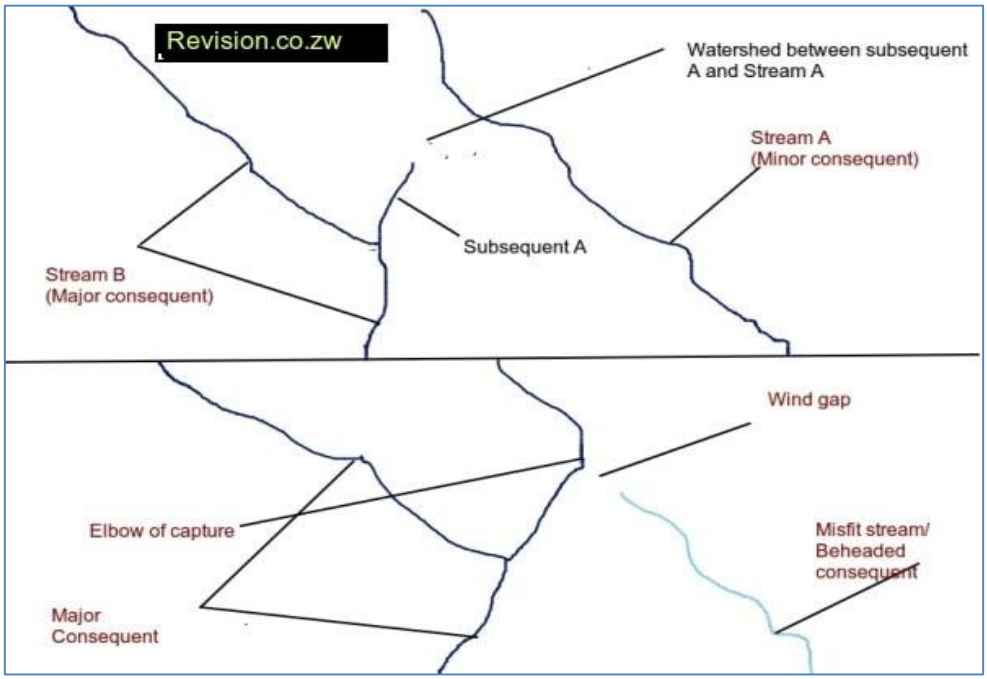
Home work

Qn 1 (a) what are braided channels? [2]

(b) describe the formation of braided channels. [4]

River capture

- This is a process where one River captures the headwaters on a nearby stream.
- This can occur due to several reasons viz:
- Tectonic earth movements, where the slope of the land changes, and the stream is tipped out of its former course.
- Natural damming, such as by a landslide or ice sheet.
- Erosion, either: headward erosion of one stream valley upwards into another, lateral erosion of a meander through the higher ground dividing the adjacent streams.
- In an area of karst topography, where streams may sink, or flow underground (a sinking or losing stream) and then reappear in a nearby stream valley.



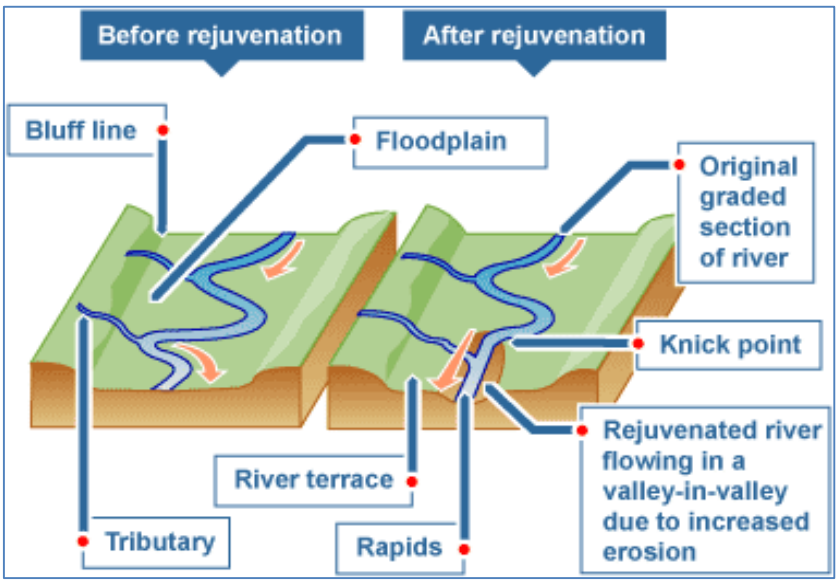
The process.

The diagram above shows how river capture can occur.

- There are two consequent rivers: Stream A and B and Stream B has a tributary (subsequent A)
- Stream B has higher discharge and thus higher erosional activity than stream A.
- Stream B might also have a lower base level and thus increasing its ability to erode.
- Subsequent A migrates upstream (headward erosion) until it reaches Stream A's channel.
- Through a process known as watershed migration Subsequent A enlarges its own drainage basin at the expense of Stream A.
- In time because Subsequent A and Stream B have a lower base level the headwaters of Stream A will be captured and diverted into Subsequent A.

- The point at which the headwaters of the minor river change direction is known as the elbow of capture.
- Below this point a wind gap marks the former course of the now beheaded stream or misfit stream.
- A misfit stream is a river whose headwaters were captured resulting in the stream flowing in a valley that is too large to be accounted for by the low discharge.
- A knick point and waterfall might form at the elbow of capture especially if the base level of the capturing river is far lower than that of the beheaded stream.

Rejuvenation



- occurs when there is a negative change in a river's base level (i.e. when the river's base level falls) which increases its potential energy and thus enables it to revive its erosive energy in the processes.
- A river's base level is the lowest point to which a river can erode.
- A negative change in a river's base level may be brought about by vertical uplift (for example isostatic uplift) or by a fall in the level of the sea for example due to tides.
- This change renews a river's ability to erode due to an increased gradient.
- A rejuvenated river erodes vertically into the floodplain to produce new features that are different from those typically found in the flood plain.

Landforms resulting from rejuvenation

- Rejuvenation produces several features including: incised meanders, terraces and waterfalls/knick points.
- River terraces and incised meanders
- River terraces are remnants of former floodplains.
- Which following vertical erosion brought about by rejuvenation have been left high and dry above the current and present-day flood plain.
- If a river quickly erodes and cuts quickly into the floodplain a pair of terraces of equal height may be seen flanking the flood plain creating a valley into a valley feature known as paired terraces.
- Sometimes the river does quickly cut into the flood plain, allowing it to meander, resulting in one terrace being removed as the meander migrates downstream.
- This results in the formation of unpaired terraces.
- If uplift continues for sometime, incised meanders may form.
- These are meanders that have been cut deeply into the valley floor.
- Incised meanders are also known as entrenched meanders.

Knickpoint, rapids and waterfalls.

- Sometimes the point where the uplift occurs can be visible especially when the uplift or fall in base level is rapid.
- The point where the river crosses from the old plain into the new plain is known as knickpoint.
- A river may have to descent this knick point as either a rapid or waterfall.

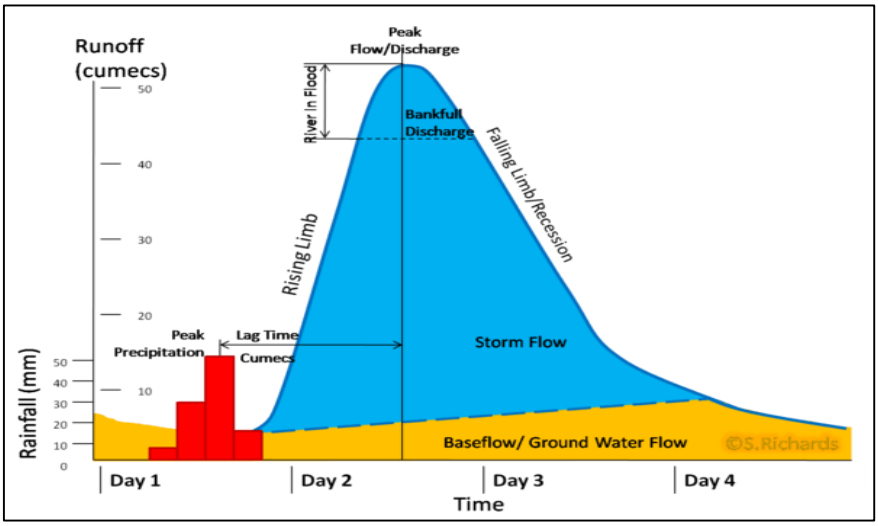
River regime

- A river regime is the term used to describe the annual variations in a specified river's discharge.
- A river's discharge is the volume of water flowing through a river channel.
- This is the total volume of water flowing through a channel at any given point and is measured in cubic metres per second.
- Sometimes this measure/unit is known as cumecs.
- A river's regime is shown on a graph called a hydrograph.
- A hydrograph shows the discharge of a river as well as total rainfall in the river's basin/catchment area over a period of time, before, during and after the storm.
- It allows for a relationship between the rainfall falling in a river's catchment area and the river's discharge.
- Such information can be used to, for example, predict the risk of flooding in a given area after a storm event.

Hydrograph

- As already said a river's regime is shown on a storm hydrograph.
- During a storm most of the rain falls onto the land rather than directly into the river.
- The water then will make its way into the river and you can use a hydrograph to see how quickly this occurs.
- By looking at the peak rainfall and comparing it with the peak discharge you can work out the lag-time (the time between the two peaks).
- Different catchment areas will have different flood hydrographs.
- A river's regime is shown on an annual hydrograph with all the months listed.

Characteristics of a hydrograph



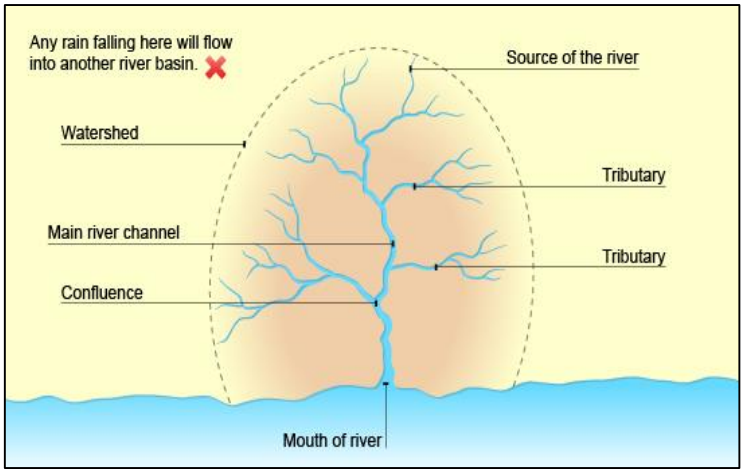
- Peak discharge-shows the maximum amount of flow in the river.
- Peak rainfall-the maximum amount of rainfall and when it fell.
- Lag time-the difference between the peak rainfall and the peak discharge i.e the time it takes for the rain to reach the river.

- A rising limp which shows a rise in discharge.
- A falling limp which shows a fall in discharge.

Factors affecting a river's regime.

- Seasons- there will be a rise in discharge during summer/rain months and a fall in discharge in the dry months when there is little rainfall. There will be a lag time as water moves through the ground and from storages into the stream.
- Climate-rivers that pass through Mediterranean climates tend to have more than one peak period as they have another surge in discharge during the winter months when these regions receive their rains.
- The same is also true of rivers that pass through areas that experience snow for example the Nile's famed floods are due to snow melting in the Kilimanjaro mountains resulting in peak discharge even in the hot dry months as water moves from snow storage e.g. glaciers into the streams.
- Geology for example rivers that flow through porous and pervious rocks tend to have smaller peaks/small changes in discharge as opposed to rivers in granite (non-porous and impervious) rocks.
- Human activities for example urbanisation results in more impervious surfaces and very high peaks, short lag time and higher peaks (differences between the lowest and highest discharge.)

Drainage basin

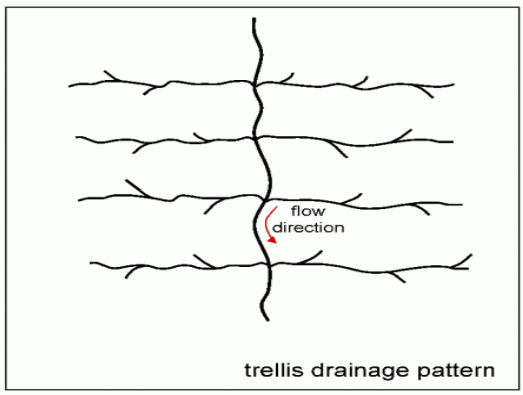


- The term drainage basin refers to an area of land drained by a river and its tributaries (river system).
- It includes water found in the water table and surface run-off.
- The drainage basin is also known as catchment area among an assortment of terms.
- There is an imaginary line separating drainage basins called a watershed.
- Usually, the watershed is a ridge of high land for example mountains forming a boundary between two adjacent drainage basins.
- The point where a river begins is called the source. It is usually in the form of a lake or spring.
- A confluence is the point where two rivers join.
- A tributary is a stream or smaller river that joins a larger river.
- The mouth is the point where a river enters the sea.

Drainage patterns

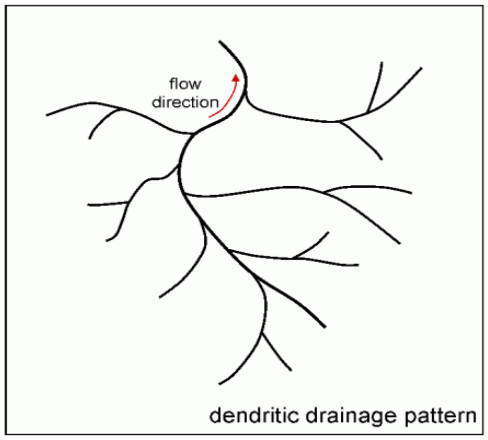
- Drainage pattern is a term that refers to the way in which a river and its tributaries arrange themselves in the drainage basin.
- The drainage pattern evolves over a long period of time and is affected by such factors as the underlying rock, the slope of the land, the existence or nonexistence of fault lines and tectonic movements.
- The most common drainage patterns are: trellis, dendritic, radial, centripetal and parallel.

Trellis



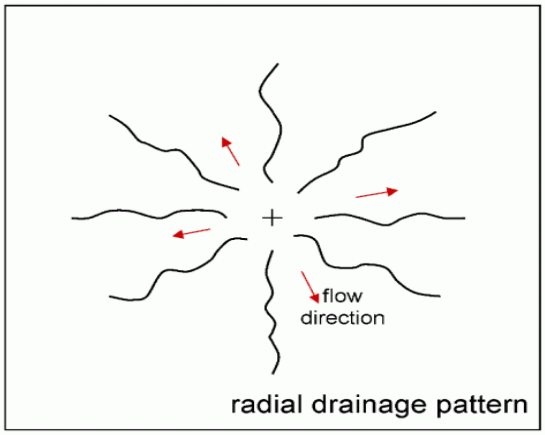
- It is formed where streams join the main river at right angles.
- The trellis pattern develops in areas of alternate hard and soft rocks.
- The main river (also known as the consequent stream) follows the dip of the rocks down the slope after an initial uplift.
- The tributaries (also known as the subsequent streams) which develop along the soft rock join the main stream at right angles.
- These tributaries are at times joined by their own tributaries at more or less right angles.
- Streams that flow against the dip of the rock strata are called obsequent streams.
- In Zimbabwe Trellis drainage is found in the Chimanimani mounts.
- Trellis drainage also occurs along fault lines and rectangular joints in eroded fold mount areas due to headward erosion by streams.

Dendritic



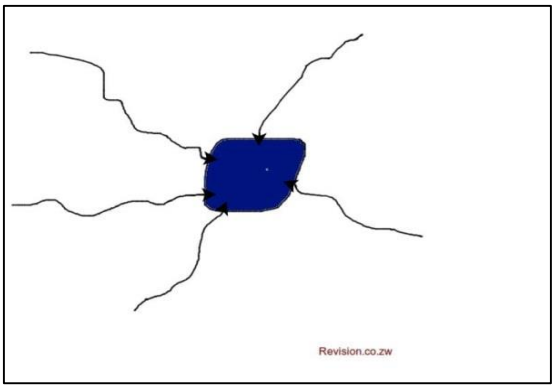
- The word dendritic comes from the Greek dendron meaning tree.
- In dendritic drainage patterns the streams join one another in a shape that looks like the branches of a tree.
- These streams eventually end up as one big river (the trunk).
- The tributaries join each other at acute angles.
- It is commonly found in areas with a uniform rock structure resulting in uniform erosion.
- It is also found in areas which have gentle slopes.

Radial



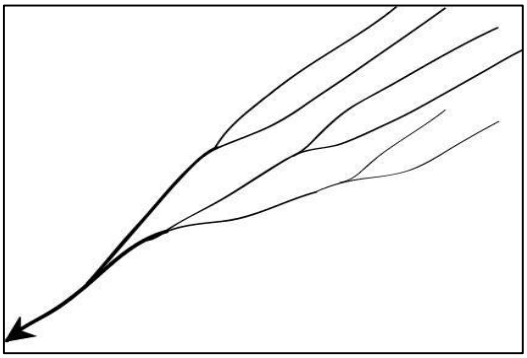
- Is formed where streams drain from a central highland in all directions.
- It is also known as centrifugal and divergent drainage.
- It is common in areas with conical hills and/or domes for example volcanic cones and other conical landforms.
- Streams radiating from these areas can later end up forming other patterns as the flow downstream and meet up with other tributaries.
- In Zimbabwe these type of drainage pattern is found in areas that have granite domes still covered by soil.

Convergent Drainage



- Is found in areas where rivers drain towards a central inland lake, swamp or depression.
- It is in essence an inland drainage system e.g. as in the case of the Dead Sea.
- It is common in inland depressions such as faulted intermontane (between mountains) basins, calderas as well as in arid and semi-arid areas.

Parallel



- Rivers and tributaries flow downhill together in a more or less parallel pattern.

- It is the simplest and most basic drainage pattern.
- It occurs on newly uplifted land or land that is gently sloping allowing rivers and tributaries to flow in parallel channels.
- Examples include the Zambezi and its tributaries.

Multi – Purpose Schemes in Africa

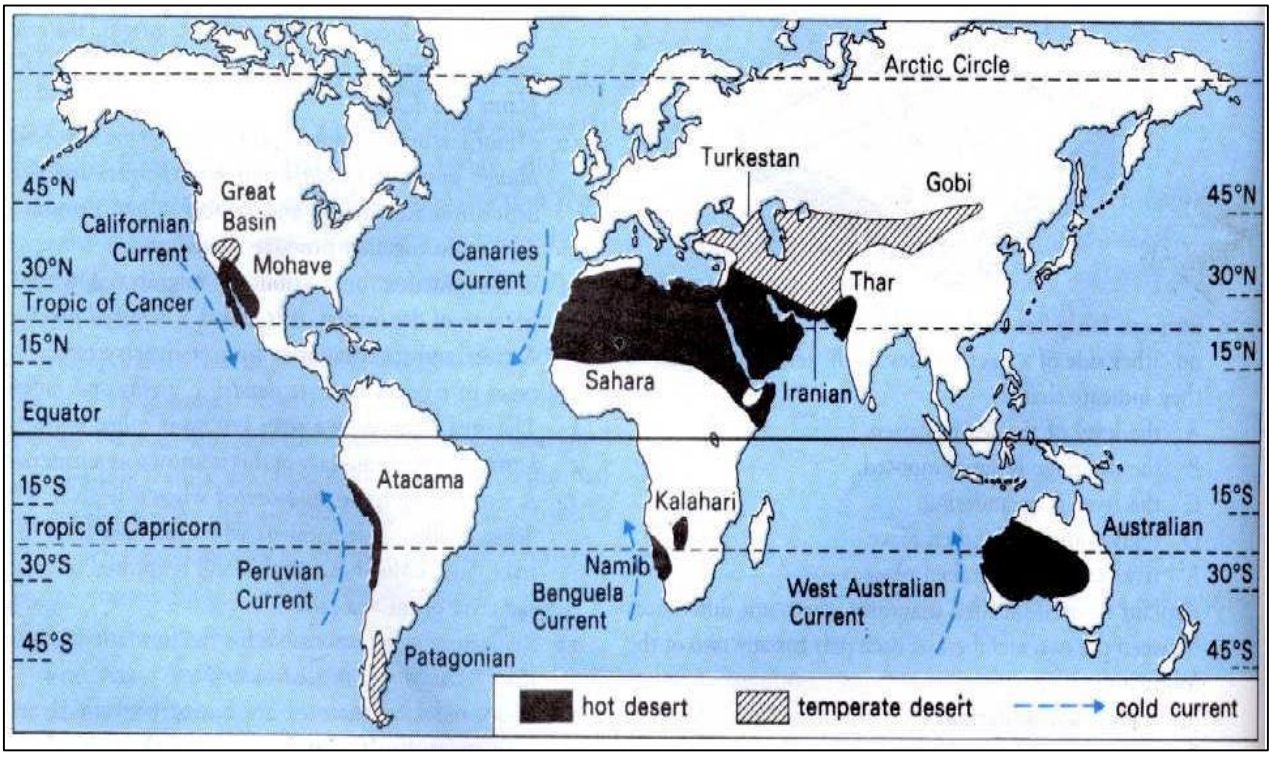
- Kariba project in Zimbabwe, Cabora Bassa in Mozambique, Kafue river project in Zambia, Volta in Ghana, Kaini in Nigeria and Orange River Project in South Africa.
- Zimbabwe has many inland water bodies including Mutirikwi and Lake Kariba on the Zambezi river.

Kariba project

Advantages
a) Provides waater for domestic and industrial purposes.
b) Fishing and tourist centre.
c) Hydro-electric power generating.
d) Irrigation.

Hot Deserts

Location and causes of deserts



- The largest arid and semi-arid deserts occur between latitudes 15° and 30° North and South of the equator.
- Most of these deserts are located on the western sides of the continental masses on which they lie.
- They occur within the Trade wind belt where the winds are off-shore.
  - Off-shore winds are those winds that blow from the shore towards the ocean.
  - These winds (Trade winds) tend to be dry after loosing their moisture as they journey across the eastern side of contents.

- Although west coasts have on-shore winds (winds from the ocean towards the land) blowing towards them, they rarely bring rain.
- This is because the onshore winds meet with cold currents that blow parallel to coast lines (e.g. the Cold Benguela current in the case of the Kalahari and the Cold Angola current in the case of the Namib desert) this causes the moisture within the on-shore winds to condense and form mist, fog and light rain before the winds reach the coast.

- Most of the winds that blow across deserts are land winds which are dry/contain little moisture and therefore do not result in any form of precipitation.
- Some deserts as the Arizona desert are far from oceans, moisture from oceans is exhausted in the form of rainfall in other areas before it reaches these deserts since they are further in the interior.
- Some deserts such as the Gobi Desert, are located in rain shadow areas because they are in depressions or basins.
- Since they are on the leeward side of mountains where warm dry air is sinking they tend to receive little to no rainfall.
- In addition to this the relative humidity of the air mass falls resulting in high evapotranspiration rates thus exacerbating the aridity of deserts while increasing their temperature.
- The Kalahari and Sahara deserts are also located on the rain shadow side of major mountains.
- In Zimbabwe areas like Save valley and major parts of Matabeleland are hot and receive very little rainfall, droughts are frequent and may eventually become deserts.
- Some deserts are located in the sub-tropical high pressure zone 30° North and South of the equator which means winds tend to blow from these areas and dry warm air is sinking creating permanent high pressure belts.
- In some areas as the Patagonian Desert cool off-shore currents prevent local on-shore winds from bringing in rain.
- Most Hot Deserts are increasing in area in a process called desertification.
- Human action sometimes contribute to desertification so in some ways deserts are a man made feature.
- Climate change has also resulted in changes in local rainfall patterns with increased incidence of droughts in places like Somalia where rainfall might not fall for years on end.

Wind action

- Wind action in deserts are also known as aeolian processes.
- Wind is responsible for eroding, transporting and depositing materials in deserts.

Wind erosion

- Wind is a process where the wind detaches soil particles from the land surface and transports them by its force along the surface of the ground.

Erosion

- Wind erosion involves three main processes: deflation, abrasion and attrition.

a) Deflation

- This is the progressive removal of fine material by wind leaving reg landscapes behind.
- By blowing away sand and other rock waste, the wind lowers the desert surface producing depressions known as closed depressions or deflation hollows.
- Because the finer material is composed of smaller particles, it is lifted off and carried away by the force of the wind.
- The deflation process provides the supply of sand used to build up sand dunes in other parts of the desert.
-

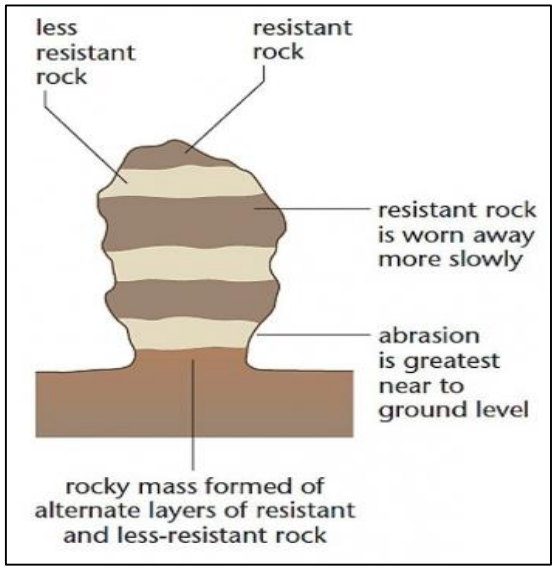
b) Abrasion

- is the sandblasting action produced by materials during saltation as they are transported by wind.
- This process smooths, pits, polishes and wears away rocks that are close to the ground.
- Since sand particles cannot be lifted up very high off the ground the zone of maximum erosion tends to be within about 1 meter from the desert surface.
- This sometimes results in undercutting of effects on rocks.
- Large rocks are polished on their windward sides and rocks that are not uniform like granite are turned into spongy, pitted, rough surfaces due to some minerals being softer than others.
- Pebbles and small rocks are shaped into ventifacts with polished windward sides. see diagram above.

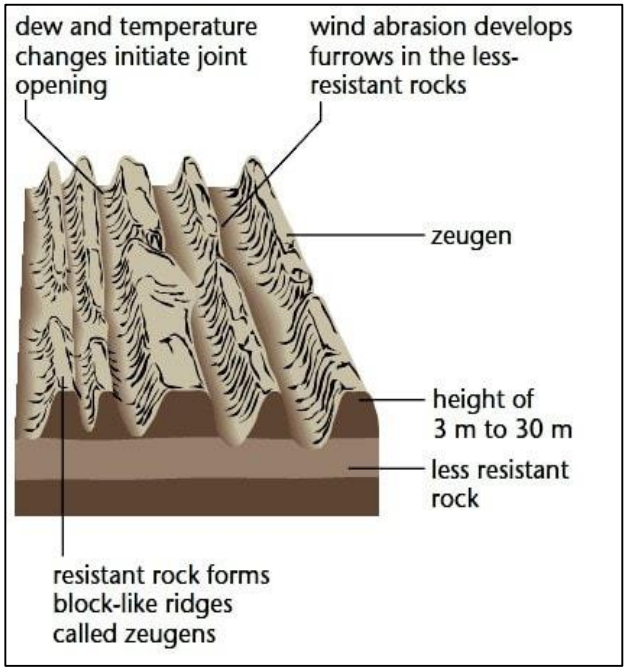
c) Attrition
- Is the process by which large rock particles roll and rub against each other and wear away.
- This happens during the wind transportation processes.
- This process produces sand particles that are rounded into particles about the size of millet seeds.

Landforms produced by wind erosion

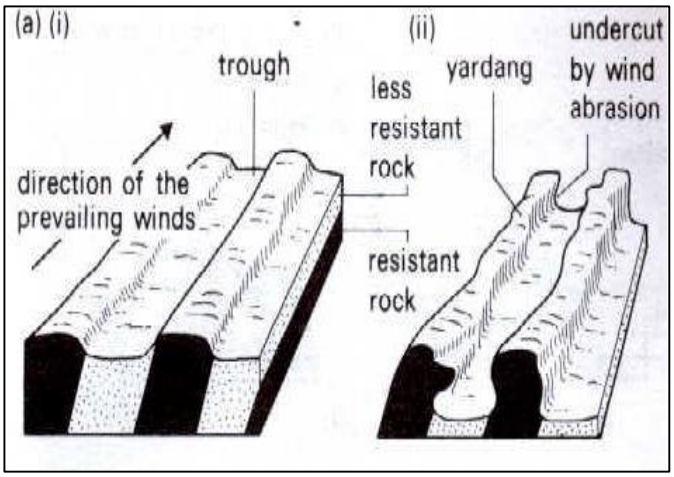
Rock pedestals
- Wind abrasion attacks rock masses and sculptures them into strange shapes.



Zeugen
- Wind abrasion turns a rock surface with layers of horizontal resistant rock underlain a non-resistant rock into a ridge and furrow.



Yardang
- Develops when bands of hand and soft rock lie parallel to prevailing winds, wind abrasion produces a ridge and a furrow e.g. Salah in Algeria.



Landforms by wind deposition

Sand dunes

- As soon as wind velocity drops wind deposition occurs.
- The heaviest material is deposited first while the finer material and dust is carried further before being dropped.
- As a result loess (which consists of fine particles) is sometimes deposited thousands of kilometers from deserts.
- Large mounds of sand result from sand depositions within the desert.
- These result in the formation of erg landscapes such as those found in the Sahara.
- Three major types of features result from wind deposition and form part of the erg landscape: sand ripples, barchan dunes and seif dunes.

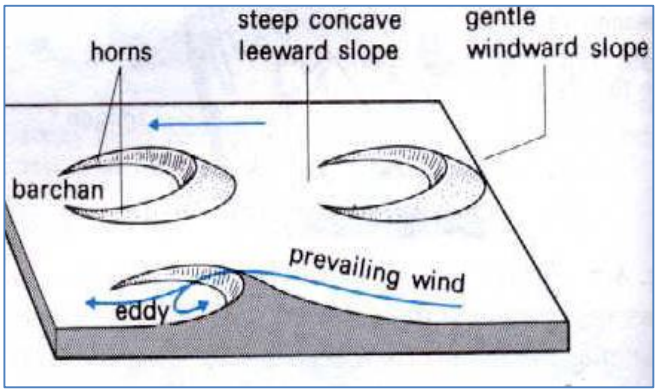
Sand ripples

- These are small wave-like features which develop on sand which move easily.
- They range from a few centimeters to about a meter in height
- They are often temporary and suffer destruction when the wind changes direction.

Sand Dunes

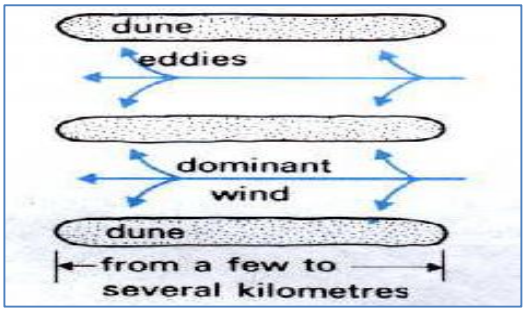
- These are hills of sand which are found in a variety of shape,size and direction.
- Dunes develop when sand grains moved by saltation and surface creep are deposited (remember suspension material forms loess which is deposited outside deserts).
- Some dunes, but not all, form around obstacles such as trees, bushes, rocks, a small hill or even a dead animal.
- Most dunes form on areas that are flat and sandy rather than those areas that are rocky and uneven.
- Dunes vary in size from a few meters to over a 100 meters in height.
- Although they take many shapes, there are two common types of dunes: Barchan and Seif dunes.

Barchan



- A barchan dune is a small crescent shaped dune.
- It has a height can range from a few meters to about 30 meters in height and it can be 400 meters wide..
- They lie at right angles to the prevailing wind.
- It has its “horns” pointing downwind.
- They usually form around an obstacle such as a rock, piece of vegetation or even a dead animal.
- As the mound, which is wind ward grows due to continued sand depositions,
- Its leading edges are slowly carried forward in a downwind direction.
- The windward slope of the dune is gentle.
- The downwind side is steep and slightly curved.
- This is caused by eddies that are set up by the prevailing wind.
- A barchan dune moves as grains of sand are moved up the windward slope to fall onto the leeward side.
- They can occur both singly or in groups.

Seif dunes

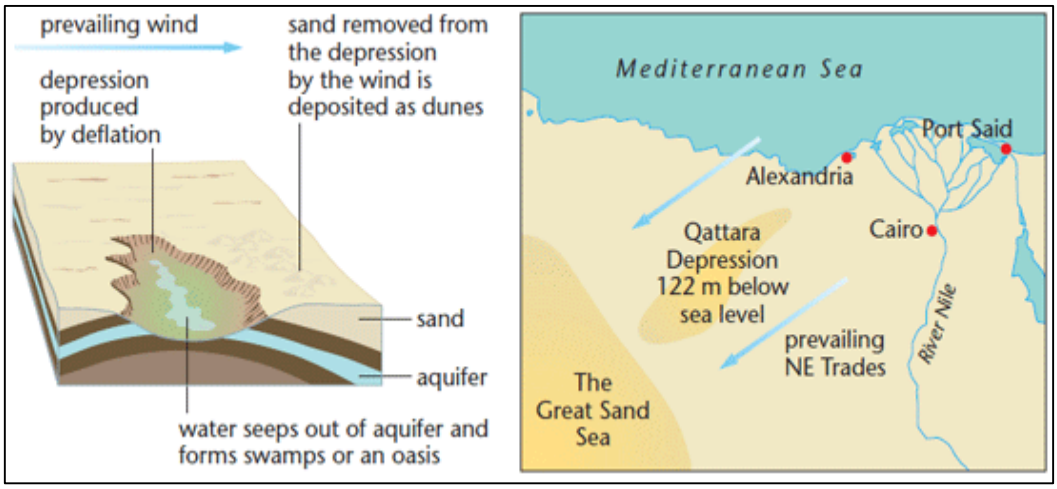


- Are also known as transverse dunes, linear dunes.
- They are ridge-shaped with steep sides and lie parallel to the prevailing wind.
- They are also formed and appear parallel to each other.
- A seif dune has a sharp crest which may be a 100 meters in height and they can stretch for up to 150 kilometers in length.
- They are separated by flat corridors which are between 25 and 400 meters wide.
- These corridors are swept clear of sand by the prevailing wind.
- Eddies blow up against the sides of dunes and drop deposit sand that is added to the dunes.
- They usually develop from small sand ridges.
- They slowly move forward in the direction of the prevailing wind as they move forward.
- They feature in parts of the Namib Desert and the Sahara Deserts as well as other deserts.

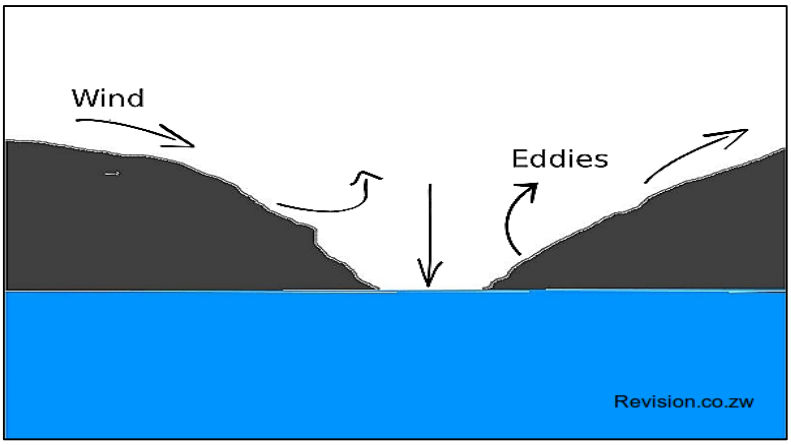
Deflation hollows

- Are also known as closed hollows or blowouts
- These are enclosed depressions caused by wind erosion.
- In deserts the wind erodes loose material from flat areas which have, uncemented sediments such as those occurring in tropical deserts.
- Deflation hollows develop in areas where the transported materials is deposited.
- As already mentioned deposition occurs when the wind meets with an impediment.
- Deflation hollows are usually formed on surfaces patches where the protective vegetative cover has been lost for example due to human activities or periods of extended droughts.
- Since that portion becomes unprotected, the wind deflates and scours continuously at relatively unconsolidated material,
- The material is deposited on the edges of the hollow that are still protected by vegetation such as marram grass.
- The removal of the fine particles the lowering of the landform leads to the formation of a depression.
- An example is the Qattara Depression
- Sometimes water that falls in these depression hollows during freak storms collects to form pools in the midst of deserts providing an essential source of water for local ecosystems, animals and humans and their activities.
- If an area is eroded down to the water table, further deflation is prevented unless the water table is also lowered by evaporation.

The Qattara Deflation hollow



A diagram showing the formation of deflation hollows.



- Some oases in the Sahara were formed in this manner and may be below sea level.
- Dunes are made from sand that is deposited at the leeward side of the wind.
- Some deflation hollows may be formed in part due to the presence of faults within the rocks which are exploited and widened by weathering and the regolith removed by wind erosion.
- Note: all oasis are formed by deflation some are naturally occurring springs and some result as a result of freak storms and the underlying geological rocks limiting the amount of infiltration.

Water action

Water action in deserts can be divided into three:

- freak storms or rain that falls sometimes in semi-arid regions, dew which plays formed as a result of temperatures falling below dew point at night in deserts and play an important role in chemical weathering, water action in deserts as a result of past pluvial periods.
- Various landforms result from water erosion and deposition in deserts viz: Wadis, Mesas and Buttes, Bahadas, Playas

Water action

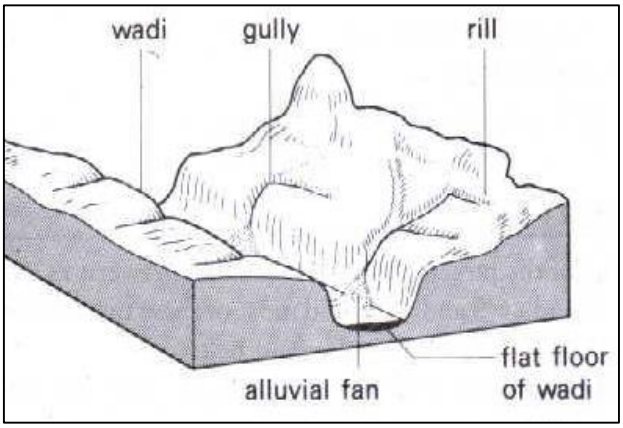
- In most deserts no rain does not fall for several years.
- When it does it comes in the form of unexpected and infrequent downpours.
- Therefore despite the low rainfall totals (about 250mm per annum), water is still a dominant agent of erosion and deposition.
- This is especially true in semi-arid deserts like the Kalahari where rain falls more frequently.
- Dew also forms in deserts where temperatures, due to relatively little cover resulting in temperatures falling below dew point, is also found in deserts where it plays an important role in chemical weathering.
- The infrequent but violent thunderstorms result in rushing torrents in steep slopes and to sheet floods on gentle slopes
- The run-off is more pronounced due to the relative lack of vegetation in desert landscapes.
- The run-off on steep slopes is usually in the form of rills/shallow grooves which link up to form gullies.
- These lead in turn to wadis/chebkas
- During these storms water may flow in these wadis as flash floods and as they progress and carry more and more materials they may turn into mud flows.
- The mud is later deposited and forms features known as alluvial fans.

Past pluvial periods

- Even though some places in deserts do not receive rain at all for years on end,
- There is evidence for example, paleolithic marks on some desert rocks,

- This evidence proves that deserts had more pluvial (humid) conditions that current arid conditions in the past.
- Some wadis, dry river channels and gullies may have been formed during these pluvial periods.

Wadis / canyon



- As already pointed out freak storms occur in deserts characterised by excessive precipitation over short periods of time.
- Due to infiltration excess flow and even saturation excess flow there is significant run off in the form of sheet floods,
- This flow occurs in the form of rills which later join to form gullies which in turn form into wadis,
- These are deep canyons resulting from sustained erosion, the have steep banks and flat floors.
- At times the floor may have material deposited by stream floods.
- Wadis may also be formed by stream floods which erode valley sides although some wadis can be dry and only have water during and in the immediate aftermath of these storms.
- An example is the Grand Canyon in the United States.

Alluvial fans/Bahadas/Bajadas

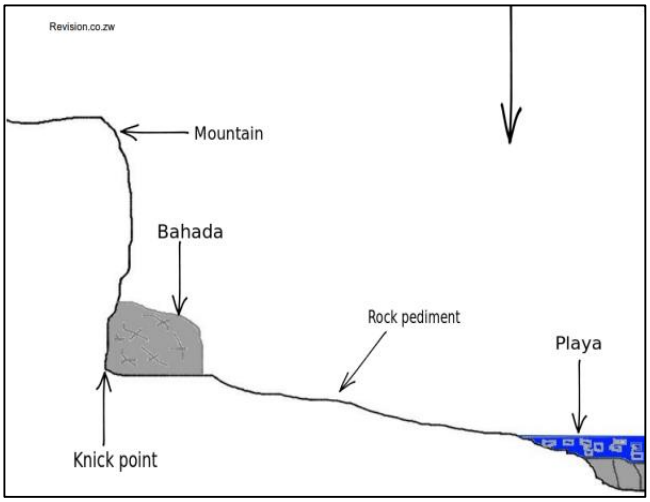
- During the sudden rain storms, flash floods rush down the wadis,
- They carry large amounts of materials including a lot of silt (all this material is referred alluvium) forming a mud flow
- As the water dissipates after the end of the storm and when its looses its energy upon reaching less steep slopes the alluvium is deposited to form fan shaped features at the base of the piedmont zone.

Desert piedmont zone

- Is made up of water landforms formed by erosion, transportation and deposition.
- The landforms found on the piedmont zone include: mountain front, bahada, peri pediment, playa and rock pediment.

The desert peidmont zone.

Features of a piedmont zone.



Mountain Front

- It is formed as a result of erosion along a steep slope and sometimes as a result of headward erosion.
- It may also be a made up of large rock boulders resulting from weathering.

Bahada
- A depositional feature see above.

Knickpoint
- A sharp change in profile that marks the transition from the mountain front into a pediment.

Rock pediment
- It is the gentle slope that starts at the knickpoint at the foot of the mountain.
- This may be made out of bare rock or it can be covered in alluvium deposited during floods

Peripediment
- It is made up of deposited material washed across the pediment.
- The peri pediment is a depositional feature that is formed in the same way as bajadas but it is larger.

Playas

- These are sometimes known as inland drainage basins.
- Due to the fact that there are no permanent drainage patterns in deserts any rain that falls either evaporates or infiltrates into the soil or runs off and drains into basins.
- Basins are depressions.
- When rain falls temporary rivers that flow in canyons/ bahadas are formed and these may eventually drain in a basin/depression.
- These rivers form lakes in these depressions.
- When these lakes dry up due to evaporation they are turned into salt flats.
- These temporary lakes and salt flats are known as playas or sebkhas.

- Examples of these can be found in the Sahara desert.

- When alluvium is deposited at the edge and overlies the edge of the pediment around the playa it is known as a peri-pediment.
- Most deserts are characterised by inland drainage basins as few rivers e.g. the Nile have enough water supply to flow and persist through the deserts.
- Most form inland drainage basins/lakes/playas.

Human activity in deserts

Desertification

- Desertification refers to the spread of desert conditions for example resulting in aridity or semi-arid conditions and scant vegetation cover in the encroached area.
- Desertification is therefore the spread of deserts as well as a reduction in the biological productivity of a given piece of land.
- It is also attributed to a process by which previously productive land turns into a desert like land and its agricultural productiveness drops by ten percent or more due to natural and human factors.
- A more comprehensive definition might define desertification as an enviromental degradation process brought about by both natural causes (e.g. chronic droughts) and excessive human activities (such as climate change and deforestation) resulting in the fall in productivity of a given piece of land and the spread of desert like conditions to the affected piece of land.

Natural factors that lead to desertification

- Climate change for example a reduction in the amount of rainfall received at a given area or increases in evapotranspiration rates can lead to desertification.
- The El Nino effect resulting in droughts.
- Acid rain leads to the reduction of land productivity.
- A land's distance from the sea.
- Continental drift for example most of the Sahara desert enjoyed pluvial periods during the so called Quaternary era when the African plate was further south that it currently is and the Sahara region occupied the latitudes currently occupied by the present day Savannah regions.

Human factors

- Deforestation as people cut down trees for use as firewood, thatching, making furniture and other industrial and domestic uses.
- The clearing of land for agricultural use.
- Overgrazing for example in the Sahel region.
- Overpopulation as more population increases are not matched with increases in resources.
- Expansion of human settlements such as towns and land is cleared for industrial and residential use.
- Mining activities for example open cast mining and oil mining which leads to oil spills and destruction of vegetation.
- Salinisation which makes soils less fertile and makes vegetation growth impossible.

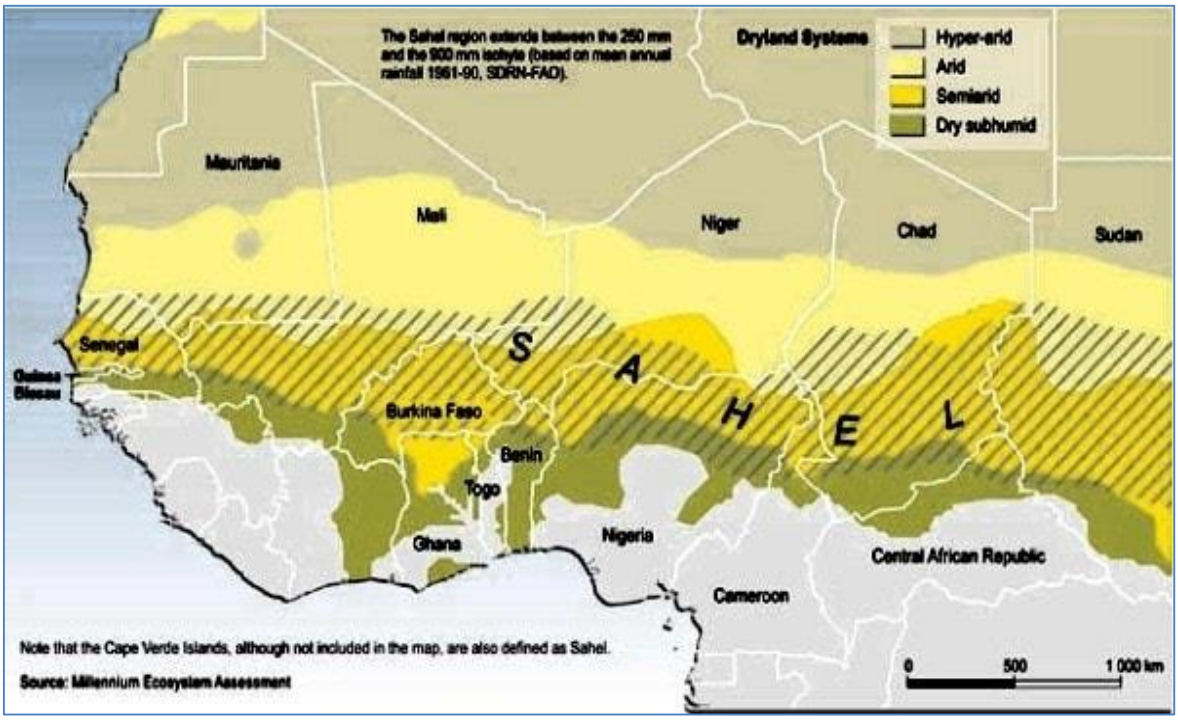
Effects of desertification

- A reduction in vegetative cover due to deforestation and drought.
- Barren sandy soils and sometimes soil hardening.
- Increased surface runoff due to reduced vegetative cover resulting in the formation of gullies and dongas.
- Reduced soil fertility.
- Reduced productive capacity of agricultural land.
- Reduced land carrying capacity.
- Death of livestock as a result of water and pasture shortage.
- Water and pasture shortages.
- Famine and starvation.
- Reduction in annual rainfall and persistent droughts.

Solutions

- Afforestation that is planting trees where none previously existed.
- Fallowing-allowing fields to fallow instead of growing crops on them continuously.
- Legislation-passing laws that favour conservative farming methods and practices and penalises those who do not follow the practices.
- Educating people about the impact of poor farming methods and schooling them on the best farming methods available to them.
- Planting trees lines for example gum trees to act as wind breaks and lessen the impact of wind erosion.
- Dam construction-for use in irrigation schemes and to provide alternative hydro-electric energy instead of relying on firewood.
- Practice irrigation for example using oases and rivers such as the Nile river.
- Limit settlements near water sources such as oases.
- Construct contours to conserve land and lessen the effects of erosion.
- Terracing to lessen the impact of erosion.
- Paddocking to implement controlled grazing and prevent overgrazing.
- Practice crop rotation.
- Create sand embankments.
- Fencing to protect forests.
- Grow drought resistant crops such as sorghum or practice activities such as extensive cattle ranching that put less pressure on pastures.
- Use alternative sources of fuel instead of firewood for example LP Gas.

Case Study
Example of desertification (Sahel Region)



- The Sahel is the semi-arid transition region between the Sahara desert to the north and wetter regions of equatorial Africa to the south.
- It extends from the Atlantic in the west to the Indian Ocean in the east.
- Its annual rainfall varies widely from year to year, and the land consists of stabilized ancient sand seas is one of the poorest and most environmentally degraded areas of the world.
- It forms a boundary between the Sahara and the wetter parts of Africa.

- The Sahara desert is slowly encroaching on Sahel land due to overpopulation and overgrazing, persistent droughts, erratic rainfall and climate change.
- The area has been plagued by persistent droughts.
- The drought was partly caused by natural causes in the form of climate change.
- The harmattan winds that affect the area are dry because they come from the Atlas mountains.
- Human activities have also contributed to the desertification in the area.
- The people of the region practice Nomadic pastoralism, moving from place to place looking for fresh pastures.
- This movement has caused deforestation and overgrazing as more and more animals grazed repeatedly on the same piece of land.
- This resulted in the degradation of the land whose productivity decreased.
- This meant that less productive land would be available while the number of animals kept and keeps increasing worsening the situation.

Effects of desertification in the Sahel

- Drying up of wells and springs
- Destruction of pastures.
- Loss of life due to droughts and famine. A quarter of the people in the region died in the droughts of the 1970s.
- A massive influx of refugees into the adjacent countries of Mali and Niger resulting in semi-permanent camps which usually have unsanitary living conditions.
- Loss of livelihood as animals died.

Reaction

- UNESCO held a meeting in Nairobi Kenya to alert the world about the disaster.
- They also provided food and water to the affected people.
- Other international relief agencies such as UNICEF and the Red Cross were involved.
- Concerted efforts have also been made to educate the people of Sahel on the effects overpopulation, overgrazing and conservation methods.

BIOTIC STUDIES

Deforestation in tropical rainforests

- Tropical rain forest areas include Amazon Basin, coast West of Africa, Congo basin and South East Asia.

Deforestation is the cutting down of trees without replacing them (Chenje et al 1998) or permanent destruction of indigenous forests and woodlands.

Reasons for deforestation
- Agriculture; plantations and ranching.
- For building materials and fencing.
- For logging of hardwoods to export to developed countries.
- For firewood.
- Road, dam and H.E.P construction.

Challenges in exploitation of tropical forests
- Wet and muddy conditions.
- Thickness of forests making transport and felling difficult.
- Pests and diseases.
- Hot humid condition not suitable for human labour force.

Effects of deforestation

- Damage to habitat, loss of biodiversity.
- It has adverse impacts on bio sequestration of atmospheric carbon dioxide. Bio sequestration is the capture and storage of the atmospheric greenhouse gas carbon dioxide by biological processes.
- Adverse soil erosion and lands degrade into wastelands.
- Disruption of the water cycle.
- Flooding and Drought.
- Climate Change.

Solutions

- Reforestation and afforestation.
- Recycling.
- Environmental education.
- Rural electrification.
- Using other alternative sources of energy like solar and gas.
- Fine and imprisonment of environmental offenders.

Soil erosion in tropical savanna

- Soil is the uppermost layer of earth's crust, which supports growth of plants.
- Soil is a renewable as well as non-renewable resource.
- Soil is renewable because its productivity can be maintained with fertilizers and manures rich in humus.
- If the soil has been removed from a certain place by erosion, it is practically non-renewable because formation of new soil may take hundreds and thousands of years.

Soil formation

1. Regolith - Loose broken material due to weathering of rock or deposition of alluvium, drift loess and volcanic material.

2. Formation of topsoil by adding water, gasses, living organisms, and decayed organic matter (humus).

- Five major factors of soil formation - Time, parent materials, climate, living organisms, topography

Soil composition and properties

- Components of soil - mineral matter (45%), inorganic matter (5%), soil water (25%), soil air (25%).
- Inorganic Matter - Provide minerals required for plant growth
- Soil Water - Derived from rainfall and is important for regulating temperature, dissolving nutrients.
- Soil Air - Plants and animals gain oxygen for metabolism from soil air

Soil profile and characteristics

- Characteristics of soil are influenced by - Vegetation, parent rock, climate and weathering
- Properties of soil - Soil profile, soil depth, soil colour, soil texture, soil porosity, soil structure.
  a. Soil Profile - A vertical cross-section of the soil showing its horizons.
  b. Soil Depth - Varying properties depending on the maturity of the soil and nature of rocks below.
  c. Soil Colour - Colour is determined by mineralogical composition of the soil.
  d. Soil Texture - The degree of coarseness or fineness of a soil.
  e. Soil Porosity - Total volume of pores or empty spaces between particles of soil material.
  f. Soil Structure - Refers to the arrangement of soil particles

- Factors influencing soil fertility - Presence of mineral plant nutrients, presence of water, presence of air, soil pH, soil, presence of colloids, presence of organisms
- Loss of soil fertility - Leaching, over-cultivation, monoculture, soil pollution, soil erosion, mass wasting, loss of water in the soil

Simple soil classification

- Podzol - The group of soils which occur mostly in moist cool temperate climates.
- Clay Soil - Is a naturally occurring material composed primarily of fine-grained minerals
- Laterites (Red Lateric Soil) - Are soil types rich in iron (causing red from oxidation) and aluminum, formed in hot and wet tropical areas.
- Loam - Is soil composed of sand, silt, and clay in relatively even concentration.

Leaching - Is the loss of plant nutrients from the soil, contributes to groundwater contamination.
Humus - Refers to any organic matter that has reached a point of stability, where it will break down no further and might, if conditions do not change, remain essentially as it is for centuries, if not millennia

Types of soil
- Azonal, intrazonal, zonal

Azonal Soil

- Are without well-developed characteristics due either to their youth or to some condition of relief or parent material which prevent soil development, Soils forming in recent eolian, alluvial and colluvial deposits are azonal

Intrazonal Soil

- Have well defined soil profile characteristics that reflect the dominant influence of some factor of relief or parent material over the classic zonal effects of climate and vegetation

Zonal Soil

- Soils with clearly distinguishable horizons which occur in definite regions of climate and vegetation

Soil Erosion

- Erosion literally means "to wear away" or removal and detachment of soil from the earth`s surface is called soil erosion.

Causes of soil Erosion
- Natural causes; and Anthropogenic causes (human generated causes)

Natural Causes
- Natural agents like wind and water – high velocity winds and running water over lands.

Human generated causes
- Deforestation.
- Poor farming methods.
- Overgrazing

Conservation of Soil

Soil conservation means checking soil erosion and improving soil fertility by adopting various methods.
- Maintenance of soil fertility by adding manure and fertilizers as by rotation of crop.
- Control on grazing through paddock system.
- Reforestation.
- Terracing - dividing a slope into several flat fields to control rapid run of water.
- Contour ploughing.
- Ploughing across slopes.

Wetlands

The Environmental Management Act (Cap 20; 27) define wetlands as : "Areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including riparian land adjacent to the wetland".

- In Zimbabwe, wetlands cover approximately 4.6 percent of the land; vleis are the most dominant as they cover 3.6 percent of the land area and it is estimated that there are 1 262 000 hectares of wetlands.
- In Zimbabwe wetlands are also known as Matoro (Shona), Mapani (Shona) and Amaxhaphozi (Ndebele).
- Zimbabwe is a Signatory to the Ramsar Convention on Wetlands of 1971 and has domesticated provisions for the protection of wetlands under the Environmental Management Act (Cap 20;27), Statutory Instrument 7 of 2007 on Environmental Management (Environmental Impact Assessment and Ecosystems Protection) and Regulations and Government Gazette 380 of 2013.
- The Ramsar Convention embodies commitments by member countries to maintain the ecological character of wetlands and to plan for the "wise use" or sustainable use of all of the wetlands in their territories.

- In Zimbabwe seven sites have been designated as Ramsar protected wetlands and these are: Victoria Falls, Driefontein, Middle Zambezi/Mana Pools, Lake Chivero, Monavale Vlei, Chinhoyi Caves and Cleverland Dam.
- The Government Gazette 380 of 2013 declares 26 wetlands in Harare as protected areas. These include Mabvuku, Honeydew, Balantayne Park etc.

Importance

a) Provide important habitat for a wide variety of wildlife.
b) Ensure food security if sustainably utilized.
c) Trap moderate amounts of soil running off nearby uplands before they enter lakes and streams.
d) Maintain and improve water quality by filtering contaminants and excessive nutrients.
e) Renew groundwater supplies.
f) Help and control flooding and reduce flood damage.
g) Fire control.
h) Provide a source of economically valuable products such as wild rice and commercial fish.
i) Support recreational activities including fish, hunting, nature appreciation, bird watching and so much more.
j) Provide opportunities to participate in outdoor educational activities and to enjoy the aesthetic qualities of wetlands.

However, settling in wetlands makes the spreading of water-borne diseases easy. Diseases such as cholera, typhoid, dysentery, and diarrhoea among others thrive in such environments.

Causes of Wetland degradation

- Agricultural activities.
- Drilling of boreholes.
- Commercial and residential development; road construction; impoundment; resource extraction; industrial siting, processes, and waste; dredge disposal; care and cultivation of forest trees (silviculture); and mosquito control through drainage, channelization and use of toxic pesticides.

What does the law say?

- The Environmental Management Act (CAP 20:27) and Statutory Instrument 7 of 2007 Environmental Management (EIA and Ecosystems Protection Regulations) govern wetland utilisation in Zimbabwe.
- Section 113 of the Environmental Management Act (Chapter 20:27) section 113 gives the Minister of Environment powers to declare any wetland to be an ecologically sensitive area and may impose limitations on development in or around such an area.
- Prohibit the reclamation or drainage, disturbance by drilling or tunnelling in a manner that has or is likely to have an adverse impact on any wetland or adversely affect any animal or plant life therein.
- Prohibit the introduction of exotic animal and plant species into a wetland.
- Failure to abide by the law is a crime that attracts a fine not exceeding level eight ($500, 00) or to imprisonment not exceeding two years or to both such fine and such imprisonment.

Measures

- Plant native species to maintain the natural balance of the wetland. The plants in and around a wetland trap and filter out sediments and chemical pollutants and aid in groundwater recharge by retaining runoff waters;
- Direct storm water into wetlands especially in urban areas because they supply much of the water necessary to maintain wetlands.
- Maintain a green belt around the wetland.
- Fence the wetland against animals that may destroy vegetation.
- Do not cut down trees and clear grass.

- Do not introduce non-native (exotic) plants as they damage or ruin ecosystems e.g. gum trees drain a lot of water.
- Use organic manure instead of fertilizers and pesticides.
- Avoid dumping waste on wetlands, this causes land and water pollution.

World Wetlands Day Commemoration is on the **2nd of February each year**.

NATURAL RESOURCE STUDIES

Types of natural Resources

Non-renewable energy: Energy that cannot be reproduced in the time that it takes to consume it e.g. coal.
Renewable energy: Energy that is naturally occurring and potentially infinite.
Fossil fuels: Any combustible organic matter that is made from the remains of former flora and fauna.
Raw material: Any unprocessed material.

Global Energy

- As the world's population continues to grow and as peoples level of development continues to grow, so does the demand for energy. In traditional less developed societies the main source of energy tends to be fuelwood. Fuelwood can be used for heating, cooking and even scaring away wild animals.
- As countries begin to develop they can begin to afford to buy raw materials and to build power stations. Most commonly fossil fuels are burned because the technology exists and at the moment they are widely available.
- However, as countries develop further their sources of energy may change again. They will probably still be heavily dependent on fossil fuels, but will begin to use more renewable energy and probably more nuclear. The reasons for the change include:

- Greater concern for the environment.t
- Rising prices of fossil fuels.
- Aim to reduce reliance on fossil fuel exporting countries.
- Improvements in renewable technology.
- The hope of developing and selling renewable technology
- Better technology and increased stability allowing nuclear development

Type of non-renewable energy (fossil fuel)

Coal
Advantages

1. Energy production using coal can be increased or decreased according to demand
2. The technology to burn coal to generate electricity already exists

Disadvantages

1. Coal is finite so will eventually run out.
2. Many existing reserves are becoming harder to extract or are in environmentally sensitive areas
3. Coal releases large amounts of greenhouses gases when burnt
4. Mining deep underground coal is very dangerous
5. Coal is very bulky and expensive to transport around the world

Thermal Power

- Fuel such as coal, oil and natural gas can be used to heat water in huge boilers to produce steam.
- The steam at high pressure turns turbines.
- Turbines turn generators to produce electricity.
- E.g. Hwange and Munyati power station.

Locational factors

- Near fuel source e.g. S.E Lowveld uses baggase from sugarcane.
- Market based.
- Flat land.
- Near large rivers or source of sufficient water.
- Transport.

Oil
Advantages

1. Energy production using oil can be increased or decreased according to demand
2. The technology to burn oil to generate electricity already exists
3. Technology is improving to extract deeper reserves as well oil in tar sands (Canada).

Disadvantages

1. Oil is finite so will eventually run out
2. A lot of oil is located in politically unstable countries or environmentally sensitive areas e.g. Libya and Iraq.
3. Oil can cause widespread pollution when spilt
4. Oil releases large amounts of greenhouse gases when burnt
5. Oil is vulnerable to large scale changes in its price
6. The production of oil refineries is expensive

Gas
Advantages

1. Energy production using gas can be increased or decreased according to demand
2. The technology to burn gas to generate electricity already exists

Disadvantages

1. Burning gas releases less greenhouses gases then coal and oil
2. It is now possible to compress gas and transport it more easily.
3. Gas is finite so will eventually run out
4. A lot of gas is located in politically unstable countries or environmentally sensitive areas.
5. Gas is vulnerable to leaks and explosions

Type of Renewable Energy

Solar: Using the power of the sun to heat water or generate electricity.
Advantages

1. It is a clean form of energy
2. It is an infinite resource
3. Panels can be used locally e.g. on top of someone`s house.
4. It can be used to heat water and generate electricity.

Disadvantages

1. It is expensive to make solar panels.
2. The sun does not shine all the time.
3. Not every country gets adequate levels of sun.
4. They can't be used at night.

5. It is hard store surplus energy.
6. Supply does not always equal demand.

Wind
Using the power of the wind to drive a turbine to generate electricity.

1. Advantages
2. It is a clean form of energy
3. It is an infinite resource
4. It can be used on a local scale e.g. in your back garden
5. Technology is proven
6. They can be placed at sea on in mountains away from settlements

Disadvantages

1. Visual pollution.
2. Noise pollution.
3. Wind is unreliable.
4. They are expensive to install, especially offshore.
5. It is hard to store surplus energy.
6. They have to be turned off in very strong winds.

Tidal
Using the incoming and outgoing motion of the tide to generate electricity.
Advantages

1. It is a clean form of energy.
2. It is an infinite resource, tides happen twice a day.
3. Ideal for island countries.

Disadvantages

1. It can block important shipping routes
2. May interfere with some animals e.g. sea otters and seals
3. Limited number of sites
4. Useless for landlocked countries
5. High start up costs. The technology is still being developed
6. May be damaged by tropical storms

Wave
Using the motion of waves to generate electricity.
Advantages

1. It is a clean form of energy
2. It is an infinite resource
3. Ideal for island countries.

Disadvantages

1. Again it can block shipping routes and interfere with animals.
2. Again not suitable for landlocked countries.
3. The strength of waves can vary
4. May be damaged by tropical storms
5. The technology is still being developed.

HEP (Hydroelectric power)

- Using the power of falling water in rivers to drive generators.

Advantages

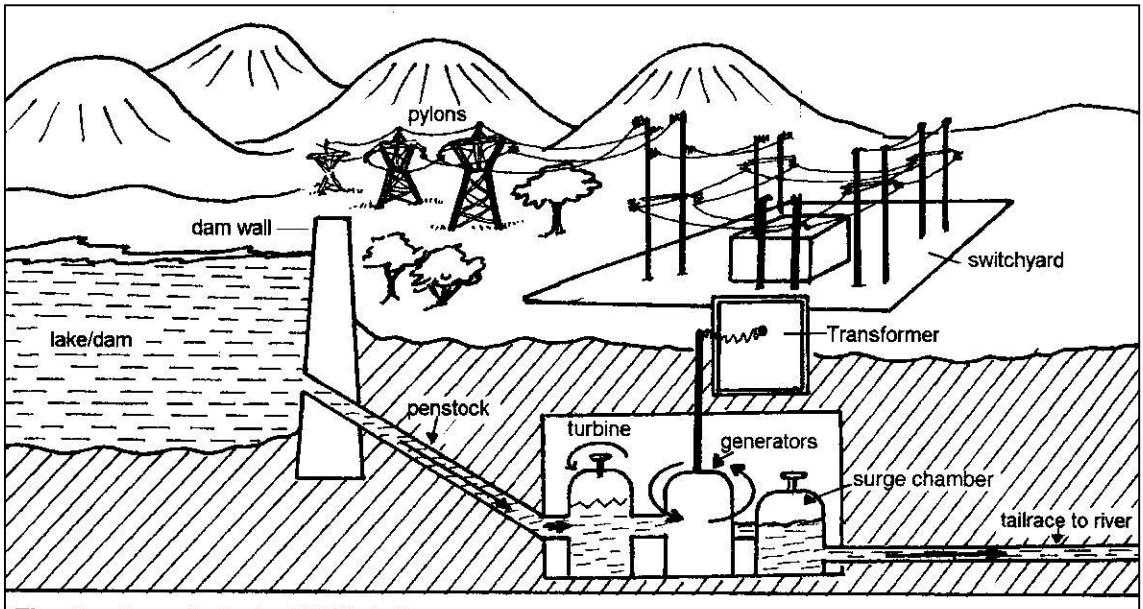
1. It is a clean form of energy
2. It is finite as long as rivers are managed properly.
3. The built dam can also prevent flooding.
4. The reservoir behind the dam can be a store of water.

Disadvantages

1. Only a limited number of suitable rivers.
2. Can hamper navigation up and down river.
3. Reservoirs may force resettlement.
4. Migration patterns of animals may be disrupted.
5. Dams reduce the deposition of alluvium downstream.
6. Dams can flood large areas of land.

Hydro – electric power generation at Kariba

- Water leaves the lake (head of water) at high pressure and goes through the penstocks (concrete and steel pipes).
- The larger the depth of water, the more the pressure hence high electricity generation.
- High speed water hits cups of turbines.
- Turbines start spinning and rotating.
- They in turn generators to which they are attached with pistons.
- Generators produce electricity.
- The water passes through surge chambers and return back to the river through trailrail pipes.
- Electricity is transmitted to huge transformer which regulates the power .
- Electricity is transmitted through cables to homes for use.



The structure of a typical HEP station

Siting and production of HEP

Factors

- A gorge and water falls – much water in the narrow valley, a large head of water at the falls, low cost of construction, firm dam wall on hard rocks e.g Kariba gorge, Cabora Basa gorge in Mozambique.
- Large perennial rivers for large volumes of water e.g. Zambezi river.
- Space for dam construction and the scheme, thus why people have to be relocated to other areas.
- Income since it`s expensive to erect the project.
- Demand.

Biofuels

The use of biological matter to create energy. It is a renewable form of energy, but because the mater is often burnt it still releases greenhouse gases.
Advantages

1. It is a renewable form of energy as long as people replant crops.
2. It is cheap and the resources can be grown locally

Disadvantages

1. It can still release greenhouse gases.
2. Areas can be deforested to grow crops for energy generation.
3. If crops are used for energy production it can lead to an increase in food prices.

Geothermal
Geothermal uses thermal energy from the earth to heat water. The water can be used as a source of hot water or the steam released can be used to drive turbines e.g. Nyanyadzi.

Advantages

1. It is a clean renewable form of energy.
2. It is a finite resource.
3. Can be used to heat water and generate electricity.
4. Geothermal energy can be created constantly and is not dependent on the weather.

Disadvantages

1. Not every country has geothermal potential.
2. Installation and startup costs are expensive
3. Drilling can release harmful gases.
4. Geothermal activity can change which can make the production of energy harder

Nuclear Energy

Some people consider nuclear energy to be a renewable energy. However, because nuclear energy uses uranium and uranium is non-renewable, then nuclear energy should also be considered to be non-renewable. Although the first man-made reactor was first operated in 1942 in the US, the first electricity producing nuclear power station was not completed until 1951.
It is estimated that nuclear power provides about 14% of the world's electricity (6% of its energy). Japan (all nuclear reactors are temporarily closed after the Fukushima Disaster March 2011), US and France

combined account for about 50% of the world's nuclear power produced although are 439 nuclear power stations in 31 countries.
Nuclear power has created widespread debate, because some people see it as a solution to declining fossil fuels while others worry about the waste produced, the technology falling into the wrong hands and accidents.

Advantages of nuclear energy

1. The technology to make nuclear power already exists.
2. There is a plentiful supply of uranium, enough to last hundreds of years.
3. Nuclear energy releases very low amounts of greenhouse gases.
4. It reduces the dependency on oil, coal and gas producing countries
5. Nuclear waste can be safely stored underground

Disadvantages of nuclear energy

1. The supply of electricity can be altered depending on the demand.
2. There is always the risk of nuclear accidents like the Chernobyl accident in the Ukraine
3. There is a risk that nuclear power stations will become terrorist targets or that nuclear material will fall into the hands of terrorists.
4. Countries can use nuclear technology to make nuclear weapons. North Korea and Iran have both been accused of doing this.
5. Transporting nuclear material and nuclear waste is risky and expensive.
6. Nuclear power stations only have a limited life period and the cost of decommissioning them is expensive.
7. There is a belief that living next to nuclear power stations can increase the risk of cancers (leukemia).
8. Nuclear waste remains radioactive for thousands of years (it has a very long half life).

Fuelwood

Fuelwood is often the main source of energy because countries either can't afford to buy raw materials to produce energy, don't have the technology or money to build and operate powers stations and certainly don't have a national grid to distribute energy.

Problems include:

1. Deforestation.
2. Biodiversity loss (vegetation is removed and animals lose their home).
3. Desertification and reduced rainfall.
4. Increased soil erosion and increased sandstorms.
5. Increased time spent looking for wood.
6. Children taken out of school to look for wood.
7. Dangers of breathing in smoke inside houses.
8. Risk of fire within houses.

Impacts of Energy Crisis

- Increase in the prices of many commodities.
- Increase in the prices of imports due to high oil prices.
- Retrenchments in industries because of the high cost of production which can cause losses.
- It causes the price of other forms of energy e.g. charcoal and gas also to become expensive.

- Environmental degradation as a result of environmental degradation brought about by the high demand for charcoal and firewood which leads to soil erosion.

Solutions

- Developing alternative sources of energy e.g. solar, biomass, Geothermal and HEP.
- Management and conservation of energy.
- Encouraging industries to use coal which is slightly cheaper than petroleum.

Management and Conservation of Energy

- Management of energy is effective planning and control of energy resources.

Management Measures

- Encouraging many people to use public transport .
- Educating people through mass media to create awareness on the importance of conserving energy.
- Improvement and proper planning of road network to reduce traffic jams in which a lot of fuel is wasted.
- Agroforestry, afforestation and reforestation programmes to reduce overexploitation of natural forests.
- Banning logging, selective felling of trees and resettling people who have settled into forests.

Conservation of Energy

- Conservation of energy is using available energy resources in the most effective manner to ensure there isn`t wastage.

Conservation Measures

- Putting off electricity gadgets when they are not in use.
- Proper motor vehicle maintenance in order for them to use fuel efficiently.
- Encouraging use of public transport which carries many people at a go e.g. buses.
- Encouraging use of renewable sources of energy e.g. solar, wind and biogas to save on oil and wood.
- Encouraging use of energy saving stoves which use little charcoal and produce a lot of energy.

Fishing in Southern Africa

Fishing

- The act of catching fish and other aquatic animals.
- Fisheries are fishing grounds or areas where water resources such as fish, seals, clubs, whales, etc. are exploited.

Factors Influencing Fishing

Physical Factors
Presence of Plankton

- Large shoals of fish are found in shallow waters of lakes and seas where there is plenty of plankton. They thrive where depth of waters less than 180 m deep because it is up to where suns rays can reach.

Nature of the Coastline

- There is more fish on coasts with sheltered inlets and estuaries because of calm water and shelter from natural enemies like predators e.g. Fiords of Norway.

Relief

- People in some countries engage in fishing due to mountainous landscape which hinders other economic activities such as agriculture e.g. Japan, Norway and Alaska.

Climatic Conditions

- In temperate regions there is more fish because there is cool waters which plankton requires to grow while in tropical lands there is less fish due to high temperatures resulting in warm waters which hinders plankton growth.

Convergence of Cold and Warm Ocean Currents

- There is plenty of fish in areas where warm and cold ocean currents meet because upwelling takes nutrients to the surface and improves the circulation of oxygen and cold ocean currents cool waters in tropical regions resulting in conducive conditions suitable for plankton thriving e.g. the coast of Namibia washed by the cold Benguela current.

Human Factors

Supply of Labour

- Fishing is intensively carried out in Europe, Asia and N. America due to labour availability as its labour intensive.

Market

- Fishing is done extensively in highly populated and developed regions with a ready market because fish is a perishable commodity e.g. in Norway, Japan, China, etc.

Fish Eating Culture

- Fishing is extensively done in areas where there is a habit of eating fish

Transport and Preservation Facilities

- Fishing is done extensively in countries with transport and refrigeration facilities because fish is perishable and has to be transported in refrigerated lorries and ship.

Capital

- Fishing is extensively done in developed countries because they can afford huge sums of money required for hiring labour force, buying fishing equipment and preservation facilities.

Technology

- Rapid growth of fishing industry in developed countries is as a result of presence of advanced equipment like large refrigerated ships, trawl nets, fish detecting equipment, etc.

Types of Fishing

Pelagic Fishing

- Catching of fish which live close to the surface e.g. mackerel, menhaden, herring, sardines and tuna.
- Best method to catch pelagic fish is drifting and seining.

Demersal Fishing

- Catching fish that live at the bottom of deep water bodies e.g. cod, haddock, Pollock and halibut.
- Methods are trawling and long lining.

Inshore Fishing

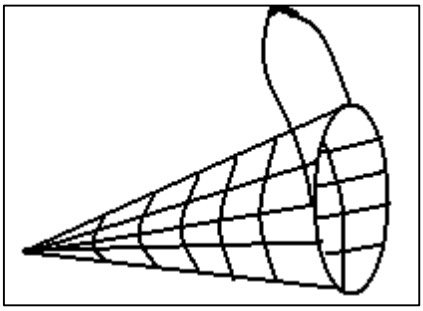
- Fishing close to the shores in shallow sheltered coastal waters and the lower stretches of rivers.
- Fish caught are shell fish, lobsters, prawns, shrimps and crabs.
- Methods involved are casting nets, hooks and line.

Fresh Water Fishing
- Fishing done in fresh water bodies such as streams, rivers, lakes, ponds and paddy fields.
- Examples of fresh water fish are sturgeon, carp, tilapia and trout.
- Methods are line and drifting methods.

Methods of Fishing

Traditional Fishing Methods
- Commonly practised in tropical areas along the African coast and the inland fisheries.
- Fishing is mainly done for subsistence purposes.
- Simple hand- made equipments are used.
- The methods are employed in small scale.

Types
Basket Method

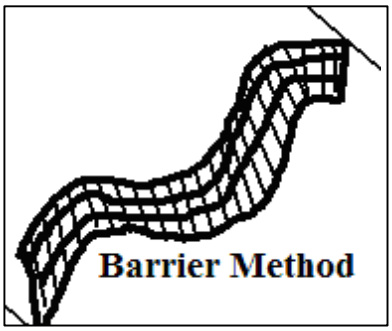


A basket with a cone opening with bait inside is used.
- It is placed at the shallow end of the water.
- The fish are attracted by the bait.
- Fish run to hide in the basket get inside and are trapped.
- The catch is relatively small.

Harpooning

Using a sharpened arrow or stick to strike Fish.
- One fish is caught at a time.
- Dangerous in waters infested with crocodiles and hippopotamuses

Barrier Method

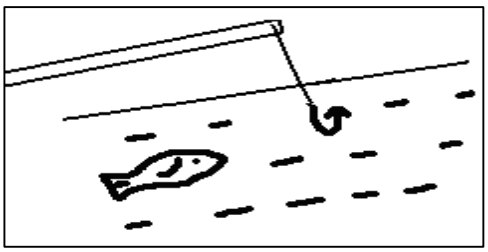


Using Barriers made of reeds or sticks to catch fish in flood waters.
- Are placed on the downstream side of a flooded region and when water levels drop the fishermen scoop the fish.

Herbs
- Sprinkling crushed herbs in waters making fish to become unconscious then the fishermen collect fish from the river using hands.

Use of Lamp and Net
- Placing a lit lamp on the edge of the boat to attract fish.
- Fish swim towards the light and are caught using net.

Hook and Line



Throwing a line with a baited hook into the water.
- The fish are attracted by the bait which they swallow together with the hook.
- The line is pooled from the water together with the fish.

Gill Nets
-Nets with mesh which lets only the head of a fish through and then traps it by the gills.
-They can be swerved across or round the river on the path of fish.
Modern Fishing Methods

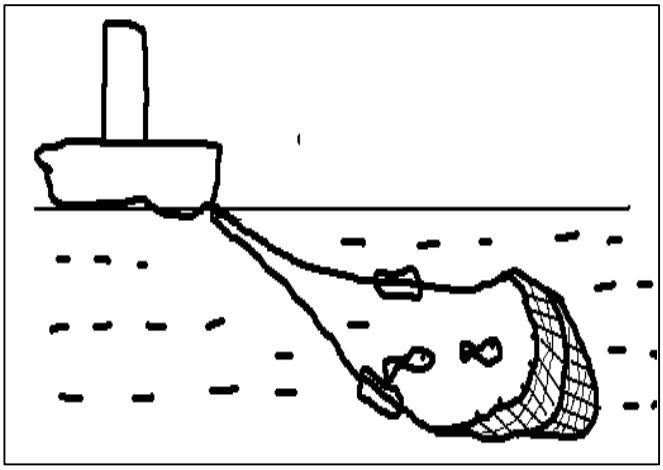
Seining
- Method is used to catch pelagic and migratory fish which swim in shoals.
- A Bag like nets with small meshes (seine) attached to two boats on each end is cast into the sea.
- It`s kept open and held in position by floats on top and weights at the bottom.

Mainly used to catch demersal fish.
- A bag shaped net is attached to a trawler (ship) is is cast into deep waters
- The upper part is kept open by floats and lower part kept down by weights.
- The net is dragged by the trawler along the sea bed.
- The trawl net sweeps in the fish.
- The net is hauled into the trawler and the fish is emptied onboard.
- Also catches immature fish.

Line Fishing
-The method is used to catch demersal fish.
- Fishing boats spread out long line with several baited hooks on them.
- Floats keep the lines suspended and also show the fishermen where the lines are.
- Baited hooks catch the fish as they compete to feed.
- Hooks are drawn and fish unhooked and put in refrigerated containers.

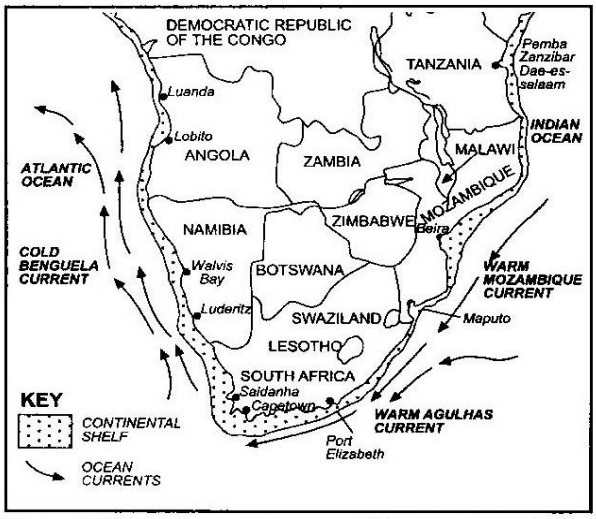
- Fish move towards the net and get trapped.
- The net is hauled over and fish emptied onto the ship or the net is hauled to the shore (haul seining).
- Leads to overfishing because it doesn`t discriminate the ages of fish caught

Trawling



Southern Africa

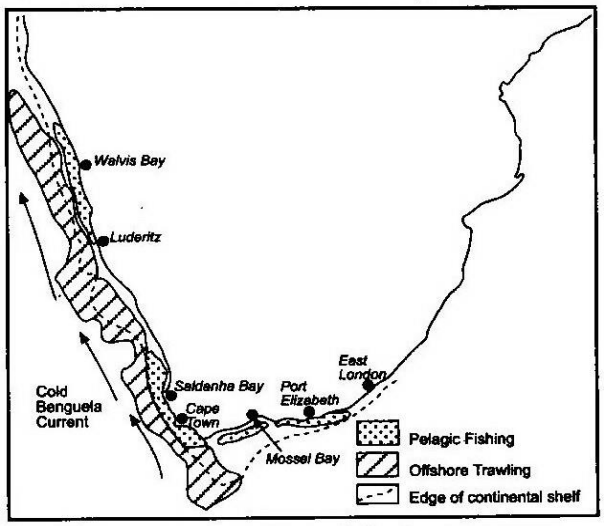
a. Located in East coast of Southern Africa – breams, hakes and herring.



Conditions

Warm Mozambique and Agulhas currents, poor growth of plankton, poor fishing grounds and narrow continental shelf.

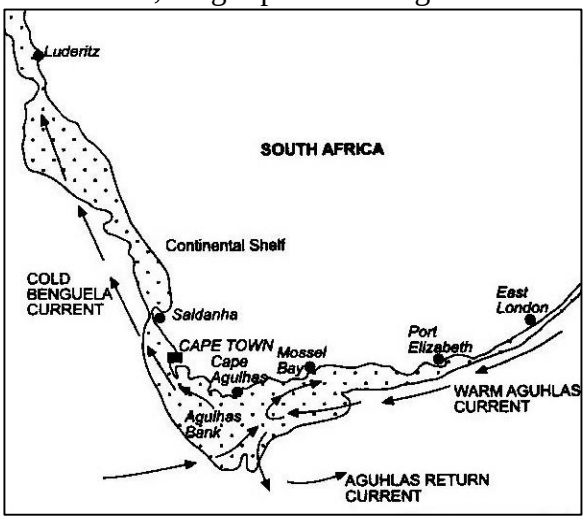
b. West coast of Southern Africa- pilchards, tuna, sardines, lobster and hakes.



Conditions

Washed by cold Benguela current which cools the warm tropical waters hence favouring the growth of plankton, rich in nutrients, rich fishing grounds and ideal fishing harbours.

c. Agulhas Bank – mackerel, cape hake, sardines, kingklip and herring.



Conditions

Broad continental shelf, warm agulhas currents and cold Benuela currents, calm water, moderate temperature, rich in fish food, ideal breeding ground of variety fish species.

Fresh Water Fisheries
- Found in inland in lakes, dams, rivers and ponds.

ZIMBABWE
- Kariba dam was completed between 1955 and 1959.
- Commercial exploitation of Kapenta started in the 1970s
- Fishing is controlled by the Ministry of environment and Tourism through issuing of permits to individuals and cooperatives.
- Fishing takes place at night where light and seine purse nets are used methods.
- Most of fish is dried before packed and transported to urban and rural markets.
- Small quantities are frozen and sold fresh, or canned.
- Tiger fish is also found but mostly for recreation and commercial purposes.
- Commercial and subsistence fishing take place in Chivero and Manyame, Mutirikwi with tilapia (bream).
- Fishing has contributed a lot to the economy of Zimbabwe.

Problems with Inland Fishing
a) Overexploitation due to accessibility of Lake Kariba, Chivero and Mtirikwi.
b) Indiscriminate fishing leading to catching even immature fish.
c) Water hyacinth in Lake Kariba and Chivero of Zimbabwe.
d) Lack of capital leading to lack of modern fishing equipment which restricts the catch per day.
e) Increased siltation reducing water volumes in Zimbabwe`s water bodies.

Aquaculture

The farming of aquatic (water based) plants and animals e.g. mussels, fish and seaweed.
Lake Harvest Farm at Kariba
Advantages

- Includes the development of tourist industry in the Eastern Highlands of Zimbabwe.
- Provision of cheap protein food.
- Source of income.
- Allows recycling of wastes e.g. chicken droppings used as feeds.
- Reduction of diseases such malaria and bilharzia as fish species feed on larvae.

Significance of the Fishing Industry in Zimbabwe
(a) A source of income to fishermen and traders when they sell their catch to co-operatives and customers at a profit.
(b) Employment creation such as making and repairing of boats and officers and clerks of co-operatives.
(c) It is a tourist attraction and source of foreign exchange and revenue to the government.
(d) A source of protein and food because it`s a major dish to some communities.
(e) Has led to development of industries such as those depending on fish as a raw material e.g. fertilizer plants, for making cod liver oil, etc.
(f) A source of medicine whereby cod liver oil is used in alleviation of chest problems.
(g) Fish oil is used directly or indirectly as a source of cooking fat.

Problems Facing Fishing Industry in Zimbabwe and their possible Solutions
(a) Overfishing resulting from use of small meshed nets and unlicensed fishermen resulting in extinction of such species.
- Restrictions should be made on the type of net that should be used.

- Licensing a selected number of fishermen and limiting their catch per day.
- Fish farming to ease pressure on natural fishing grounds.

(b) Pollution of water bodies by oil spillage and seepage of industrial and agricultural chemicals into water which kills marine organisms and prohibits introduction of fish into such waters.

- Agricultural activities should be prohibited close to fishing grounds.
- Legislation should be put in place to check disposal of wastes from industries.

(c) Transport problem as key fisheries being far from centres of population which causes many places to rarely receive fresh fish.

- Roads should be tarmacked for efficient transportation of fish.

(d) Lack of adequate market due to many communities having not developed fish eating culture, availability of agricultural products such as beef and pork.

- Roads to the potential markets should be improved.
- People should be educated on the importance of fish in the diet so as to develop fish eating culture.

(e) Inadequate capital making fishermen unable to afford fishing equipment with speed and greater capacity making them unable to venture into deep waters where there is more fish and modern preservation facilities limiting their catch per day.
- Fishermen should form co-operatives so as to get financial assistance.
(h) Fluctuation of volume of water in rivers and lakes due to seasonal variation of rainfall and prolonged droughts which causes fish death or migration
- Conserving water catchment areas to ensure regular supply of water.
(i) Growth of weeds e.g. water hyacinth in L.Kariba and Mtirikwi.
- Mechanical or biological removal of weeds.
(j) Human activities near fishing grounds which cause soil erosion which causes siltation which lowers the depth of water affecting fish breeding.
- Discouraging agricultural activities near fishing grounds and planting of cover crops around fishing grounds to reduce siltation.

Management and Conservation of Fisheries

Management of fisheries refers to effective planning and control of fish resources and their habitats while conservation of fisheries is careful use and protection of fish resources from overexploitation by people.

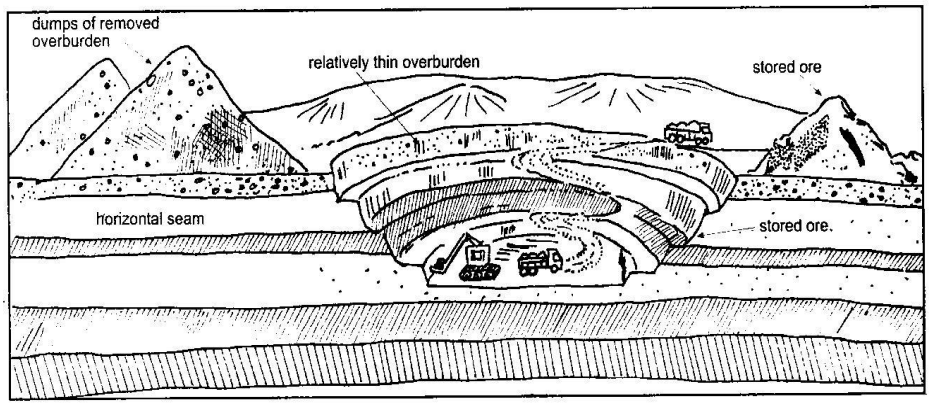
Management Measures
(a) Establishment of research stations to come up with fish species which can do well in various conditions and know fish predators and separate them from fish.
(b) Educating people on the importance of fishing grounds and fish resources such as by advising farmers not to cultivate near fishing grounds to prevent siltation and industrialists to treat wastes before disposing them.
(c) Government inspecting inland water resources to ensure people don`t interfere with regular flow of water through their activities.

Conservation Measures
(a) Enact law banning of small meshed nets to prevent catching of immature fish.
(b) Improve transport infrastructure to enable exploitation of fishing grounds in remote areas in order to reduce overexploitation of the few accessible fishing grounds.
(c) Fish farming to ensure fish caught in natural waters aren`t overexploited and depleted.
(d) Restocking overfished waters using fingerings from hatcheries or from overpopulated fishing grounds.
(e) Banning fishing temporarily whenever over fishing is detected to let fish to mature and breed.
(f) Licensing fishermen to regulate the rate at which fish are exploited to prevent their depletion.

Mining

Mining Methods

Open Cast Mining (Open Pit Mining



- Is a method of extracting rock or minerals from the earth by their removal from an open pit.
- The overburden is removed using large excavators and draglines.
- Used to extract coal at Hwange, asbestos in Zvishavane.

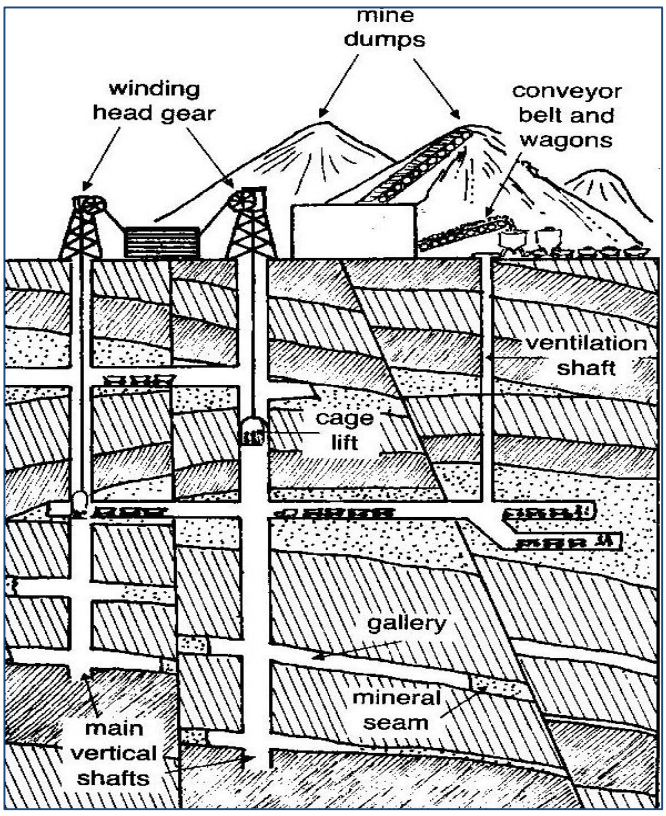
Advantages

a) Cheap and simple method of extracting shallow seams.

Disadvantages

a. Causes deforestation.
b. Blasting destroys buildings and causes noise pollution.
c. Use of explosives harms miners.
d. Open cast leaves land scared.

Shaft Mining Method



- Is the method of excavating a vertical tunnel from the top down, where there is initially no access to the bottom.
- Used to extract deep seated ores over 50m deep.
- Involves sinking of vertical or inclined shafts to the level of the seam.
- Horizontal tunnels are built following the seam e.g. chrome in Shurugwi, coal at Hwange and gold in Mazowe.

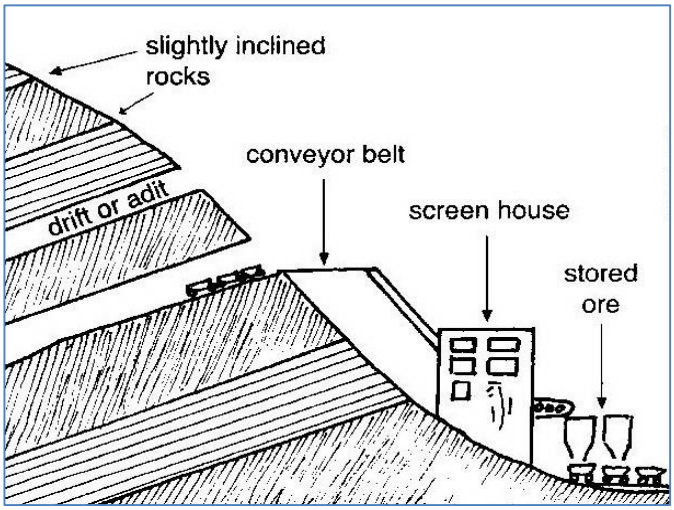
Advantages

a. There is less deforestation.
b. It allows extraction of deep seams.

Disadvantages

a. It is very expensive.
b. Flooding can be a danger to miners.
c. Cave ins and toxic gases are a great risk.
d. Deep mines can cause earth tremors.

Adit / Drift



- Used to extract minerals that are on the sides of mountains and river valleys.
- Involves building of horizontal or inclined tunnels along the mineral seam.
- Conveyor belts and railway lines are also built to facilitate the extraction of the ore.

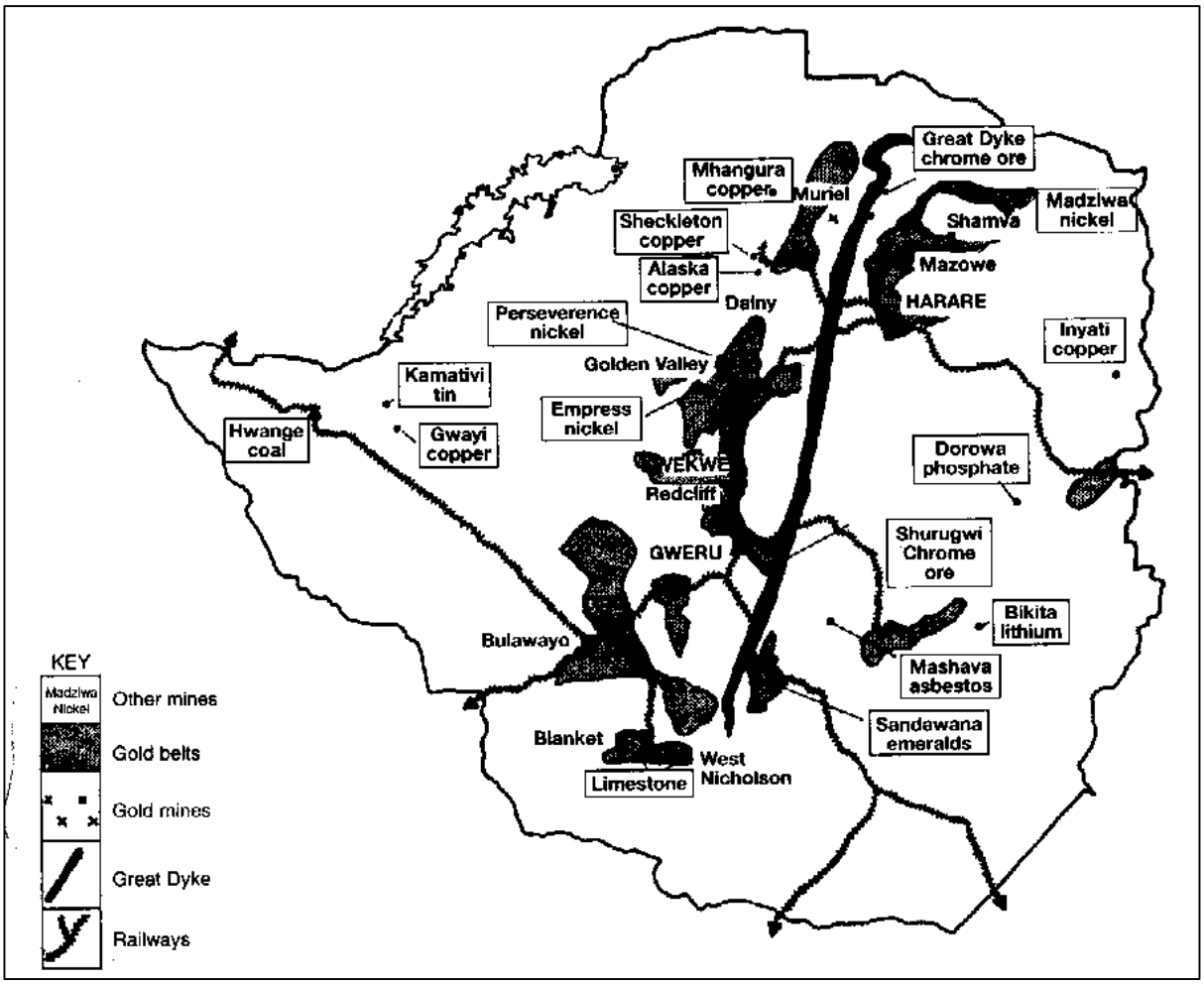
Advantages

a. It`s safer than shaft mining.

Disadvantages

a. Tunnels can cave in.
b. Causes deforestation.
c. Leads to landslides.

Distribution of minerals in Zimbabwe
Qn: describe and explain the distribution of minerals shown below:



Factors affecting the exploitation of mineral resources

- Availability and size of mineral deposits.
- Quality of deposits.
- Availability of capital to extract minerals.
- Transportation system.
- Availability of labour forces.
- Methods used to exploit resources.
- Market prices for minerals.
- Availability of water supply to cool machinery and for washing minerals,
- Government policy towards mining.
- Climatic conditions – some are linked to diseases.

Importance of mining to Zimbabwe

Home work: why is mining important to the economy of Zimbabwe? [7].

Gold panning

The extraction of gold from alluviums and river valleys.

Benefits of gold panning

- Income and wealth generation.
- Foreign currency earnings.
- Employment creation.
- Creates a market for informal traders.

Effects of gold mining activities

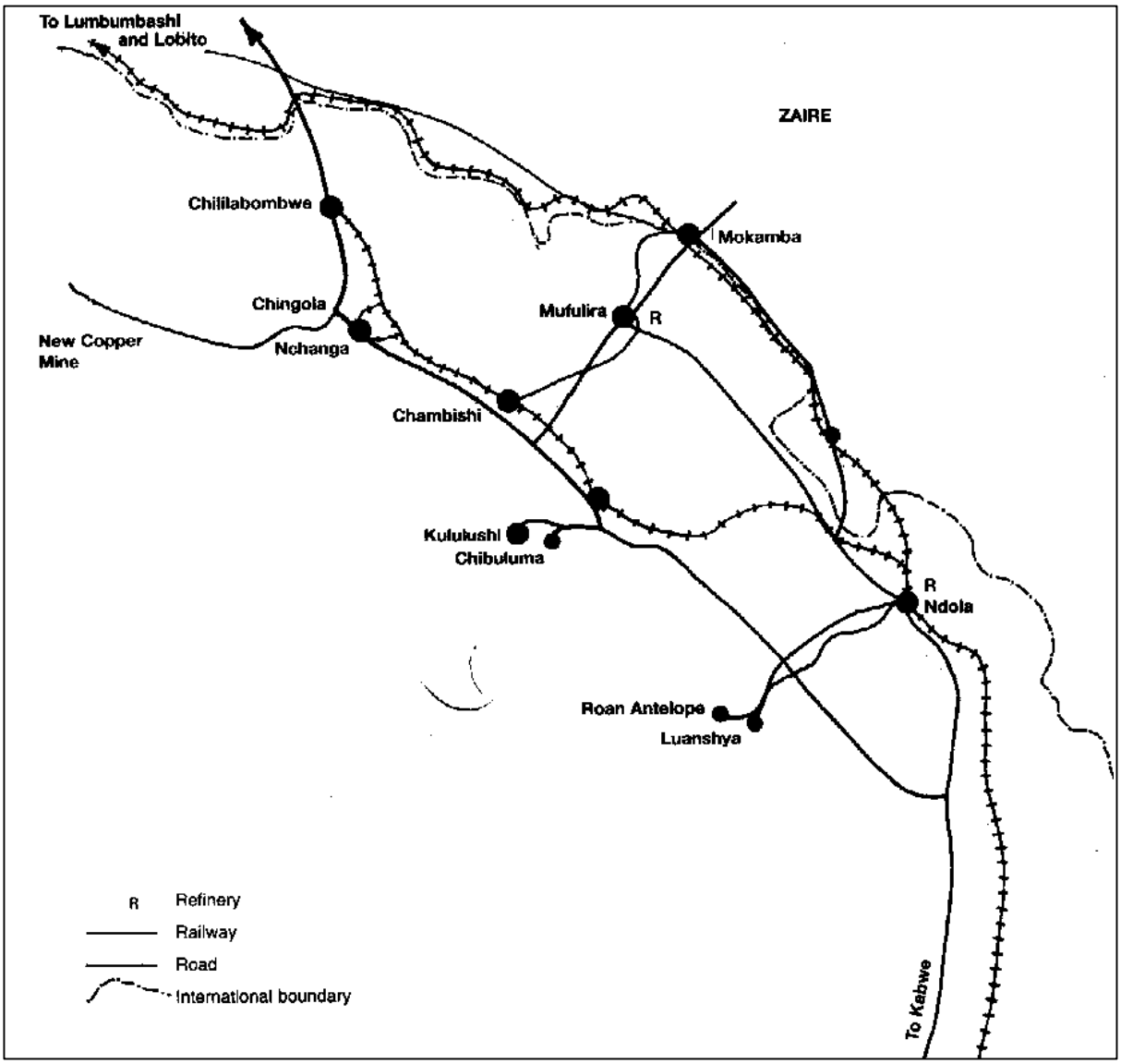
- Pollution e.g. How Mine disaster.
- Soil degradation and siltation.
- Land degradation – open pits and trenches are dangerous to people.
- Accelerates deforestation - disappearance of valuable plant species.
- Damage to buildings e.g. destruction at Effel Flats primary school in Kadoma.
- Not all gold is sold to government buyer.
- Reduction in tourism potential e.g Mzingwane in Matebeleland.
- Loss of life due to collapse of tunnels.
- Social pathology.

Measures to control problems of gold panning

- Licencing of panners.
- Enforcing environmental laws.
- Education and training of panners on environmental friendly methods of mining.

Case Study: one non – renewable resource

Copper Mining in Zambia



- Copper deposits occur in an axil belt stretching from Zambia to Democratic Republic of Congo (DRC) with mines from Nchanga, Mufulira to Ndola.
- Occurs in seams of various depths such that both open and shaft mining are used.
- Factors that led to development of mining on the copper belt are labour from nearby countries e.g. Zimbabwe, technology and capital, market, power supply and political stability.

Benefits of copper mining

- Earns foreign currency,
- Employment creation.
- Infrastructural development.
- Raw materials for industries.
- Income generation.

Disadvantages

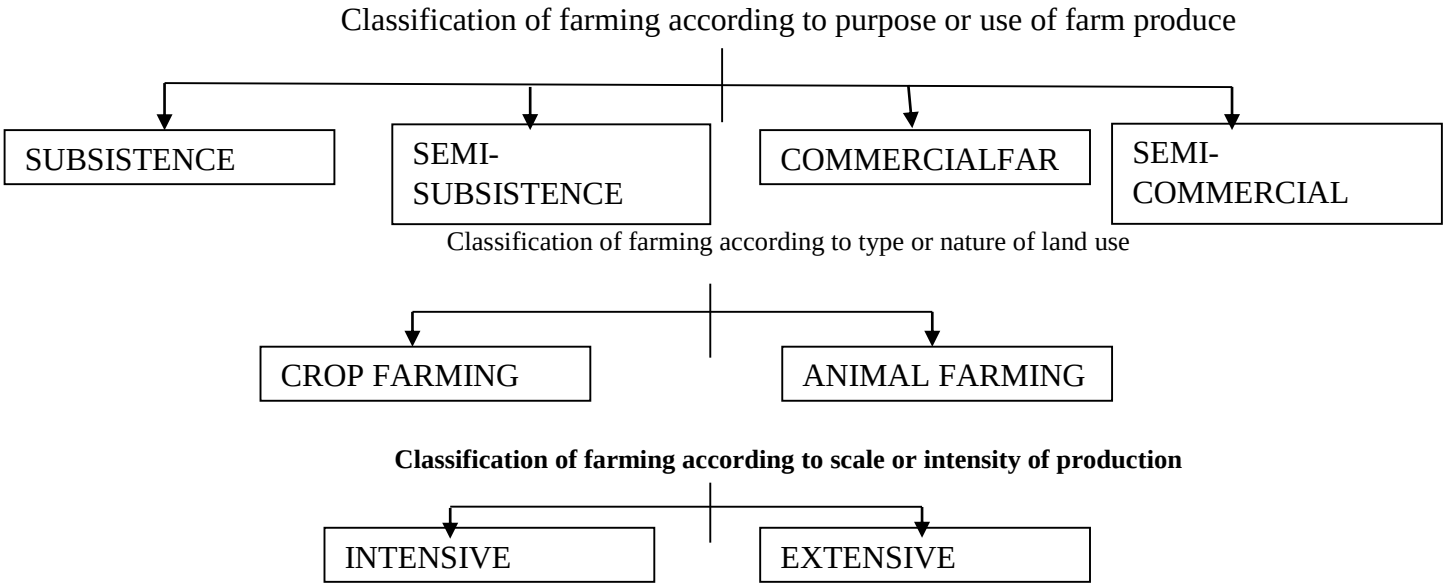
- Neglecting development of other economic activities like agriculture.

- Over – dependency on copper resulted in reduction of foreign currency due to fall in prices of copper on international markets.
- Pollution of the environment.
- Landslides occur on mine dumps.

AGRICULTURAL STUDIES

Agriculture (Farming)

Refers to the growing of crops and rearing of livestock for a purpose.
Farming can be classified into three major criteria according to purpose of farm produce, type or nature of land use and according to scale or intensity of production.



Factors that affect agriculture

Human Factors

All farming activities need either human labour or machines to do the work. Some farming use very little labour e.g. sheep farming, others require large labour forces e.g rice farming or tobacco farming. Availability of labour may influence the type of farming. The farm wages, the skills and family labour affect farming.

Demand/Market.

This is the customer who buys farm products. Farmers need to sell their crops and animals to make a profit. The higher the demand the higher the price of the product: and the lower the demand, the lower the price. The price of the produce and availability of the market are important factors that affect farming.

Finance /Capital.

This is money for the payment of wages, purchase of farm inputs/ or imports. This can affect the type and state of farming. Some crops are capital intensive e.g. money to set up irrigation facilities etc. Money can be in the form of loans from banks or grants from the government or capital saved by the farmer.

Government (Political)

Government provide subsidies and loans or inputs to encourage new farming practices but they also place limits on production to prevent food surpluses. Government influence farming through its police or through infrastructural development and support services eg providing tillage facilities through DDF.

Transport

This is needed for the transportation of inputs to the farm and outputs to the market. In Zimbabwe and Zambia commercial farming is concentrated along main roads. Colonial government made efforts to provide the white commercial farmers with efficient transport services e.g. compare Burma Valley and Bocha, Buhera e.t.c.Transport network eg roads and the type of transport affect farming activities.

Technology

Irrigation and machinery are two examples of expensive technology which increase yields. Genetic engineering allow new plants to be grown, this reduces diseases and droughts and give higher yields. Computer control in green houses provides suitable conditions for good quality crops. Type and availability of equipment and service affect farming activities.

Physical factors

Climate

- A minimum temperature of 6ºC.
- Different crops need a different growing season e.g. wheat 90 days. Rainfall-all crops and animals need water.
- Too much rainfall can pose problem to farmers the same is true with very little rainfall below.

Relief

- Temperature decreases by 17ºC every 160 metres vertical heights.
- Uploads are more exposed to wind and rain.
- Sleep slopes also cause thin soils and limit the use of machinery.
- Lowland areas are more easily farmed.

Soils

Crops grow best on deep, fertile, free draining soils. Soil type and fertility influences the types of crops that can be grown, the yields per unit area and the cost of production.

Aspect

The direction a slope faces. In the extreme northern hemisphere south-facing slopes are best for growing crops and in the southern hemisphere north facing slopes are best for crop production. (Why?)

Pest and diseases

These affect workers; crops and animals. Farmers have to fight them in order to avoid disastrous effects. Pests which affect crops include locusts, Birds, boring insects, worms.

The farm as a system

Farming can be viewed as a system involving inputs, processes and outputs as elements of the system. Inputs are the initial things needed to carry out something eg land knowledge, capital. Processes is the work done, manipulating the inputs in order to produce items. Outputs are the end products from the work /processes done.

The table below shows the main components of a farming system

INPUTS	PROCESSES	OUTPUTS
a)natural inputs Sun's energy, water, soil minerals, land, conducive temperature. **b) human inputs** labour, knowledge/skills, capital **c) other inputs** crops/seeds, animals, machinery, pesticides, insecticides, fertilizers/manure etc.	Preparing land, ploughing, cultivating, planting, weeding, watering/irrigating, dosing animals, application of insecticides and pesticides, harvesting, dipping animals, vaccinating animals, application of manure/fertilizers and other chemicals etc	Different variety of animals eg cattle, goats, pigs, sheep, chicken etc. Different variety of crops eg maize, millet, wheat etc Money Milk and other dairy products. Eggs Different variety of vegetables Different variety of fruits

Types of agricultural systems

<u>Shifting Cultivation / Chitemene System.</u>

- It is a subsistence cultivation system involving the clearing a piece of land and its cultivation for a few years (5 to 10 years) and abandon it for a new area as soil become infertile to allow regeneration of vegetation and fertility.
- It is practiced in northern Zambia in Luapula District by the Bemba-Ushi people, parts of Mozambique, Malawi and Tanzania and it is also called slush and burn in the Amazonian forests of Brazil.
- In Zimbabwe no longer practised.
- It is practiced where population is very space.
- It involves the following stages.
    - Cutting down trees and stark to dry.
    - Burning and ash is sprinkled in the field.
    - Cultivation using simple tools like hoes and digging sticks
    - Crops grown include, millet, sorghum, ground nuts, some maize, pumpkins, cassava.
    - When yield decreases normally between 5 to 10 years,
    - The land is abandoned and a new piece is cleared.

Reasons for shifting fields and homesteads

- Decline in the fertility of the plot after three to ten years

- High rainfall received especially in northern Zambia for example cause leaching which leads poor acidic soils which cannot support permanent agriculture.
- Distance to the fields become to long for daily walking.
- Availability of space due to low population pressure in area where it is practised.
- The rudimentary type of housing used makes it easier to build new houses than to repair the old ones.

Shifting Cultivation as A System

Inputs	**Process**	**Outputs**
Sunshine Rainfall Soil Hoes/digging stick Family/community labour	• Cutting trees • Burning • Cultivation/digging • Harvesting • Transporting crops	• Vegetables • Grain e.g. millet • Groundnuts • pumpkins • maize etc

Shifting Cultivation in Northern Zambia- By the Bemba-Ushi People (Farming Calendar)

May- June – land clearing, large trees are cut down.

September –November- burning of branches following a signal from village heads

November – December – planting of seeds.

March – June- harvesting.

Advantages of shifting cultivation

- Ash provided fertility leading to high yield in the first year.
- Allows land to recover.
- System destroys pests and diseases (burning)
- Cheap method of farming relying on natural inputs.
- Free choice of land.
- Part-time activities are possible such as hunting and fishing.
- Use of natural inputs e.g. ash means less pollution to the environment.

Disadvantages of shifting cultivation

- Wastes land and timber (wasteful system).
- Promotes soil erosion
- Low fertility with time/low yield.
- System kills micro-organisms in the soil
- Does not allow technical improvement on standard of living.
- The system cannot accommodate large numbers of people.

Bush fallowing

- This is another type of subsistence agriculture which involves the rotation of cultivated land without necessarily changing the homes.

- The land is left fallow for about 5 years the advantages and disadvantages are more or less the same as those of shifting cultivation.

Nomadic pastoralism

- This refers to the traditional herding of livestock such as cattle, goats, sheep and donkeys following pastures without maintaining a permanent home. It is practiced by people known as Nomads in areas of low rainfall such as the arid and semi-arid regions of Africa such as West Africa. In Africa pastoral nomadism is practised by the Masai of East Africa and the Fulani of West Africa.

Way of life of the nomads

- They follow traditional routes following the rain belt.
- Their whole life depends on the livestock.
- They are very brave people who can scare dangerous wild animals such as lions using their bare hands and sticks.
- They usually travel light so that when they breaking camp they quickly move on.
- Men rear cattle while women grow crops.
- They are war like and they usually clash with sedentary commercial farmers over grazing land.

Problems of the nomads

- Shortage of grazing land
- Uncontrolled movement lead to spread of disease (makes it difficult to provide veterinary services and to control disease).
- Illiteracy level remains high and leads to low national development since they are always moving, therefore they cannot have they permanent plans.
- Pressure from government policies favouring sedentary farming
- Population growth resulting in reduced pastures
- Conflicts about land use are common between nomads and sedentary farmers.
- Land degradation such as erosion are common around waterholes.
- The quality of livestock is poor since emphasis is on quantity.

In recent years this type of farming is generally fading out because of the following reasons.

a) Governments have encouraged permanent settlements to make it easy for the provision of services and the development of infrastructure.
b) In West Africa the Fulani have been sedentarised and organised into cooperatives with a central well and About 20 homesteads around the well.
c) Each homestead if allowed about 15 herds of cattle.
d) Permanent homes are built and each farmer is given a plot to cultivate crops.
e) In counties such as Kenya nomads have been commercialised here the quality of the cattle is improved and the government provides services such as dipping and vaccines.
f) This measure can only succeed if the nomads are educated and trained and this is being done in Kenya.
g) In already damaged areas rehabilitation programmes such as reforestation, regressing and building of dams is being done and encouraged.

Case study

Nomadism: Fulani of West Africa

- Nomadism is practised in the Sahel region which stretch from Atlantic coast to Ethiopian Highlands in the east.
- Sahel means fringes (edges) of Sahara desert.
- Sahel includes countries Mali, Niger, Sudan and Burkina Faso.
- The region is hot, dry with short wet conditions and subjected to dust storms from the north.
- Vegetation is semi – arid scrub with thorn bushes and baobab.
- Pastures bloom from May to August due to short rainy season.
- Water holes appear also during the rainy season.

Movements of Fulani

- During summer, ITCZ moves northwards bringing rains and the Fulani moves north ahead of the tsetse flies.
- The nomads also move into highlands which are cooler and tsetse fly free.
- Settle where there is plenty pastures and water.
- They establish temporary settlements in groups of 20 to 40 families.
- Men herd cattle while female do small scale agriculture.
- As dry conditions occur due to the shift of ITCZ, nomads move to the south, but behind tsetse belt.

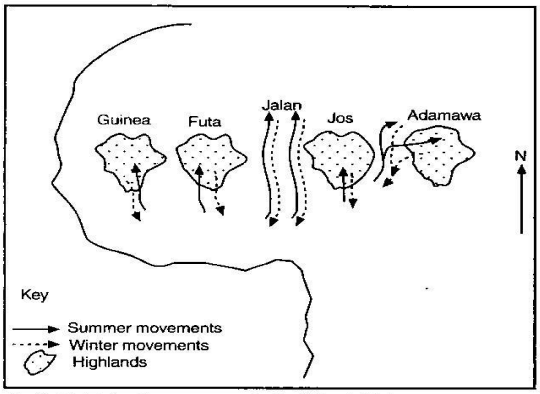


Fig 8.11 Fulani movements in West Africa

Sedentary peasant farming

- This refers to a more settled type of farming with people having permanent homes and farming the same fields throughout year after year. This the most common type of farming in Africa.
- The peasant farmers practice mixed farming as they rear animals and grow crops.
- In countries like Zimbabwe one or more cash crops can be grown so that the farmer sells the crop for cash.
- However production is largely for family consumption.
- In recent years agricultural extension workers have been deployed to educate the peasants on better agricultural methods.
- Tillage units have been supplied tom increase draught power.
- Seed handouts have been distributed to boost agricultural output.
- Land redistribution has also been carried out to ensure that many peasants have the land.

Problems faced by sedentary peasant farmers in Zimbabwe

These include physical and socioeconomic problems. The physical problems include:

a) Poor and heavily leached soils caused mainly by over cultivation and the fact that the farmers cannot afford to by fertilisers to maintain fertility.(make fertilisers available and also resettle people).
b) Cultivation of marginal land due to rapid population growth which comes with a higher demand for food.(practice effective family planning programmes to contain the exponential growth of population).
c) Low and unreliable rainfall in most parts of Africa reduces productivity.(harness water through the construction of dams for irrigation purposes).
d) Pests such as the army worm, locusts, ticks and tsetse flies also reduce productivity. (Use chemicals to control pests and also practice crop rotation.)
e) Diseases such as foot and mouth and anthrax also reduce animal productivity.(vaccinate the animals and control their movement avoiding the mixing of cattle with the wild buffalo).

Economic problems include

- Shortage of capital to buy inputs- make inputs available at reasonable prices and also provide handouts especially after a period of drought.
- Lack of knowledge and skills of modern farming and the use of traditional poor farming methods. E.g. stream bank cultivation, slope wise cultivation- extension workers are in place to try and teach the farmers on more modern and efficient farming methods.
- Population pressure caused by rapid population growth results in land fragmentation which makes the use of machinery difficult and also reduces the overall output of the individual farmer. Put in place sound population planning policies to limit rapid population growth, and also to resettle people.
- Communal land tenure makes it difficult for the farmers to receive loans from banks as they lack collateral. This type of tenure also makes it difficult for any improvements to be done as no one in particular owns the land. Give the communal farmers security of tenure through long term lease agreements.
- Lack of draught power in the form of cattle and donkeys also lowers productivity.- provision of tillage units.
- Poor infrastructure such as roads, storage facilities and marketing facilities reduces the will of the farmer to farm for sale.-improve infrastructure and establish collecting depots in the communal areas.
- Poor producer prices and high cost of inputs and transport also dampen the spirit of many sedentary farmers causing a general unwillingness to produce for sale. Announce reasonable producer prices well before the planting season

The nature of subsistence farming is changing over the past year because of a number of reasons:

a) Colonialism brought with it new ideas from the west.
b) Education and training.
c) Transfer of technology.
d) Government intervention.
e) Discovery of new agricultural techniques such as the use of hybrid seeds and HYVs.
f) The development of irrigation facilities.
g) The implementation of the land redistribution programme.
h) Establishment of cooperative farming

Plantation agriculture

- This is the large scale production of one crop on a large piece of land called an estate for a long period of time. The crop can be perennial or annual.

Characteristics of plantation agriculture

- They are owned by transnational companies or by government which can raise the large capital needed to start and run the estate.
- There is specialisation of production with specialists and research centres on the estate.
- Each estate is self- contained and efficiently run with factories, workers houses schools, clinics and recreational facilities on the estate.
- Production is market oriented, the market being domestic or foreign.
- There is production of both food crops and industrial raw materials.
- They are usually attached to out growers.
- They have monocultural tendencies.
- They employ a large number of people raising the standards of their lives in the process (examples to include hippo valley and triangle estate)

Advantages of plantation agriculture

a) They produce food for the local industry.
b) They create employment for a large number of people. E.g triangle estate employs more than 8000 people.
c) They lead to industrial growth by providing raw materials for the industries.
d) They produce cheap goods which can be afforded by the local people.
e) They develop infrastructure.
f) They provide services to their workers and the surrounding community.
g) They also to a certain extent provide education and training.
h) They provide revenue for the government.
i) They lead to the creation of towns in less developed areas.
j) They also develop remote areas, providing power, roads and dams.
k) They bring foreign currency into the country.

Disadvantages

a) Their monoculture tendencies result in rapid removal of nutrients from the soil resulting in exhaustion of the soil.
b) Large sums of money are repatriated to the mother country since most are foreign owned.
c) They occupy large tracks of land while the indigenous people are landless.
d) They indulge in local politics and at times may sabotage the economy.
e) Extensive clearing of the land may have negative effects on the environment.
f) In some areas there is exploitation of workers as workers earn very little and also workers live in squalid conditions.
g) They can sometimes rapidly plunder the land and then leave for other countries leaving the land exhausted.

Case study 1

Hippo valley estate- Size -111 455 ha

- Ownership- Anglo American Corporation.
- Products –sugar cane, bananas, oranges and beef.
- Markets- home and abroad.
- Employment- 6500 permanent and 4000 contact during the period of cutting sugar cane.
- Industrial growth- afdis factory for spirits and a sugar mill.
- Research and training- a sugar cane research station next to its fence.
- Infrastructural development-Hippo Valley High School, Chiredzi general hospital, banks, country clubs, beer halls, thermal power station, rail and roads. State of the art irrigation equipment.

Case Study 2

Katiyo Tea Estate

Location

- Honde valley in the north eastern part of Mutare, on the bank of the Pungwe River on the eastern border with Mozambique.

Crop

- Tea- grown on two estates, Rimbizi and Chiwira estates.

Climatic characteristics

- Rainfall 1740mm per annum falling mainly in November to March
- Temperature is high during the rainy season.
- During summer humidity is high.

Relief and Soil

Grown on gently sloping to steep slopes.

Soils are deep and fertile ideal for tea growing.

Organisation

- It is a parastatal owned and managed by ARDA since 1982.
- It is surrounded by about 137 small out growers.

Production of tea

Planting stage

- It is grown from seeds or cuttings in nursery beds, seeds takes a longer period before it is ready for harvesting 2-3 years
- Cuttings takes a short period
- Growing from cuttings ensures high quality
- When ready seedlings are transplanted into prepared fields (when about 15 cm high
- Constant weeding, and pruning to allow the bush to grow outwards

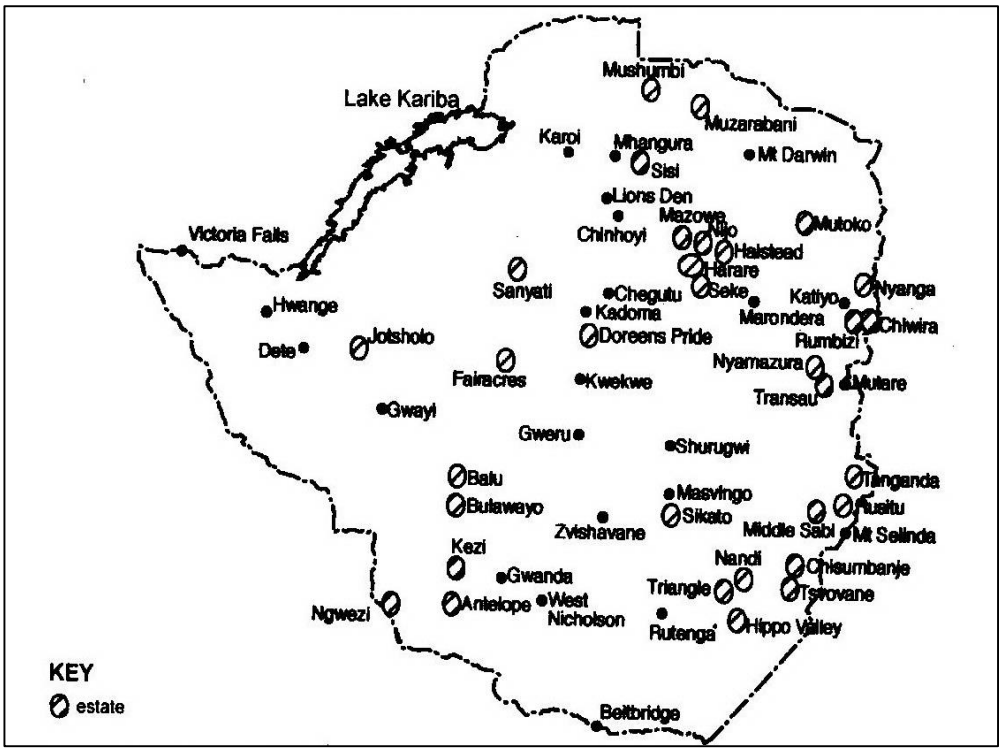
Harvesting

- Starts after 2-3 years if grown from seeds or 9 months if from cuttings.
- Done by both females and males
- Hired labour is required during this period
- 2 leaves and a bud is plucked and loaded into baskets
- The baskets are offloaded into a tractor.
- Harvesting is done at intervals i.e. after 5-7 days in the dry period.
- The tea leaves are transported to the factory for processing.

Tea processing

- Withering- tea enters into heated whither and loose weight by 25%
- Extracting rubbish by machine
- Fermentation- leaf cells are broken oxidation changes the colour from green to brown then blackish
- Drying- tea goes into drying trays
- Extractors remove fibre
- Sorting- black tea is sorted into sizes or grades
- Package- done by machines
- Market
  - Local market- wholesalers, shops, e.t.c
  - Export

Distribution of Plantations in Zimbabwe



- Most are along the the Eastern Highlands – Nyanga, Tanganda, Rusitu, Katiyo, Chiwira, Transau and Nyamazura due to high rainfalls, cool temperatures for tree crops and fruits.
- Many in S.E Lowveld – Chisumbanje, Middle Sabi, Hippo Valley, Tsvovane, Nandi and Triangle because of low population density, high temperatures for sugarcane, large rivers for dams for irrigation.
- Low in the Central Highveld – Mazowe, Seke, Doreens Pride near Kadoma, due to competing land uses, large population densities.
- Few in the North – Sisi near Mhangura and Mushumbi.
- Very few to none in the west and South west – Balu, Kezi, and Jotsholo because of too hot and dry, diseases, poor soils, areas used for ranching and National parks.

Irrigation farming

This refers to the artificial application of water to crops in order to grow crops when the prevailing climatic and weather conditions cannot sustain crop growth.

Reasons for practising irrigation agriculture - (these are advantages)

- Increase food production.
- Produce crops throughout the year.
- Deal with the problem of moisture stress.
- Bring marginal land into effective use.
- Generate more employment.
- Produce more industrial raw materials.
- Raise the standards of living of the employed.
- Improve the national economy.
- Harness and utilise water that might have been lost through run off.

Problems

- Salinisation of the soil.
- Irrigation water contains toxic chemicals derived from fertilizers and pesticides which can contaminate drinking water sources.
- Dams constructed for irrigation water can increase incidences of bilharzia.
- Rapid siltation of dams.
- It is expensive to set up.

Methods of Irrigation

(a) Water lifting method
- Lifting water from a source by using a bucket or watering can and pouring it on the crops.
- Used widely in market gardens and on farms adjacent to the water.

(b) Flood/basin irrigation
- Diverting river water into a canal then to plots where it`s flooded.
- Commonly used in irrigation schemes.

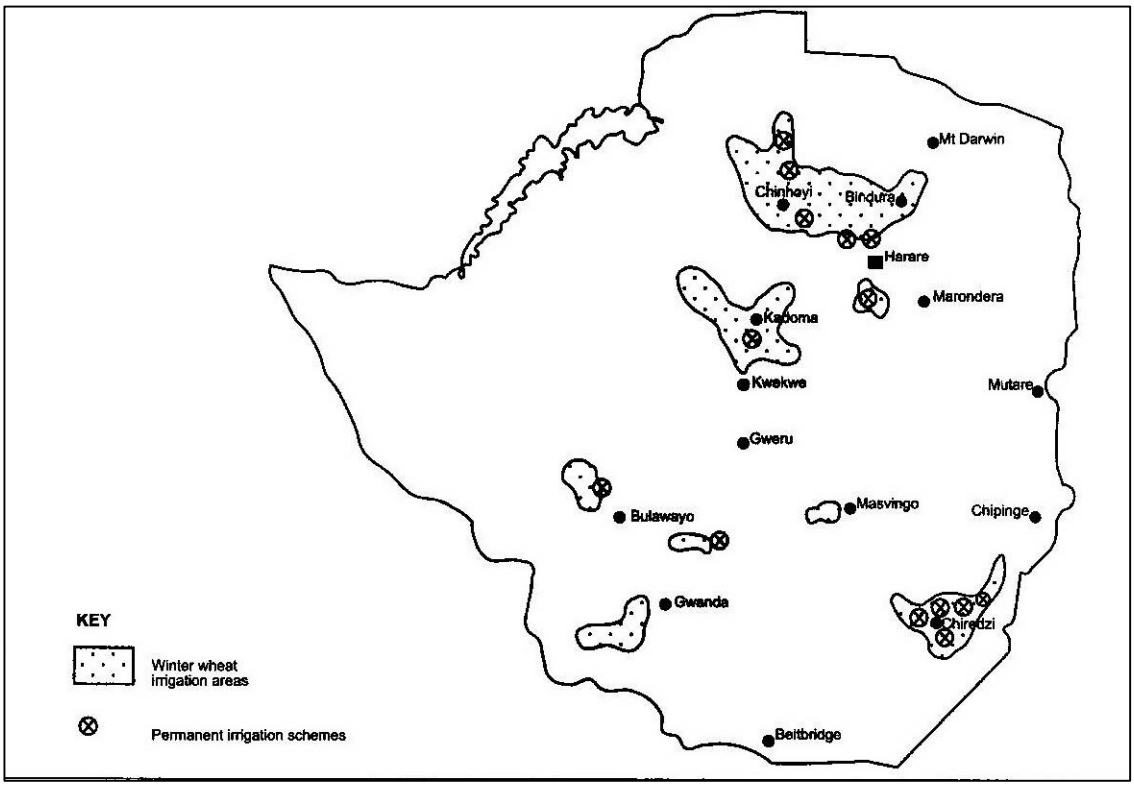
(c) Sprinkler or overhead irrigation
- Taking water to the fields by pipes and applying it on crops by rotating sprinklers mounted on vertical pipes.
- Used on golf courses and market gardening.

(d) Trickle irrigation
- Plastic pipes with holes laid in the fields through which water trickles to the base of plant.
- Popular where fruits and flowers are grown.

(e) Canal irrigation
- Directing water through canal to farms.
- Commonly used in areas experiencing low rainfall e.g. Yatta in Machakos

(f) Drip irrigation
- Inverting bottles filled with water into the roots of a plant.
- Used in low rainfall areas to grow trees, fruits and flowers.

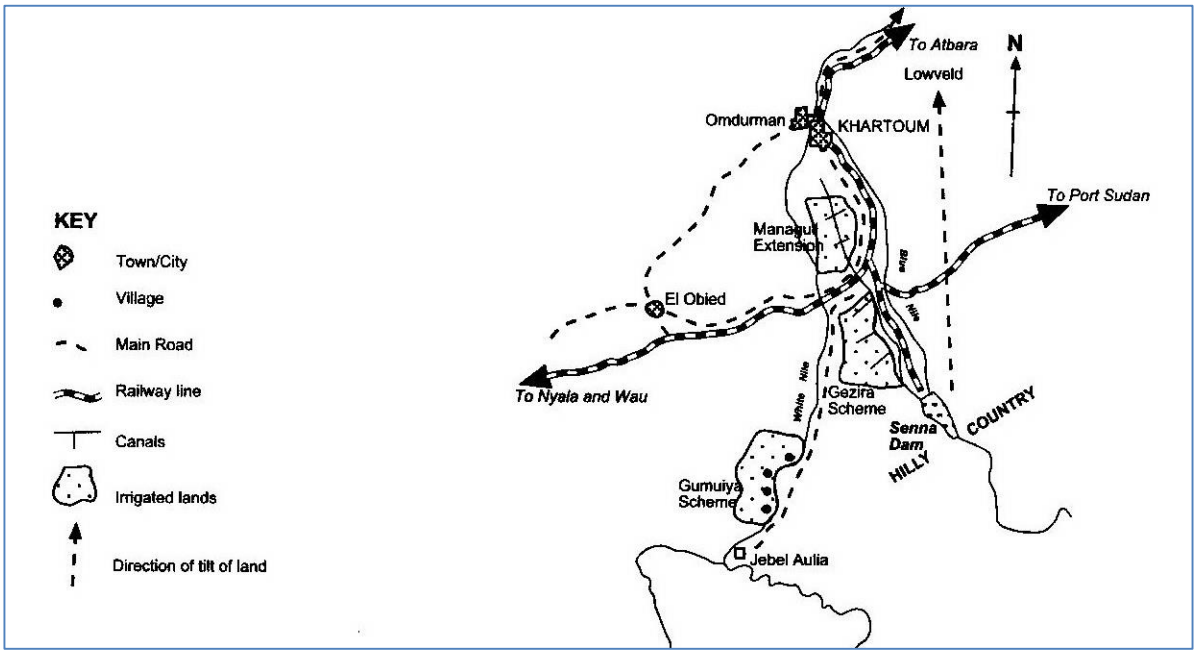
Question 1. Describe and explain the distribution of irrigation schemes in Zimbabwe shown. Dynamics of O`level Geography page 131 [8].



Case Studies

Case Study 1

The Gezira Irrigation scheme in Sudan



- It covers about 882,000 ha fed by gravity irrigation.
- The Gezira plain is located in the triangle land between the Blue and the While Nile south of Khartoum.

- The Blue Nile is the source for the water supply for the Gezira Scheme
- The Sennar dam is situated on the Blue Nile some 260 km southwest of Khartoum was completed in 1925 to supply the Gezira irrigation scheme.
- The Jebel Aulia dam is situated upstream of Sennar dam, was constructed and completed in 1966 to provide storage for irrigation in the low water season (reservoir) and for hydropower generation.
- The irrigation system comprises of canals and flood irrigation.
- The Managuil main canal was constructed in parallel to the old Gezira main canal to serve the Managuil extension.
- The uniform slope of the land has permitted a very regular layout of fields.
- The soils are fairly uniform, and classified as vertisols that have clay content (rich volcanic soils).
- Movement of water in the soil is very slow. Where soils crack to good depth, water penetrates to be followed by roots.
- The climate of the area is semi-arid and continental characterised by a low rainfalls
- The area has low population densities due to harsh conditions.
- Roads have been built to link the scheme to markets. Industries e.g. ginneries have been developed to process agric products.

Management

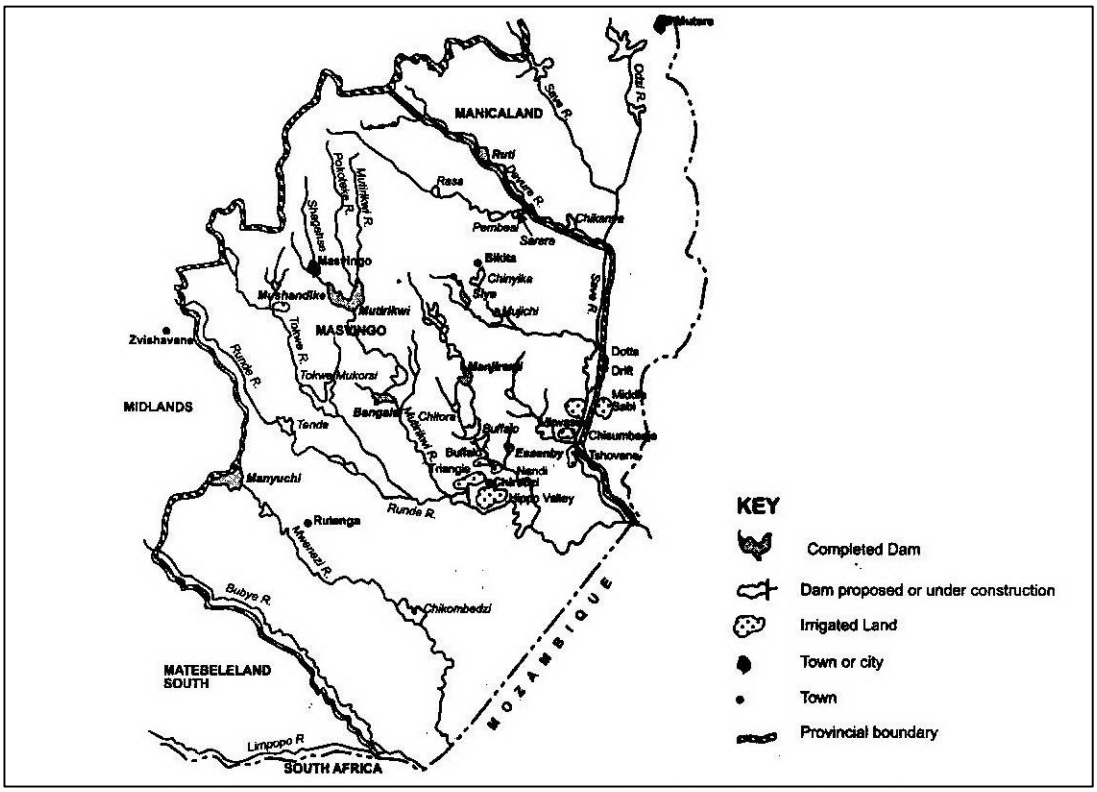
- The Gezira Management Board, a large centrally managed corporation, is responsible for the agricultural management of the scheme, lease land to tenants, determines crop rotations and prepares the land for cotton. For cotton, the Board is responsible for application of fertilizer and pesticides, seed propagation and distribution and ginning. It is also responsible for the maintenance of the infrastructure, which includes a railway network of 1,050 km in length, used for transporting cotton.
- The Ministry of Irrigation is confined to ensuring the delivery of water into the minor heads as indented by the block inspectors provided that the water demands are within the canal carrying capacities.
- Farmers do not own their lands; they are tenants.
- Tenants supply or hire labour, tend the crops, pick seed cotton and transport it to ginnery collection centres. They are responsible for land preparation for crops other than cotton.
- Tenant participation in agriculture has fallen hence rely on family labour, hired resident labour and migrant labour.

Successes and problems

- Increase of the irrigation area in recent years.
- The cropping intensity increased however, the economic situation in Sudan deteriorated as in most countries dependent on the export of agricultural production.
- Siltation has resulted in reducing the live storage at Sennar and the reservoir
- In 1984/85, for example, wheat rotation was cut due to insufficiency of water.
- Shortage of financial resources, insufficient funds become available to finance the recurrent operation and maintenance costs of the Gezira.

Case Study 2

South East Lowveld Irrigation Scheme



- Ownership is varied i.e. Sikato, Nandi, Chisumbanje and Middle Sabi are owned by ARDA and Hippo Valley is owned by Anglo-American company.
- The climate of the area is semi-arid and continental characterised by a low rainfalls
- It relies on water drawn from dams built on large rivers in the south e.g. Manjirenji and Bangala.
- It includes commercial and indigenous out growers growing cotton, sugarcane, wheat coffee, fruits and beef.
- The area has low population densities due to harsh conditions.
- The uniform slope of the land has permitted a very regular layout of fields.
- The soils are fairly uniform, and classified as vertisols that have clay content (rich volcanic soils).
- Roads have been built to link the scheme to markets.
- Industries e.g. ginneries have been developed to process agric products e.g. sugar mills.
- S.E Lowveld relies on sprinkler and flood irrigation.

Mixed commercial farming
The rearing of animals and the cultivation of crops on one farm.

Characteristics
- Several products are produced in different seasons.
- Livestock production complements crop production, with animals feeding on crop residues while their dung contributes towards increasing humus and fertility of the soil. It is highly mechanised with tractors combine harvestors, boom sprayers and silage cutters.
- Skilled man power and management results in high outputs per unit area.
- It is capital intensive and the money is used to buy machinery, vaccines , fertilisers, seeds, extra feeds for livestock, herbicides and to pay workers.
- The money is also used to construct buildings sheds and storage facilities.
- Mixed farms practice crop rotation

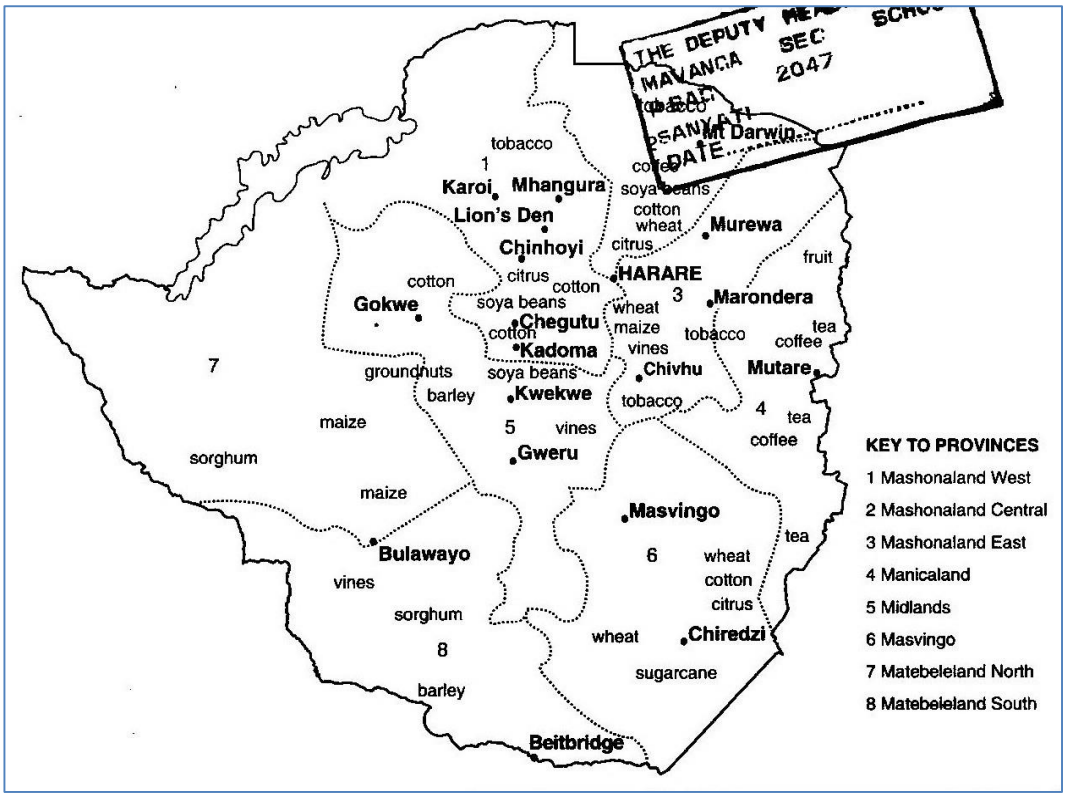
Advantages

a) Diversified production ensures that the farmer gets a steady income all year round. This include food crops, industrial crops, and beverages, poultry, piggery, aquaculture plus a herd of cattle for beef and for dairy products. It ensures that a farmer is not affected by fluctuations of prices on the market since the farmer produces several products.
b) High outputs due to the complementary nature of raising animals and food crops.
c) There is maintenance of the ecosystem to some extent due to the rearing of animals and the cultivation of crops on the same farm.

Case studies- Gletwyn farm

Location- outskirts of Harare along enterprise road.
Size -1200 ha-of which 320 arable and 880 used for pasture.
Region- 2- has enough rainfall for crop production; red sandy loams are suitable for maize, potatoes and soya beans. The area is near a large market which is Harare.
Inputs-1 manager, 1 mechanic. 30 workers,6 tractors, 3 lorries and 4 trucks
Seeds, fertilisers, lime, cattle, vaccines, labour
Processes-cultivation, planting, potato lifting, marketing crops, dipping, selling seed maize harvesting, cattle fattening.
Outputs-maize, soya beans, potatoes, sorghum, cattle and seed maize.

Distribution of commercial farms in Zimbabwe



Commercial ranching
- This refers to the rearing of cattle on a large scale with the sole aim of selling them for a profit.

Characteristics

- The farm covers large areas which are divided into paddocks.
- Rotational grazing is practiced.
- Large amounts of capital are needed to purchase the land, fence, drilling of boreholes, irrigating fodder crops, paying workers and veterinary services for the animals, purchase concentrate for fattening.
- Owned and operated by rich individuals or by Parastatals .e.g. CSC. Lemco and Union carbide Mat south.
- There is extensive use of land characterised by low input per unit area of land.
- Artificial insemination can be practised to produce breeds with desirable characteristics.
- No computers used.
- Animal left to roam around looking for pastures.
- Less capital required once initial capital has been used.
- Ranches scientifically managed.
- Animals are vaccinated and dipped regularly.
- Diseased animals are slaughtered or treated; quarantining is also done followed by treatment.
- Cross breeding is done to suit conditions

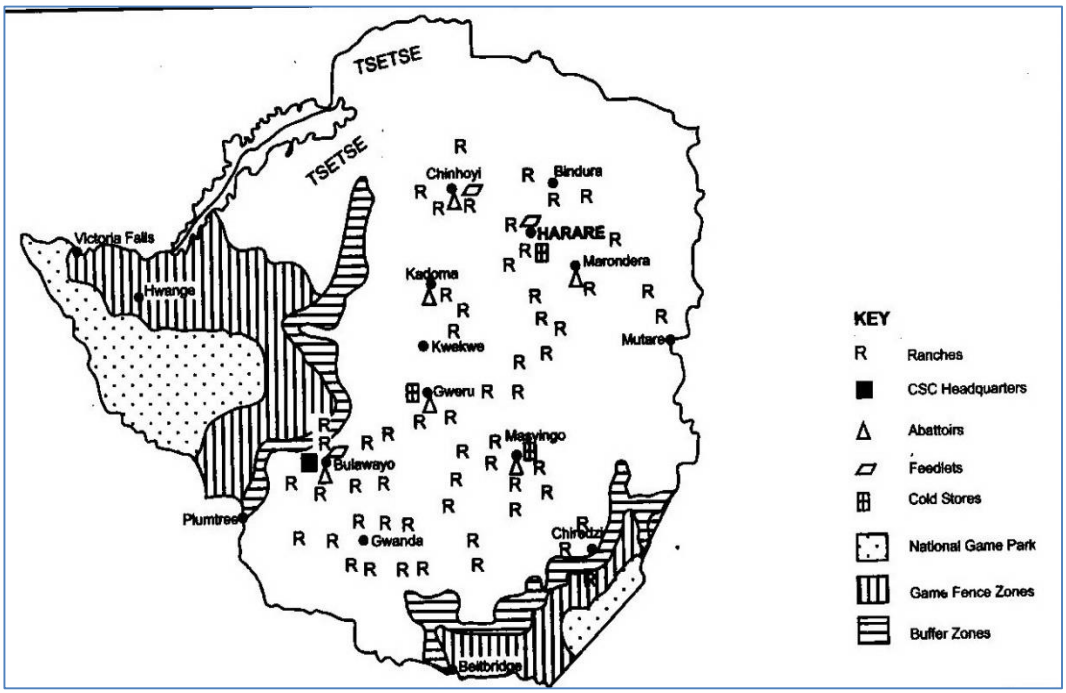
Advantages

a) Earns the country valuable foreign currency as there is high demand for our beef in the EU.
b) It makes meat products available for local and foreign markets.
c) It leads to the sprouting of by-product industries such as glue manufacturing companies and shoe making such as Bata.
d) Makes use of semi- arid land which is otherwise not suitable for agriculture.
e) Rotational grazing is sustainable.
f) Allows for integration with game ranching especially in the drier parts of the country e. g. in Mwenezi.

Problems

a) Frequent droughts- drill bore holes and construct dams. pen feed the animals.
b) Pests and diseases-buy pesticides, dip the animals and avoid mixing the cattle with the buffalo, quarantine and vaccinate , kill the affected. Cross breed with other breeds which are disease resistance

Distribution of ranching in Zimbabwe



Market gardening

- The intensive growing of vegetables, fruits and flowers for sale.

Characteristics

- Land is under cultivation all year round.
- Perishables which require special attention and precise harvesting are grown.
- It is capital intensive- for purchasing irrigation equipment, hybrid seedlings, fertilizers agrochemicals, paying of workers, and construction of green houses, artificial incubators and automatic milkers.
- It is labour intensive- picking of flowers and sorting them, nursing seedlings
- It employs qualified personnel who in turn ensure proper management and expertise so as to survive the market completion.

Advantages

a) It produces products in demand on the local market and abroad.
b) It brings in a lot of foreign currency.
c) Provides employment to university graduates.
d) Encourages the growth of fertilizer and pesticides industries.

Disadvantages

a) Can incur huge losses in the event of a natural or human triggered hazard. Crops can be destroyed by frost, floods, hailstorms and strong winds.
b) Fluctuations of the market can reduce the farmer's income.

Market Gardening as a System

INPUTS	**PROCESSES**	**OUTPUTS**
Land Conducive climate Water	Planting Weeding Watering	Vegetables e.g. cabbage, carrots, rape etc. Fruits

Irrigation equipment Green houses Labour Fertilizers and chemicals Capital Spraying equipment Vehicles.	Application of fertilizers and chemicals Harvesting Transporting Land preparation	Flowers Cash etc.

Factors favouring intensive agriculture in MEDCs

- ❖ Large urban population has to be fed.
- ❖ Farmers well educated with all modern skills.
- ❖ Strong commitment and support from government.
- ❖ Fertile soils.
- ❖ Mild, maritime climate favours the growth of pastures.
- ❖ There is a large ready market in Europe.
- ❖ Good transport links

Case study- Honeydew farm : Market Gardening

- ❖ Location- 14 km from Harare's city centre into Greendale.
- ❖ Size – 50 acres.
- ❖ Crops gown- 30 different types including cabbages, tomatoes, onions, cucumbers, garlic, carrots, cauliflower, beetroot, turnips, germ squash, fennel, lattice to name a few. 130 workers- less machinery because the farm is labour intensive.
- ❖ Crops are grown throughout the year.
- ❖ Crop rotation is practiced.
- ❖ Compost manure is also used in addition to the use of fertilizers.
- ❖ Drainage ditches are constructed to improve the poor drainage of the soils.
- ❖ Inter cropping is continuous and it ensures that there is a reduction in the incidences of pests and diseases.
- ❖ The most serious pests are aphids, caterpillars and red spider mites to name a few.
- ❖ Leaf blight is the most common fungal disease.

Infrastructure

- 7 boreholes.
- 5 green houses.
- Three main irrigation systems- overhead, micro jet and T-tap drip system.
- The boreholes pump large quantities of water needed at the farm e. g. Over 21000 litres per hour.
- The micro jet system is used in green houses.

Commercial Dairy Farming

- It is an intensive type of livestock farming for the purpose of producing milk and related products.
- The system is capital intensive.
- It requires animal sheds and storage facilities for winter fodder.
- Common breeds are jersey brown to yellowish suited to hot humid conditions (produces milk with a high butter fat content).

Friesland – large animal with a large udder back and white in colour, can tolerate hot dry regions, it is economical (preferred by most farmers as it has a high milk production) and also supplies meat

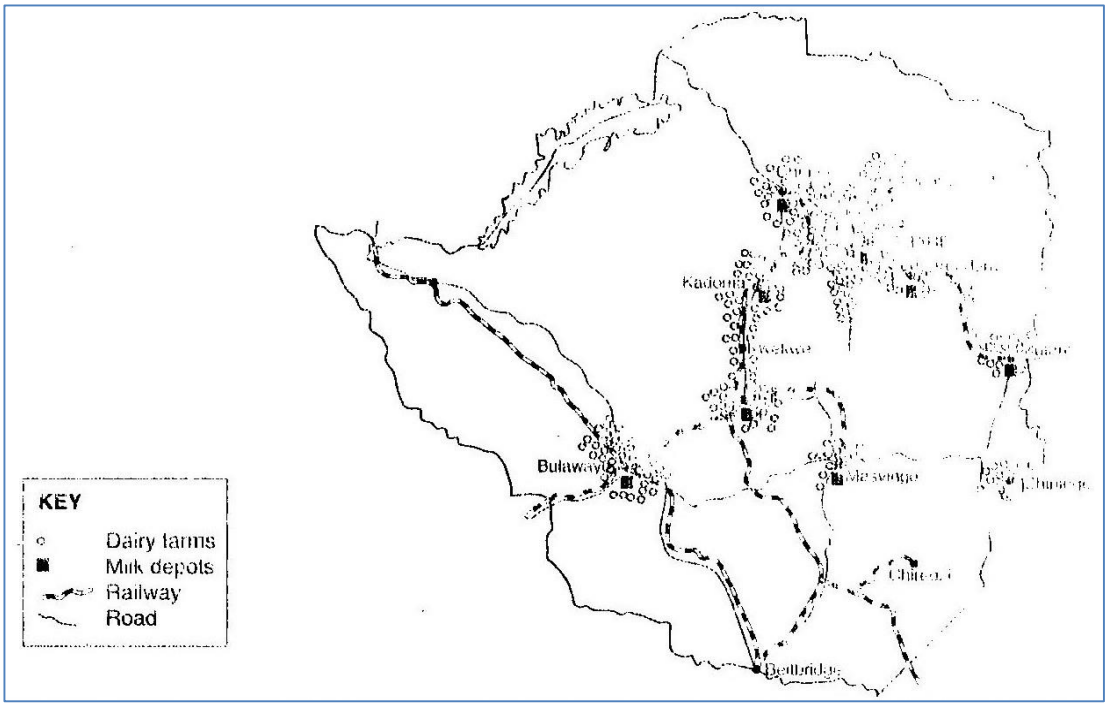
Guernsey- golden yellow to red with white marks second to jersey in milk fat.

- Requires temperate climates.
- Milk is processed into cream, butter, cheese, condensed milk and powdered milk.
- Can be practiced on small areas.
- Requires veterinary services, automatic milkers vaccination, feeding towers, milking.
- High output per unit area.

In less economically developed countries transport plays a major role in the distribution of dairy farms.

- Dairy farms decrease with distance from the urban where there are good road networks the farms can be some distance from the market.

Question 1. Describe and explain the distribution of dairy farms in Zimbabwe and Africa. [16], Dynamics of O`Level Geography page 135.



Location of Dairy Farms.

- Dairy farming is practised near urban areas or around cities or towns so that milk is transported while fresh. (Why)
- Dairy farms are found along/near roads so that transportation of milk will not be a problem and also inputs and other requirements from urban areas will be easy and cheap to obtain.
- Dairy farms are located where there is reliable water supply since dairy farming needs a lot of water i.e. near urban areas.
- Dairy farms are located near urban centres because there is high demand for dairy products i.e. the Kintyre farm near Harare.
- In Zimbabwe dairying occurs around Mutare, Chipinge and Chimanimani and around Harare, Marondera and Kadoma

Case Study

Dairy Farming: The Kintrye Estate.

This is farming system whereby cows are kept for milk production as at Kintyre dairy farm near both Harare and Norton along the Harare- Bulawayo road. Or Gushungo Dairy Farm in Mazowe area.

Urban Agriculture

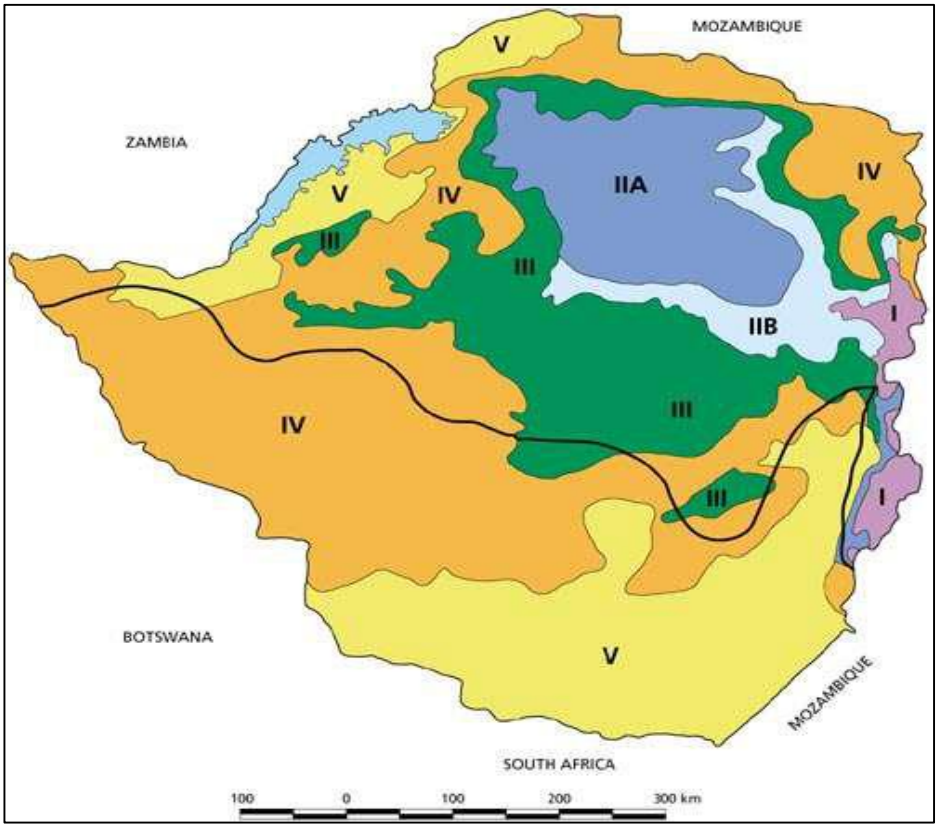
Research work

Qn 1. (a) What is urban agriculture? [2]
(b) State any five reasons why people practise urban agriculture. [5]
(c) Outline any our features of urban agriculture. [4]
(d) Suggest benefits and problems of urban agriculture. [7]

Agriculture in Zimbabwe

- Zimbabwe is a landlocked country in the Southern Africa region with an area of over 390 000 km2. It is situated between 15 and 22° south latitude and 26 and 34° east longitude.
- Climatic conditions are largely sub-tropical with one rainy season, between November and March.
- Rainfall reliability decreases from north to south and also from east to west. Only 37% of the country receives rainfall considered adequate for agriculture.
- Zimbabwe was once the bread basket of southern Africa producing most of the food crops but it has since changed due to a number of factors.
- Zimbabwe can be divided into 6 agro ecological regions looking at annual rainfall and annual temperature variations.

Natural farming Regions of Zimbabwe



Source: Rukuni and Eicher, (1994 pp.42)

Natural Region I: Specialised and diversified farming region

- This region lies in the east of the country.
- It is characterised by high rainfalls of over 1000mm per year, low temperatures, high altitude and steep slopes.
- The country's timber production is located in this region. The plantations are owned mainly by the State through the Forestry Commission and by multinationals. There are several small owner-operated plantations and sawmills.
- It is ideally suitable for intensive diversified agriculture and livestock production, mainly dairy farming.
- Common crops are tropical crops such as coffee and tea, deciduous fruits, such as bananas and apples, and horticultural crops, such as potatoes, peas and other vegetables. Flowers, such as protease (Proteaceae spp.), are grown for export.

Region IIA - Intensive Farming

- This region is located in the middle of the north of the country.
- Rainfall is confined to summer and is moderately high (750-1000mm).
- Two sub-regions have been defined. Sub-region IIA receives an average of at least 18 rainy pentads per season and normally enjoys reliable conditions, rarely experiencing severe dry spells in summer.
- The region is suitable for intensive systems of farming based on crops (tobacco, maize, cotton, sugar beans, sorghum, barley, various horticultural crops and coffee) and /or livestock production including beef, dairy, pig and poultry.
- Supplementary irrigation is done for winter wheat (May-September).
- A large proportion of the farms were subdivided into smaller units and allocated to new farmers under the A1 and A2 small-scale farming system.

Region IIB - Intensive Farming

- This sub-region receives an average of 16-18 rainy pentads per season and is subject either to rather more severe dry spells during the rainy season or to the occurrence of relatively short rainy seasons.
- In either event, crop yields in certain years will be affected, but not sufficiently and frequently to change the overall utilisation from intensive systems of farming.

Region III - Semi-Intensive Farming

- NR III is located mainly in the mid-altitude areas of the country.
- Rainfall in this region is moderate in total amount (650-800mm), but, because much of it is accounted for by infrequent heavy falls and temperatures are generally high, its effectiveness is reduced.
- The region is also subject fairly severe mid-season dry spells and therefore is marginal for maize, tobacco and cotton, groundnuts and sunflower production, fodder crops) and cash crops.
- Smallholders occupy 39% of the area of this region. Large-scale crop production covers only 15% of the arable land.

Region IV - Semi-Extensive Farming

- This region experiences fairly low total rainfall (450-650mm) and is subject to periodic seasonal droughts and severe dry spells during the rainy season.

- The rainfall is too low and uncertain for cash cropping except in certain very favourable localities. Smallholder farmers grow drought-tolerant varieties of maize, sorghum, pearl millet (mhunga) and finger millet (rapoko).
- NR IV is ideally suitable for cattle production under extensive production systems and for wildlife production, but it can be intensified to some extent by the growing of drought-tolerant fodder crops.
- Communal farmers occupy 50% of the area of Natural Region IV .

Region V : Extensive Farming

- The rainfall in this region is too low and erratic for the reliable production of even drought-resistant fodder and grain crops like millet and rapoko and farming has to be based on the utilisation of veld alone.
- The extensive form of cattle ranching or game ranching is the only sound farming system for this region.
- Included in this region are areas of below 900m altitude, where the mean rainfall is below 450mm in the Zambezi valley and below 600mm in the Save-Limpopo valleys. 46% of the area of Natural Region V.

Region V1

- This is a more recent demarcation which does not appear on the map. The area around the Tuli circle.
- Consists of barren soils unsuitable for arable farming. Used mainly for wild life.

NOTE:
A rainy pentad is defined as the centre one of three five-day periods (pentads) which together receive more than 40 mm and two of which receive at least 8 mm of rainfall.

Communal peasant farming in Zimbabwe

The characteristics are those listed under sedentary farming.

- In Zimbabwe communal farming is under semi-subsistence farming.
- Farmers grow food crops (millet,sorghum, rapoko, ground nuts and round nuts) and cash crops (cotton, paprika, maize and sunflowers).
- Land holdings are small 2-6 ha per family.
- The system is labour intensive (usually from family members).
- Domestic animals such as cows, donkeys are used as draught power.
- Capital is from employed family members.
- Production is limited because of the shortage of capital.
- Most peasant farmers lack knowledge of new farming techniques (pAREX officers help).
- Soil fertility is maintained by crop rotation and some animal manure is also added to the fields.

Some farmers are now increasingly using fertilisers and hybrid seeds.

Reasons why production of food is low in the communal areas of Zimbabwe

a) Poor management.
b) Use of traditional methods of farming.
c) Low levels of technology and low level of skills.
d) Shortage of land suitable for farming.
e) Rapid population growth which exceeds food output.
f) Growing cash crops instead of food crops.
g) Land tenure system.

h) Low investment in farming.
i) Inheritance laws which lead to land fragmentation.
j) Lack of capital to buy inputs.
k) Poor soils due to over cultivation.
l) Lack of machinery.
m) Political interference.
n) Frequent droughts
o) Pests and diseases.
p) Shortage of labour due to rapid rural to urban migration by the economically active.

Ways of increasing out put

a) Educating farmers on modern farming methods.
b) Land consolidation for better profitable farming.
c) Land reclamation to increase area under crops.
d) Use of artificial fertilisers.
e) Use of hybrid seeds.
f) Government assistance through issuing loans.
g) Resettlement of people on fertile land.
h) Use of green houses in winter and irrigation such that production is all year round.
i) Changing the communal ownership to private ownership.
j) Use of agro chemicals for pests.
k) Use of HYVs.
l) Use of green revolution technologies.
m) Input schemes and technical assistance.
n) Adequate research and extension services especially on rainfall, soils and type of crop to be grown.
o) Use of genetically modified varieties of seeds.
p) Switch from cash crops to food crops.
q) Heifer project to increase draught power.

The role of information technology in agriculture

- Computers – these can be used in irrigation to detect when plants need water and the water is supplied automatically.
- Use of computerised machines in the milking of dairy cows.
- Use of computers for the incubation of eggs, this serves time and labour.
- Storage of agricultural data base on computers which can quickly be retrieved and used when needed.
- Office automation improves communication with farmers in the same line of production. E. g telephone, fax.
- Easy and fast transactions with consumers and suppliers.
- Status of orders and consumers kept on real time.
- Management information systems, help generate information to assist farmers in decision making.

Land reform in Zimbabwe

Land reform in Zimbabwe is an attempt by governments to correct a colonial imbalance by equitably redistributing land to the landless Zimbabwean rather than a situation whereby 1 % of the population (whites) occupy more than 70 % of the land.

It can be divided into 2 phases

- Phase 1-1982-1997.
- Phase 2000 onwards.

Aims of the land reform programme

- Rectify the colonial land take over.
- Utilise land lying idle and increase food production in the process.
- Equitably redistribute the land to the majority blacks.
- Relieve pressure on overcrowded communal lands.
- Give land to the landless.
- Improve the living standards of the poor.
- Give land to people displaced during the war of liberation.
- Create jobs on farms owned by individuals and co-operatives.
- Provide a token of appreciation to those who fought during the liberation struggle.
- To facilitate profitable farming by the peasants.

Phase I : 1980s

- It began soon after independence in 1980 through an act of parliament which was drawn in the spirit of the Lancaster house agreement i.e. willing seller, willing buyer. This could not be changed for 10 years.
- The government only acquired 40 % of the required 8 million hectares of land to resettle about 162000 families.
- The government only managed to resettle 71 000 families in 1992.
- Another act of parliament was enacted to remove the willing seller willing buyer close and to limit the size of the farm and to introduce a land tax which was never implemented.
- The aim was to speed up the land reform programme.
- The act empowered govt to compulsorily buy the land for redistribution however land owners could challenge the decision by government in court.
- In the 1990s 2.47 million acres were acquired and this benefited only less than 20 000 families.
- The land acquired during this phase was of poor quality according to the Human Rights Watch.
- In 1997 the government conducted a land identification exercise where it published a list of 1471 farms it intended to acquire compulsorily.
- The costs were to be paid by the British government.
- The then secretary of state for the labour government rejected the responsibility of paying for the land if it were acquired.
- In 1998 the Zimbabwe government published a policy frame work on land reform and resettlement programme phase 2

Phase 2 : LRRP II

- The policy frame work envisaged the compulsory purchase of over 50 000 square kilometres from the 112 000 owned by white commercial farmers, public corporations, churches, MNCs in the next 5 years between 1998-2003.
- Broken down it meant that the government was going to compulsorily buy 10 000 square kilometres of land each year.
- In 1998 September the government of Zimbabwe held a donor conference on Harare on the LRRPII to inform the donor community and involve them in the exercise.
- 48 countries attended and endorsed unanimously the programme in 1999.
- The commercial farmers union offered 15 000 square kilometres of land for sale.

- The constitution was amended so that acquisition of land was to be done compulsorily without compensation.
- The draft constitution was put to a referendum where it was rejected.
- A few days later war veterans decided to march on white owned farms biting drums singing and dancing. As marching continued they began seizing the land violently and when the violence ended they had seized 110 000 square kilometres of land.
- In 2004, The minister for lands, land reform and resettlement John Nkomo declared that all land would soon become state land.
- Farm land deeds would be replaced by 99 year leases and wild life conservancies would be limited to 25 years.
- Farmers resettled under A1 and A2 Models 2006.
- Newly resettled farmers fail to secure loans because of lack of collateral.
- Minister of agriculture was considering legislation which would compel commercial banks to issue loans to the newly resettled farmers. Failure oif which the operating licence would be withdrawn.
- The land reform in Zimbabwe was a strong tool for the 2000, 2008 and 2013 presidential elections which saw Zanu PF winning resoundingly according to the reports published by the ZANU PF spokesperson.

Results of the land reform programme

- Many thousands of people resettled.
- Living standards raised.
- People given the right to own land.
- Crop production per family increased for those who were resettled.
- Some equity in the ownership of the land established.
- Commercial farmers abandon their operations.
- Inexperienced new farmers led to a reduction in the overall production of food crops hence the country experienced food shortages from 2008 -2009.
- Movement of animal across ecological regions saw the spread of animal diseases such as foot and mouth and anthrax.
- Lack of technical knowhow saw a general decrease in the national herd.
- Poor quality livestock produced.
- However this has since improved due to increased grazing land and new innovative ideas.
- Multiple ownership of land resulted in much land under utilised.

Changes in agriculture

Organic farming
Many of today's farm systems are a direct consequence of farming practices originating hundreds of years ago. There have been numerous changes in other areas. One significant change in recent years has been the movement to organic farming.

We can define organic farming, as:
"Farming that does not use industrially produced chemicals as pesticide, herbicide, fertiliser. Nor does it use drugs to increase the size / yield of its livestock."

Organic farming has increased for two reasons:
- It has been led by farmers with smallholdings who feel a deep commitment to the environment.

- It is also consumer led as people are concerned about the chemical content and safety of many foods. The BSE crisis has furthered the demand for organically grown food. Yields are lower and costs greater but people are prepared to pay more for organically produced food.
- Many people believe that organic farming is a return to more traditional farming method.
- This does seem to be the case for many practices. For example, there has been a return to crop rotation and fallow periods and manure and crop residues are being used instead of chemical fertilisers. A greater diversity of crops is grown - often in the same field so that if a pest does strike it will not affect the whole crop.
- All of this has clear benefits for the environment and is an example of increased sustainability in agriculture.
- There are however some concerns. Converting a farm to be officially organic is a lengthy and very expensive process. It can take five years for a farm to be recognised as organic.
- In the meantime the farmer is paying extra costs for a lower yield with no extra revenue.

Impacts of agriculture on the physical environment

- Loss of natural habitat - farming can lead to the loss of natural habitats.

- The soil itself is an ecosystem and inappropriate farming techniques can lead to soil erosion.
- Overgrazing, over cultivation and deforestation all damage the soil making it more prone to the effect of erosion.
- Use of chemicals have potentially damaging effects on the environment. Causing soil pollution and eutrophication.

INDUSTRIAL STUDIES

Industry

- Industry-any form of economic activity through which people produce goods and services for their consumption.
- Industrialisation-process through which a country establishes manufacturing industries.

A country is referred to as industrialised when production of manufactured goods is the main economic activity in that country. Less industrialised countries mainly produce agricultural raw materials.

The four main types of industry are:

1. Primary industry: The exploitation of raw materials from the land, sea or air e.g. farming and mining.
2. Secondary industry: The manufacturing of primary materials into finished products e.g. car building, food processing or construction.
3. Tertiary industry: The providing of services to individuals and other businesses e.g. teaching and nursing.
4. Quaternary industry: The generation and sharing of hi-tech knowledge e.g. medical research or computer design.

Other Ways of Classification

According To the State of Finished Goods

Heavy Industries
- Manufacture heavy and bulky products.
- Use heavy raw materials.
- Involve heavy investment in their production.
- Production is in large scale e.g. ship building, car manufacturing and assembling, oil refineries, steel rolling mills, fertiliser making plants, glass industries e.g. ZIMASCO, Lancashire in Gweru, ZIMCAST and ZIMALLOYS in Gweru etc.

Light Industries
- Ones involved in making goods with little volume and weight e.g. textile, cosmetics, plastic, printing, electronics, cigarette, e.g Phillips, David Whitehead, etc.

Industry as a System

Industry nearly always involves the making or creation of something, hence often looked at as a system. The three main parts of the system are:

- ✓ Inputs: The things that are needed to make or create a product. These maybe physical or human e.g. labour (workers), money or raw materials.
- ✓ Processes: The events or activities that take place to make a product e.g. watering crops or assembling a car.
- ✓ Outputs: The finished product that is sold to a consumer e.g. milk, a television or a car.

Location of Industry

Factors Affecting Industrial Location

- ✓ Skilled and cheap labour: In some industries especially quaternary it is important that there is an availability of skilled labour. Industries like clothes production relies on cheap labour.
- ✓ Available Capital: For industries to build factories or offices, research and develop new products or enter new markets, they need access to money.
- ✓ Market: For any industry to survive, they need customers. Therefore it is very important to locate near their potential market.
- ✓ Supply Network: Most industries have a large supply network. To ensure the smooth production of products it helps being close to suppliers.
- ✓ Good Housing: To attract any workers it is important to have suitable housing nearby. For quaternary industries this might be good quality housing for secondary industries this might be high density cheaper housing.
- ✓ Good Schools and Hospitals: Again to attract workers and especially their families, it is important to have good nearby schools and hospitals.
- ✓ Transport Links: It is important to be close to good roads and rail links so that industries can receive supplies and distribute products.
- ✓ Good Communications: It is now very important for industries to have good communications so that they can contact suppliers and customers.
- ✓ Reliable Electricity and Water Supply: For all industries a constant electricity supply is essential because industries can't afford breaks in production.
- ✓ Available Land: If industries are successful they will want to expand, so most industries will look for sites that have the potential to expand factories/offices.
- ✓ Available Raw Materials: For any industries that use raw materials (especially weight loss industries), it is very important to be close to them.
- ✓ Water Supply: For many industries, especially manufacturing, it is very important to be near a reliable water supply (river or reservoir).
- ✓ Climate: For some industries a good climate can be very important. For example you would not locate a solar panel research and development company in a place where the sun never shines.
- ✓ Industrial Inertia – Tendency of an industry to remain in a particular place even when the factors for its location no longer exist e.g. industries in the Ruhr Region of Germany have remained at the same place despite closure of coal fields and decline in coal as an energy source.

Causes

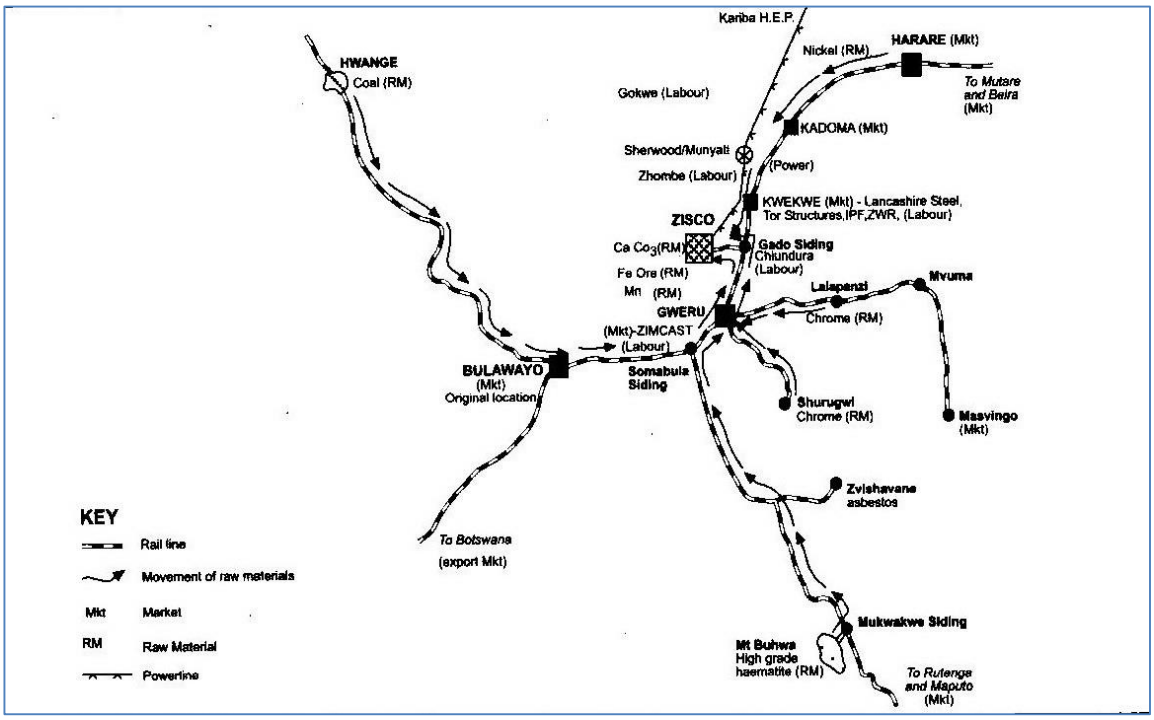
- It may be expensive to move to a new place because new factory buildings would have to be constructed, buying new machinery and equipment.
- Due to availability of experienced workers.
- To avoid the problem of transportation and other basic infrastructural facilities.

Hi-tech industry: Industries that are focused on research and development and the production of products that often contain microchips.

Conglomeration: The process of clustering together in one area.

Industrial location Case Study
ZISCO Iron and Steel Industry

Raw material based industry



- Located in Redcliff in Kwekwe.
- Relies on iron ore from Redcliff, coal from Hwange, haematite from Buchwa, water from Cactus Poort dam on the Kwekwe river.

Locational advantages

- Centrally located in the country to distribute products easily.
- Low costs of transporting raw materials.
- Availability of land.
- Water supplies from Cactus Poort dam on the Kwekwe river.
- Availability of labour and shared skills with ZIMASCO, ZIM ALLOYS and ZIMCAST in Gweru.

Importance of ZISCO

- Employment creation.
- Foreign currency earnings.
- Improvement in transport.
- Raising living standards of people.
- Growth of social services.
- Urban growth.

Problems faced by ZISCO

- Old machinery and the blast furnace need to be repaired.
- Shortage of money.
- Poor management.
- Too small markets for iron and steel.
- Competition from Chinese companies producing iron and steel from scrap metals.

Case Study 2

Japanese Car Assembly

- Japan is a country to the east of Asiatic continent made of numerous major/large and minor/small islands.
- Lacks basic raw materials and energy at home hence relies on exports.
- Examples of automobile companies include the Mitsubishi and Toyota Motor Corporations.

Factors Favouring and Car Manufacturing In Japan

- Advanced technology e.g. all the plants dealing with electronics and automobiles are automated (robots controlled by computers) which increases efficiency leading to production of large number of units, lowers production costs and leads to production of high quality goods which are competitive in the world market.
- Cheap cars as compared with those from European countries.
- Japan produces cars which are fuel efficient which creates a high demand for them in the world market encouraging the country to produce more.
- There is availability of a ready market due to Japanese high population with high purchasing power and high demand.
- There is availability of capital from the profits accrued from other industries like ship building, machinery, textiles, fishing and tourism which are invested in the development of other industries including automobiles.
- There is availability of skilled, dedicated and hardworking manpower.
- Very stable socio – political system since 1945.

Industrial relocation

- Is a situation where an industry shifts from its original site to locate to a new area or different site.
- UK Iron and steel industry has relocated from inland, coal and iron ore based location to South Wales and N.E England.

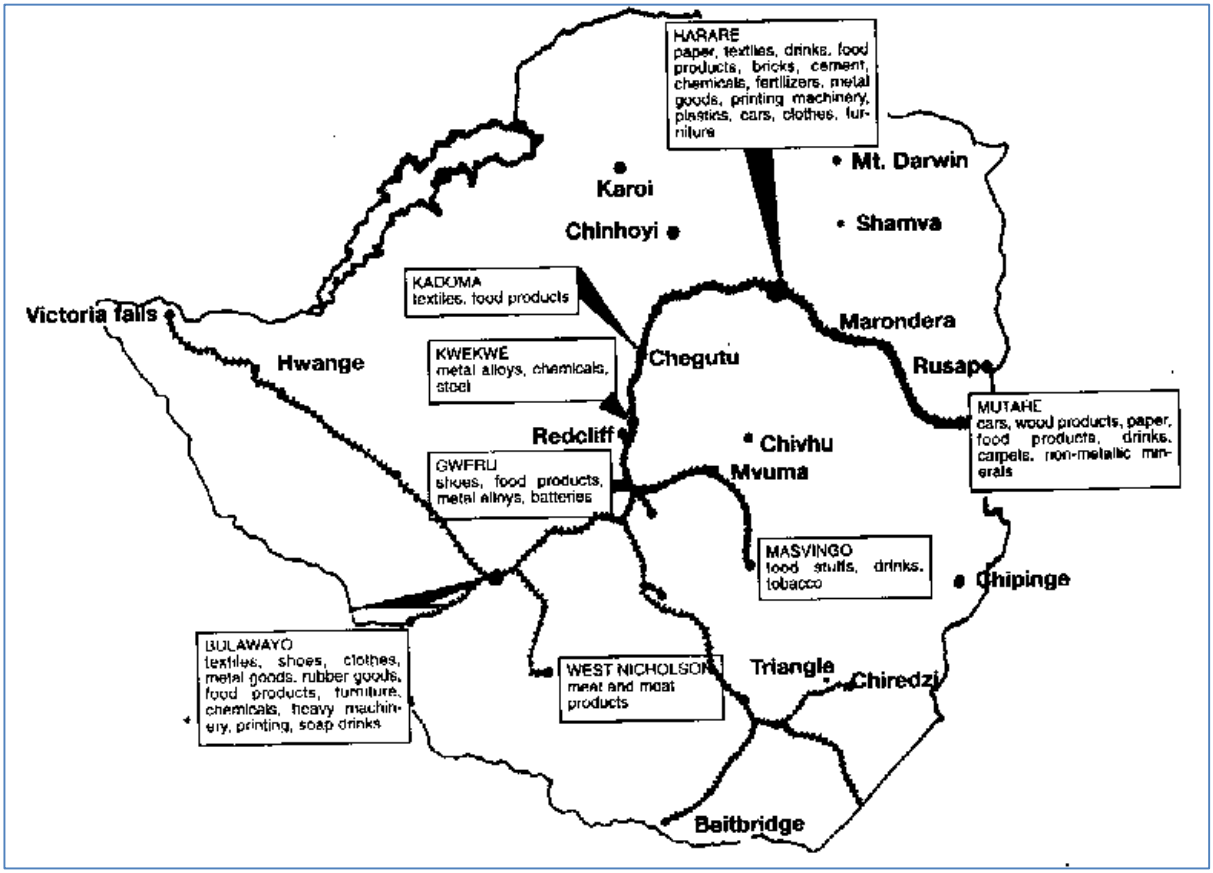
Causes of relocation

- Government policy.
- Environmental pollution.
- Raw materials exhaustion.
- Changes of market demands and transport.

Effects of relocation

- Unemployment.
- Increase in crime and prostitution.
- Economic declines as shops close down.

Distribution of Industries in Zimbabwe



- Metallurgical industries – 1. Iron and steel at ZISCO in Kwekwe, 2. Basic metals at ZIM ALLOYS, ZIMCAST in Gweru, ZIMASCO, SALWIRE in Harare and Bulawayo.
- Mechanical engineering – Harare, Mutare, Kwekwe, Gweru, and Masvingo, Car industries in Harare at Willowvale and Mutare, electrical goods in Harare and Bulawayo.
- Light industries – textiles in Harare, Bulawayo, Gweru, Kadoma e.g. Martin Spur, David Whitehead in Chegutu, food stuffs in major towns, foot wear in Gweru e.g. Bata and Bulawayo.
- Chemical industries – chemicals in Harare, Bulawayo, Triangle, Sable in Kwekwe, fertilisers in Harare, Bulawayo and Kwekwe.
- Other industries – Hi – Tech industries in Harare and Bulawayo e.g. Phillips, paper and printing in Harare, Mutare, marondera and Gweru, furniture in Bulawayo and Mutare,
- Cotton ginneries near source of raw materials in Kadoma, Chegutu, Muazabani and Sanyati.

- The factors that can account for the distribution has been sited earlier on the factors affecting industrial location.

Transnational Companies

- Are companies with economic operations in more than one country.
- Examples of TNCs in Zimbabwe are Anglo – American - UK, Lonrho - UK, Rio Tinto Zinc – UK, Nestle - Switzerland, Heinz - Germany etc.

Advantages of TNCs locating in a country

- ❖ Creates jobs for local people
- ❖ Locals with jobs then spend money in their local economy at local businesses and therefore there is a positive multiplier effect as extra money gets added to the local economy.
- ❖ TNCs will pay local and government taxes.
- ❖ Improves workers skill and education levels
- ❖ They introduce new technology into the country
- ❖ Development of Infrastructure like roads.
- ❖ Diversifies the economy, might move away from the reliance on one industry like farming or tourism

Disadvantages of TNCs locating in a country

- ❖ Many of the best paid managerial jobs go to foreigners
- ❖ Local workers often do manual jobs which are poorly paid and often workers suffer exploitation (long shifts, no breaks, etc.)
- ❖ There will be some economic leakage as profits from TNCs go back to their home country
- ❖ Products produced by TNCs maybe too expensive for locals to buy. TNCs may also use local raw materials.
- ❖ The increased demand created by TNCs may cause local inflation.
- ❖ TNC decision makers are often foreign so policies of TNCs may not always benefit local people.

- Formal Economy: The economy that is formally registered with authorities and regulated by the government. The formal sector will be liable to pay taxes.
- Informal Economy: The section of the economy that is not registered with the government, is not regulated and does not pay taxes. The informal economy is sometimes called the black market.

Informal Economy

Advantages

- ❖ Many independent poor people work in the informal sector e.g. car washers or shoe shiners. This often means the money goes where it is most needed.
- ❖ It often employs people with low skill and education levels who might normally find it hard to get a job.
- ❖ Workers may learn skills which means that they can get jobs in the formal economy.
- ❖ Many businesses actually work in local communities and recycle waste material (a form of recycling).

Disadvantages

- ❖ Parts of the informal economy is involved in illegal activities like the drugs and sex industry.

- ❖ The government does not receive taxes from these businesses.
- ❖ Because they are not regulated they don't follow any environmental guidelines and can often cause pollution.
- ❖ Workers can be exploited by not being paid fully, not receiving sick pay or being forced to work in dangerous conditions.

Formal Economy
Advantages

- ❖ They pay taxes to the government so are contributing to government revenue.
- ❖ Workers are protected so that they get a proper and regular wage and have safety regulations, etc.
- ❖ It provides products for the export market which then gain foreign income for the country.

Disadvantages

- ❖ Many businesses in the formal economy tend to mechanise to try and reduce costs and therefore don't employ as many people.
- ❖ The formal sector is often dominated by TNCs and there is often economic leakage out of profits.

Service Industries

- Is an industry which provides back – up to other services such as primary and secondary industries as well as to people for them to function well.

Tourism as a Service Industry

Tourism: The business or industry of providing information, accommodations, transportation, and other services to tourists.
Leisure: Any freely chosen activity that takes place in non-work time.
Domestic Tourist: Someone who goes on holiday in the country that they are resident in (live in).
International Tourist: Someone who goes on holiday to a country they are not resident in e.g. they live in Zimbabwe but go to the USA for holiday.
Resort: A type of large hotel that offers extra facilities like swimming pools, spas, restaurants, bars, activities, etc.
Package Holiday: This is when all aspects of a holiday e.g. flights, hotel, transfers, etc. are included in one overall price.

All-inclusive: A hotel or resort that includes everything e.g. food, activities and drink in one overall price.

Growth of Tourism

Tourism is a rapidly growing industry and is considered by many countries to be an important development strategy. Currently the majority of international tourists go to MEDCs, but many LEDCs are also seeing rapid growth in tourism.

Reasons for Growth in Tourism

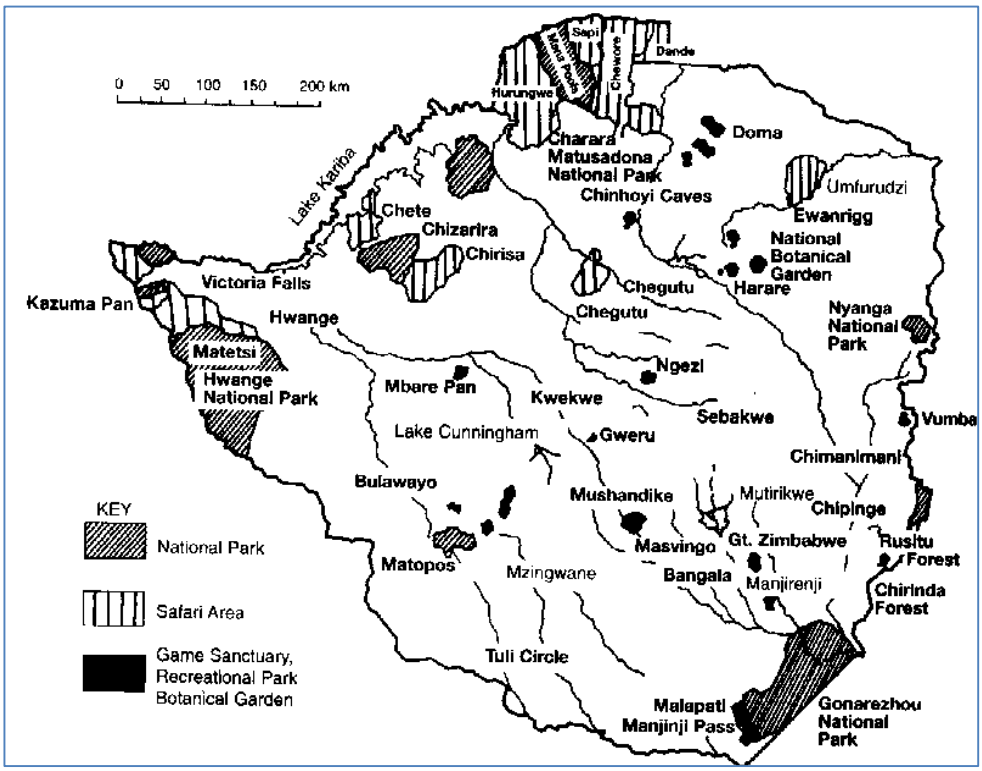
- ❖ Leisure Time: Most workers now enjoy a two day weekend and in addition are entitled to several weeks holiday. This holiday time can be spent going on holiday.

- ❖ Paid Holiday: Not only do an increasing amount of workers receive holiday, they are also paid for it. This means that people do not lose their weekly income by going on holiday.UK workers get least paid leave.
- ❖ Income: More and more people are working in the secondary and tertiary sectors, where pay is generally higher. Also many more females are now working. This means that more people now have money to spend on holidays (higher disposable income).
- ❖ Transport: Air travel has become relatively cheaper and there are now more airports open for holiday flights.
- ❖ Advertising: People are now bombarded by holiday adverts on the internet, television, radio, mobile phones, billboards, etc. This makes people more aware of holiday destinations and possibly more tempted to book them.
- ❖ Tourist facilities: Tourist facilities have generally improved and increased in number. There are now many more hotels of all sizes and most have fairly standard services.
- ❖ Freedom: More people, especially women and the elderly are free to travel and go on holidays. In addition formerly closed countries like China now allow most of their citizens to travel.
- ❖ Passport Ownership and Visa Regulations: More people now own passports so are able to travel and the process of obtaining visas is now much more straightforward.

A region may experience a decline because of:

- Terrorism e.g. Bali bombing or Mumbai terror attacks.
- Crime e.g. South Africa.
- Natural disasters e.g. tsunami in Indian Ocean or hurricanes in the Caribbean.
- Economic downturn e.g. recessions and debt crisis in Zimbabwe from 2000 to 2008.
- Wars e.g. Afghanistan.

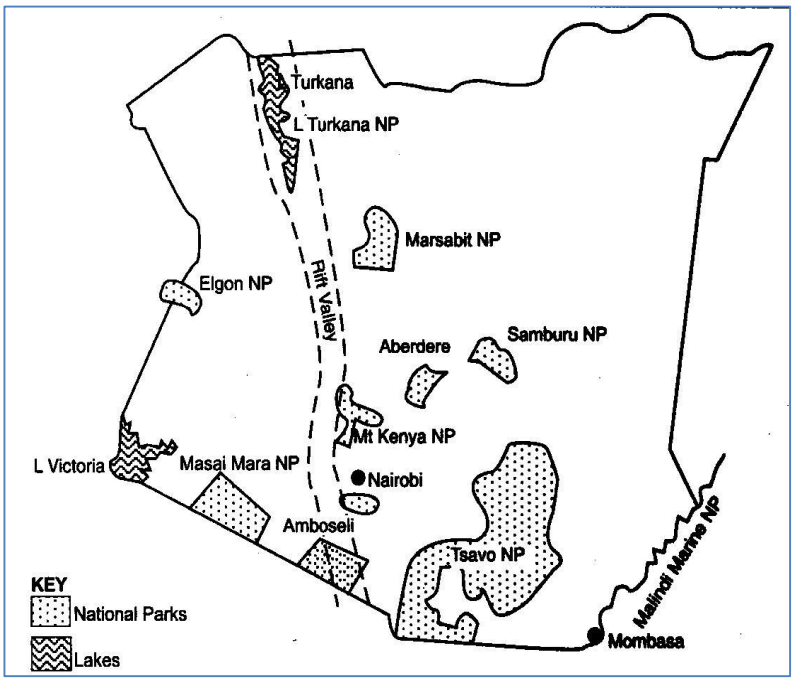
Tourist Attractions in Zimbabwe



Physical Attractions

a. Victoria Falls – the waterfalls, rainball, rainforest,gorges, crocodile farm,traditional dances, photography,hotels and golf courses.
b. Matopos – the granite topography, caves, monuments, paintings, birds wildlife and vegetation.
c. Nyanga, Vumba – mountains, forests, gardens, gorges, waterfalls, cool climate.
d. Chinhoyi – Limestone caves and paintings.
e. Hwange – wildlife, lodges and vegetation.
f. Gonarezhou – wildlife and scenery.
g. Lake Kariba- fishing, boat cruising, gorge and bird viewing.
h. Matusadona – Vegetation.
i. Mana Pools – wildlife.
j. Dande, Devule–wildlife, hunting and scenery.
k. Kyle, Great Zimbabwe – fishing, wildlife, Mushandike Rrruins, African Heritage.
l. Harare – botanic garden, heroes acre, City life.

Tourist Attractions in Kenya



Main Attractions at the Coast

(b) Beautiful natural uncrowded and unpolluted sandy beaches which are ideal for sun-bathing (sitting or lying in strong sunlight in order to make the body brown).

(c) Warm and sunny climate due to tropical location which attracts tourists from temperate regions who escape from the harsh winter cold and come for health purposes.

(d) Water sports like yatching, surfing and sport fishing which are carried out in the Indian Ocean.

(e) Historical sites such as Fort Jesus, Gedi ruins, Vasco Dagama and slave caves in Malindi and Shimoni.

(f) Traditional culture of the coastal people e.g. they have a unique way of dancing, songs, clothing and handicrafts and shrines e.g. Kaya of the Mijikenda which attracts tourists.

(g) Mangrove swamps which have unique plants and different species of fish, snails, snakes, birds etc.

Main Attractions Inland

(a) Wild life conserved in National Parks and Game Reserves. Wildlife is conserved in their natural habitats.

(b) The Famous wildebeest migration in the Mara.

(c) The sunny warm climate which attracts tourists from temperate countries.

(d) Attractive scenery such as the snow capped Mt. Kenya, the Great Rift Valley and its lakes and hot springs and geysers and great rivers with waterfall

Diverse culture of inland people e.g. the Maasai way of dressing, dancing, housing.

(f) Historical attractions such as Kariandusi near Gilgil and Orgesailie near Magadi featuring artefacts of Iron Age.

(g) National museums of Kenya in Nairobi.

Question 1

Compare tourism industry of Zimbabwe and Kenya. [10]

Advantages of Tourism

Social/Cultural

- Local people can perform traditional dance and music to tourists therefore protecting their local culture.
- Tourists may pay to visit museums protecting local artifacts.
- May improve countries reputation and create cross-cultural links.
- Encourages education in order to work in tourist sector and should improve linguistic skills

Disadvantages

- Tourism can increase certain crimes, like prostitution and theft
- People may become more materialistic and homogenised with the arrival of international tourists.
- May create racial tensions between tourists and locals

Economic

- Jobs are created for local workers in hotels, restaurants, etc.
- Workers and companies pay taxes to the government. This money can then be invested.
- People learn new skills that can then be transferred to other parts of the economy.
- New equipment or technology may be introduced to the country which again can be used in other sectors of the economy.
- Local infrastructure like roads and electricity may be improved.
- Attracts foreign investment hence country get foreign currency.
- Diversification of the economy

Disadvantages

- Many of managerial jobs go to overseas workers. Local workers often get low paid jobs
- There is economic leakage (loss of money overseas) because many of the tourist companies are TNCs and the profit is sent elsewhere
- Many jobs are only seasonal so workers are only paid half of the year e.g. the ski season is less than 6 months long.
- The increased demand for products and services may cause inflation
- Countries or regions may become dependent on just one industry.
- Increased congestion on roads

Environmental

- National Parks may be created protecting areas of natural beauty
- Animals obtain an economic value if people are willing to pay to see them. Sometimes tourist developments may cause the destruction of forests, sand dunes, etc.
- Noise and light pollution created by tourist developments may also interfere with animals.

Problems facing Tourism in Zimbabwe

1. Illegal hunting of animals which reduces some rare wildlife species which attract tourists which reduces the number of tourists visiting the country e.g. death of Cecil (Lion). The solution using game rangers to patrol game parks to hunt for illegal hunters and banning trade in game trophies and inspecting tourists at departure.
2. Pollution of aquatic systems such as Lake Mutirikwi which has caused the death of fish reducing the number of tourists since some are specifically attracted to fishing. The solution is regular inspection of factories to ensure treatment of effluents before they are released to water bodies.
3. Lack of incentives e.g. tariffs levies etc.

4. Funding and operation of National Parks has been reduced.
5. Sudden changes in domestic airline schedules.
6. Political instability, disputed elections and failure to respect property rights.
7. International media giving negative publicity of Zimbabwe by portraying it as an insecure country.
8. Lack of tourism national policy.
9. Air fares from and to many parts of the world is high due to high fuel prices which discourages tourists from coming to Zimbabwe.

- Sustainable tourism: Tourist activities that are socially, environmentally and economically sustainable.

Eco-tourism
Environmentally friendly tourism or tourism emphasizing environmental conservation where tourists and local communities are involved in enjoying nature as well as conserving it or.

Aspects/Characteristics of Ecotourism

(a) Tourists are guided along marked trails instead of driving to the areas where there are animals.
(b) Telescopic viewing of animals to avoid disturbing animals.
(c) Use of camping sites rather than big tourist hotels so as not to put pressure on resources which animals depend on.
(d) Prohibiting off road driving and travelling by foot.
(e) Allowing particular types of vehicles.
(f) Warning people against throwing cigarette remains on dry vegetation.

Ecotourism Activities
- Bird watching, safari (animal watching), cycling, beach cleaning

How Ecotourist Resorts Can Be Eco-friendly

- Tree planting, Use renewable energy sources e.g. wind and solar, build using only local products, serve only local food, using locally sourced products, employ only local staff, recycle all waste, treat and clean all water,educate guests about the importance of protecting the environment promote local culture

Protectionism

- Protectionism is measure that a government uses to try and protect domestic industry. The three main ways that a government aims to protect its domestic industry are through; tariffs, quotas and subsidies:
  a) Tariffs: A tax placed on foreign imports to make them more expensive and less competitive than locally produced products.
  b) Quotas: A limit placed on the amount of foreign imports. By limited the amount of imports this again should increase the price of them and make them less competitive.
  c) Subsidies: Financial support given to domestic producers to make their products cheaper compared to foreign imports. This might take the form of a grant or loan (money), or it might be reduced taxes or a plot of land that is given to them to build on.

POPULATION STUDIES

Population

Total number of people occupying a given area.

Demography-study of statistical data on human populations or the study of population
Census- This is the door to door counting of people, recording of economic activities, age, sex, education, information flow (e.g. radio) and occupation.

Enumerators - are people who do the counting of people.

Advantages of a census

- Information is collected from almost every corner of a country.
- Information is reliable and fairly detailed hence reasonable planning can be based on such information i.e. it helps the government to plan for the future.
- Keeps the government more organised.
- Keeps detail of all the people within the country.
- Shows the government the population status of the country.

Disadvantages of a Census

- Very expensive to conduct.
- People may feel uncomfortable revealing their personal details.
- It is time consuming
- Some areas are not reached or inaccessible and information may not be collected.
- There may be language barriers when asking for information.
- Some people can run away from enumerators due to ignorance and low level of education.

Other Ways of Collecting Population Data Include

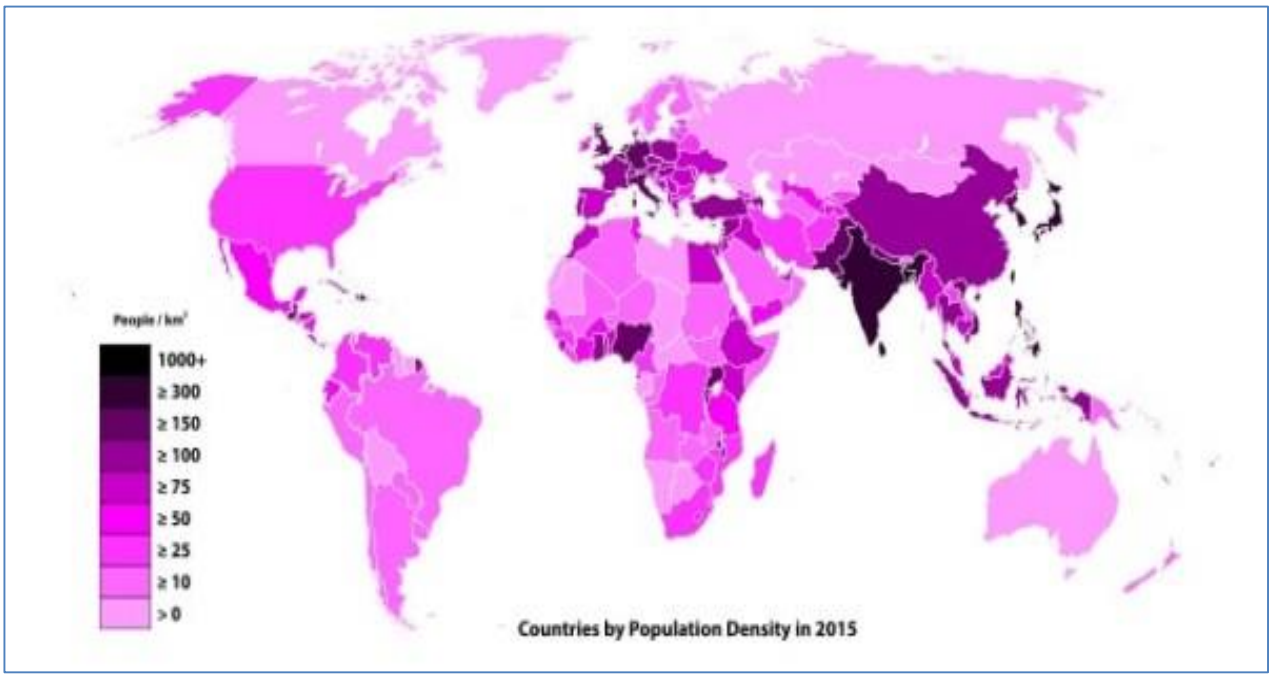
- Sample surveys.
- School registers.
- Vital registration of events (office of the registrar general).
- Maternity clinics and child welfare services.

Population density-number of persons per unit area= number of people in a given area/total area of the place=XP/km2.

Population distribution-the way people are spread out on the land. If a country's population is distributed in a regular pattern then we say it has an even population distribution. However, if there are areas with many people and then areas with few people, then we would say that it has an uneven population distribution.

Sparse population: When not many people live in an area e.g. Commercial areas in Zimbabwe.
Dense population: When a lot of people live in an area e.g. the communal area of Zimbabwe.

World Population Distribution



- 1n 2012, world population was at 7 billion people.

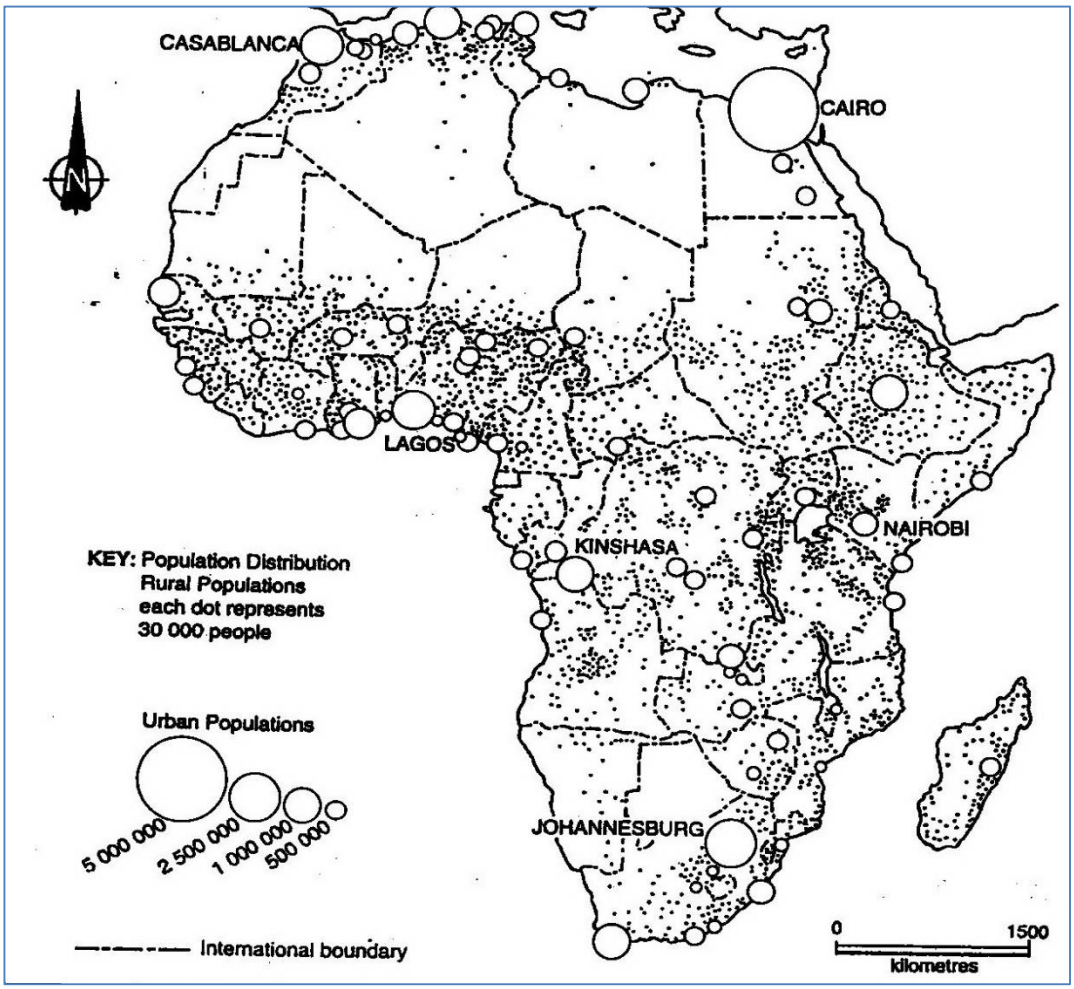
Causes of Sparse Population

- Mountainous area e.g. Himalayas that are hard to build houses and transports links on.
- Very hot or very cold area e.g. Sahara desert, Namib desert of Africa, or Antarctica, cold desert of Alaska and Iceland.
- A heavily forested area e.g. the Amazon Rainforest.
- Areas that flood a lot e.g. Mekong river delta.
- Areas with poor economic development.
- Areas that regularly suffer from natural disasters e.g. volcanoes or droughts e.g. Sahel region.

Causes of Dense Population

- Coastal areas that are good for fishing, trading etc. Brazil and Nigeria.
- A flat area of land that is easy to build on.
- Areas that are close to a good supply of water e.g. River Thames in London. Water is important for fishing, drinking, washing, East Asia there are finger-like extension of dense popn that follows the Ganges and Indus rivers. etc.
- Areas with good natural resources e.g. wood and minerals e.g. Zambian copper belt and Rand region in South Africa and Europe's population distribution is not closely tied to terrain, but more closely tied to coal fields.
- Areas that are close to good fertile agricultural land e.g. Nile valley in Egypt.
- Economic development – Areas with good developed transport links, plenty of available jobs, available electricity and water supply, good communications e.g. internet and mobile phone network, good quality schools and hospitals e.g. Harare, Johannesburg and Nairobi.

Population Distribution in Africa



- In 2012, Africa had a total population of 1.32 billion.

Regions of low population concentrations

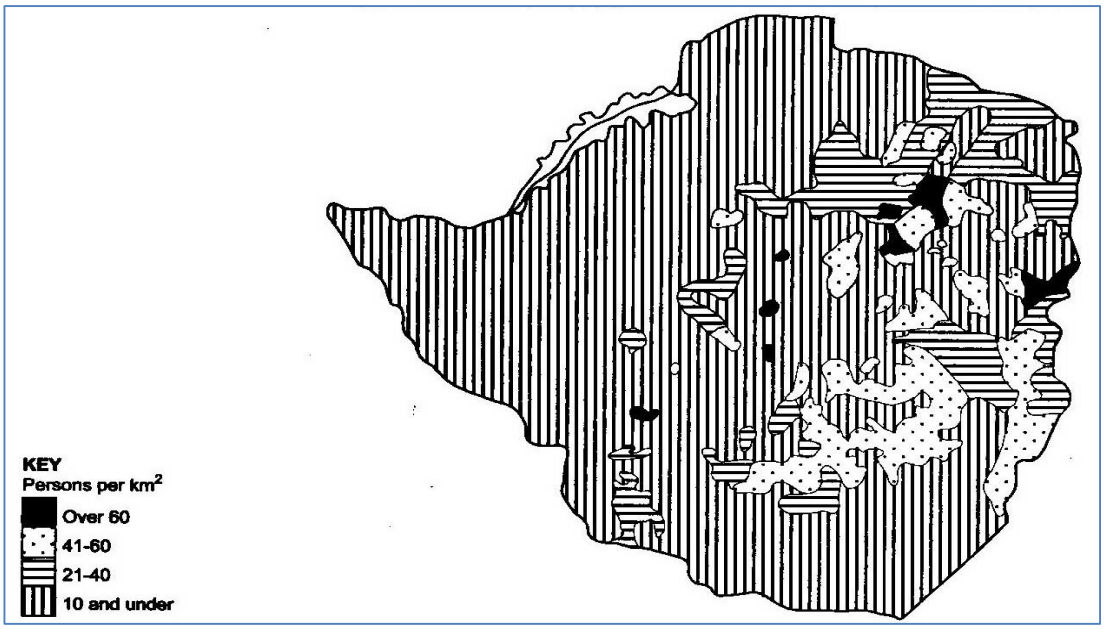
- The northern fringe of West Africa – slave trade encouraged conflicts that led to depopulation of certain regions in Africa.
- The desert and semi-desert region of Botswana, Namibia, Angola, Sahel region, western South Africa and Zimbabwe due harsh climatic conditions.
- Landlocked states of west central Africa between Chad and Angola, most tropical zones in Congo, Gabon, Zaire due rainforests, swamps, pests and diseases.
- Horn of Africa (Somalia, Djibouti, Ethiopia, Eritrea) due to aridity and persistent droughts hence low population densities.
- Middle belt of West Africa and river valleys, parts of Zambia and Zimbabwe e.g. Gwaai, S.E. Lowveld– diseases and pests such as sleeping sickness and river blindness and malaria.
- Commercials areas of Zimbabwe.

Areas of high population concentrations

- West Africa along coasts and Savanna region due historical reasons- slave trade and strong political kingdom and trade.
- Savanna grasslands – cereal production and capacity of area to support life.

- Southern Africa in small nodes- the Rand region(rich in diamond and gold), coastal areas in the east, in Natal and arrears of (Johannesburg, Pretoria) due to industrial conurbations.
- Along railway lines in Zimbabwe and Zambia, N. Eastern Zimbabwe due to economic development, agriculture and mining e.g. copper belt in Zambia.
- Shores of Lake Victoria population density is 100 people/ km2.
- Availability of water and pastures also encourage high population concentrations.
- Mining towns and urban areas due to better facilities and employment.
- Communal areas of Zimbabwe have high population densities.

Population Distribution and Density in Zimbabwe



- Zimbabwe has total population of 13,061,239 where 52% are women and 48 are men (ZIMSTAT 2012).
- Harare with a population of 2,123,132.
- High population densities – over 41 people per km2

a. A horse shoe shaped area from NE to East and SE of the country, Eastern Mash west, Southern Mash Central, Manicaland Central, Masvingo and Southern Midlands due to cool, wet, good agric soils, disease free, industries, transport networks, mining and towns.

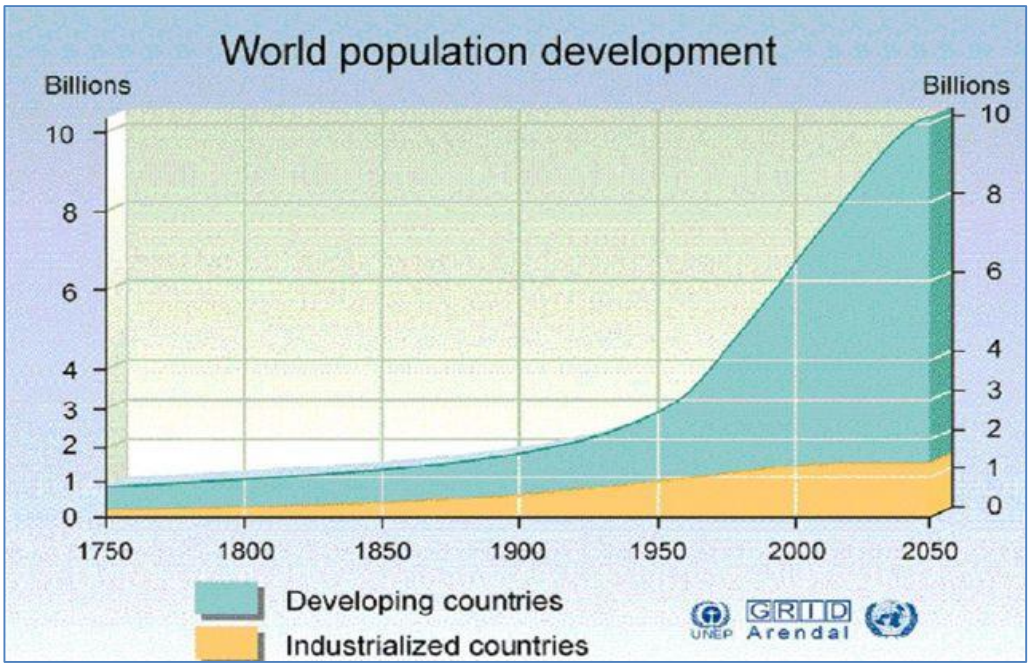
- Medium population densities – 21 – 40 people per km2

a. High density areas, west of Kadoma, Karoi, around Bulawayo and Plumtree, North of Nyangaand west of Zishavane due to agro – ecological region and Land Apportionment factors (1930), small industrial towns and commercial centres.

- Low population densities – below 0-20 people per km2

a. Low veld areas (Limpopo valleys), around Hwange, Kariba, Beitbridge, Gweru, Kwekwe etc. this is due to hot, dry, poor soils e.g Kalahari sands, national parks and forest lands, diseases, remote, commercial farms and mining concessions.

World Population Growth



- When describing a graph it is important look for trends, changes in trends e.g. quicker increase, slower increase and also anomalies.
- It is also very important to support your findings with evidence (this means figures e.g. dates and population figures).

- From 1750 to the present day the world's population has been constantly increasing. In 1750 the population was less than 1 billion.
- The population rose very slowly for the next two hundred years reaching 1.2 billion in 1850 and 2.7 billion in 1950. From 1950 to 2012 the population started to rise at a faster rate. By 1975 it reached about 4 billion and 2000 about 6 billion.
- In the last decade the population has increased at an even faster rate reaching 7 billion by 2012.
- Population growth takes place when birth rates are higher than death rates (natural increase).

Population Terms

Natural increase: When birth rates are higher than death rates.
Natural decrease: Where death rates are higher than birth rates.
Growth Rate - birth Rate – death rate.
Birth rates: The number of births per 1000 of population per year.

$$\text{Birth Rate} = \frac{\text{Number of births x 1000}}{\text{Total population}}$$

Dependency Ratio: The ratio between the amount of dependents (old and young) and the economically active.
Young Dependents: The number or the percentage of the population under the age of 16.
Old Dependents: The number or the percentage of the population over the age of 65.
Economically Active: People between the ages of 16 and 65. This is basically the working active group.

$$\text{Dependency Ratio} = \frac{\text{No: of elderly people + No: of children}}{\text{Number of people of working age}}$$

Fertility-number of live births a woman has during her reproductive period.
Fecundity-ability of a woman to conceive and give birth to a child regardless whether alive or still born.
Infecundity/Sterility-inability of a woman to conceive and give birth to a child regardless whether alive or still born.
Fertility Rate- average number of children that a woman of child bearing age (15-49 years) will have in her lifetime.

Doubling time is the time takes for a population to double.

$$\text{Doubling Time:} \quad \frac{70}{\text{Percentage growth rate}}$$

$$\text{Percentage growth rate} = \frac{\text{growth rate X100}}{1000}$$

Life expectancy: The average age that someone is expected to live within a country. Generally women tend to live a few years longer than men.
Population explosion or population bomb: The rapid growth in population or the rapid population growth of just one country.

Mortality

- Mortality refers to deaths among members of a population.
- It reduces the population in a given area.
- It also affects its structure or composition of the population in terms of age and sex whereby if there is consistent death of a particular age or sex there will be marked change in the population because the other ages or sex will be more than the affected ones.

Infant Mortality - is the number of deaths of babies less than one year old per 1000 babies born that year.
Infant mortality rate may be caused by the following factors:

a) Diarrhoea.
b) Economic situations affecting health services and purchase of nutrient supplements.
c) Impact of HIV/ AIDS pandemic on child health and survival.
d) Mother`s educational levels

Death rates: The number of deaths per 1000 of population per year.

$$\text{Death Rate} = \frac{\text{Total number of deaths X 1 000}}{\text{Total population}}$$

Causes of High Birth Rate

- Lack of contraception e.g. condoms
- Religious beliefs e.g. belief against contraception and abortion (Roman Catholicism)
- Agricultural based society (need for people to farm and collect water)
- High infant mortality (if some babies may die, couples will be tempted to have more children)
- No care homes or pensions so old dependents will need their children to care for them in old age.
- Pro-natalist policies (governments encouraging couples to have more children)

Causes of High Death Rates

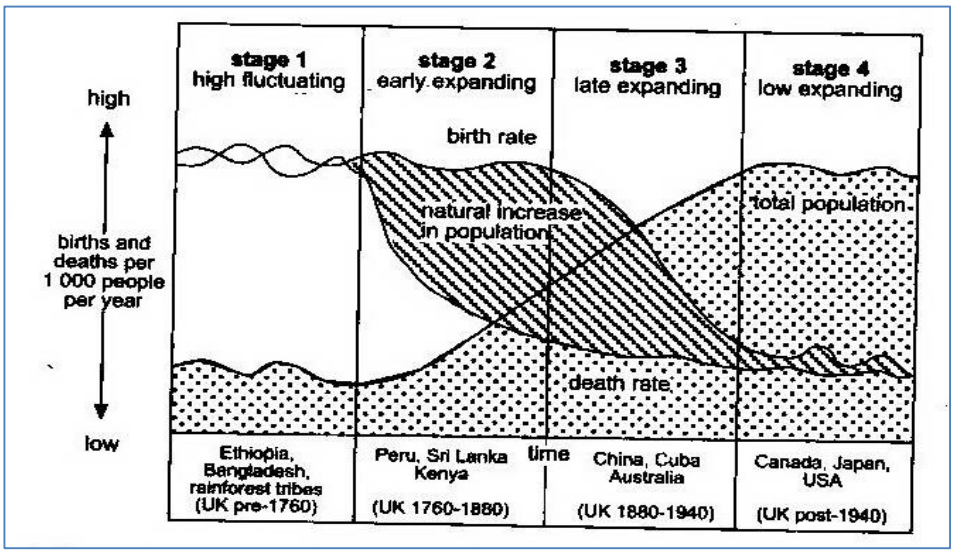
- Natural disasters (often only causes short term increases) e.g. Indian Ocean tsunami.
- Conflicts and wars.
- Poor medical care.
- Poor hygiene and sanitation.
- Poor diet (might be a shortage of food or unhealthy food).
- Shortage of clean water.
- Diseases e.g. cancer and AIDS

Cause of low birth rate

- Availability and affordability of contraception e.g. cheap or free condoms.
- Emancipation (freedom) of women (freedom to get an education and work).
- Improved levels of education (especially female).
- Reduced infant mortality.
- Introduction of pensions and care homes.
- Development of economy into secondary and tertiary sectors.
- Delayed marriages and less children.
- Anti-natalist policies e.g. China's one child policy.
- High cost of raising children.
- Immunisation programs e.g. small pox.
- Availability of clean water.
- Improved diet and knowledge of diet e.g. five portions of fruit and diet.
- Improved medical care.
- Improved preventative testing e.g. for cancer so people can be treated before it kills them.

Demographic Transition Model (DTM)

Demographic means population and transition means change, so the DTM basically means the population change model. The DTM looks at how a country's population may change as it develops. It looks at birth rates, death rates and total population. The DTM is usually divided into four stages. Stage 1 is the poorest stage and stage 4 is the richest stage.



Stage 1: High fluctuating

- High birth rate and high death rate due to inadequate food supply, wars, diseases and insufficient medical facilities.
- Little or no increase in population.
- Was experienced in Europe before 19th Century.

Stage 2: Early expanding

- High birth rate and a decline in death rate due to improved food supplies and medical facilities.
- High population growth rate.
- Zimbabwe and Kenya are in this stage.

Stage 3: Late expanding

- Relatively low death rates and declining birth rate due family realisation of the need to have small families due to pressure exerted on economic resources and social facilities, level of education attainment leading to use of birth control measures e.g. South Korea, Singapore and Hong Kong.
- Moderate population growth rate.

Stage 4 : Low fluctuating

- Low birth and death rates.
- Low population growth rate.
- The population becomes static and can only reproduce to replace the dying ones (population replacement level).
- It`s experienced in industrialised countries like Germany, UK, France and Sweden where death rate is falling below death rate.

Population Pyramids

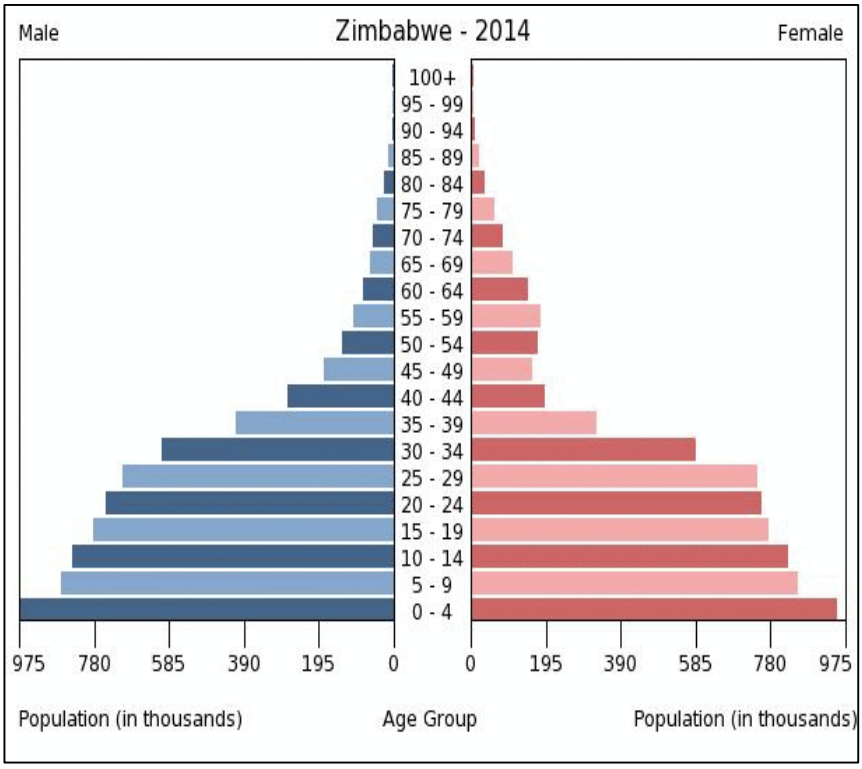
- A population pyramid shows the age and sex structure of the country.
- Population pyramids can be related to stages in the DTM.

Characteristics of an Age Sex Pyramid

- Vertical axis represents age ranges.
- Horizontal axis represents percentage of total population.
- Right hand side represents female proportion.

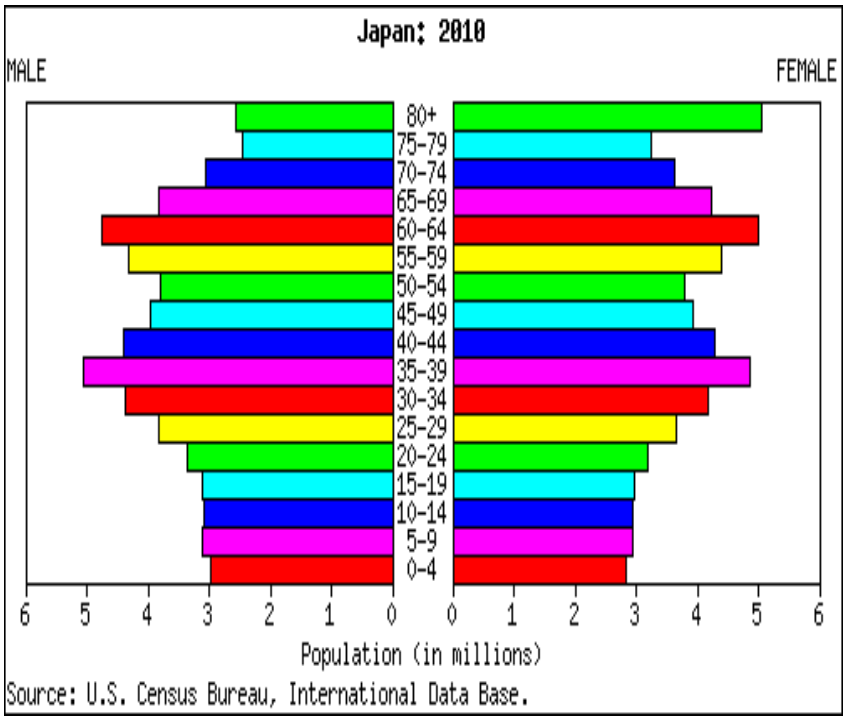
- Left hand side represents male proportion

Population Structure of a Developing Country



- It`s broad at the base due to factors contributing to high fertility rates already discussed.
- Hollows for ages 5-9 due to high mortality rate.
- Thins towards the top due to the low life expectancy (average number of years a person is expected to live) as few people survive to 70 years.
- Tapers towards the top due to relatively high death rates throughout age groups.

Population Structure of a Developed Country



- Narrow at the base due to low birth rates causing low population of children and young people.
- Broadens towards the top due to high life expectancy leading to a high population of old people (ageing population).
- Broadens towards the top which is an indication of low mortality rate throughout age groups.

Significance of Population Structure

- For planning by enabling the government to know the percentage of available funds to allocate for various sectors e.g. if most of the people in the population are youth it will allocate more funds for education and health services and if most are elderly more funds will be allocated for health and social welfare.

Consequence of Population Structure

- Strain on budget due to developing countries having a large population of young people whose health and education cost is high and developing countries having a large proportion of old people whose cost of health and social welfare is high.
- Low quality of education and health care in developing countries due high population leading to the high cost of those services.
- Better quality of health and education in developing countries due low population.
- Strain on working population in developing countries since most of the money is consumed leaving less for investment. Large population of old people does the same in developing countries.
- Boost in food production when there is a large proportion of males due to the availability of a large labour force.
- Heavy taxation of the working population when the dependency of young and old is high in order to avail funds for provision of social amenities.
- Large number of females than males leads to low birth rates and consequently slow growth of population.
- Increase in promiscuity when there are a large number of females than males.

Ageing Population

This is when the proportion of old dependents is increasing. This happens because life expectancy increases, but also because birth rates start to fall. This happens in stage 4 of the DTM (it is currently happening in very developed countries like Japan).

Problems of Ageing population

- There may be a shortage of workers (not enough economically active).
- If there is a shortage of workers there are less tax payers and the government receives less money.
- Old people tend to get sicker, so there will be an increase in pressure on hospitals.
- In many countries retired people can claim pensions off the government. If there are a lot of old people this can be very expensive.

Solutions to Ageing Population

- The government has to provide places in care homes or provide services so people can care for themselves at home e.g. meals on wheels.
- Increase the retirement age. In the UK the retirement age has increased from 65 to 67.
- Increase the amount of tax charged to economically active.
- Introduce private healthcare, so that the government doesn't have to pay.
- Encourage people to have private pensions so that the government does not have to pay.
- Economic immigration could be encouraged to reduce the dependency ratio.
- Have a pro-natalist policy so that birth rates and the number of young people increase

Retirement Age: The age at which people officially stop working. People have retired are often called pensioners because they receive a pension.
Pensions: Money that people who have retired receive. The money may be received from the government or from private pensions.

Advantages of ageing population

- Less need to spend money on schools
- Older people are less likely to commit crimes.
- Old people tend to travel less (no commuting) so congestion and pollution might reduce.

Young Population: When talking about a young population, you are usually referring to young dependents (those under the age of 16)..

Problems of Young Population (too many)

- Child care has to be provided so that parents can return to work.
- Governments need to pay so that young people can go to school
- Young people get sick so the government has to pay for healthcare.
- An increase in the dependency ratio

Solutions of Young Population (too many)

- Creation of teaching and nursing jobs.

- An anti-natalist policy might be introduced like China's one child policy.
- Increase family planning. Make contraception available and affordable
- Ensure females are educated and emancipated.

Problems of Young Population (too few)

- Closure of child related services and loss of jobs e.g. schools and nurseries.
- Less consumers and taxpayers in the future.
- An increase in the age of the population.
- Birth rates fall below replacement rate cause the population decline.
- Also in the future there will be less people in the reproductive age range causing further declines.

Solutions

- A pro-nalalist policy to increase birth rates.
- Subsidised childcare and education to encourage more families to have more children.

Replacement Rate: The number of children each couple has to have to maintain a country's population. The replacement rate is about 2.1 - two to replace the couple when they die and then 0.1 for children who might die in infancy or who are unable to have children themselves (infertile).
Reproductive age range: The age that females normally have babies. Biologically this can be anytime between puberty and menopause but is more likely to be between 18 and 35.

Caring For Dependents

Case Study

Japan's Ageing Population

- Japan has an ageing population because the birth rates have fallen and it has one of the world's highest life expectancy. In fact the islands of Okinawa of Japan's south coast have the highest life expectancy and the greatest percentage of centenarians.
- Japan has the highest proportion of old dependents (about 23%) and the lowest proportion of young dependents (about 13%) in the world. It has a total fertility rate of only 1.25. This is well below the replacement rate of 2.1.
- Even though the Japanese are working longer, it may have to look outside its borders to prevent future population decline and economic decline. Japan is traditionally a very insular (closed) country so allowing large scale immigration would involve huge social and cultural changes.

Pro and Anti Natalist Birth Policies

Pro-natalist Policy: A policy that encourages couples to have more children. You can not force people to have more children so you have to offer incentives instead e.g. free childcare or even money.
A government can't force couples to have more children, so instead it must offer incentives. Incentives may include:

- Cash payments.
- Free or subsidised healthcare and childcare.
- Free or subsidised education.

- Reduced tax rates.
- Child benefits e.g. weekly or monthly payments.
- Poster and advertising campaigns

Singapore's Pro-natalist Policy

- Singapore is a developed country in SE Asia with a population of about 5 million people. For many years the Singaporean government has believed that Singapore is underpopulated and has tried to increase its population.
- Singapore has one of the lowest total fertility rates in the world, standing at 1.1, which is well below the replacement rate of 2.1. Already 36% of the Singapore population is made up of foreign nationals and in some sectors like industry, 80% of the workers are foreign.
- To overcome worker shortages, the Singapore government has encouraged immigration, but it is also trying to increase the population through raising birth rates.
- The government is doing this in a number of ways. It has increased maternity leave by 50% to 12 weeks and it will cover the cost of maternity leave (the cost to the parents employers) for the first four babies.
- The Singapore government is also increasing child benefits paid to families. The government will pay money into a special bank account of up to nearly $1000 for six years.
- The Singapore government has also sponsored dating organisations to encourage people to get married earlier and start having children.

Anti-natalist policy: A policy that attempts to reduce birth rates. This might be through better education and supply of contraception or through much stricter policies like China's one child policy.

China - One Child Policy

- After China were invaded and occupied by Japan in the World War II, they wanted to strengthen their military so that it never happened again.
- To do this they encouraged citizens to have more children, because a bigger population potentially meant a stronger army.
- This policy would have been fine if China had the resources and technology to match. However, they did not and coupled with the crippling policies of the cultural revolution, mass famines ensued. It is estimated that up to 30 million died during the 1960's and 1970's. This was not a sustainable policy, so the Chinese government was forced to introduce an anti-natalist policy.
- The policy China decided to introduce was extremely strict and probably not possible in a non-communist country.
- The government stated that from 1979 all couples were only allowed to have one child. They also increased the marriageable age of men to 22. To get married and to have a child, citizens had to apply to the government. If you applied by these rules you were entitled to free education, healthcare, housing and given a job. If you did not follow the rules, then benefits would be removed and females who were found to be pregnant were given forced abortions and even sterilised.
- To enforce the policy the government relied on community enforcement. Often elderly residents who were trusted within the community were asked to inform, elderly female informants were nicknamed 'granny police.

- The strict enforcement of the policy led to a problem of female infanticide. This is the killing of female babies, because couples favoured male children. Males ensured the family name was maintained and were able to work manual jobs, whereas females would be lost after marriage (females normally went to live with their husbands family).
- There were a number of exceptions to the rules, if you had twins or triplets this was fine, if your first child had a physical or mental disability you could have a second, families in rural areas (farming areas) were often allowed a second, ethnic minorities were allowed a second and often couples who bribed officials could have a second.
- The policy has been relatively successful, birth rates have fallen from a peak off 44 in the 1950's down to just 12. China's population is also expected to peak in the next 20 years and then slowly start to decrease. Because of its success there have been further relaxations including:
  - All of families in females areas can now have two
  - Two people who marry from single children families they are allowed two
  - Females are better educated about contraception and are free to make their own choices.

However, there are also a few problems:

- China is still overpopulated; there are over 1.3 billion Chinese.
- There is a male female imbalance in the population.
- People are demanding greater freedom and choice.
- China will slowly get an ageing population.
- There are large numbers of abandoned children

Consequences of Population Growth

Overpopulation (Positive Population Increase)

- When there are more people that the resources available. Overpopulation might lead to unemployment, famine and homelessness.

Positive Effects
1. A large population provides cheap labour due to a large number of people competing for jobs.
2. Increased exploitation of natural resources and industrial development due to increased demand for goods and services causing those activities to be increased to meet the demand.
3. Technological innovation due to pressing needs associated with a high population (necessity is the mother of invention).

Negative Effects
1. Pressure on land leading to land fragmentation.
2. Environmental degradation when people clear forests to make room for settlement and agriculture.
3. Low investment and slow growth of industry as the government spends a lot of money on education and medical facilities leaving less for investment.
4. Lowering GDP (aggregate value of goods and services that a country can produce) due to inability to save any money for investment.
5. High rate of unemployment due to employment sector growing at a slower rate than population growth.
6. Towns face problems of water shortage, pressure on social amenities and high cost of housing leading to development of informal settlements such as slums which expand covering agricultural land surrounding the towns.

Under population (Negative/Slow Population Growth)

- When there are not enough people to fully maximise the potential of a country. For example there might be vacant jobs or resources that cannot be fully exploited e.g. developed countries.

Negative Effects

1. High government spending on health and social welfare as the population consists of a high proportion of old people due to low birth rates and low death rates.
2. High cost of production since there is a small work force consisting of skilled people whose wages are high.
3. Underutilisation of resources such as agriculture and mineral resources since there is shortage of labour due to sparse population and most of it being concentrated in urban areas.
4. Inadequate market for goods and services due to a small population.
5. Underdevelopment and low living standards in rural areas since a large percentage of people live in urban areas.
6. Traffic congestion and atmospheric and noise pollution in urban areas due to continuous expansion of towns.
7. Reduced food production as towns expand and engulf surrounding agricultural land.

Optimum Population

- When population and resources are perfectly matched. In reality this is almost impossible to achieve.
-

Carrying Capacity: The amount of people that the resources of a country can support. The carrying capacity of a country can change with improvements in technology e.g. desalination, discoveries of new resources, or the loss of existing resources e.g. volcanic eruption destroying farm land.

Theories about population and resources:

Malthus

- Malthus looked at population and resources and believed that population was growing at a much fast rate than resources.
- He believed that this would cause a series of preventative and positive checks.
- Preventative checks would be people trying to reduce population growth themselves and positive checks would be famines and conflicts.

Boserup

- Boserup was a more optimistic person who believed that humans always came up with solutions to problems.
- Her famous saying was 'necessity is the mother of invention' which basically means that humans will also find a solution to resource shortages e.g. desalination, development of renewable energy.

Population Health and Disease

1) Nutritional disease: Kwashiorkor

Qn: What are the causes, effects and symptoms of kwashiorkor? [10]

- Water linked diseases: Cholera

- Is caused by a comma shaped bacterium known as vibrio cholerae.
- Is spread by contamination of water and food.

- Bacteria of infected person will pass out in faeces and if no hygiene, it will spread to others through food handling and hands shaking.
- Vectors such as flies and other animals can carry the bacteria from faeces to infect other people.

Symptoms of Cholera

i. Severe diarrhoea (watery faeces) like "rice" water.
ii. Vomiting
iii. Fever (body temperatures over 40℃).
iv. Muscular cramps and weakness.

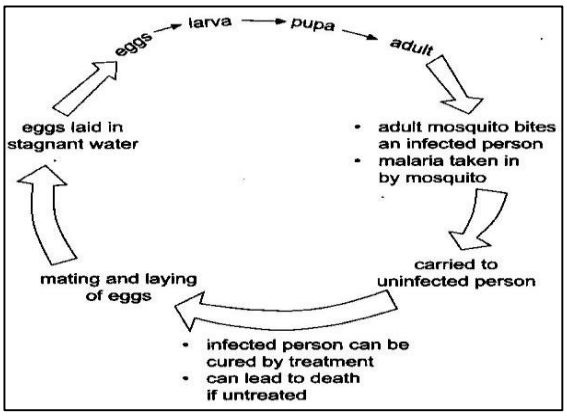
Treatment

i. To replace the body fluids and salts (rehydration) with a solution of water; salt and sugar (SSS).
ii. Use of antibiotics which kill the bacteria.
iii. Notification since it spreads over quickly.
iv. Personal and food hygiene are important in preventing the spread of the disease.
v. Immunisation if there is outbreak.

- Vector linked disease: Malaria

- Is a disease caused by a protozoa called plasmodium which lives in female Anopheles mosquito and in humans.
- Anopheles feeds on blood while the male mosquito feeds on plant juices. It is a vector of carrier of the pathogen.

Mosquito Life Cycle



- The mosquito lays about 200 to 300 eggs on the water surfaces.
- They hatch and larvae hangs under the surface of water film.
- The larvae has a head thorax and abdomen.
- Larvae sheds its outer covering (cuticle) in a process called moulting.
- The larvae will develop into a pupa.
- The pupa develops into an adult which climbs out onto water surface.
- Later its cuticle will harden and then flies as adult mosquito.

Ways of Preventing Malaria

- Spraying oil on surfaces of stagnant water to kill the larvae (will sink and suffocate due to surface tension of water).
- Using insecticides to destroy stages of the insect.

- Drain all stagnant water and get rid of containers that may store water.
- Prevention of bites by sleeping covered with a mosquito net, using repellents on skin surfaces and wearing long sleeves and covering legs.
- Use of preventive drugs such as paludrine, deltraprim and malaquine as prophylatic measure.
- Correct dosage and usage of drugs such as chloroquine as treatment measures.

Bilharzia

- Schistosomiasis, also known as bilharzia or "snail fever.
- Is a parasitic disease carried by fresh water snails infected with five varieties of the parasite Schistosoma.

Symptoms

- Initial itching and rash at infection site.
- Frequent, painful or bloody urine.
- Abdominal pain and bloody diarrhoea.
- Fever, chills and muscle aches.
- Enlargement of the liver or spleen.
- Liver Cirrhosis.
- Blood disorders in cases of colon damage.
- Children with repeated infection can develop anaemia, malnutrition, poor growth and learning disabilities

Transmission

- The parasitic larvae live in fresh water and can penetrate human skin, placing people at risk through everyday activities such as washing, swimming or fetching water.
- The larvae migrate to the blood vessels where they mate and produce eggs. Some eggs travel to the bladder or intestines and are passed into the urine or stool. Others remain trapped in the body and cause damage to internal organs.

Prevention and Treatment

- Education campaigns about risks of infection by bathing in fresh water lakes and ponds.
- Praziquantel is the primary form of treatment.
- A single dose of praziquantel has been shown to reduce the severity of symptoms in cases of subsequent re-infection.
- Access to safe water.

Migration

-Movement of people from one place of residence to another.
It causes reduction of population in the place of origin and increase of population in the area of destination.

Terms used in Migration

Temporary Migration: Migration for a limited period, this might only be for a few weeks or even several years.
Permanent Migration: Migration with the intention of staying forever.
Forced Migration: When people are forced to migrate, often because their life is in danger.
Voluntary Migration: When people freely choose to migrate e.g. for better weather or better universities.
Economic Migration: Migration for work e.g. better salary or promotion
Seasonal Migration: Migration just for a particular season e.g. the ski season or the harvesting season
Commuting: Movement from home to workplace and vice versa.
Emigrant: A person who leaves a country to migrate to another.
Immigrant: A migrant arriving in a new country.
Migration Balance: The difference between emigrants and immigrants. If a country has more emigrants than immigrants that it is experiencing net migration loss. If a country has more immigrants than emigrants then it is experiencing net migration gain.
Rate of net migration = $\frac{\text{immigration} - \text{emigration X1000}}{\text{Total population}}$

Causes of Migration

Push Factors
-Problems or circumstances which force out a person from his/her area of residence.
1. Pressure on land due to increase in population which cause people to move to other areas where land is available e.g. from Masvingo Province to Gokwe North.
2. Land becoming too poor to support crops which cause people to move to other areas where fertile land is available.
3. Unemployment and underemployment which cause people to move to other areas to seek jobs or better paying ones.
4. Insecurity such as tribal clashes and terror gangs which cause people to other safer places.
5. Persecution of specific religious groups due to their faith which causes them to move to areas where they can practise their faith freely e.g. Jews from Europe to Israel.
6. Political persecution e.g. many Zimbabweans moved to neighbouring countries (South Africa) during 2008 political instability.
7. Occurrence of natural calamities such as diseases, floods and severe droughts forcing people out of their place of residence e.g. in monsoon Asia.
8. Government policy where people are moved from one area to give room for development e.g. Tokwe Mukosi dam.

Pull Factors

-Positive conditions which attract a person to a new place.
1. Attraction of urban life where there is electricity, piped water, entertainment and social amenities.
2. Availability of employment such as in urban areas where there are many industries and businesses or in rural areas with estates and plantations.
3. Opportunities for better education e.g. in urban areas with many education institutions.
4. Security
5. Plenty of land
6. Fertile land
7. Higher standard of living e.g. in urban areas

Types of Migration

- Two basic types namely: Internal and External

Internal migration
-Migration within a country e.g. Harare to Kadoma

Types of Internal Migration

Rural to urban Migration
-Movement of people from rural areas to urban areas.
It involves:
1. Youth who have completed various levels of education moving to urban areas to seek employment in while collar jobs.
2. People moving to urban areas in search of alternative ways of earning a living due to shortage of land in rural areas, unemployment and low prices for agricultural produce.
3. Traders relocating to urban areas where there is a larger market as the people in rural areas have low purchasing power.
4. People moving to urban areas where there is adequate social amenities such as hospitals, entertainment, electricity and generally exciting life.
5. Youth seeking for further education who join universities and colleges many of which are located in urban areas.
6. Transfer of people employed in rural areas to urban areas.

Rural to Rural Migration

-Movement of people from one rural area to another.
It involves:
1. People moving to plantations and other large farms seeking employment e.g. sugarcane harvesters, cotton pickers in SE Lowveld from rural areas.
2. Movement of nomadic pastoralists from one place to another in search of water and pasture.
3. People moving to other parts of the country to buy land and settle there.
4. Movement of people into settlement schemes e.g. Gambura and Chinhoyi to ease pressure on land.
5. Movement of public and private employees on transfer from one rural area to another.

Urban to Rural Migration
-Movement of people from urban areas to rural areas e.g. from Harare to Gokwe rural.
It involves:
1. Transfer of people employed in urban areas to rural areas.
2. Movement of people from urban areas to search for jobs in rural areas.
3. People moving from urban areas to rural areas to settle permanently after retirement.
4. People moving away from stressful urban life to suburbs to be commuting daily to work.

Urban to urban -Movement of people from one urban area to another or from one part of urban area to another e.g. Kadoma to Gweru.

- People moving from one part of town to another due to:
  - Transfer.
  - in search of affordable housing.
  - in search of better employment.
  - in search of better business opportunity

External Migration

Movement of people from one country to another e.g. Zimbabwe to South Africa or China.
It involves:

- People who seek employment abroad for a short period who end up settling permanently.
- Refugees who are forced out of their country by factors such as war.
- People seeking political asylum due to political persecution in their country.
- Government employees such as ambassadors who are in assignment abroad.

Problems faced by migrants

- They are represented on the Lee's Model by the wiggly line in between country of origin and destination country.
- Shortage of money, Language barriers, Passport or visa issues, Bad weather, Transport delays, Problems with housing, Kidnap, Rape, Robbery, Death and Torture

Impacts of Migration

- Migration can have positive and negative impacts on both the source country and the receiving country.

Source Country (losing country)

Positive Effects

- Reduced unemployment.
- Reduced pressure on schools and hospitals.
- Remittances sent by family and friends living abroad. Remittances go straight into the hands of the people, not the government.
- Improved relations with foreign countries. Migrants may return home with new skills and knowledge of new technology

Negative Effects

- Reduced birth and fertility rate and people in reproductive age range leave.
- Often skilled and educated migrants leave 'Brain Drain'.
- The dependency ratio increases as the economically active leave.
- A dependency on remittances develops.
- There may be shortage of workers, especially during harvests
- Family separation.

Destination Country (receiving country)

Positive Effects

- Source of manual workers who are prepared to work dirty low paid jobs e.g. farming, construction and cleaning.
- Also source of skilled workers who are added to skilled workforce 'Brain Gain' e.g. teachers, nurses and lawyers to South Africa in 2008.
- New cultures e.g. food and dance.
- Improved links with source countries, possible new markets e.g. Zimbabwe and South Africa.

Negative Effects

- Possible racial tension. South African will often blame Zimbabweans for taking their jobs.
- Inflation caused by increase demand.
- Pressure on schools and hospitals.
- Possible unemployment
- Pressure on housing, electricity, water, etc.
- Increased congestion and pollution

On the Individual

Positive Effects

- Improved living standard of the worker resulting from savings made from income gained after employment.
- Acquisition of skills and change in attitude due to exposure which may cause some town dwellers to change their way of life and become more sophisticated.

Negative Effects

- Lower fertility rates when some people who have migrated to towns take long time before marrying as they try to achieve various goals in their lives.
- Immorality may arise may arise when urban migrants lose touch with their cultural values.
- Marriage breakages may occur when spouses are separated for long periods of time.

Remittances: Money that is sent home to friends and family by migrants living in a different location, often overseas.

Refugee

A person who has been forced to leave their home and their country. This might be because of a natural disaster, war, religious or political persecution.

Persecution: When someone is attacked for what they believe in e.g. their religion or political belief.

Internally displaced person (IDP): When someone has been forced to leave their home but not their country.

Asylum Seekers: Someone who is trying to get refuge (residency) in a foreign country because their life is in danger in their home country. This is usually because of their political or religious beliefs.

Reasons for becoming a refugee

- War e.g. Iraq
- Natural disaster e.g. Indian Ocean tsunami
- Famine and/or drought in the Sahel region.
- Politicaland ethnic persecution e.g. Syria.

Problems faced by refugees

- No housing.
- Shortage of food and water.
- No job or no money.
- Poor medical care.
- Disease.
- Poor sanitation.
- Language barriers

Problems faced by receiving country

- No education for children.
- Cost of providing food and water.
- Cost of providing education for children and medical care for everyone.
- Possible spread of disease to native population.
- Increased pollution and congestion
- Possible racial tension.
- Language problems of dealing with refugees
- Increased unemployment.
- Possible inflation because of rising demand

Solutions to refugee problem

- The return of migrants to their home (1st choice).
- The return of migrants to areas or countries near their home (2nd choice)
- Migrants settled in a foreign country a long way from their home (3rd choice).

SETTLEMENT STUDIES

Settlement

Settlement: A place where people live. A settlement can range from one an isolated building to a capital city of over 20 million people).
Site: The actual location or place that a settlement is built.
Situation: The area surrounding the site of a settlement. For example you might talk about if the settlement is near a river, or near the coast or in a valley surrounded by mountains.
A settlement's location can also be described in relation with other settlements.
Settlements can also be described in terms of their size, structure and function.
Settlements can grow from being hamlets, to villages, then to towns, to cities or even larger settlements known as conurbations or megalopolis.
As the village grows in size the range of activities within it increases.
In a town a there is a shift to non-agricultural activities thus distinguishing it from a village.

Urban sprawl-this is when two or more towns grow into each other.
The result of an urban sprawl is called a conurbation.

A settlement's structure is known as its layout.
The layout includes the settlement's transport network and land-use.

A settlement's morphology-this is where a settlement's layout is considered in terms of settlement's types of buildings, their layout, age, type, and quality.
Many settlements are described in their functions, hence the terms like mining town, marketing centre etc.

Each settlement has a sphere of influence.
Sphere of influence-is the area around the settlement which depends on the town for various services.
The sphere of influence can be determined length of the journey between home and workplace of the settlement's workplaces or the extent of the services for example newspaper distribution.

Urban: The built up area, any city with a population of 10,000 people or more.

Rural: Basically the countryside (everywhere outside urban areas). Rural areas maybe farmland, forest, desert or savanna depending on where you are in the world. Rural areas do contain small settlements of less than 10,000 people e.g. hamlets and villages.

MEDC: More economically developed country. Basically a richer country e.g. US, Japan or UK
LEDC: Less economically developed country. Basically a poorer country e.g. Uganda, Bangladesh and Zimbabwe.

Settlement classification

Rural Settlements
Settlements that are found in the countryside (rural areas) and contain less than 10,000 residents.
Rural settlements are those settlements where mostly primary activities occur.
These include activities like mining, farming, fishing and forestry.
The populations of these settlements often depend on the surrounding land.

As such settlements grow; they also increase the variety of activities and may develop into urban settlements.

Urban Settlements

Settlements that contain more than 10,000 residents.
An urban settlement is one which mainly carries out secondary and tertiary functions.
Examples of such functions include commerce, banking, manufacturing and service provision businesses such as banking and insurance.
Urban settlements carry out a wider range of services when compared to rural settlements

Types of settlements
Isolated Building: A single building. An isolated building is normally a farm.
Hamlet: A small group of houses, normally about 5 to 10. There is often no services in a hamlet.
Village: A settlement of up to 10,000 people. Villages will have some services in them like small shops, a primary school, a doctor's surgery, and bus routes.
Town: A settlement of over 10,000 people that has not been designated a city.
City: A large town, in the UK a town becomes a city when it has a cathedral in it.
Capital City: The main administrative centre within a country and the home of the national government.
Primate City: The largest and most important city within a country. The primate city will often have double the population of the next most important city. Most of the time the primate city is also the capital city e.g. Harare.
Conurbation: Two or more towns or cities that have joined to together e.g. Birmingham, Walsall, Dudley and Wolverhampton in England.
Megalopolis: A conurbation or a clustering of cities with a population of over 10 million people e.g. Tokyo.

Factors influencing settlement location
Historical factors
- Include historical considerations including the desire to build settlements on defensive grounds.
- Factors of legislation and land tenure also affect the position of present settlement patterns and their locations.
- For example most settlements were located on higher ground which was easier to defend.
- Higher ground also meant enemies could be seen while they were still far off.
- This explains settlements like Great Zimbabwe, Khami and Nyanga hill sites.
- In European settlements river bends and pronounced meanders formed important settlements as they were favoured as defensive sites.
- Also European settlements often align themselves with the ancient feudal systems of Europe.
- Much of the settlement in Zimbabwe especially in communal areas are hugely influenced by the Land Apportionment Act of 1930.
- The linear settlement pattern often found in communal areas was a result of planned and legislated land settlement patterns

Accessibility

- The need to communicate with other areas for trade and travel purposes is another important factor that influences settlement patterns.
- Settlements are often located along transport routes and communication lines.

- These may be roads, railway lines or water routes.
- Such settlements are also known as Nodal settlements
- Nodal settlements-these are settlements that converge along roads, railway lines, water routes, mountain passes, gaps river confluences and valleys.
- Nodal settlements are heavily influenced by communication networks.

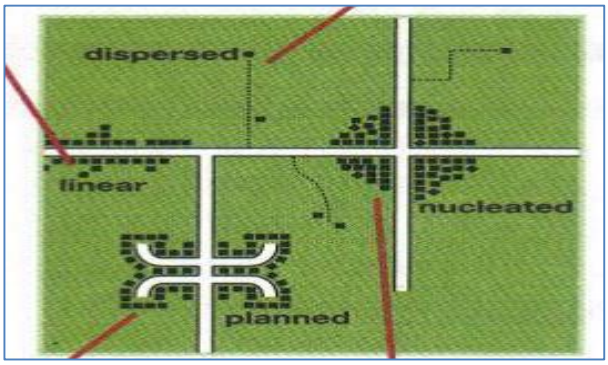
Availability of resources

- Hwange is mostly a coal town.
- A lot of settlements are located near natural resources that are necessary for people's livelihood.
- For example water, minerals, wood, fertile soil and grass.
- Minerals such as asbestos have acted as a catalyst towards the formation of towns like Zvishavane and coal in Hwange.

Barriers

- Human preferences and the influence of technology
- Most barriers that prevented settlements from being built in certain areas have since been overcome.
- Settlements are now being built in areas previously marginalized.
- For example settlements are now being built even on steep slope using landscaping.
- Urban area settlements are always planned although spontaneous settlements, which are usually illegal, often sprout out for example Epworth and Hopely farm.

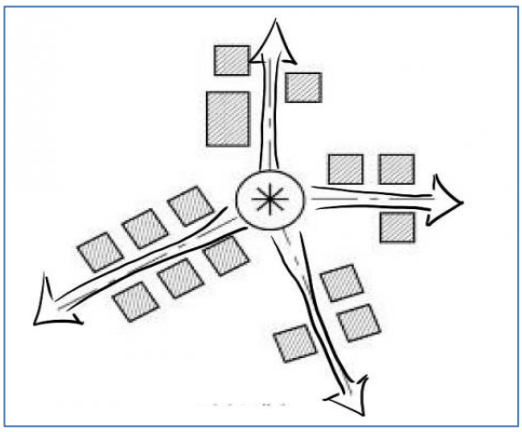
Rural settlement patterns



Linear settlement pattern.

- Consists of a line of huts or houses following a road, river, or cultivated areas/fields.
- Such patterns can also develop along a watershed or a mountain range.
- It should be pointed out that Zimbabwe's roads, especially the major roads, are found on watersheds.

Radial settlement pattern.



- This pattern usually develops at road junctions or nodal points.
- They radiate out from a central point like the spokes of a bicycle wheel going outwards in all directions.
- These nodal points include rural service centres for example District Council Offices or Growth Points.

Circular pattern

- Is a common pattern on desert nomadic camps, around dwalas, volcanic hills or wells and watering holes in semi-arid areas.
- Some tribes e.g. The Kayapo in the Amazon Basin live in circular villages for cultural reasons.
- They live in the outer houses and the central house is a meeting place.

Nucleated/Compact

- Settlements in rural areas can be nucleated/gathered around market places, commercial farming areas or in camps.
- Such settlements tend to be arranged in much the same manner as electrons in an atom.

Dispersed and Haphazard Settlements patterns

- Settlements can also be dispersed especially in areas with fewer resources that cannot support dense populations.
- This is also common pattern in commercial farming, communal areas with ragged terrain and areas with poor soils.
- Haphazard settlement patterns can be dispersed or compact but they usually do not conform to a recognizable shape showing a lack of planning.

Settlement Growth (Functions)

- Function: The job, purpose or use of a settlement. Large settlements will have more than one function and these functions may change over time.
- Functions may include:
    - Shopping (retail), business (commercial), farming (agricultural), housing (residential), educational, healthcare, administration (local or national government), fishing, tourism, entertainment, sporting etc.
- Rural Areas: Rural areas tend to have a lot less functions than urban areas. The main purpose of settlements in rural areas is normally agriculture (farming) and possibly tourism. This is because rural areas have less people, poorer transport, poorer communication, less technology and the land is better used for other purposes i.e. agriculture.

- Urban Areas: Urban areas tend to have a lot more functions ranging from shopping functions, to educational functions, to transport functions, to administrative functions and residential functions. The bigger the urban area, the more functions that it normally has.

Settlement Hierarchy and Services

Hierarchy: Placing things in an order of importance.
The hierarchy of a settlement normally depends on three variables:

- The size of population, the range and number of services and the sphere of influence
- Obviously these three variables are very much interconnected. For services to be offered there has to be a minimum threshold population. When services are then offered more people are attracted. As more people are attracted more services are offered and the sphere of influence increases.
- As you move down the settlement hierarchy the number of settlements increase. For example you only get one capital city (near the top of the hierarchy) in each country, but you get thousands of isolated buildings (farms - near the bottom of the hierarchy) in every country.

1. Sphere of Influence: The distance or area people travel from to access a service i.e. the area served by a settlement or service.
2. Services: Facilities that are offered to people e.g. supermarket, cinema, school or train station. Services have a threshold population, which helps explain why bigger settlements have more services.
3. Range: This usually refers to the number of different services e.g. a school, a post office, etc. It can also refer to the distance people travel to access a service or settlement.

4. Threshold Population: The minimum amount of people required for a service to be offered and remain open.
5. High Order Goods (Comparison): Goods that people buy less frequently. They tend to be more expensive and people will normally compare quality and price before purchasing e.g. a TV, car or holiday.
6. Low Order Goods (Convenience): Goods that people buy every day. They don't usually cost much money and people would not normally travel far to buy them e.g. bread and milk.

Quality of life in rural areas in Zimbabwe

- 95% of the rural households used wood as the main source of fuel for cooking.
- 52% of the rural housing units had no access to a toilet or sanitation facilities.
- 63% of the rural housing units had access to safe drinking water.
- 5% of rural housing units in the country had electricity
- 18% of the country's rural people lived in modern houses, compared to 90% in urban areas.
- 82% of the country's rural population lives in either traditional structures built out of pole and dagga with grass thatch, bricks with grass thatch or mixed dwellings with one or more modern structures with corrugated iron sheets, cement roofing or asbestos roofing.
- According to the 1992 Census, rural people do not have access to shops, clinics or schools.

The Structure of Urban Settlements

- This is the shape or form of urban areas in relation to land-use models or urban morphology.
- Models are used to describe and explain the structure of cities.
- A model is a systematic description of an object in this case a typical city.
- There are three urban land use models i.e. the concentric model (1924) by Burgess, the Sector Model (1939) by Hoyt and the Multi-nuclei Model (1945) by Harris and Ullman.
- These models attempt to describe what a typical town/city or urban settlement looks like, how it came to be what it is (how it developed over the years) and why.

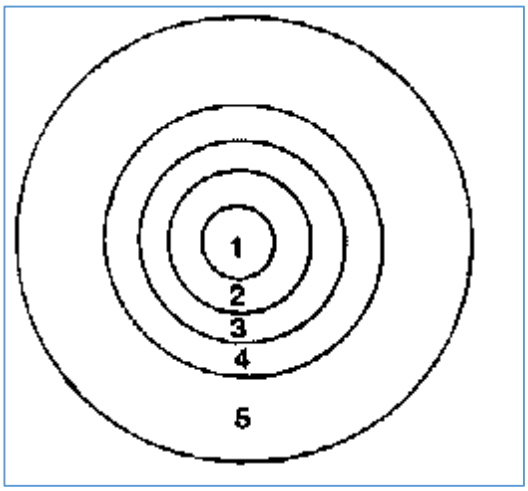
Factors that affect land use in urban areas

- Communication and roads.
- Accessibilty.
- The nature of the land for example whether it is gentle in terms of terrain.
- The cost of the land.
- The position of the plots in relation to other settlements.
- The size of the piece of land.

Types of Land uses in urban areas

- Land use i.e. what the land is used for in urban area differs with each area.
- Although land uses are usually mixed for example some industries can be found in residential areas land uses tend to be defined.
- Most areas have one dominant land use.
- These can be classified into industrial, commercial and residential.

The concentric model/Burgess's model (1924)



- It was formulated by Burgess and Park in 1924 after their studies of the city of Chicago in the United States.
- Their study revealed that the city could be divided into a number of concentric land-use zones:
  1. The Central Business District
  2. The Zone of transition
  3. The Zone of workingmen's houses
  4. The Zone of middle income or medium density housing
  5. The Commuter Zone
- The model assumes that the city grows from a single nucleus (core) in concentric circles of distinct land uses.
- The city grows by urban ecology or expansion due to demand of different goods and services.
- The city will continue to grow into surrounding rural areas.

The CBD
- It is the nucleus of the city
- All (communication) routes meet in this area.
- It has high rise buildings/skyscrapers.
- Rentals are normally high in this area.
- It has very few people and traffic during the night and high traffic densities of people and traffic during the day.
- It is the commercial core where hotels, banks, specialized services, theatres, departmental stores, finance houses and cinemas are found.

Zone of transition
- It surrounds the CBD.
- It has residential areas with poor housing.
- It has offices and light industries.
- It is characterised by industrial functions that require a lot of land.
- It is famous for its crimes and social problems for example prostitution.
- It is characterised by transient population, migrant workers, the poor, aged and unemployment for examples Mbare and Avenues.

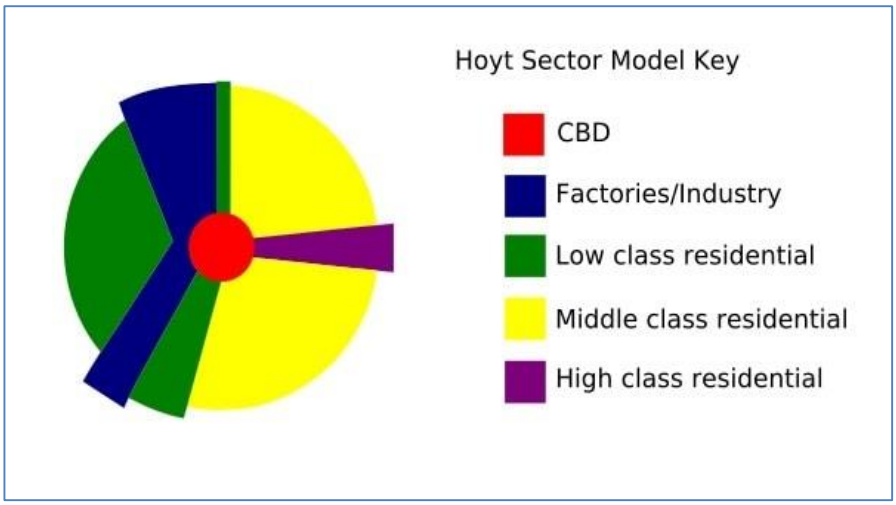
Zone of workingmen's houses/Low class residential areas
- Is the zone of workingmen's houses or low-income residential zone
- Is found near heavy industries for example Highfield and Glen Norah suburbs near Willowvale industries and Mbare and Graniteside Industries.

- The density of houses per unit area is high
- The zone is characterized by high density suburbs with each house located on a small plot of land.
- This area is occupied by factory works, single houses, small yards and untarred roads.

Zone of middle income/medium density housing
- This is characterised by large houses, with gardens and broad tree-lined streets..
- A small commercial centre and greenbelts can be found within this zone.
- Social centres like pre-schools and schools can also be found in this zone.
- Examples are Hillside and Cranborne suburbs in Harare.

Commuter zone
- Is located some distance away from the city centre.
- People use commute to the CBD in order to get to work using trains, cars and buses.
- The zone starts off with low density, high income residential areas, with large spaced houses and gardens.
- In some places market gardening may be practiced for example Honey Dew farm in Greendale.
- They usually have a suburban shopping centre for example Sam Levy in Borrowdale and Kamphinsa in Greendale.
- The zone may also give way to larger farms supplying fresh fruits, dairy products and vegetables to the town.
- Sometimes the farming zone may be interrupted by small dormitory towns such as Chitungwiza.

Hoyt's Sector model (1939)



- It was published as an alternative to Burgess and Park's concentric model.
- It was based on a study of 142 American cities.

Assumptions
- In making the model Hoyt made some assumptions

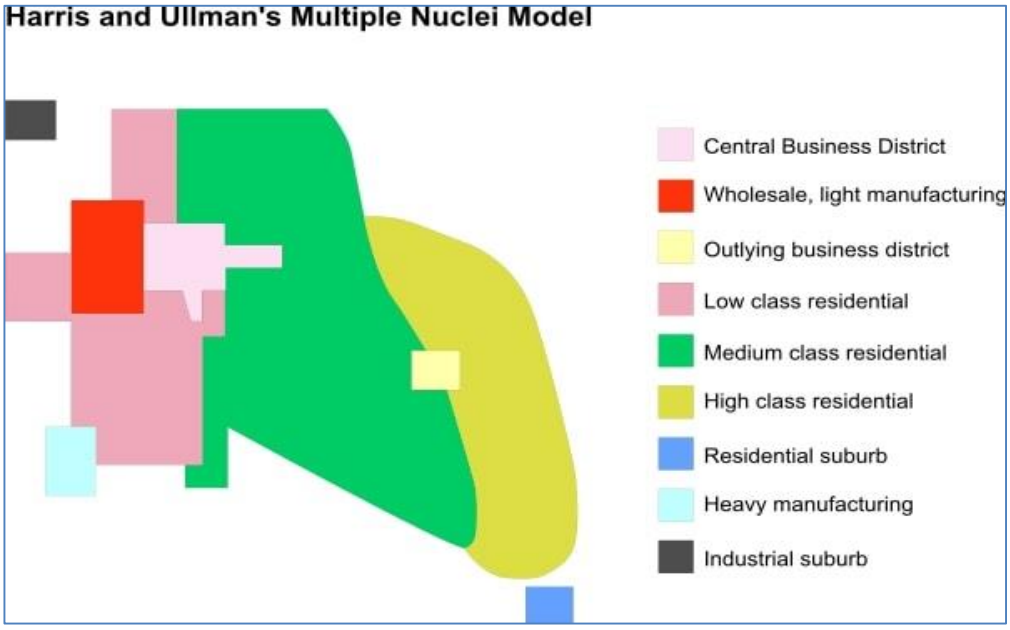
- The model assumes wealthy people who can afford the highest rentals and rates chose the best sites.
- Wealthy residents can afford private cars or transportation thus they live further from industry and near main roads.
- Similar land uses attract each other and repel other land uses.

❖ This process is referred to as sector development
❖ The city or town as a single CBD or core.
❖ People need to move from one area of the town to another.

The model

❖ According to Hoyt areas alongside main roads/communication lines attract the highest rent and rates.
❖ The city grows in a series of wedges.
❖ Land use follows transport routes from the CBD.
❖ Once a certain area has developed a distinctive land use or function it tends to retain that land use as the city grows outwards
❖ Hoyt also identifies different residential zones in relation to income, opportunity and class.
❖ Sectors thus replace the rings in Burgess and Park's model.
❖ This is because of unequal access as the city grows outwards along major routes.
❖ Major routes attract manufacturing.
❖ Next to the industrial zone are low class worker's houses for example Mbare and Leighton industries, Willowvale and Highfields and Mbare and Graniteside.
❖ These houses are followed by middle class houses (Waterfalls next to Mbare) and then high income houses.

Harris and Ullman's Multinuclei model (1945)



- They made their study well after the other two models had been published and thus had the benefit of hindsight and cities had since grown in size.
- They realised the fact that modern cities have a more complex structure than described by the Concentric and Sector models
- Cities usually grow from several independent nuclei rather than or in addition to the main CBD.
- These cores include sub-urban shopping centres in most modern cities.
- Each of these nucleus acts as a point of growth and usually has some of the functions found in the main CBD and other nuclei for example it might have banks, shopping malls, supermarkets etc.
- For example Sam Levy shopping centre, Kamphinsa, Westgate, Makoni shopping centres
- These centres grow with time to merge with each other to form one large urban centre.
- Harris and Ullman were able to study later urban settlements that had satellite residential and industrial suburbs in their model.
- If the main city becomes too large and congested some functions may disperse to form new nuclei.
- Multiple nuclei thus develop out of the need for quick access to the centre, to keep certain land uses apart and to decentralise.
- The city of Harare closely approximates this model with the main large CBD at the centre and various nuclei in the form of shopping centres such as Borrowdale, Same Levy, Machipisa in Highfield, Kamphinsa in Greendale, Westgate, Pendennis in Mt Pleasant etc.
- It also has satellite towns in Ruwa and Chitungwiza.

Zimbabwe`s towns and cities

- An urban settlement in Zimbabwe is one whose population is more than 2 500 or more with the majority of its workers (more than 50%) engaged in non-agricultural activities.
- It must have a compact settlement pattern
- This definition also, by custom, tends to omit Growth Points even when they meet the definition.
- According to the 2012 census report 33% of the population in Zimbabwe live in urban areas and 47% of the urban population lives in Harare.
- Most, if not all of Zimbabwe's towns are influenced by their colonial heritage.
- Each town usually has a core/CBD, an industrial zone e.g. Willowvale in Harare, high density or low income residential zone e.g. Highfields in Harare, middle income residential zone (middle density suburb) e.g Cranborne in Harare and low density or high income residential zone e.g. Borrowdale in Harare and sub-urban commercial centres e.g. Sam Levy and Westgate in Harare

- Other cities have satellite towns around them for example Norton, Chitungwiza and Ruwa around Harare
- There are very few large urban settlements in Zimbabwe
- Most urban centres rose out of administrative centres for example Harare, Bulawayo, Gweru, Bindura and Marondera act as provincial administrative centers
- Some towns began as mining centres for example Hwange, Zvishavane, Shurugwi, Kwekwe, Bindura, Kadoma and Gwanda.
- Some grew as service centres. For example some towns act as agricultural service centers for surrounding farmlands e.g. Harare, Gweru, Bulawayo, Mutare ec.
- A few towns grew as tourist/resort towns for example Victoria Falls, Kariba and Masvingo.

Harare

- According to the 2012 census, Harare has a population of 2 098 199 people, with a male population of: 1 011 831 and a female population of: 1 086 368
- It is Zimbabwe's administrative capital and largest city.
- It is the focal point of all roads, rail and air routes in Zimbabwe.

- ❖ It was granted municipal status in 1897.
- ❖ The railway line reached Harare in 1899 from Beira.
- ❖ It became a city in 1935.
- ❖ Industries sprouted up including motor assembling, trucks, radios, furniture etc.
- ❖ Harare is also Zimbabwe's largest commercial centre.
- ❖ It is also the country's financial centre where most of the banks are found.

The structure of Harare

- ❖ Harare consists of a CBD which forms the city's commercial hub.
- ❖ It has developed a few industrial zones mainly to the south, south west and east of the CBD.
- ❖ Most industries are also found along railway lines.
- ❖ High density suburbs are found next to the industrial areas for example Highfields near Willowvale.
- ❖ These are the low income residential areas - they are mostly found to the south-west and west of the CBD.
- ❖ The high density of Mabvuku, Tafara and Epworth are found on the Eastern fringes of Harare
- ❖ They mainly provide domestic labour to the low density suburbs such as Greendale, Mandara and Chisipiti.
- ❖ The medium and low density residential zones are mainly located on the north and eastern sectors of the city way from the industries and high density residential areas.
- ❖ The low density suburbs are spacious and large.
- ❖ Sub-urban shopping centers have developed in these areas to service residents for example Sam Levy in Borrowdale.
- ❖ Several dormitory towns have also developed around the City include Chitungwiza, Ruwa and

Bulawayo

- Bulawayo resembles the Hoyt`s sector model.
- Is the second city in Zimbabwe with a population of 620 936 people, 309607 males and 311 329 females.
- Is a nodal town linked by roads, rail being headquarters of NRZ and air routes.
- It has an iron grid street pattern with wider roads.
- Has a variety of industries including tyre manufacturing and cement manufacturing however some are not functional due to economic instability prevailing. Most industries are situated to the west. Residential high density and low income areas are close to the industrial zones and include Mpopoma, Nkulumane and Emakhandeni.
- Low density areas are to south, east and north-east.
- It is more based on ranching and mining.
- It is also linked by a railway line to South Africa, Botswana and Zambia hence easier for importation and exportation of goods.
- Has good communication links and has been the host for International trade fairs.
- Is a tourist centre with several hotels and attractions including Matopo National Park, Khami, Umzingwane Dam and Chipangali sanctuary.
- The town has water problems and many industries have relocated to other towns.

Gweru

- Has a population of 124 735 people, 62 760 males and 61 975

- Is the administrative capital of Midlands region, a route centre situated on Harare – Bulawayo road and railway route.
- It is a nodal centre with rail branches to Shurugwi, Masvingo and low veld.
- Dabuka near Gweru handle most of the country`s international traffic.
- Ii also lies in a rich mining region with Chrome in Shurugwi and iron at Redcliff.
- Industries include footwear, engineering, dairy processing and publishing.
- It hosts the Airforce of Zimbabwe and Zimbabwe Military Academy.
- The CBD forms the commercial zone.
- Industrial zone is to the west. Near railway station.
- High density residential areas are close to industries to the west and north west.
- Low densities are to the south, east and north-east.
- Senga being the only one far away from the industrial zone.

Mutare

- Has a population of 131 808, 68734 males and 63 074 females.
- Is Manicaland`s administrative capital located near the Christmas pass.
- It lies in rich agricultural area hence developed in commercial and industrial centre.
- It is accessible to the Indian Ocean.
- Industries include paper and timber, furniture, tea and coffee processing and a car assembly.
- It is a tourist destination with attractions like mountain climbing, wildlife, Vumba, Nyanga and Chimanimani mountains, Chirinda forests, hot springs.
- It has a well planned CBD, residential suburbs and suburban services as well as communication service.

Urban Problems

Urbanisation

- The increase in the proportion of people living in urban areas. Although this can be caused by natural increase (higher birth rates in urban areas than rural areas), it is more likely to happen because of rural-urban migration.

Urban growth or Sprawl: A growth in the size of the urban area. This normally happens because of building in the rural-urban fringe, although it may also include things like land reclamation.

Rapid urbanisation and urban growth can cause many problems in urban areas including:

- ❖ Congestion (an increase in the amount of traffic leading to traffic jams).
- ❖ Pollutions (air, water, noise, visual).
- ❖ Electricity blackouts.
- ❖ Water shortages.
- ❖ Unemployment.
- ❖ Growth of informal settlements.

- Crime

Congestion in Harare
The problem of congestion is caused by multiple factors, including:

- Increase in car ownership
- Limited amount of public transport or expensive public transport or overcrowded public transport
- Roads not designed for many cars
- Population growth and rural-urban migration
- The movement of freight (containers) onto lorries

Problems Caused by Congestion

- As car ownership increases so does the amount of pollutants released by cars. This can lead increased chest problems e.g. asthma.
- People travelling to work have to leave home earlier and arrive back later, therefore spending longer away from their families.
- More cars on the roads increases the frequency of accidents
- More vehicles on the roads increase the amount of air pollution, but also noise pollution.
- Late deliveries caused by traffic jams costs companies and the economy money.
- Workers also arrive late to work because they are stuck in traffic.
- It creates a reliance on oil and more oil is used at slow speed than normal travelling speeds

Solutions

- Pedestrianisation.
- Improve rail links in town.
- Car sharing
- Reurbanisation: This means the movement of people back in the centre of urban areas (near the CBD). By encouraging people back into the centre then commuter times and traffic jams should decrease.
- Increased car tax and petrol duty.
- Park and ride

Rush hour: The period of time when most people travel to work. This normally between 7-9 in the morning and 5-7 in the afternoon. Traffic is normally worst during these periods.

TRANSPORT AND TRADE

Transport

Transport is the act of moving items and people from one place to another while communication is the process of transferring information between individuals, groups and places.

Factors influencing Transport

1. Existence of sets of corresponding places with surplus (supply) and deficits (demand) for goods, services and information.
2. Alternative sources may hinder transport e.g. a nearby source of market of a required commodity.
3. Infrastructure depending on how it is can lead to establishment of efficient or inefficient transport.
4. Politics where by the government may decide to be the leading provider of transport facilities.

Modes of Transport

There are 3 common modes of transport namely land, water and air transport.

Land Transport
-The type that involves movement of people and goods on land.

Types of Land Transport

1. Human Porterage

-Movement of people from one place to another carrying light goods on their back, hands or shoulders or by using hand carts, trolleys, bicycles or motorcycles.

2. Use of animals
-Use of domesticated animals to carry goods and people on their back or pull loaded carts (drought animals).

Advantages of Human and Animal Transport
(a) It` s the cheapest and can be used by all classes of people since no fuel is used. Animals require very low maintenance costs as they feed on vegetation.
(b) Relatively safe because few accidents occur during transportation.
(c) Doesn` t pollute the environment as it doesn` t use fossil fuels.
(d) They are flexible in that they can be used to transport goods in areas without good road network.
(e) It` s convenient in that it` s readily available whenever required.

Disadvantages
(a) Goods can be stolen or destroyed by wild animals and extreme weather conditions because they are exposed.
(b) They are a very slow means of transport hence time consuming, tedious and boring.
(c) They can‟t transport large quantities of goods because human and animal energy get exhausted with time.
(d) They can cause congestion on busy urban roads which may delay other forms of transport.

3. Road Transport
-Means of transportation of people and goods by motor vehicles on roads.
Types of Roads
(a) All weather roads- which are used all year round i.e. tarmac and murrum roads.
(b) Dry weather roads- which are used reliably during dry seasons.
(c) Motorable trucks- which are used by people on foot and by vehicles on dry season. A truck is a path or rough road made by people, vehicles or animals.

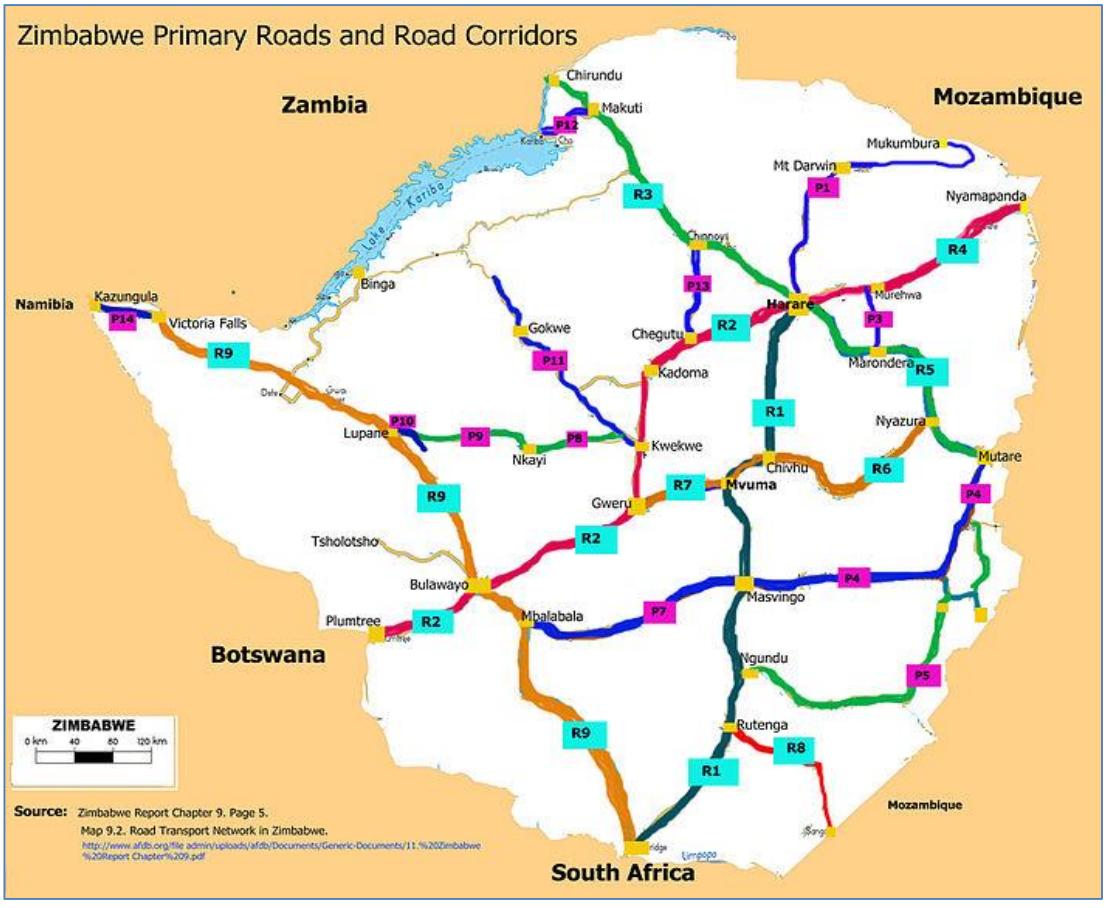
Principal Trans-Continental Highways in Africa

- Great North Road connecting Cape Town and Ca
- Tr -Africa Highway from the Port of Mombasa to Dakar in Senegal through east and Central Africa.
- Da -Djamena Highway through Core De Ivoire , Nigeria and Chad.
- Tr -Sahara Highway from Lagos to Tripoli through Algeria.

Advantages of Road Transport
(a) It`s a faster means of transport compared to human and animal transport.
(b) It`s cheaper compared to railway transport because construction of roads is cheaper than that of railways.
(c) Its available at ones convenient time.
(d) Roads can be constructed in stages improved and even repaired while they are being used.
(e) It`s flexible in that road connections are available all over the country.

Disadvantages
(a) Traffic congestion and jams when there are many vehicles on roads which leads to delays and fuel wastage.
(b) Its expensive over long distances and when transporting bulky goods.
(c) Vehicles can carry a limited number of people and amount of goods at a time making them expensive and uneconomical.
(d) It‟s adversely affected by weather e.g. during heavy rains, roads become impassable and foggy conditions hinder visibility making it easier for accidents to occur.
(e) Vehicles pollute the environment by their exhaust fumes and noise which they produce.

Road Networks in Zimbabwe



- Roads in Zimbabwe are grouped into wide – tarred and other roads.
- Are classified using the A system (autobahn) where they vary from the best surfaced to not surfaced.
- There are wide tarred roads in the central, north east and eastern parts of the country due to lot of economic activities, more towns with large populations and the land is fair and easy to make roads.
- Other roads link communal areas while wide tarred roads also link commercial areas.

- Wide tarred roads crosses Zimbabwe`s boarders at six points e.g Chirundu, Mutare and Victoria Falls for international trade and tourism.
- High concentration of tarred roads are in Harare followed by Bulawayo.
- Wide tarred roads are fewer because they are expensive to construct.
- Other roads are in communal areas due to imbalances created during the colonial era.

4. Railway Transport

-Means of transporting people and goods using trains or rails.
Advantages of Railway Transport
1. Less expensive compared to road transport because it can carry a large number of people and heavy and bulky goods in one trip.
2. There is no congestion or jam because there is only one train on a given truck at any particular time.
3. Passenger trains are comfortable for passengers travelling over long distances in that they have facilities such as accommodation, dining and toilets accommodation.
4. Safer than motor vehicles because they are less prone to accidents.
5. Have less maintenance costs because they don`t require frequent repairs like roads.

Disadvantages
(a) Very slow means of movement especially of perishable and urgently required goods.
(b) Expensive to construct as much iron and steel is used to construct railway lines and trains.
(c) Inflexible in that railway lines aren`t available all over the country and their direction cannot be changed.
(d) Are affected adversely by terrain as where there are steep gradients, tunnels and winding tracks have to be used which adds to the cost of setting up railway system.
(e) Specific gauge of railway line can only be used by a specific design of train unlike roads which can be used by many varieties of vehicles.
(f) Trains can‟t use rails while they are being constructed unlike roads which can be used while they are being constructed, improved or even repaired.

Examples of Railway Links in Africa

- Tazara railway- connects Zambia Copper Belt with the sea port of Dar-es-salaam.
- Benguela Railway- runs from Zambia Copper Belt to Angola.
- Kenya Uganda Railway- runs from Mombasa to Kisumu. It has an extension from Nakuru through Eldoret to Malaba then through Tororo to Kampala.
- Kenya‟s other railway branches are Voi to Taveta, Konza to Magadi, Nairobi to Nanyuki, Gilgil to Nyahururu, Nakuru to Eldoret and Kisumu to Butere.

Why There Are Few Railway Links among African Countries?

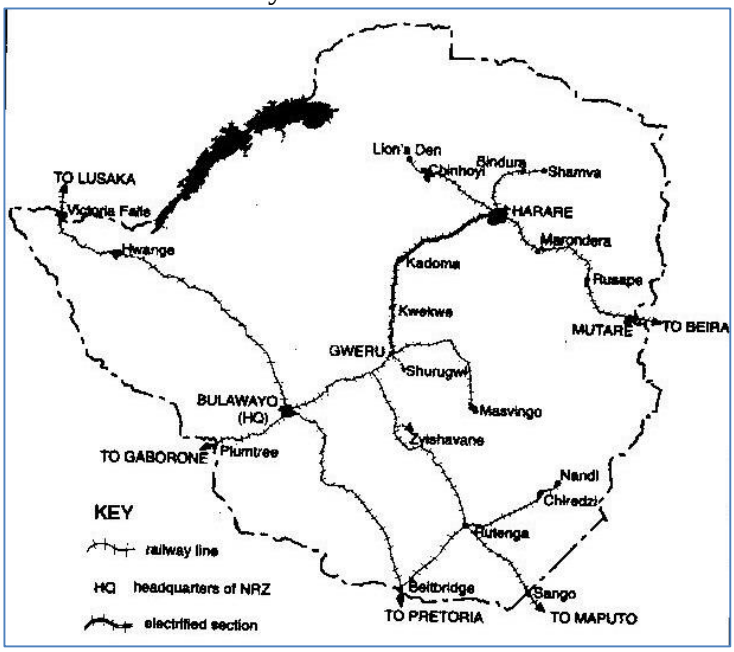
- Administration by different colonial governments who constructed railway links only within areas of their jurisdiction.
- Political differences which led to mistrust and hostility which works against effort to construct railway jointly.
- Countries have railways of different gauges making connection to be difficult.
- Little interstate trade which doesn`t warrant construction of railways to transport bulky goods.
- Countries lack sufficient capital to establish railways.

- Mountainous landscape and swampy terrain which hinder the development of rails to link the countries.

Problems Which Zimbabwe Experiences In the Rail Transport

- Competition from other modes of transport which are cheaper and flexible.
- High maintenance and expansion costs causing little expansion of rail lines.
- Mismanagement of rail services leading to deterioration at lower income.
- Vandalism during political unrests and by people dealing in scrap metal.

Zimbabwe`s Railway network



- Was built in the late 1890s and early 1990s during political events.
- Main railway line runs along the Central watershed from Bulawayo to Harare and Mutare.
- Railway line are linked to other countries e.g. to Pretoria and Zambia for international trade.
- Other line branch from the main route for specific reasons e.g to move minerals and goods.
- They are few railway line in the country because it`s expensive to build them.

Air Transport

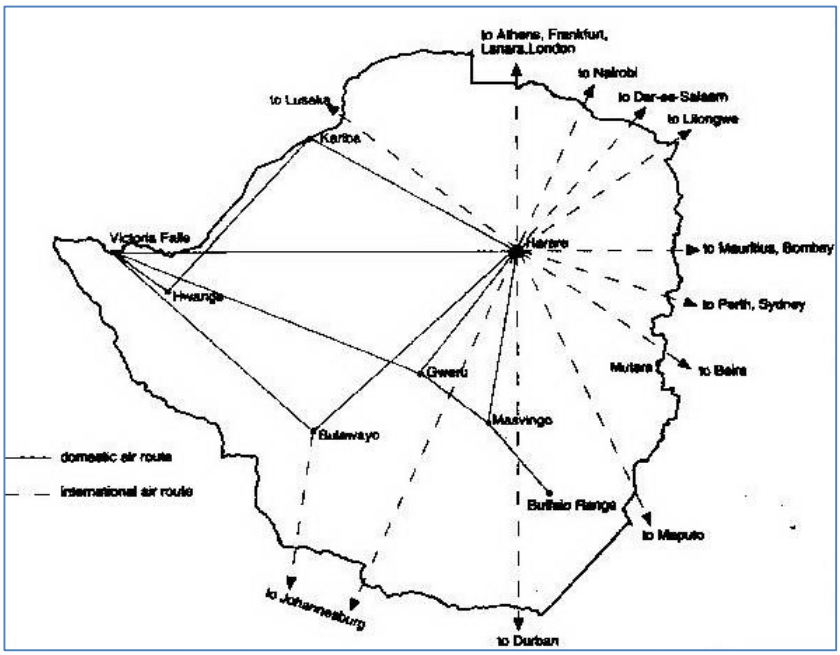
Advantages

- Very fast means of transport.
- Can be used in case of emergency e.g. rescue operations in disasters such as floods.
- Not affected by relief.
- High value goods and perishables are carried fast.

Dasadvantages

- Prone to sabotage and terrorism.
- Influenced by bad weather like smogs.

Air routes of Zimbabwe



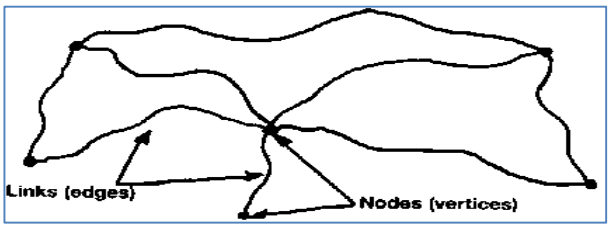
- Are designed for domestic and international travels.
- Harare dominates international air routes due to being the capital city for holding international conferences, nice hotels and bookings for tourists and large population/ market for airlines including Air Zimbabwe.
- Airlines also connects other towns and tourist resorts like Victoria Falls.
- Zimbabwe`s air port are located far away from residential areas to avoid accidents and noise pollution.
- Zimbabwe is trying by all means to upgrade its airways and handling facilities, purchasing high speed aircraft with comfort and extending existing air ports.

Problems with air transport in Zimbabwe

- Lack of foreign currency to buy spares.
- Ageing aircrafts.
- Corruption and inefficiency leadership.
- No markets for Air Zimbabwe due to political instability in the country.
- Competitions from cheap airlines like Kenya.

Transport Network Analysis

- A pathway followed by a transport type is called a route or and edge.
- Any settlement through which the route passes is called a node.



Beta Index(B.I.) of a transport network = $\frac{\text{Number of edges (E)}}{\text{Number of nodes (N)}}$

5. Pipelines

-Means of movement of fluid or gas products such as water, gas and oil through pipes from one place to another. Pumping stations are constructed along the pipelines to keep the product flowing steadily.

Advantages of Pipelines

(a) No delay as there is a constant supply of commodity.
(b) Convenient in that amounts of commodity can be transported within a short period.
(c) There are low operating costs in that minimal labour is required in operating pipelines and also the cost of maintenance of pipelines is lower than for other means.
(d) They aren`t affected by bad weather like other means of transport.
(e) It doesn`t pollute the environment like other means of transport except in cases of leakages which are rare.

Disadvantages

(a) Selective in that they can be used to transport fluids and gasses and can transport only one type of commodity at a time.
(b) Insecure in that they may be sabotaged if they run across a number of countries when there are political differences or when one country decide to withhold the product.
(c) Pipelines may cause pollution if they burst spilling oil, gas or sewage and the problem would be grave if it occurred under water.
(d) Inflexible in that they remain permanently in one position and rerouting becomes impossible and further distribution of the substance from depots has to be done by roads and railways.

6. Water Transport

- It involves movement of goods and people over waterways/ water bodies.

Water transport is classified into two: Sea Waterways/ marine water transport and inland water ways.

Sea Waterways/ Marine Water Transport
-Involves movement of goods and people over seas. There are the following types of vessels used in sea transport:
1. Liners
They are ship with the following characteristics:

- Operate along fixed routes and time schedules.
- They transport both people and goods.
- Fixed rate of freight charges.

There are two types of liners:
Passenger Liners

- Carry people and small valuable items.
- Have luxurious facilities e.g. cinemas, shops, banks, hotels, etc.

Cargo Liners

- For carrying both goods and people.
- Have loading and unloading facilities.
- Slower in speed.

- Less prestigious.
- Smaller in size compared to passenger liners.
- Some carry different products while other carry specialised goods e.g. petroleum.

2. Tramps
- They are ships meant for transporting cargo.
-No fixed routes or schedules.

- Are slower in speed.
- Have lower freight charges compared to liners

Improvements in Ocean Transport

1. Refrigeration facilities to enable transportation of perishable goods.
2. Containerisation (parking of goods in standard sealed metal containers which are unsealed at the destination).

Advantages of Containerisation

(a) Safety and security because containers are sealed which protects goods from destruction by bad weather and from being stolen.
(b) Easy to handle because containers are fitted with special devices like hooks and rings which makes loading and unloading easy.
(c) Time saving because goods are put in one container than being carried in several boxes which makes loading and unloading easy.
(d) It`s economical in terms of space because containers have a standard shape which reduces wastage of space by allowing tight packaging of goods.

Ocean/ sea Routes/ Ocean Trade routes
Are well marked routes through which Ocean traffic passes. They are also called ocean trading routes because they have come about as a result of trading activities among various regions.
Major ocean routes are concentrated in the northern hemisphere due to the following:
 High degree of
 Intensive tra
 High pc
 Avai y of ocean terminals in developed countries of Europe, N. America and parts of Asia.

World major Sea Routes

1. Panama Canal Sea Route- connects Pacific and Atlantic oceans.
2. Cape of Good Hope Sea Route- serves eastern and western coasts of Asia, New Zealand and Australia.
3. North Pacific Sea Route- serves industrialised countries of Asia e.g. Japan, Singapore, Hong Kong, S. Korea and W.N. America.
4. N. Atlantic Sea Route- connects W. Europe to E.N. America.
5. Mediterranean Asiatic Sea Route- connects Europe to Africa and the Far East countries.
6. Trans-Atlantic sea Route- connects Europe to E.S. America.

Inland Water Ways

-Movement of goods and people over rivers, lakes and canals.

Examples of Navigable Rivers of Africa
- Section of
- R. Nile from Uga
- R. Ogowe
- Sections o
- Ta
- Zam

Examples of Navigable Rivers in Other Parts of the World

- R. Rhine and its tributari
- Mississ ts tributaries Ohio, Missouri, Arkansas and Tennessee.
- Mackenzie, Yukon, Nelson
- Most important water way in N. An

Examples of Lakes which are inland water ways are such as Victoria (largest inland waterway in E. Africa, Tanganyika, Malawi, Albert and also man-made lakes such as Kariba, Nasser, Volta and Kainji.
Factors Which Have Hindered Development of River Transport in Africa
1. Inadequate capital to develop waterways, ports and for the purchase of vessels.
2. Fluctuation of water levels which makes sailing difficult as a result of rivers passing through dry areas.
3. Presence of rapids and waterfalls which hinders the vessels‟ movement.
4. Siltation of rivers which makes their channels shallow hence hindering movement of vessels.
5. Presence of floating vegetation which makes it difficult for vessels to sail due to narrowing of the river channel.
6. Most rivers pass through unproductive zones hence it‟s uneconomical to develop river transport.
7. Rivers flow across political boundaries which may require negotiation in order for the countries involved to use them for transport.
8. Inadequate technology.

Canal Transport

A canal is a water channel that is cut through land for boats or ships to travel along. Some canals join large water bodies like seas and oceans.
Examples of Canals
- Suez Canal which joins Mediterranean and Red Sea.
- Panama Canal which connects Caribbean Sea with Pacific Ocean.
- Dortmund-Ems Canal which joins R. Rhine to the N. Sea.
- Soo canals which connects connecting L. Superior to L. Huron.

Advantages of Water Transport

(a) Offers less friction to the movement of vessels as it‟s the case with roads.
(b) Are natural and free transport routes requiring less artificial infrastructures
(c) Less expensive because large loads can be carried at minimal costs and water routes require minimal maintenance.
(d) It`s a reliable mode of transport since there is very little traffic congestion on waterways because the waterway is large.
(e) Goods are protected because they are transported in containers or tankers.
(f) It`s a safe mode of transport for delicate goods.

Disadvantages

(a) Many water ways are affected by water fluctuation like low volumes and high volumes which make them to flow swiftly which make them unnavigable.
(b) Water transport is the slowest and unsuitable for perishables, casualties and medicines.
(c) Great loses are incurred during accidents such as fire outbreaks, typhoons, tsunamis and mechanical breakdown due to the large carrying capacity of the vessel.
(d) High capital is required in the purchasing of modern shipping vessels and maintenance of parts.
(e) Ocean transport is available only to people who live near water ways unlike roads which are flexible.
(f) Insecurity in the oceans where pirates steal from and attack sailing ships.
(g) Sea vessels greatly contribute to water pollution as most of the wastes are thrown into the sea.

Role of Transport in the Economic Development of Africa

1. development of trade because buyers are able to move to markets, traders are able to move to market centres where products are in high demand and order goods for sale without necessarily going to the suppliers which reduces transport costs and hence increases profits.
2. Development of infrastructure by making tourist attractions accessible.
3. Promotion of industrial development/establishment of more industries since areas with good transport networks are likely to attract investors to set up industries and finished goods are able to reach consumers easily..
4. Many people are employed in the transport sectors e.g. drivers, mechanics and engineers.
5. Settlements develop where transport routes converge e.g. Khartoum at the confluence of blue and white Nile and Mombasa.
6. Transport opens up remote areas for exploitation of natural resources such as minerals, fish, tourists‟ attractions because labour can be easily ferried to such areas and resources can be taken easily to processing sites.
7. Transport is source of revenue to the government e.g. tax is levied.

Problems facing transport in Africa and their Possible Solutions

1. Some countries are landlocked i.e. located far inland away from oceans e.g. Uganda, Rwanda, Burundi, etc. the solution is to develop good relations among the nations in the continent so that countries which have access to the sea permit their landlocked neighbours to have direct access to the sea routes.
2. Regions having rugged relief due to presence of features like mountains e.g. mountains Kenya and Kilimanjaro which makes construction of roads and railways difficult and expensive. Presence of rapids and waterfalls which causes swift movement of water makes development of river transport difficult. The solution is constructing passes and tunnels through ridges and slopes and building of bridges across rivers and valleys to allow construction of roads and railways.
3. Shortage of navigable rivers because rivers have navigable stretches, presence of obstacles and fluctuations of water volumes, narrowness and shallowness all of which makes navigation difficult. Solution is widening and deepening of river channels through dredging and construction of dams across rivers to improve navigation.
4. Lack of adequate capital for establishment and maintenance of transport infrastructure e.g. vehicles and locomotives.
5. Political instability in countries such as Somalia and Zimbabwe which have affected transport. Solution would be to set peace mission in the affected countries in order to restore stability.
6. High cost of travelling due to high cost of fuel causing the low and middle class persons to travel less which reduces profits realised in the transport sector. The solution is management and conservation of energy to save on the available resources and alternative sources of energy.

TRADE

- Buying and selling or exchange of goods and services.

Types of Trade

A. Domestic/Internal/Home/Local trade
-Buying and selling of goods within a country`s borders.
It`s classified into:
1. Wholesale Trade-purchasing of goods in bulk from producers and selling them to retailers.
2. Retail Trade-buying goods from wholesalers and selling them to individual consumers.

B. Regional Trade
-Trade between countries found in the same geographical region.
C. International Trade
Exchange of goods and services at the global level.
It`s classified into:
1. Export Trade-selling of goods and services to foreign countries. Examples of major exports are coffee, tea, cotton and flowers
2. Import Trade-buying of goods and services from other countries. Examples of imports are crude oil, vehicles, electronics, sugar, skilled labour, vehicle parts etc.
3. Bilateral Trade-exchange of goods and services between two countries.
4. Multilateral Trade-exchange of goods and services between many countries.
5. Visible Trade-trading in tangible goods.
6. Invisible trade-trading in services.

Balance of Trade

-Difference in value of countries visible exports and imports.
It‟s of 2 types:
1. Adverse Balance of Payments-in which value of visible imports exceeds that of visible exports.
2. Favourable Balance of Trade-in which value of visible exports exceeds that of visible imports.

Balance of Payment
-Difference in value between visible and invisible exports and imports.

Factors Influencing Trade
1. Difference in natural resources which makes it necessary to trade with other countries or areas in order to obtain goods and resources which are not found in their area.
2. population whereby large population or one with high purchasing power provides a large and ready market for goods and services encouraging trade.
3. Trade occurs when there is demand and supply of goods and services.
i. If the supply is low and the demand is high, prices go up stimulating trade.
ii. When the supply is more and the demand is low, prices go down discouraging trade.
4. Adequate and efficient means of transport and communication encourage trade because bulky goods can be transported quickly and over long distances from producers to consumers. Poor transport discourages trade due to the difficulty in getting goods to the market in time. Goods can be supplied faster when traders communicate with suppliers without having to travel a lot which reduces travelling cost and hence increasing profits.
5. Trade restrictions can encourage or discourage trade. They are of two types:

a) Tariffs- taxes or duties levied by a country on a particular type of commodity imported in order to protect its domestic industries.
b) Quotas-specified quantities of goods which must not be exceeded during importation or exportation.

 Trade A -agreements made between countries regarding which commodities are exported or imported from specific countries.
 Tota -complete restriction of importation of a particular commodity in order for a country to protect its domestic industries or due to political hostility.
6. Trading Blocks or economic Unions/Associations among countries aimed at promoting regional trade among members states can encourage trade between members and discourage trade with non-members.
a) Free Trade Associations-liberalise trade among member countries by lowering and abolishing tariffs.
b) Common Market Associations-liberalise trade among members and raise tariffs for non-members.
7. Trade can only take place between countries only when they are in good terms. Hostility leads to total ban as was the case with s. Africa during apartheid and Iraq when it attacked Kuwait and failed to destroy weapons of mass destruction.
8. Existence of aids to trade e.g.
a) Banking facilitates storage and transfer of money used in trade transactions.
b) Insurance protects businesses against theft and destruction from fire which instils confidence among investors.
c) Warehouses are essential for storage of large quantities of goods for sale.

Significance of Trade to Zimbabwe

1. Employment creation.
2. It`s a source of revenue for the government by charging sales tax such as V.A.T. on manufactured goods sold locally and tariffs at the point of entry into the country.
3. Foreign trade enables a country to earn foreign currency.
4. Leads to development of settlements e.g. many towns started as a small market and more people moved there when trading activities increased.
5. International trade ensures availability of a wide range of goods for consumers.
6. It leads to development and improvement of transport infrastructure such as roads and railways.
7. Leads to development of industries because as the goods are bought demand for goods increases hence more industries are set or existing ones increase their activities in order to satisfy the increased demand.

Problems Facing Trade in Zimbabwe

1. Zimbabwe depends on agricultural exports which are sometimes affected by climatic change, pests and diseases leading to low production, and hence low foreign currency.
2. Zimbabwe`s exports are of low value as they consist of raw materials or semi processed commodities which fetch low prices.
3. Local manufactures suffer unfair competition from foreign firms.
4. Unexpected trade restrictions are sometimes imposed on Zimbabwe`s exports
5. Inadequate transport and communication as most roads are poor and impassable during rainy season meaning goods can`t reach the market and hence increased costs for such goods.

The Future of International Trade in Zimbabwe

The future of it is bright because of the following:
1. Zimbabwe has signed trade agreements with various countries of Europe, Asia, America and Africa.

2. It`s a member of COMESA, SADC and AU which will increase the volume of regional trade.
3. Zimbabwe is exploring markets in the Far East countries (Look East Policy), Middle East and Libya.
4. Goods from Zimbabwe have markets abroad.

The Role of Regional Trading Blocks

The Common Market for Eastern and Southern Africa (COMESA)

- It was established in 1994 to replace Preferential Trade Area (P.T.A.).
- It has 22 member states e.g. Kenya, Uganda, Ethiopia, Zambia, Zimbabwe, Namibia, etc.

Objectives of COMESA
(a) To reduce and eliminate trade barriers on selected commodities to be traded with member states.
(b) Abolish restrictions in administration of trade among member countries.
(c) Fostering relations, peace and political stability for member states.
(d) Raise the standard of living within member states.
(e) Promote goods being produced in the member states.
(f) Establish and foster co-operation in all fields of economic activity.

Achievements
(a) Increased volume of trade.
(b) Increased accessibility to markets in member countries.
(c) Free movement of goods among member countries due to elimination of trade barriers.
(d) Increased efficiency in production as each member is allowed to specialise in what she produces.
(e) Improvement of transport and communication facilities.
(f) Increased political and economic cooperation among member states.

The Southern African Development Community (SADC)

- It started as Southern African Development coordination in 1980 in Lusaka Zambia and transformed into SADC after collapse of apartheid.
- It has 15 member states e.g. Tanzania, DRC, S. Africa, Zambia, Zimbabwe, Mozambique, etc.

Objectives
(a) Encourage self-reliance among member states in the face of instability posed by apartheid regime of S. Africa.
(b) Promote and defend peace and security.
(c) Promote regional integration.
(d) Eradicate poverty.
(e) Facilitate trade and economic liberalisation.
(f) Promote self-sustaining development on the basis of interdependence on member states.
(g) Promote and maximise utilisation of natural resources and effective protection of environment.

Achievements
(a) Promotion of regional industries based on domestic and regional raw materials.
(b) Reliability and development of regional transport and communication infrastructure.

The Economic Community of West African States (ECOWAS)
- Was established in 1976 by the treaty of Lagos.
- It has headquarters in Lagos Nigeria.
- It has 15 member states e.g. Nigeria, Liberia, Ghana, Benin, Guinea, Sierra Leone, etc.

Objectives

(a) Promote mutual trade by eliminating trade restrictions among members.
(b) Create a monetary union.
(c) Impose uniform tariffs for imports from non-member countries.
(d) Give special treatment to goods imported from member states.
(e) Promote free movement of people to and from member countries by eliminating visas.

Achievements

(a) Brought peace to troubled countries like Liberia and Sierra Leone.
(b) Promotion of trade in the region through the peace achieved.
(c) Development of schools to train people on peace keeping e.g. The National War College.
(d) Free movement of goods among member states.

The European Union (EU)

- An organisation of European countries dedicated to increasing economic integration and cooperation among members.
- It was formerly inaugurated in 1993 and has headquarters in Brussels in Belgium.

Objectives
(a) Promote cooperation in economic, trade, social, security and judicial matters.
(b) Implementation of economic and monetary union.

Achievements
(a) Signing of many trade agreements between EC and other countries.
(b) Free trade among members as a result of abolishing trade barriers.
(c) High agricultural production as farmers receive guaranteed prices which have enabled them to increase efficiency.
(d) Free movement of factors of production which include capital and labour.

Problems Facing Regional Trading Blocks

(a) Civil wars taking place in some countries which has caused insecurity in turn affecting trade between countries.
(b) Political differences among leaders of member states may affect cooperation among member states.
(c) Some countries produce similar goods making the volume of trade to be low and less rewarding.
(d) Free trade affects local industries as the imported goods without taxes are usually cheaper than locally produced goods.
(e) Free trade denies countries revenue they would have earned from taxing imported goods.
(f) Poor transport and communication limits inflow of goods and services.
(g) Some member states don`t remit their annual subscriptions which affects the operations of the organisations.

Measures to deal with Regional imbalances in Zimbabwe

- Growth points development.
- Explore minerals in remote areas.
- Irrigation schemes in hot and dry regions.
- Rural electrification.
- Industrial location to be evenly distributed.
- Establish Export Processing Zones (EPZs) in undeveloped areas.

QN: 1 (a) What are Export Processing Zones? [2]
(b) State five advantages and three disadvantages of Export Processing Zones. [8]
2. (a) What is informal cross border trading?
(b) State five advantages and three disadvantages of informal cross border trade. [8]

ENVIRONMENTAL PROBLEMS

Greenhouse Effect and Global Warming

Greenhouse gasses (GHG): Any gas that absorbs and emits radiation in the thermal infrared range. The gases include: Carbon monoxide, carbon dioxide, methane, sulphur dioxide, Nitrous Oxide, water vapour and ozone.

Sources of greenhouse gases include:

- Transport (cars and planes).
- Animals (cow release large amounts of methane)
- Burning fossils fuels (especially oil and coal)
- Melting Permafrost (methane is released when permafrost melts).
- Industry
- Domestic use (wood fires)

There are some natural causes of changes in climate including:

- Changes in the sun's solar radiation.
- Gases (sulphur dioxide) released from volcanoes.
- Dust and ash from volcanoes and meteorites blocking incoming solar radiation.
- Changes in the earth's orbit/axis, making earth close to or further from the sun

Problems Caused by Global Warming

- Rising Sea Levels.
- Coastal Flooding.
- Climate Refugees.
- Loss of Biodiversity.
- Desertification.
- Loss of Industry: Coastal industries like tourism and fishing will be effected as sea level rise and destroy holiday resorts (or even whole islands) and engulf fishing ports and communities.
- Flash Floods: Rising temperatures will in turn mean more water is evaporated into the atmosphere. Because of the amount of evaporation rainfall (especially convectional) will become more intense an cause more flash floods.
- Increased Tropical Storms.
- Heat waves and Forest Fires
- Melting Permafrost: The melting permafrost not only releases large amounts of methane in the atmosphere increasing the greenhouse effect, but also releases freshwater into the seas which may affect some of its ocean currents.
- Droughts and Famines (crop failure).
- Skin Cancer (diseases).

Solutions to Global Warming

- Renewable Energy.
- Hybrid Cars.
- Reduce, Reuse, And Recycle.
- Afforestation and Reforestation.

- International Agreements: International agreements like the Kyoto Protocol should help limit the amount of greenhouse gases being released into the atmosphere.

Adaptation: Changing lifestyles to suit new conditions.

- Build More Sea Defenses.
- Air con and/or Heating
- Improved Meteorology: Predict and track events (hurricanes, droughts, etc.) so that populations can be warned and therefore prepare.
- Disease Treatment: If the strength of the sun's rays intensify diseases like skin cancer and eye cataracts will increase. We will have to improve prevention (slip, slap, slosh) and improve treatment.
- Desalination.

Are there any Positive Impacts of Global Warming?

- Improved Arctic Navigation: Global warming will mean that the amount of Arctic ice steadily decreases. As the ice melts navigation across the North Pole will become safer and quicker. Trade between Scandinavia, Russia, Canada and US will all be a lot easier.
- Increased Agricultural Land: As permafrost melts and temperatures start to rise it will be possible to grow more crops on more land. With a rising global population this might be vital in the fight to reduce global famine.
- Reduction in Cold Deaths: Old, young and sick people are very vulnerable to the cold. If global temperatures start to rise then latitudes further north and south will become more hospitable and less people will die from the cold.
- Release of Freshwater: Currently a lot the world's freshwater is held in glaciers or as permafrost. As global temperatures rise, we might be able to capture and use some of this freshwater to reduce the effects of drought.
- Accessibility of Resources: It is believed that places like Greenland, Alaska, Siberia and Antarctica contain a lot of resources (oil, gas, etc.). As global warming causes large areas of ice to melt they will become more accessible for human exploitation.
- Reduced Heating: If global temperatures rise people will have to heat their properties less. Not only will this save money but it will also reduce the demand for gas and electricity and therefore reduce the amount of greenhouse gases being released.

Acid Rain

- Acid rain can take two forms, wet deposition and dry deposition. Wet deposition is when pollutants mix with rain water and fall to the ground as acidic precipitation. Dry deposition is when pollutants and particulates fall to the ground without mixing with rain water. Some acid rain has had pH levels as low as 2.
- Sulphur dioxide and nitrous oxides are the two main chemicals that react with water to make acid rain. The chemicals are commonly released from power stations, factories and transport.

Acid rain can cause many problems including:

- Damage to buildings.
- Metals (iron, aluminum, etc.) dissolved by acid rain can be washed into water courses.
- Vegetation can be damaged and growth reduced.
- Lakes and rivers can become acidic harming the ecosystem and aquatic life.
- Soil acidity increases.

Dry Deposition: When acid falls directly back to earth without mixing with precipitation. This tends to happen close to source.

Wet Deposition: When acids are dissolved in precipitation and fall to the ground as acid rain.

The Ozone Layer

The ozone layer is a layer of gas (mainly ozone O3) high in the Earth's atmosphere (20-30km up). The ozone layer helps to protect humans from the sun's harmful ultraviolet solar radiation (it absorbs up to 99%). The existence of the ozone layer was first discovered in 1913. The ozone layer can be damaged by chemicals and gases including; nitrous oxide, bromine and chlorine. Although all occur naturally the amount of chlorine and bromine were increasing because of the human use of CFCs (chlorofluorocarbons) and bromofluorocarbons. CFCs were being used in products like: aerosols, packaging, fridges and refrigerators, air con and solvents

Even though it was known that the ozone layer could be damaged, it was not until 1985 when holes were discovered over the poles that serious action was taken. This meant that more of the sun's harmful ultraviolet radiation was reaching Earth causing more disease (skin cancers and cataracts) and damage to vegetation. Because of the depletion of the ozone layer, countries started to ban the use and production of CFCs. USA and Norway were the first to ban in 1978 and then in 1985 the Montreal Protocol (now signed by 160 countries) severely limited the production of CFCs. After 1996 only recycled CFCs could be used. Since the banning of CFCs the rate of depletion is believed to have slowed.

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END OF TEACHING NOTES