

## **FORM 2 GEOGRAPHY NOTES NEW CURRICULUM**

### **Topics**

- 1: Weather and Climate.
- 2: Landforms and Landscape processes.
- 3: Ecosystems
- 4: Natural Resources
- 5: Energy and Power
- 6: Mapwork and GIS
- 7: Minerals and Mining.
- 8: Environmental Management.
- 9: Agriculture and Land Reform
- 10: Industry
- 11: Settlement and Population.
- 12: Transport and Trade

# TOPIC 1

## WEATHER AND CLIMATE

### Weather Hazards

- ∂ The term weather hazard refers to an abnormal or extreme weather condition that poses a threat to life and result in discomfort and even loss of life.

### Common weather Hazards.

- Floods
- Drought
- Lightning
- Tropical cyclones

### Floods.

- The term flood refers to water that flows over the banks of the river when the carrying capacity has been exceeded.
- In such a situation the river channel can no longer hold the water and it overflows the banks.

#### Causes of floods.

- Floods are caused by heavy rainfall of about 250 mm in 12 hours.
- Floods may also be caused by melting of ice.

#### Human activities may also contribute to flooding through the following ways:

- Creation of concrete surfaces especially in urban areas which result in reduced infiltration and increased surface runoff.
- Deforestation which leaves the land bare, increasing surface runoff.
- Poor farming methods such as monoculture and stream bank cultivation which promote soil erosion, lead to siltation of rivers thus reducing the depth of the river.
- Poorly constructed dam walls which often burst and cause flooding downstream.
- Overgrazing which causes soil compaction resulting in increased surface runoff.

### Effects of floods.

Floods have both positive and negative effects.

#### A. Positive effects.

- a. Floods help to recharge ground water.
- b. Floods enrich the soils due to increased nutrients.
- c. Floods results in diverse ecosystems due to availability of water and enrichment of the soil.
- d. Floods result in increased fish therefore promoting fishing activities.

#### B. Negative effects

- a. Floods may result in drowning of people and loss of people' lives.
- b. Floods results in destruction of homes and loss of property.
- c. It may results in washing away of crops or waterlogging, thus causing food shortages.
- d. Floods cause soil erosion and result in land degradation.
- e. Floods may result in the death of livestock as well as wild animals.
- f. Floods are associated with the outbreak of waterborne diseases such as malaria.
- g. Floods may destroy infrastructure such as transport network systems, power lines and bridges.
- h. Floods may result in water pollution, thus causing water shortages.

Measures to reduce the effects of floods.

- People should build homes on highlands, far from floodplains.
- Building of canals or artificial channels to divert water away from settlements.
- Building artificial levees or embankments on river banks to increase the carrying capacity of the channel. -Planting vegetation of catchment areas to reduce surface runoff.
- People may be encouraged to sack sand bags around the houses to prevent water from flooding into them.
- Introduction of early warning systems which help people to be prepared for floods.
- Widening and dredging river channels so that they hold more water.
- Relocating people to higher grounds.
- Straightening river channels to increase its speed and reduce water overflowing from meanders and marshy areas.
- Educating people about the causes and ways of reducing impacts of floods.
- Resettling people to areas that are less prone to flooding.

### **Drought**

- The term drought refers to a situation where there is low rainfall than expected in a given area.
- The rainfall does not fall when it is expected and when it falls it does so in small quantities.

Causes of drought.

- Droughts are caused by natural variations in rainfall patterns of the world.
- It is caused by the El Nino effect which results cycles of drought.
- It is also caused by the rain shadow effects where there is low rainfall on the leeward sides of mountains.
- Continentality- whereby areas far away from the oceans in the interior of the continents experience droughts.
- -Global warming may also result in drought.
- Severe deforestation which leads to reduced evapotranspiration may also cause drought.

Effects of droughts.

- Droughts may result in the death of people indirectly over a long period of time.
- Droughts results in lower crop yields thus increasing food shortages and famine.
- Drying up of wells and rivers.
- Food shortage may lead to outbreak of diseases.
- It may result in the death of livestock and wild animals.

Measures to reduce the effects of droughts.

- Construction of dams for irrigation water storage during periods of drought.
- Growing of drought tolerant or resistant crop varieties.
- Use of agro-forestry which combines growing of trees along with crops.
- Building good storage facilities to store surplus production to use during the period of drought.
- Creating a drought levy in the national budget for use during periods of drought.
- Creating food for work programmes so as to help people affected by floods.
- Drilling of boreholes and sinking of well to help in providing water for people.

- Importing food grains from other countries.
- Establishing ‘chiefs’ food security system such as the Zunde Ramambo or Isiphala Senkosi concepts.
- Use of Indigenous Knowledge System (IKS) such as drying of food.
- Use of moisture conserving techniques such as mulching, zero or conservation and planting holes.
- Relocate animals to areas with good grazing during the periods of droughts.
- Offer drought relief supplies to people during periods of droughts.

## **Lightning**

- ▶ The term lightning refers to an electrostatic discharge that occurs typically during a thunderstorm.
- ▶ The discharge occurs between electrically charged regions of a cloud called intra cloud lightning, between two clouds or a cloud and the ground.

### Effects of lightning

- It may lead to the death of people.
- People may be injured after being struck by a lightning.
- Animals may be struck and killed by lightning.
- Destruction of property.
- Damage or destruction of telecommunication and electricity lines.
- Electrocutation as well as trauma and shock.
- It may result in forest fires.
- Positively lightning may lead to soil fertility through nitrogen fixation.

### Measures to avoid being struck by lightning.

- Making use of lightning conductors at homes.
- People should stay indoors during a thunderstorm.
- Do not use a coded telephone while there is a storm.
- Stay away from electrical appliances and plumbing during a storm.
- People be aware of the weather forecast and know local weather patterns.
- Wearing of rubber shoes.
- Ensure a property against lightning.
- Do not stand under a tree or on high mountains during a thunderstorm.
- Do not bath or wash during a thunderstorm.
- Avoid open areas which makes you the tallest object.
- Do not swim or go into a boat during a thunderstorm.
- Avoid open vehicles such as tractors and golf carts.
- Do not fly kites during a thunderstorm.
- Avoid metal fences.

## **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.

#### Tropical cyclones

- A tropical cyclone is a cell of intense low pressure which is associated with high rainfall and strong winds.
- Cyclones originate over the oceans where temperatures are above 27°C.
- They are carried by tropical easterly winds and travel from east to west affecting the coastal areas.
- Tropical cyclones may move at a speed of 10 to 20km per hour and can last up to 14 days.
- They need a continuous supply of water and usually die on reaching the land.
- In USA tropical cyclones are known as hurricanes in the United States of America.

##### The effects of tropical cyclones.

- Strong winds and heavy rainfall cause severe damage to buildings.
- Torrential rain may result in flooding which may damage roads, bridges and communication lines.
- People may lose their lives or be injured by floods and strong winds.
- In mountainous areas they may cause landslides and bury settlements.
- Strong winds and flooding may lead to washing away of crops, thus reducing harvests.
- Animals may be injured or killed during cyclones.
- Strong winds accompanied by heavy rainfall may uproot trees leading to destruction of vegetation.
- There could be outbreak of waterborne diseases such as typhoid and cholera.
- Cyclones negatively affect economic due to high costs of reconstruction.

##### Measures to reduce the effects of tropical cyclones.

- Predicting the path of the cyclone and give early warning to the people.
- Resettling people from coastal areas to higher grounds to minimize flooding.
- Tying down all loose furniture and objects to prevent these from breaking windows during storms.

- Keeping first aid kits and emergency supplies of food and clean water.
- Stack sandbags around the house to reduce the effect of flooding.
- People should stay indoors until the storm completely passes.
- Introduction of afforestation and reforestation programmes so as to reduce the rate of runoff.

Examples of Cyclones.

1. Cyclone Damoina which struck Mozambique in 1984.
2. Cyclone Eline which affected Mozambique and Zimbabwe in 2000.
3. Cyclone Japhet in 2002.

### **How people have changed weather**

- People have been changing weather deliberately and unintentional since time immemorial
- Deliberate changes can be seen as attempts to aid agriculture through dam construction, cloud seeding, green house construction etc.
- Many of these changes have become detrimental causing greenhouse effect, global warming, acid rain and urban heat island effect

### **Intentional changes to weather**

#### **Greenhouses**

- These are used to grow plants that are susceptible to frost conditions
- They create a microclimate within the enclosed area
- Are made up of glass or thin layer of polythene
- They cause a localized greenhouse effect in that they allow short wave radiation from the sun to enter through but do not allow terrestrial long wave radiation from the earth to pass through
- As a result heat is trapped inside causing them to be warmer than the surrounding areas.

Other methods of protecting crops from frost

- Burning old tyres, manure or modern gas or electrically powered frost prevention heaters
- Covering crops with a thin layer of polythene sheets i.e. on the sides and top to make tunnels
- Spraying the crops with water which act as an insulator. However this method is not very effective especially against extreme cold
- Blowing warm air around the field

#### **Cloud seeding**

- Not all clouds will give rain due to lack of condensation nuclei in the atmosphere
- Cloud seeding is a way of making the clouds that will not give rain to do so by spraying the cloud with silver iodide or dry ice which increase condensation nuclei
- This makes the cloud droplet to grow bigger due to more condensation surfaces so that it becomes heavy, move downwards and melt to give rain
- However there is no guaranty that the cloud will give rain in the area it is seeded, it may migrate to neighboring areas

#### **Dam construction**

- Big dams such as Kariba dam can change weather conditions within their surrounding areas due to increasing amount of humidity
- Lake shore breeze occur around the lake to produce more precipitation
- The breeze cools the vicinity

### **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.

### **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.

#### **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.

## **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 (O<sub>3</sub>) 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, chlorofluorocarbons (CFCs) and Bromofluorocarbons.
- 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-suppression) 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 concentrations 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.

### **The impacts of climate change and climate variability.**

- Many farmers on Zimbabwe are negatively affected by climate change and climate variability as they rely on rain fed agriculture.
- The impacts include the following:
  - Shortage of surface and underground water.
  - Frequent occurrence of forest fires.
  - Shortage of grazing lands.
  - Drying up of wells.
  - Migration of animals.
  - Crop failure leading to food shortages.
  - Occurrence of diseases such as malaria due to increased temperatures.
  - Occurrence of pests and diseases which affects livestock and crops.
  - People travelling long distances in search of water and firewood.
  - An increase in floods and heavy rainfall has led to damage in roads and bridges, thus making transport and communication difficult.

### Solutions to the effects of climate change and climate variability

- Construction of dams for irrigation purposes and water storage.
- Making use of farming methods such as contour ploughing, zero tillage to improve yields.
- Growing short variety crops which take less time to mature.
- Growing drought tolerant crops.

- Keeping drought tolerant animals.
- Sinking deep wells and drilling boreholes.
- Educating farmers on climate change and climate variability by making use of NGOs.
- Introducing policies that carbon dioxide emissions.

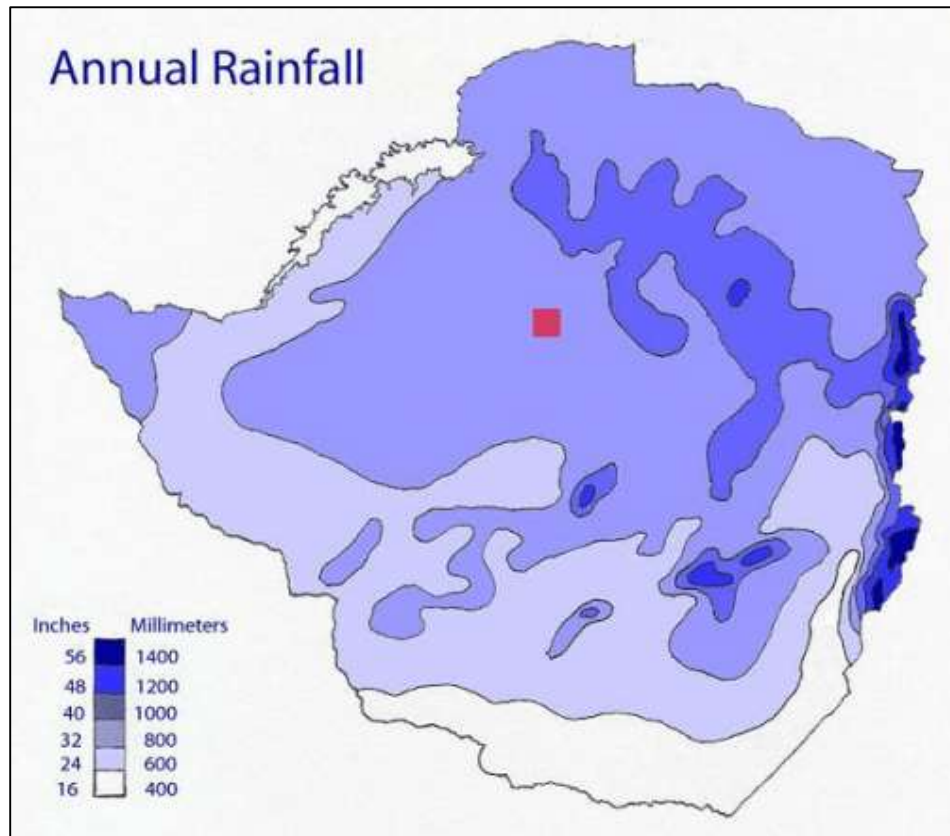
### **The Climate of Zimbabwe**

- Zimbabwe is located within the Tropics, between 16<sup>0</sup>S and 22<sup>0</sup>S of the Equator and its climate is characterized by hot wet summers and cool dry winters.
- The climate is termed tropical continental or the Savanna climate
- Although the seasonally humid conditions are more or less uniform in the country, the temperature and rainfall amounts differ from one area to another.

### **Rainfall distribution in Zimbabwe**

- Generally the country receives highest rainfall in the Eastern highlands due to the orographic effect of the Inyanga Mountains which cause the rise of the South East trade winds.
- There is therefore a general decrease of rainfall as one moves to the Western parts of the country,
- The air streams from the Indian Ocean get progressively drier as they move across the landmasses and mountains of the country.
- There is also a general decrease of rainfall from the North towards the southern parts of the country.
- The decrease is a result of the reduced influence of the Inter-Tropical Convergence Zone (ITCZ).

A map showing the rainfall distribution in Zimbabwe

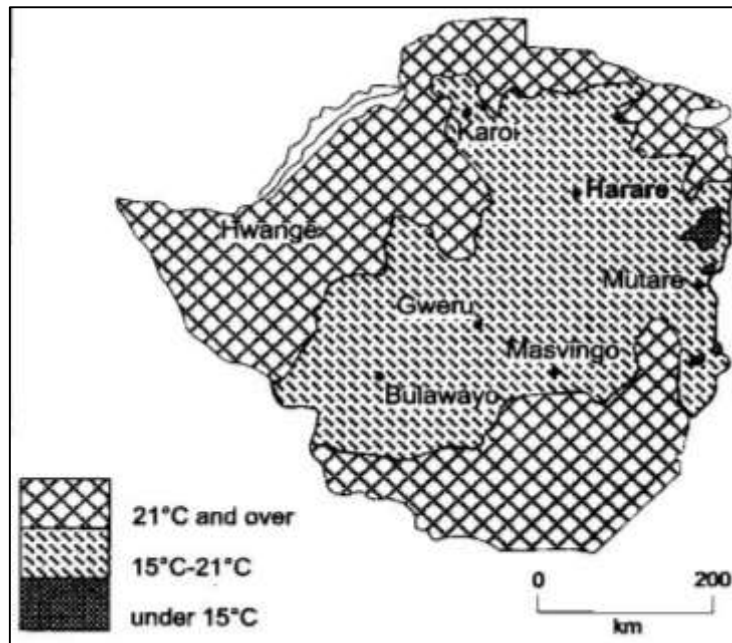


- The highest rainfall occurs in the area around the Eastern highlands whereby the zone receives around 1200 mm per annum.
- The areas on the leeward side of the mountains e.g. the Save Valley receives low annual rainfall of about 400 mm due to the rain shadow effect.
- Places in the northern parts of the country, such as Karoi and Harare receive moderate to high rainfall of about 800 mm-1200 mm per year.
- Places in the southern parts of the country, e.g. Masvingo receives lower rainfall of about 400 mm to 600 mm as a result of reduced influence of latitude, the ITCZ and the Congo air.

### **Temperature distribution in Zimbabwe**

- The temperatures are influenced by altitude as well as latitude.
- Generally the temperatures decreases from the east to the West due to the influence of altitude.

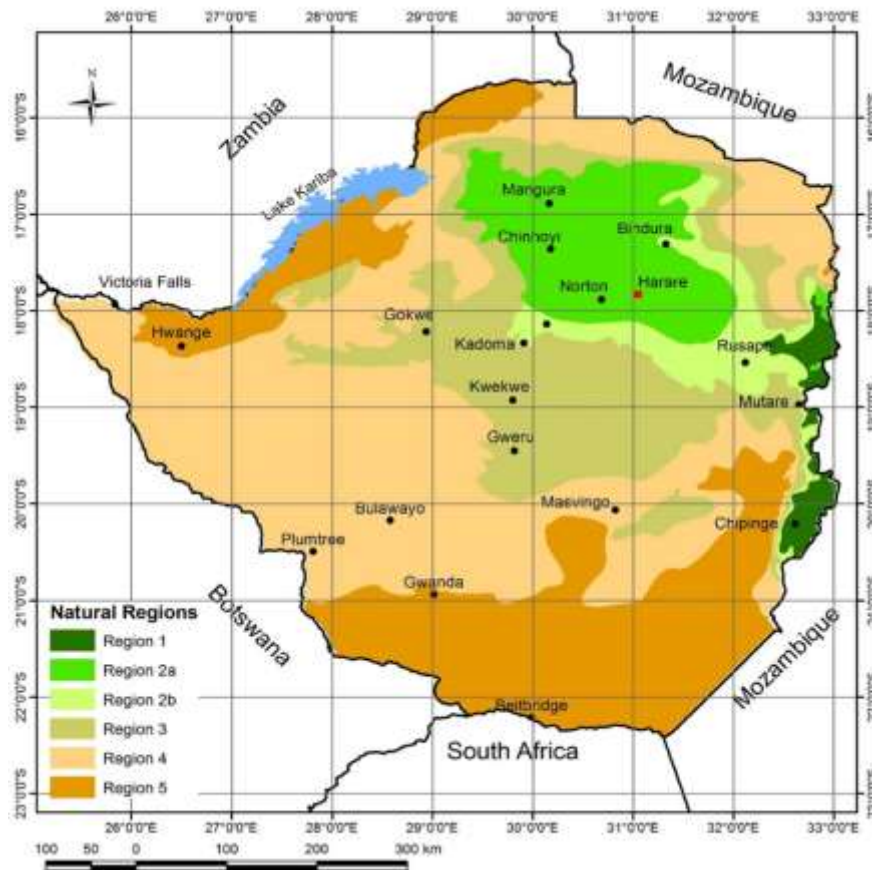
A map showing distribution of temperature in Zimbabwe



- The highest temperatures occurs along the Zambezi Valley which stretches downstream of the Kariba Dam, through Chirundu, Dande –Mbire and the Muzarabani areas.
- The warm to hot temperatures of about 20<sup>0</sup>C -22,5<sup>0</sup>C are found next to the lowveld zones.
- Warm temperatures of 17<sup>0</sup>C -20<sup>0</sup>C are experienced in the central parts of the country from the south west towards north east. (It is the Highveld area).
- There is a cool region of 17°C or lower in some portions of the Eastern highlands and parts of the Highveld in Marondera and Macheke.

### **The Agricultural regions in Zimbabwe**

- Zimbabwe was divided into agricultural regions based on rainfall and temperature.
- The regions indicate the best systems of farming that could be practiced considering physical factors such as climate, relief and soils.



#### Region 1 Specialized and diversified farming.

- The region has high rainfall of over 1000mm and cool temperatures of less than 15°C.
- The region is suitable for a variety of farming systems such as forest plantations, dairy farming, coffee and tea plantations, potatoes as well as maize farming.
- Areas in this region include Vumba, Nyanga and Chimanimani.

#### Region 2: Intensive farming

- The region has a total annual rainfall of about 700mm – 1050mm with an effective rainfall of about 635mm.
- The region is suitable for the growth of maize, wheat, soya beans, cotton, sunflower and winter wheat.
- Intensive beef farming and dairying are also practiced while some farmers also keep a number of pigs.
- Areas in this region include Chinhoyi, Marondera and Bindura.

#### Region 3 Semi-intensive farming

- The region has moderate annual rainfall of around 500mm to 800mm.
- The region experiences seasonal drought and dry spells.
- It is suitable for livestock production as well as the growth of drought tolerant crops such as sorghum and millet.
- Cotton and tobacco may also be grown in the region.

#### Region 4 Semi-extensive farming

- The region covers much of the western Highveld with a total annual rainfall of about 450mm – 600mm and experiences severe dry spells.
- The crops are mainly grown under irrigation, while some farmers grow drought tolerant animals.
- Most farmers in the region keep livestock and grow fodder crops.
- The region covers most parts of Matabeleland North, Bulawayo and the Midlands.

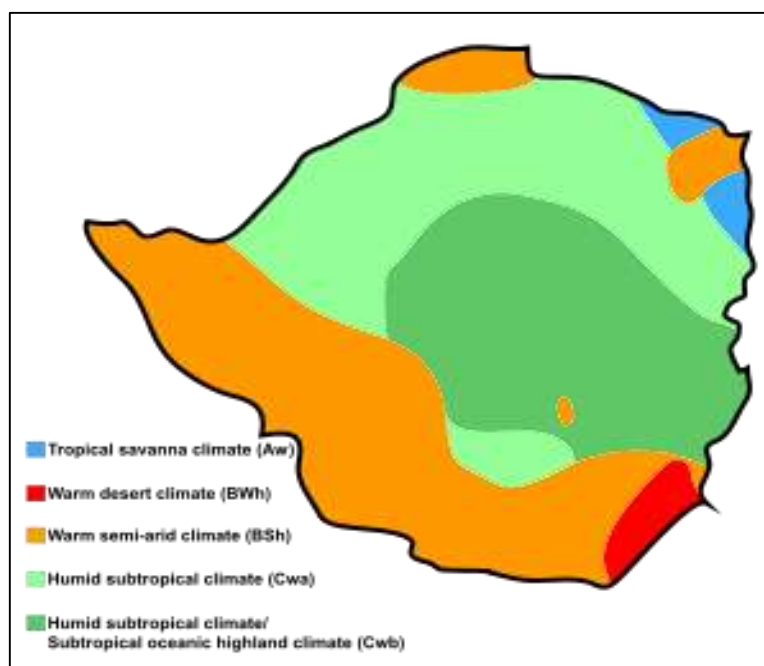
#### Region 5: Extensive farming

- The region has very low rainfall of less than 500mm with mean annual temperatures over 23°C.
- The main farming system recommended in the region is cattle ranching for example Tuli ranching in Gwanda.
- Crops such as sugarcane, maize, millet and sorghum are grown under irrigation.
- Areas in these region include Beitbridge, parts of Masvingo, parts of Hwange and Victoria Falls.

#### Region 6: Wildlife

- It is a region that was added by some geographers which has barren soils and is not suitable arable farming, except under irrigation.
- It is therefore used for wildlife which survive in dry and hot conditions.
- Such areas are found in parts of Hwange, Beitbridge and Mashonaland Central.

A map showing the climatic zones of Zimbabwe



QN: Describe the climatic regions shown above. (6)

## TOPIC 2

### LANDFORMS AND LANDSCAPE PROCESSES

#### Rocks

- A rock is a natural occurring solid cohesive aggregate of one or more mineral or mineral materials.
- Mineral is a naturally occurring, solid, inorganic element or compound, with a definite composition (or range of compositions), usually possessing a regular, internal crystalline structure.
- Rocks are broadly classified into three groups based on their process of formation.
- The three rock types are further classified based on chemistry, environment of formation and how they are formed.
- The three major rock types are igneous rock, Sedimentary rocks and metamorphic rocks.



#### 1. Igneous rocks

##### Types of Igneous Rocks

##### I) Intrusive Igneous Rocks









- ∂ Rocks formed when magma cools and solidifies below the earth's surface e.g. granite, diorite, gabbro, peridotite.
- ∂ Have coarse texture as a result of slow cooling giving minerals more time to form large crystals.
- ∂ Are classified further into two:
  - a. Hypabyssal rocks- intrusive igneous rocks which are near the earth's surface.
  - b. Plutonic rocks-intrusive igneous rocks which are deep below the surface.

##### II) Extrusive Igneous Rocks

- ∂ Rocks formed when lava solidifies on the earth's surface.
- ∂ Have fine texture due to fast cooling giving minerals less time to collect together to form larger crystals.
- ∂ They are of two types namely:
  - a. Volcanic Ejecta
    - Extrusive igneous rocks formed in the following ways:
      - When ash and lava ejected from underground as they fall on the earth's surface e.g. pumice.



- When dust and ash ejected settle on the ground and get compressed to form a rock e.g. tuff.
- b. Lava Flows
  - Extrusive igneous rocks formed when basic lava flows over a considerable distance then cools and solidifies e.g. basalt and obsidian.

|   |   |  |   |
|---|---|--|---|
|  |  |  |  |
| Granite   | Basalt  | Diorite  | Gabbro  |
|  |  |  |  |
| Andesite  | Obsidian  | Pumice   | Pegmatite   |

### General characteristic of igneous rocks

- + Igneous rocks
- + They are the oldest rocks.
- + Rarely react with acids.
- + They are not in layers.
- + Made of two or more minerals.
- + Fine grained or glassy.

## 2. Sedimentary Rocks

- ∂ Rocks formed when particles of other rocks are laid down and compressed into layers or when plant and animal remains are buried and compressed and compacted.
- ∂ When they are laid down a layer is formed.
- ∂ As deposition continues additional layers are formed which compress the lower layers into a hard mass.

### Types of sedimentary rocks

#### a) Mechanically formed sedimentary rocks

- Sedimentary rocks formed when weathered igneous or metamorphic rocks are deposited and compacted e.g. sandstone, siltstone, clay, conglomerate, breccia and shale.
- Breccia sedimentary rock – the gravel pebbles and boulders in this type have a sharper, angular shape.











- Sandstone is formed when sand particles are deposited by water and wind and bind them together to form a porous rock mass.
- Shale – is a soft, brittle, non- porous rock and smooth textured rock. Colours vary from reddish-brown to green. It results due to binding together of clay particles and sand in shallow water bodies.
- Clay – is a fine-grained rock deposited in water or found in vleis.
- Conglomerate sedimentary – is made up of rounded gravel and pebbles and smaller particles. The small particles will fill up the spaces between the large particles as they bind together.

#### b) Organically formed Sedimentary Rocks

- Sedimentary rocks formed when animal and plant or animal remains are buried, compressed and compacted.

#### Classification of organically formed sedimentary rocks

- Calcareous rocks-rich in calcium carbonate e.g. chalk and limestone.  
Coral rocks are formed from remains of sea polyps which extract lime from the sea, build shells for protection, attach themselves to each other and rocks to live in colonies, then die and shells to form coral rocks.
- Ferruginous Rocks-rich in iron e.g. ironstone.
- Siliceous Rocks-rich in silica e.g. diatomite.
- Carbonaceous Rocks-rich in carbon e.g. coal.

|   |   |  |   |
|---|---|--|---|
|  |  |  |  |
| Coal  | Limestone   | Chalk  | Sandstone   |
|  |  |  |  |
| Conglomerate  | Ironstone   | Shale  | Siltstone   |

- Coal – is a black rock with a high carbon content. Is formed when plant and animal matter decay in the absence of oxygen in swamps.
- Limestone – is a result of seawater organisms such as polyps and shellfish accumulate on the sea bed.
- Peat – is a soft fibrous brown rock in the early stages of coal formation.

### c) Chemically formed Sedimentary Rocks

- Sedimentary rocks formed when materials dissolved in water chemically react forming new substances then water evaporated leaving layers of those salts.

#### Classification of Chemically Formed Sedimentary Rocks









- Carbonates e.g. trona and dolomite.
- Sulphates-sulphate compounds.
- Chlorides e.g. halite.
- Silicates e.g. flint.
- Iron stones e.g. haematite and limonite.

#### General characteristics of sedimentary rocks

- ✚ Often contain fossils.
- ✚ Have great colour variety.
- ✚ Usually have pore between pieces.
- ✚ Are in layers (bedding planes).
- ✚ Particles are of the same sizes or vary.

### 3. Metamorphic Rocks

- ∂ Rocks which have changed their physical appearance and chemical properties as a result of subjection to great heat and pressure e.g. Gneiss, Slate, Marble, Quartzite, Soapstone, Schist, Phyllite and Novaculite.

|   |   |  |   |
|---|---|--|---|
|  |  |  |  |
| Slate   | Marble  | Gneiss   | Quartzite   |
|  |  |  |  |
| Soapstone   | Schist  | Phyllite   | Novaculite  |

- Slate - is produced from clay / shale. This type of rock contains very fine crystals which are mainly formed by small plates created from mica. Slate is used to produce writing slates, blackboards etc.
- Marble – it is a coarse grained crystalized rock which has been formed from limestone or dolomite.
- Quartzite – it is a very hard metamorphic rock which is mainly created from sandstone.

- Gneiss from granite
- Soapstone from...

#### General characteristics metamorphic rocks

- + May be composed of only one mineral e.g. marble and quartzite.
- + Rarely have fossils.
- + Have alternative bands of light and dark minerals.
- + Are usually made of crystals of different sizes.
- + Rarely have pores or open space.
- + Have layers of visible crystals
- + May react with acids.

#### Importance of rocks

- ✓ Rocks weather to form soil which is important in agriculture.
- ✓ Form aquifers which store ground water which forms springs which form rivers and wells which provide water for domestic and industrial use.
- ✓ Some rocks are sources of building materials e.g. igneous rocks are used to make ballast and limestone rocks are used as building blocks and raw material in cement manufacturing.
- ✓ Phosphate and nitrate rocks are used to make fertiliser used in agriculture.
- ✓ Granitic tors are a tourist attraction which brings foreign currency.
- ✓ Pumice is used as a scrubbing stone.
- ✓ A rock such as coal is used as fuel for heating, smelting of iron and thermal electricity generation.
- ✓ Source of minerals e.g. oil and coal is associated with sedimentary rocks.

#### 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.

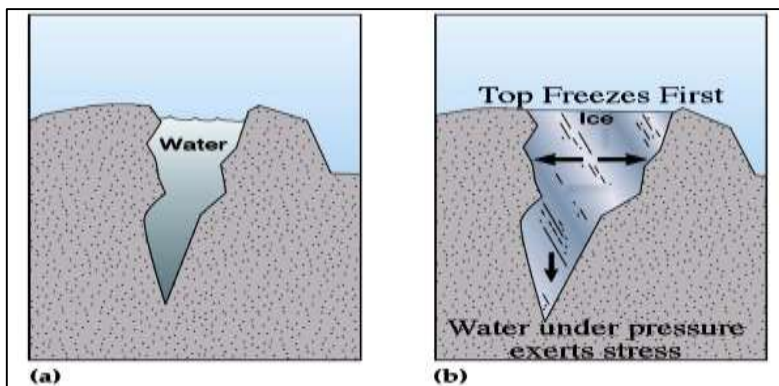
### Exfoliation



- Rocks expand when heated and contract when cooled similar to solid materials.
- In arid areas diurnal temperature can exceed 50°C.
- At night temperature falls and rock contracts and the outer layers cool faster than the inner parts.

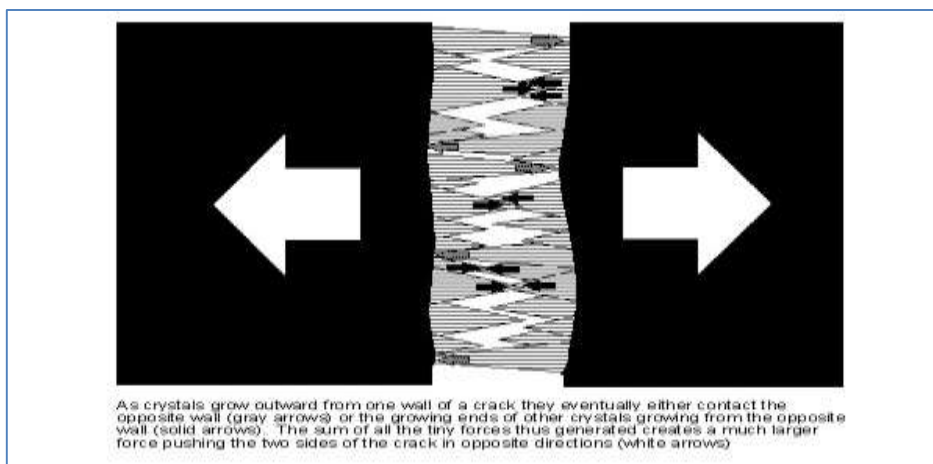
- Stresses develop within the rock causing the outer layer to peel off like the rings of an onion (Onion weathering).
- Also several different minerals within the rock expand and contract at different rates and result in granular disintegration.
- The exfoliation domes like Domboshava have been formed due to exfoliation.
- It can be termed thermal expansion or insolation weathering.

### **Frost Shattering**



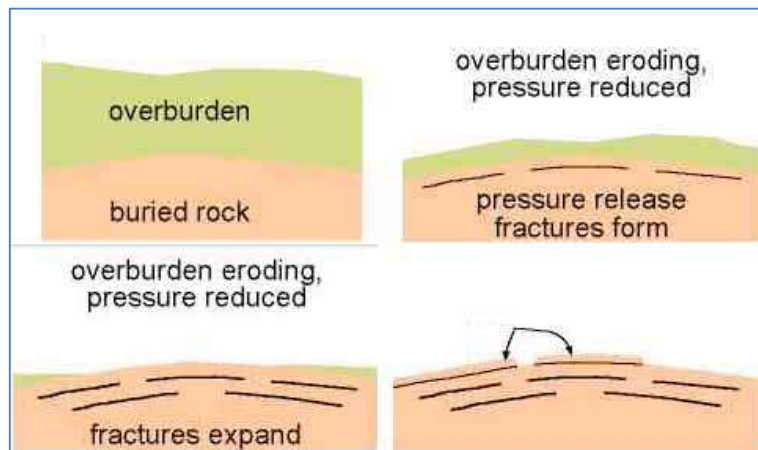
- It occurs in rocks with crevices and joints and where there is limited vegetation cover and temperatures fluctuate around 0°C.
- During the day water enters through the crevices or joints.
- When temperatures fall at night, water freezes leading to breakdown.
- Ice occupies more space than water hence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

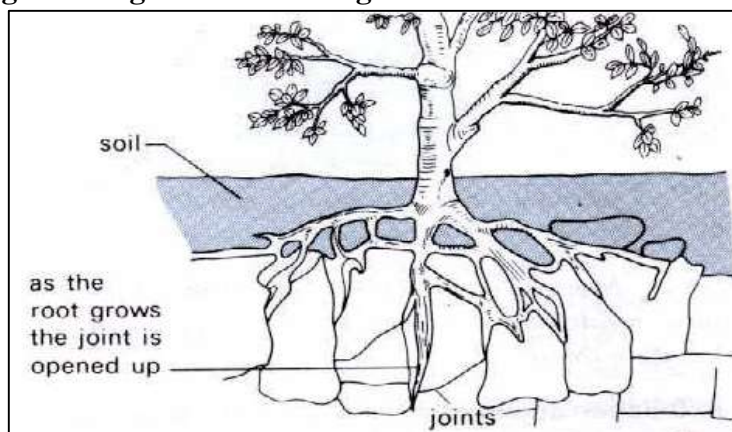


- Occurs when carbon dioxide dissolves with rain water to form carbonic acid.
- This weak acid reacts with rocks that are composed of calcium carbonate e.g. limestone.
- The calcium is dissolved and removed as a calcium bicarbonate solution by running water.
- This forms underground caves such as Chinhoyi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

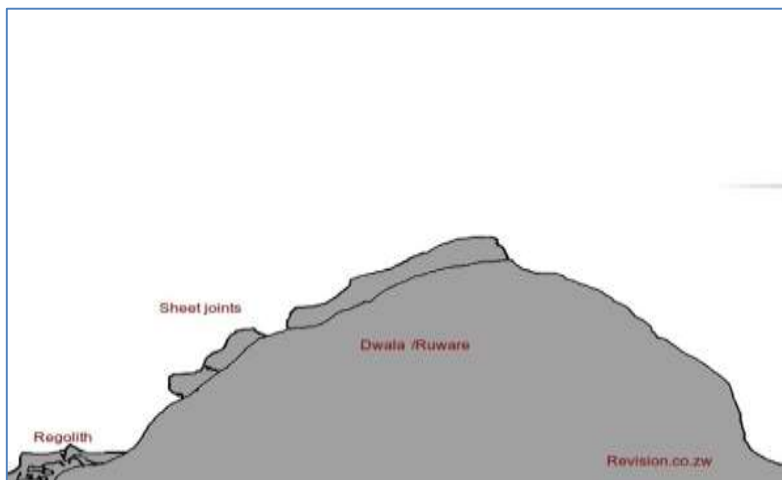


- Decomposing vegetation forms humus which releases humic acid which attacks rocks in the process called chelation.
- Respiration of bacteria and plants root increases carbon dioxide levels in the soil hence increasing carbonation.

- 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.

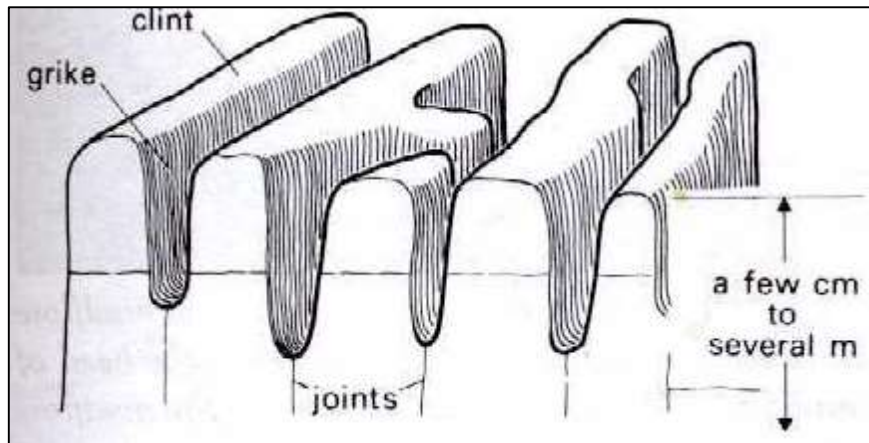
#### Formation of dwalas

- 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. Karst landforms

#### a) 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.

#### b) Stalactites

- Finger like masses of calcite hanging vertically from the roof of a limestone cave or cavern formed by repeated evaporation of water and giving off of carbon dioxide from drops of water containing calcium bicarbonate hanging from the roof of the cave causing crystallisation of calcium bicarbonate into calcite.

#### c) Stalagmites

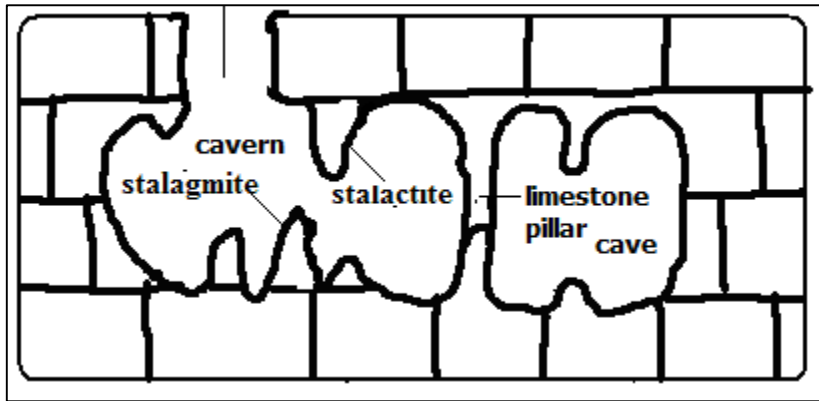
- Stumpy rock masses of calcite which grow from the floor of a limestone cave upwards formed by repeated dripping of solution of calcium bicarbonate from the end of stalactite to the floor of a limestone cave then it spreads out and crystallizes.

#### d) Limestone Pillars

- Pillar like structures in limestone caves formed when stalactites and stalagmites grow towards each other, stalagmite grows until it touches the roof of a cave or when a stalactite grows until it touches the floor of the cave.

#### e) Limestone caves

- Underground chambers or cavities in limestone rocks.
- Underground rivers dissolve limestone in horizontal joints forming a horizontal tunnel.
- Surface water and underground water percolates through the joints into the tunnel enlarging it forming a **phreatic cave** i.e. cave below the water table.
- The water flows out at the vaclusian spring lowering the water table causing the phreatic cave to become a limestone **cave**.
- Continued solution from water percolating through the caves roof widens and lowers its floor to form a larger cave called limestone **cavern** e.g. Carls band cave in New Mexico U.S.A.



## Significance of Karst Landforms

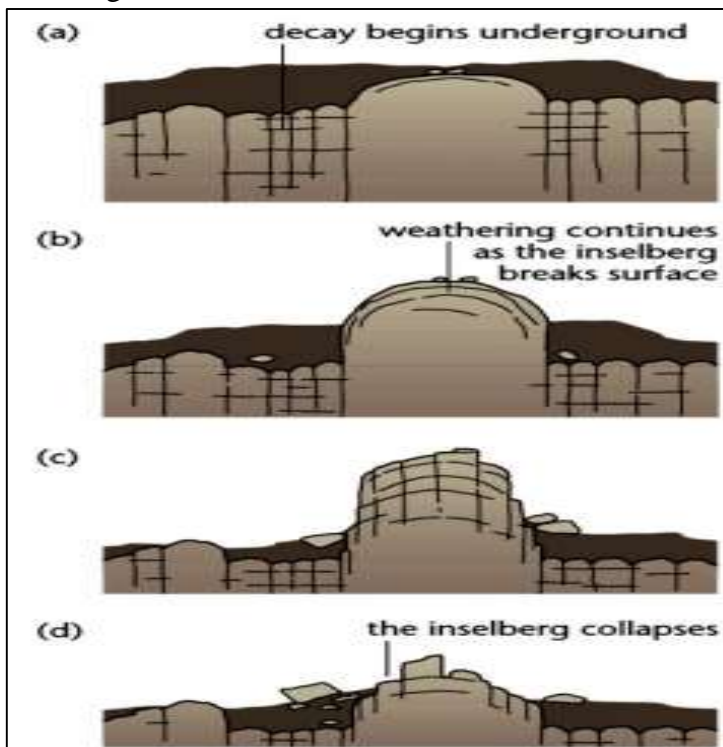
### Positive

- Features in karst scenery are a tourist attraction e.g. caves, gorges, stalactites, stalagmites, etc.
- Limestone rock is used in the manufacture of cement.
- Limestone blocks are also used for building.
- Limestone regions are very good for grazing particularly sheep because the surface is dry.
- Large villages called spring line settlements form at the line of vauclosian springs due to the availability of water.

### Negative

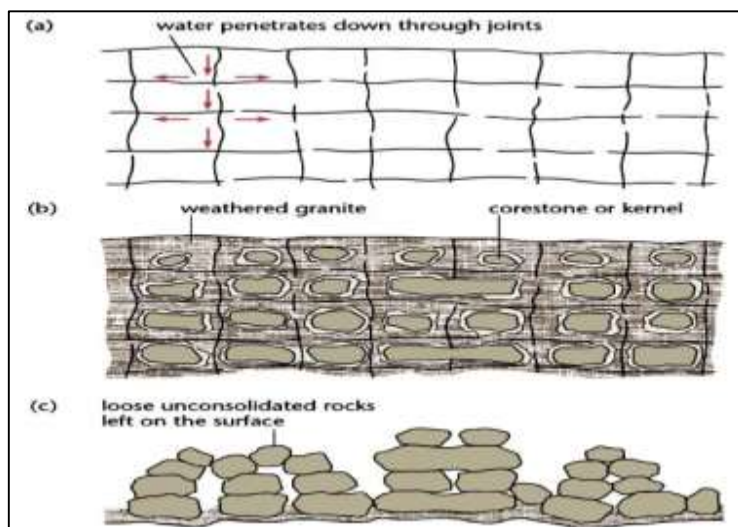
- Limestone landscape discourages settlement because the surface is rocky, soils are thin and unsuitable for agriculture, surface is rugged with features like grikes and Clints and the water supply is inadequate due to rivers disappearing into swallow holes.

### 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



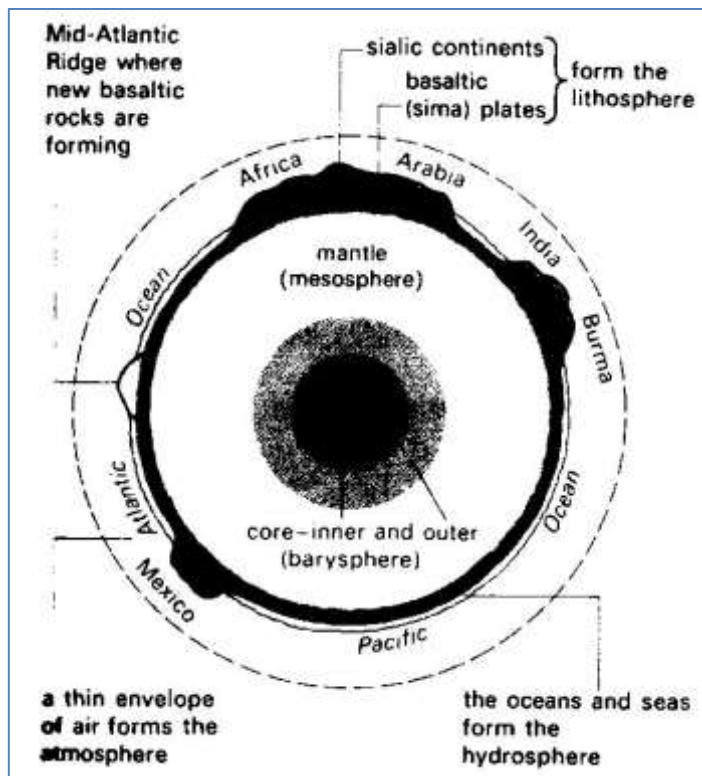
- Result from subsurface weathering of domed landforms.
- Granite intrusions are weathered beneath the surface by chemical weathering processes.
- When rock is exposed the rotten parts are washed away by erosion.
- Weathering continues in form of physical and chemical due to rectangular joints on the 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.

## 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 (Sial 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

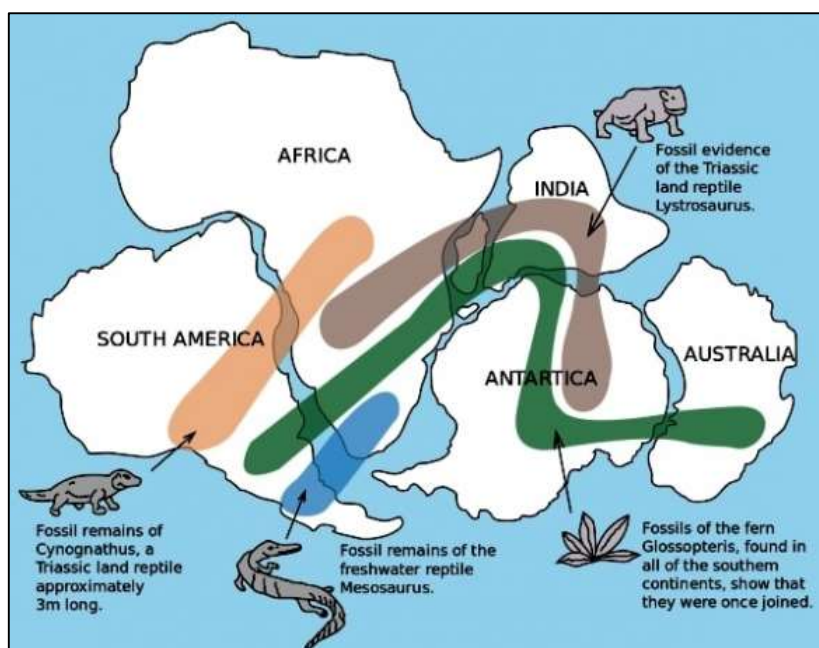
- Mainly composed of Sima and rocks rich in iron.
- The rock is also known as olivine rock.
- The rocks are solid in the top layer of the mantle.
- The lower layer rocks known as asthenosphere are in semi – molten state.
- It reaches a depth of about 2900 km into the earth.
- Temperature reaches as high as 5000°C 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°C.

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**

- a. The way some of the continents fit like a jigsaw puzzle. It is especially visible at Coastal Eastern South America which fits into Coastal West Africa.
- b. Paleomagnetic dating and fossil remains- according to paleomagnetic dating, when rocks solidified they were magnetised in the direction of the Magnetic North at that time. Using the data of information, the scientists can tell where they were first formed and if they moved from these places.
- c. Geological similarities of flora and fauna show that India, Australia, South America and Africa were once joined together.
- d. In the Congo Basin, they were glacial deposits joined in the Antarctic, they were fossilised remains of animals, plants and coral lime stones in the Greenland all show climatic different from what they are today
  - Flora – plants
  - Fauna – animal.

## TOPIC 3

### ECOSYSTEMS

#### Terms

**Ecosystem**-The term refers to a community or a group of plants and animals and the non-living component that interact with each other in a given environment.

**Biodiversity**-It refers to the variety of plants and animal that are found in a particular place. Diversity occurs within species, between species and between the different ecosystems found on earth.

-Biodiversity encompasses those species that are found on the land, in the sea and in fresh water bodies.

**Biome** – It refers to a naturally occurring community or a group of plants and animals that live in a specific environment such as a forest, grassland or a desert.

**Habitat**-It refers to a home, zone or an area in which living organisms live, shelter, feed and reproduce.

**Species** – It refers to a group of similar living organisms, which could be plants or animals, which are capable of breeding, reproducing and exchanging their genetic make-up.

#### Types of biodiversity

##### Habitat diversity

- It refers to the different living places or biomes in which plants and animals can live.
- It includes variations in both terrestrial and aquatic habitats.
- Plants and animal habitat range from the cold, frozen Polar Regions to the humid tropical rainforests.
- A habitat that is ideal for one type of a plant or animal may be hostile to another.

##### Genetic Biodiversity.

- It refers to the total number of genetic characteristic that in the genetic make-up of a species.
- The term gene refers to the basic physical and functional unit of heredity, and all animals carry genes in their cellular make-up.
- The wider the pool of genes in a species, the more diversity.
- The chances of adaptation and survival of such a species are great.

##### Species Diversity

- It refers to the variety of different organisms within an area.
- Generally more the number of species in an area the more the diversity of the environment.
- More diversity is usually a sign of a health ecosystem.

##### Indigenous and Exotic Species.

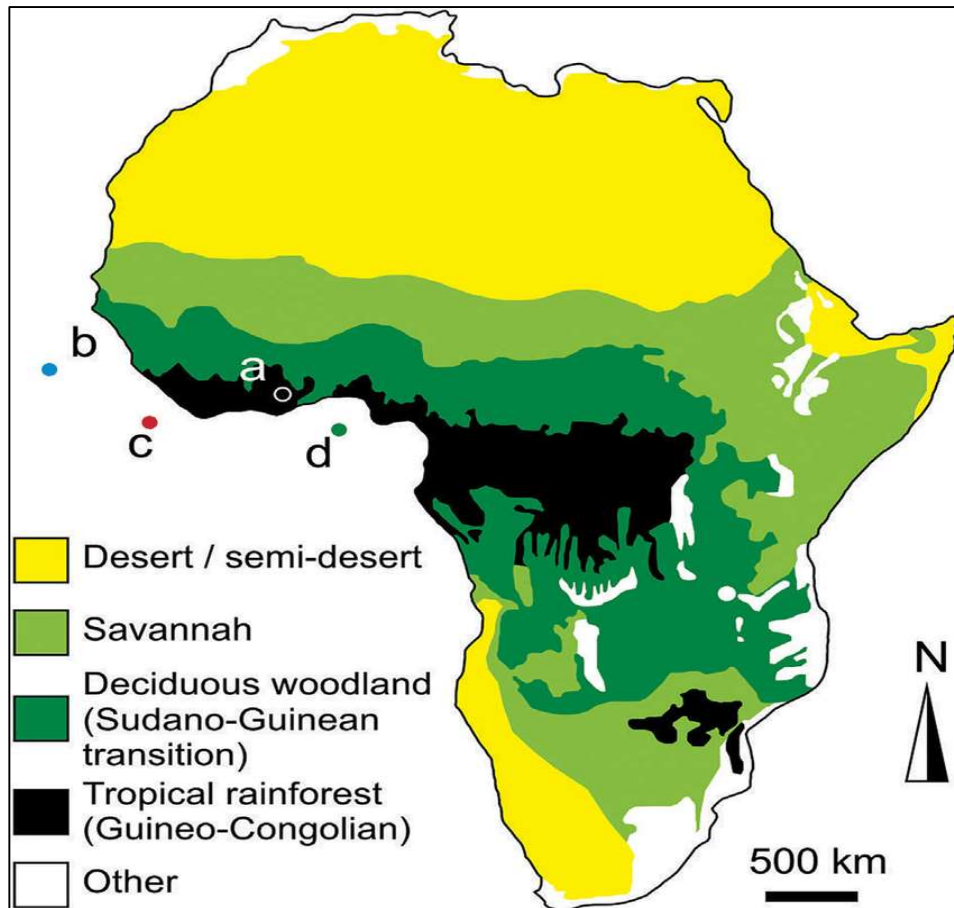
- Indigenous species are those that have evolved in a particular biome and are adapted to live in that environment in harmony with other species which are also indigenous to that environment.
  - Exotic species are those that are foreign or have been introduced to an area, and may either adapt, die out in the environment in which they have been introduced.
-



## Tropical Ecosystems

- Tropical ecosystems cover most of the African continent. The tropical ecosystems include Tropical Rainforest, Tropical Grassland and Tropical Deserts.

## Biomes in Africa



### A. The Tropical Rainforests (Equatorial rainforests)

#### Location

- It is located between  $0^{\circ}$  and  $10^{\circ}$  North and South of the Equator.
- The areas include the Congo Basin, in Africa, the Amazon Basin in South America and the West African coastlands.

#### Inputs

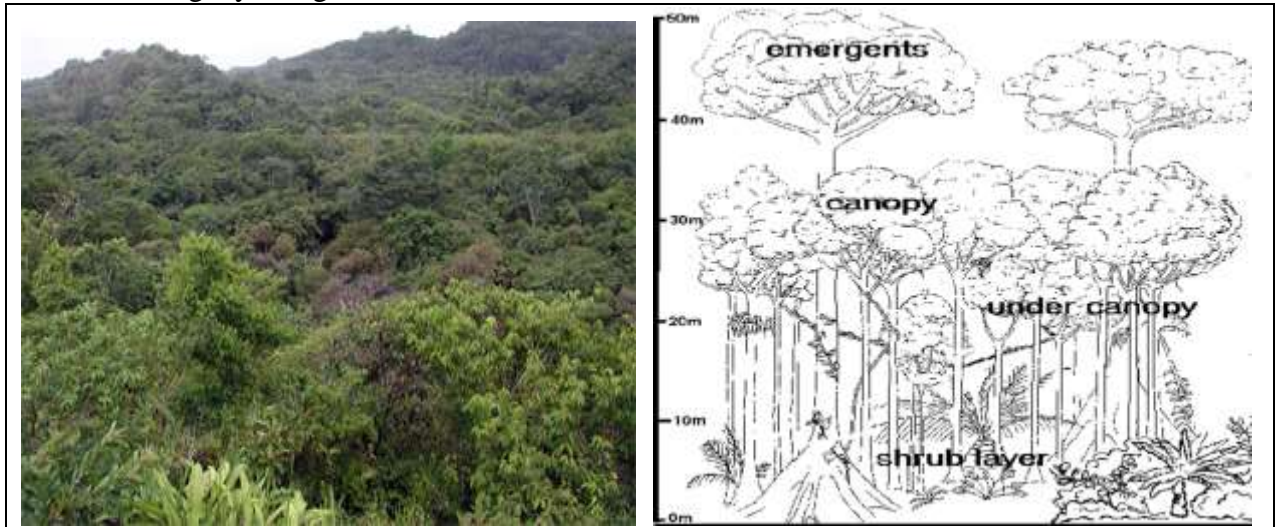
- The major inputs of the ecosystem are:
  - High rainfall all year round averaging 1800 – 2500mm per year.
  - Temperatures are high throughout the year, around  $27^{\circ}\text{C}$  with a small temperature range of about  $2^{\circ}\text{C}$  -  $3^{\circ}\text{C}$ .
  - Humidity is high for most part of the year.
  - The soils include latosols with aluminum and iron oxides as well as leached salts,
  - The soils lack minerals due to leaching.

#### Outputs

---



- Dense forests rich in flora and fauna.
- The ecosystem exhibit a large diversity of species with up to 200 species per hectare.
- The vegetation has three different layers and the common trees in the ecosystem are mahogany and greenheart.



### Characteristics of the Tropical Rainforest biome.

| Layer                         | Vegetation characteristics   | Animal life  |
|-------------------------------|--|--|
| 1. Over 45m high              | -Emergent species.<br>-The trees receive full sunlight.<br>-Broad leaved evergreen trees.          | -Birds, for example eagles, swallows.<br><br>-Insects.                                       |
| 2. 30m canopy                 | -Forms almost complete canopy.<br>-Trees have long slender trunks.<br>-Broad leaved trees.         | -Most animals found in this layer.<br>-Monkey, snakes, chameleons.<br>-Squirrels.            |
| 3. 15m lower layer            | -Smaller trees.<br>-Narrow crowns  | -Climbing mammals such as the chimpanzees and leopards, there are also reptiles and insects. |
| Ground and immediately above. | -Mainly herbaceous plants such as ferns.<br>-Little undergrowth, most are climbers such as lianas. | -Termites.<br><br>-Soil micro-organisms.   |

### Adaptation of vegetation

- The plants have developed buttress roots for balance. Some buttress roots spread out up to 2m above the soil so as to give full support to the tall trees.
- The trees are tall due to competition for the sunlight which is required for photosynthesis.
- There is limited undergrowth because the sunlight rarely reaches the ground as it is blocked by the canopy. As a result the climbers are a common feature as they search for sunlight.
- The roots are shallow and spread outwards so as to trap the nutrients before they are leached to deeper levels.
- The leavers are broad and the trunks smooth so as to drain excess water.
- The leaves tend to be leathery so as to withstand the high temperatures.

- Due to a wide variety of plants, the ecosystem has developed complex food webs.

### **Adaptation of animals**

- The ecosystem has a large variety of animals, birds and insects due to the conducive climatic conditions.
- These find homes in the emergent zone, the canopy and under canopy zones.
- Some of the animals survive in the forest floor where there is limited sunlight.
- Some of the animals have soft skins in order to allow loss of excess water.
- Some of the animals avoid predators by having a coloring similar to the evergreen environment.

### **Nutrient cycling**

- The soils in the ecosystem are highly weathered but they are not fertile.
- Most of the nutrients are stored in the living biomass as they are quickly absorbed by the dense forests.
- The soils also lose the nutrients through leaching due to excessive rainfall.

## **B. The Tropical Grasslands (Savannas)**

- The term Savanna refers to the tropical vegetation which is dominated by grasses and scattered trees.

### **Location**

- The ecosystem is located between 10<sup>0</sup>C and 23,5<sup>0</sup>C North and South of the Equator.
- The areas include most of the countries such as Zimbabwe and Kenya.
- In Zimbabwe most of savanna, that is acacia and mopane savanna occur.

### **Climate Inputs**

- The savanna are found in areas with distinct dry and wet seasons.
- The rainfall amounts vary from one savanna type to another, with up to 1500mm in woodland savannas and below 620mm in the drier savannas.
- -The temperatures range from about 18<sup>0</sup>C in winter to 32<sup>0</sup>C in summer with an annual average of about 12<sup>0</sup>C

### **Types of savanna**

#### **1. Guinea savanna.**

- In the types of savanna annual average temperature is about 27<sup>0</sup>C and the temperature range is small.

The rainfall amounts vary between 1000mm and 1200mm with a longer wet season.

#### **2. Grassland savanna**

- Summer temperatures can be up to around 33<sup>0</sup>C with a higher temperature range because in winter the temperatures may be as low as below 15<sup>0</sup>C.

#### **3. Acacia savanna**

- The temperatures range between 20<sup>0</sup>C in winter and 33<sup>0</sup>C in summer.

### **Outputs**

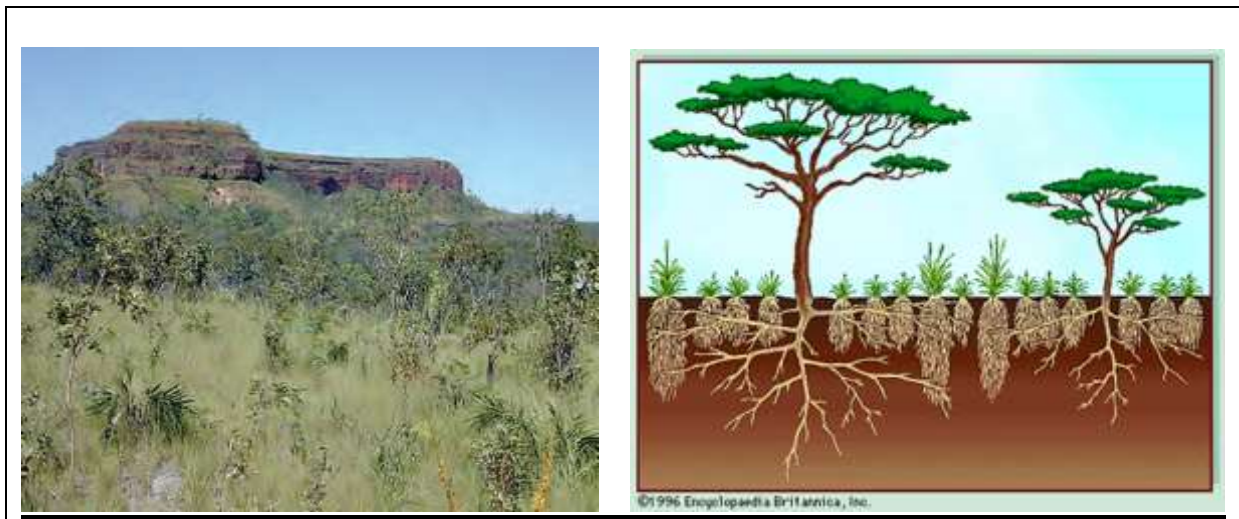
- The moderately high rainfall and high temperatures have resulted in tall grasses with scattered trees in the savanna.

- The savannas are rich in fauna in terms of large variety of big and small predators and carnivores, big and small herbivores.
- A large number of different mammals are also found in aquatic environments such as river and lakes.

### **Vegetation characteristics and adaptation.**

- Most of the trees are deciduous, they shed or lose their leaves during the dry season in order to reduce moisture loss.
  - Some trees develop huge trunks, for example the baobab in order to store water.
  - The trees develop long roots to reach the water table.
  - Some of the trees have umbrella shaped canopies to reduce moisture loss from the area around the roots.
  - The trees have small leaves in order to reduce evapotranspiration.
  - Some trees grow thorns to reduce transpiration and also to prevent destruction and grazing by the animals.
  - The height of the trees may range from about 6m to 12m or more due to the seasonal nature of rain.
  - The tall grass reach heights of up to 3.5m in summer due to abundance of moisture.
  - The upper part of the grass turns brown in the dry season to reduce moisture loss.
-

## Structure of the vegetation



### Animal Life

- The savanna vegetation supports a wide range of animals and these include the grazers and the browsers.
- In some parts of Africa they may be over 40 species of herbivores in a given area depending on the availability of grass and bush.
- The scavengers and predators prey on the wide variety of the herbivores.
- Some animals migrate and only appear during the wet season.
- Some animals such as the zebras and antelopes are grazers while others such as the giraffes and the elephants are browsers.

### Soil Characteristics and Nutrient Cycling

- Soils have high humus content.
- Bacteria activity is low in winter when trees lose their leaves and temperature will be low.
- Nutrient cycling is very slow, due to slow decomposition and uptake by plants.
- Leaching is minimised due to low rainfall.

## C. The Tropical Deserts

- In Africa the deserts are associated with the west coastal areas and they include the Namib, the Sahara and Kalahari deserts.
- They are associated with very low rainfall and high diurnal temperatures.

### Climate inputs

- There is very low annual rainfall below 250mm.
- The daily temperatures are very high, up to 40°C and night temperatures are low, may drop as low as 0°C.
- The temperature range is therefore high, over 25°C.

### Outputs

---

- Vegetation and animal life very limited because of the harsh climatic and soil conditions.

### **Vegetation characteristics and adaptation**

- The ecosystem is characterized by sparse vegetation which is mainly composed of scrub.
- The plants have developed mechanisms which make them survive long periods of drought and high day temperatures.
- Most of the plants have long tap roots which penetrate to deeper levels in search of rainfall.
- Some of the plants store water in their leaves, roots and stems.
- The stomata are close during the day and open at night in order to reduce water loss.
- Some of the plants have waxy and needle shaped leaves in order to reduce transpiration.
- Some plants produce seeds which only grow during periods of rain where they may be enough moisture for survival.
- The plants which have developed characteristics which may them survive adverse desert conditions are referred to as *xerophytes*.



### **Animal Life**

- Few types of animals survive in the desert because of the harsh conditions.
- The dry tolerant animals such as the kangaroo, the camel and some certain buck species are found in the ecosystem because they can survive long periods of drought.
- Lizards, tortoise and some small barrowing animals are also found in the desert.

### **Adaptation of animals**

- The animals have padded feet to resist the heat and move on sandy surfaces, e.g. the camel.
- Some have flapped nostrils to prevent dust.
- Some have spiky hairs to cool the body.
- Some e.g. the scorpions have hard shell surfaces to protect against the blistering sun.
- Some of the animals drink dew which accumulates at night.
- Some move, feed and mate at night when the temperatures are cool.
- Some obtain water from stems and leaves of plants.

### **Sustainable management of Ecosystems**

---

- Human engage in a lot of activities which may impact on ecosystems since they have to use the resources that are found in the environment.

### **Ecosystem sustainability**

- It entails proper management of the ecosystem where humans should correctly and carefully manage ecosystems.
- Sustainable management of ecosystems involves coming up with measures that will protect the health of the ecosystem.
- It ensures the conservation of the environment and this can be achieved through various ways.

### **Strategies for conserving forests**

#### **Education**

- ∂ Education plays an important role in making people aware of the interdependence between humans and the environment, and why there is a need to conserve the environment.
- ∂ In Zimbabwe many organizations assist in environmental education.
- ∂ Such include The Department of Natural resources, NGOs, EMA, Universities and Colleges.

#### **Legislation**

- ∂ Laws can be used to control the use of resources.
- ∂ The controls may be used on stream bank cultivation, deforestation, causing bush fires and waste disposal.
- ∂ Those individual or organisations who are caught on the wrong side of the law should be penalised by fines or laws.
- ∂ In Zimbabwe the natural resources are managed according to the Environmental Act.

#### **Substitution of resources.**

- Resource substitution helps to slow down the exploitation of non-renewable resources as well as renewable resources.
- Minerals can be substituted as well trees where solar may be used in rural areas instead of wood fuel.

#### **Waste disposal**

- ∂ Better waste disposal such as recycling, burning and sanitary land filling may be introduced.

In the local area, the learners construct fireguards around the school in order to control the spread of fires.

The learners may also plant trees in the locality.

### **Use of ecosystems in entrepreneurship**

- Ecotourism.
  - Handcrafts like mats, baskets and hats using reeds.
  - Bee keeping.
  - Photographing.
  - Hydroelectricity generation.
-

- f) Cattle ranching.
- g) Sustainable timber extraction etc.

## **TOPIC 4**

### **NATURAL RESOURCES**

#### **Population and resources**

- Population growth refers to change in the size of population over a period of time depending on the balance of birth and deaths.
- It results from the differences between birth and death rate i.e. Population growth = Birth rate plus (+) immigration minus (-) death rate + emigration.

Factors leading to high population growth in a country

- Lack of family planning.
- Better medical facilities.
- Migration.
- Child labour.
- Religious beliefs.
- Polygamy.
- urbanisation

Effects of population growth on resources

2. Poverty.
3. Land and air pollution.
4. Water pollution.
5. Deforestation.
6. Extinction of species.

#### **Natural resources exploitation in Africa**

##### **Factors influencing utilisation of natural resources**

1. Technological availability
  2. Climate and terrain.
  3. Size of the deposit.
  4. Fluctuating prices of natural resources.
  5. Infrastructure such as road and rail availability.
  6. Political instability.
  7. Demand.
  8. Accessibility.
  9. Illegal trade in certain wildlife species.
-



## **TOPIC 5**

### **ENERGY AND POWER DEVELOPMENT**

- The power required to carry out an activity e.g. diesel, electricity, etc.
- Classified into 2 types: renewable and non-renewable sources of energy.

**QN:** Give examples of renewable and non-renewable sources of energy. (12)

#### **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 fuel wood. Fuel wood 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.
  - 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

#### **Importance of energy in Agriculture**

Energy is used for:

- Fertilizer production.
- Water consumption.
- Farm equipments used in ploughing, harvesting, irrigation etc.
- Processing, packaging and transportation.

#### **Importance of energy in mining**

Mining being the major consumer of energy:

1. Energy use for onsite material movement.
2. Mineral processing.
3. Water treatment and monitoring

**QN:** Outline the importance of energy in industries.

#### **Type of non-renewable energy (fossil fuel)**

---

Coal-is a fossil fuel formed from the remains of plants which died several millions of years ago and were compressed by the pressure of the earth.

#### Advantages

1. Energy production using coal can be increased or decreased according to demand
2. Relatively cheap form of energy
3. 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 and pits affects people.
5. It makes hands dirty.
6. Coal is very bulky and expensive to transport around the world

### **Thermal power**

QN: What are the advantages of using thermal power? (8)

Oil – is found trapped between porous and non-porous rocks deep under the earth`s crust.

#### Advantages

1. Most abundant resource
2. Easily transported using pipelines.
3. Has high heating value
4. It is versatile.
5. 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

**Natural gas** – is colorless, highly flammable gas which consists of methane and ethane. It is found dissolved in oil and floats above the oil.

#### Advantages

1. Burns clean as compared to coal and oil.
2. Produces less carbon dioxide than other energy sources.
3. Less expensive compared to coal
4. It does not produce an odor.
5. It is now possible to compress gas and transport it more easily.

#### Disadvantages

1. Gas is finite so will eventually run out
  2. A lot of gas is located in politically unstable countries or environmentally sensitive areas.
-

3. Gas is vulnerable to leaks and explosions.

## **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 there 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. Low cost power for today's consumption
2. Reliable source of energy
3. There is a plentiful supply of uranium, enough to last hundreds of years.
4. Nuclear energy releases very low amounts of greenhouse gases.
5. It reduces the dependency on oil, coal and gas producing countries
6. 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).

## **Fuel wood**

Fuel wood 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 power 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.

## **Type of Renewable Energy**

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

Advantages

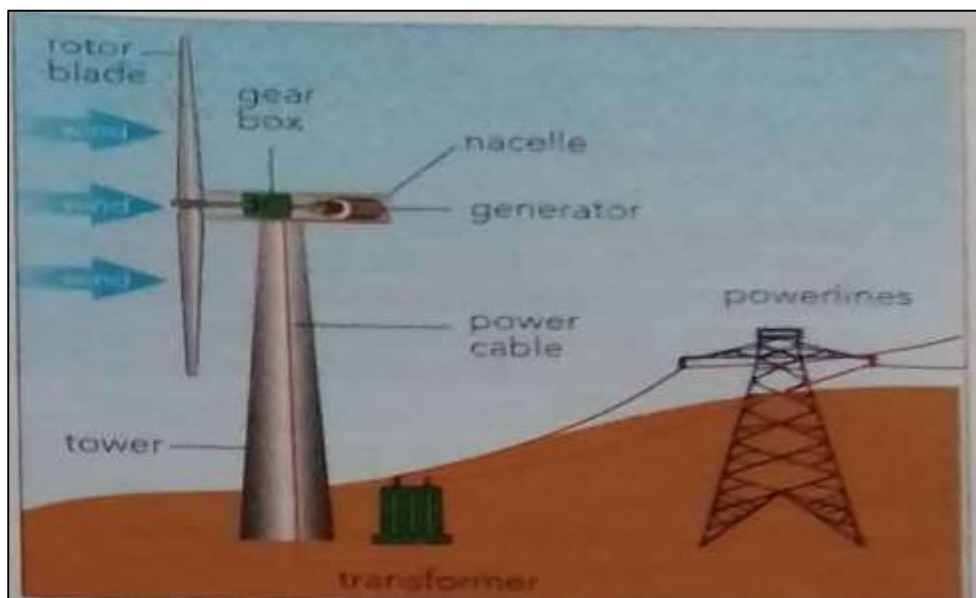
1. It is a clean form of energy
2. It is an infinite resource
3. Panels can be used locally e.g. on top of someone`s house.
4. It can be used to heat water and generate electricity.

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 or 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 startup 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.

### **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

### **Home work**

State the advantages and disadvantages of using animal power. (8)

### **Solution**

#### **Animals**

Examples of Animals and Their Uses

- (a) Oxen for ploughing and pulling carts.
- (b) Horses for transporting by riding on their backs.
- (c) Donkey for transporting of goods on their backs or by pulling carts.
- (d) Camel for transporting goods and people on their backs.
- (e) Elephant in Burma and India for transporting logs from forests

#### **Advantages**

- (a) Inexhaustible because animals keep multiplying as a result of production.
- (b) Available in all parts of the world.
- (c) Cheap to maintain as they only require food and water.
- (d) Animals are flexible because they are able go through forests and narrow paths unlike motor vehicles.
- (e) Some are slaughtered for meat when they outlive their usefulness e.g. oxen, camels etc.

#### **Disadvantages**

- (a) They are prone to diseases and fatigue.
  - (b) They can die as a result of too much work.
  - (c) Their use is restricted only to rural areas.
  - (d) They can only transport small loads.
  - (e) They can only do limited work because they tire easily.
-

## **Ways of Serving Electricity in Homes**

- use energy savers
- switch off lights in unoccupied rooms
- switching off geysers
- using cooking appliances with thermostats
- switching off TVS and Computers when not in use

## **Problems Encountered in Implementing these Solutions**

- resistance from households
- energy savers which are durable are expensive
- electronic appliances with thermostats are expensive

## **Biofuels**

The use of biological matter to create energy. It is a renewable form of energy, but because the matter 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.

## **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.
- Afforestation and reforestation programmes.
- Education campaigns on how to conserve fuel.
- Use of tsotso stove for wood.
- Developing new thermal power stations in GOKWE NORTH.
- Refurbishing KARIBA.

## **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.
-



## **TOPIC 6**

### **MAP WORK AND GEOGRAPHICAL INFORMATION SYSTEMS**

#### **Contour lines and their interpretation**

- Are lines that can connect points of equal elevation or height.
- Are numbered in metres (m).
- 1: 50 000 maps have a contour interval of 20m and 1: 250 000 maps have an interval of 300m.
- They never cross each other (they correspond to specific elevation, divide or spilt).
- Always form closed loops.
- Are shown in brown on a map and can tell us about the slope of the land as shall be shown on the next pages.

#### Types of Contour lines

##### 1. Index contour

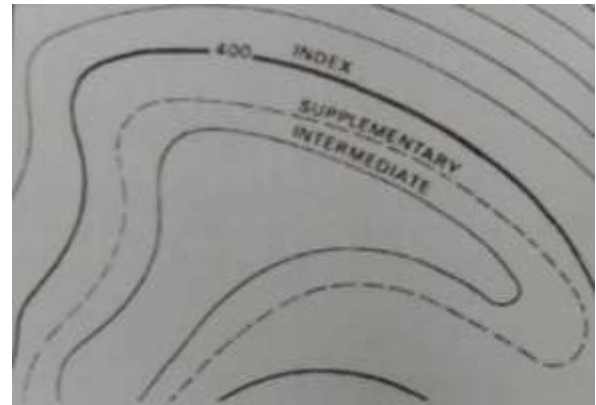
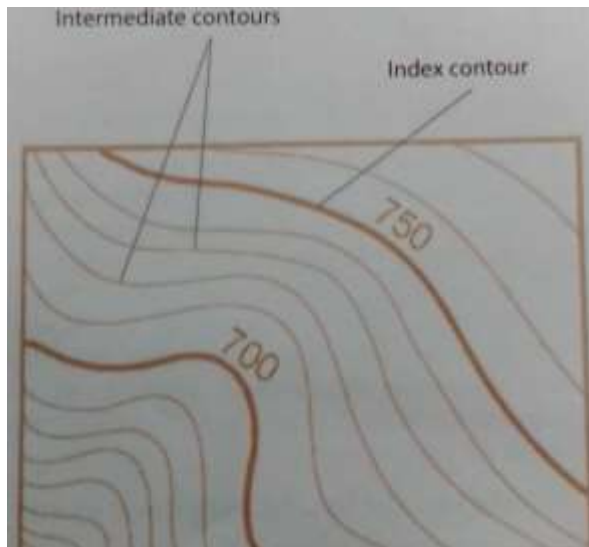
- Are the thickest lines usually labelled with a number at one point along the line.
- This tells us the elevation above sea level, accent with a heavier mark and easily seen.
- They form in concentric circles or shapes.
- Have typical interval of 100 to 200 feet.

##### 2. Intermediate lines

- Are thinner and more common lines between the indexes.
- They are not labelled with a number. One index occur for every five intermediate lines.
- Four lines create five spaces and to make the change equal, the gap between each line would have to represent 20 feet of elevation change.

##### 3. Supplementary lines

- They appear as dotted lines, indicating flatter terrain.
  - They are drawn at all one elevation but represent different elevation.
  - They are between the Index and Intermediate lines.
  - They are used on topographic maps where the overall change in elevation is very gradual or slight.
-



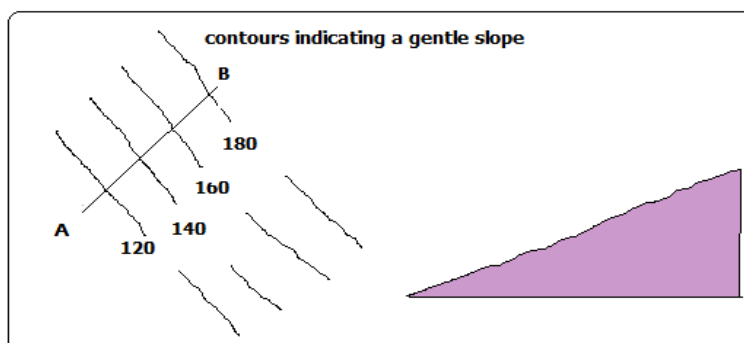
## Landform identification using contour lines/patterns

### Description of Relief

- Describe the general appearance of the entire area e.g. hilly, mountainous, plain, undulating landscape, has many hills, isolated hills, etc.
- State the highest and lowest parts of the area.
- Look out for valleys which are occupied by rivers.
- Divide into relief regions such as plateau, escarpment and lowland.
- Explain the type of slope e.g. gentle, steep, even or irregular.
- Direction of slope.
- Identify the land forms present in the area.

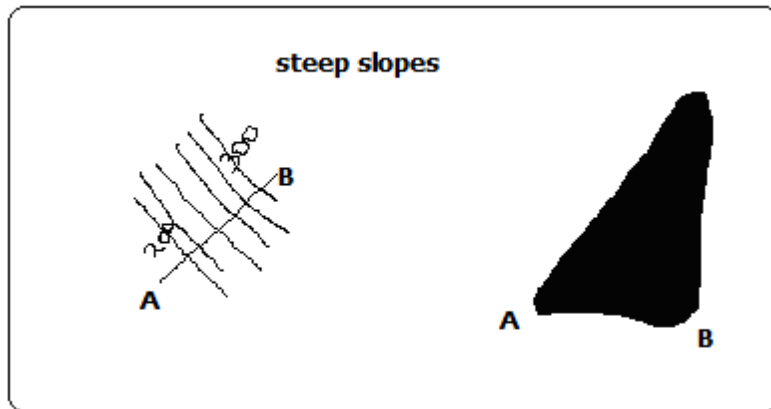
### Slopes

- Slope is the gradient of land surface.
- Gentle slope is one in which land doesn't rise or fall steeply.
- Contours are wide apart.



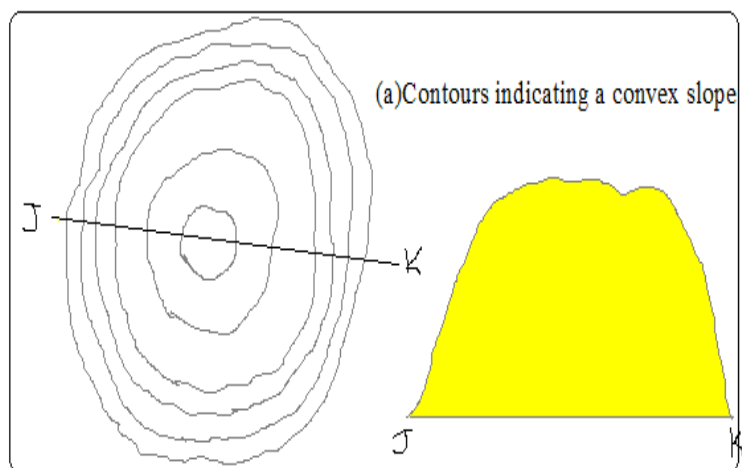
Steep Slope is here land rises or falls sharply.

- Contours are close to each other.



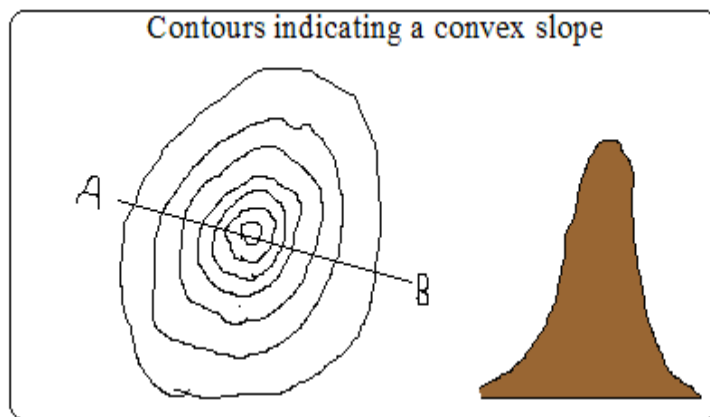
Convex Slopes

- One curved outwards.
- Indicated by contours which are close together at the bottom and widely spaced together at the top.



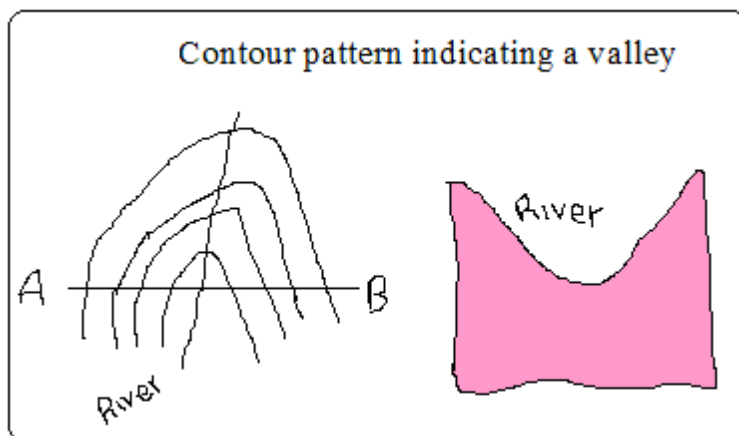
Concave Slopes

- One curved inwards.
- Contours are close together at the top and widely spaced at the bottom.



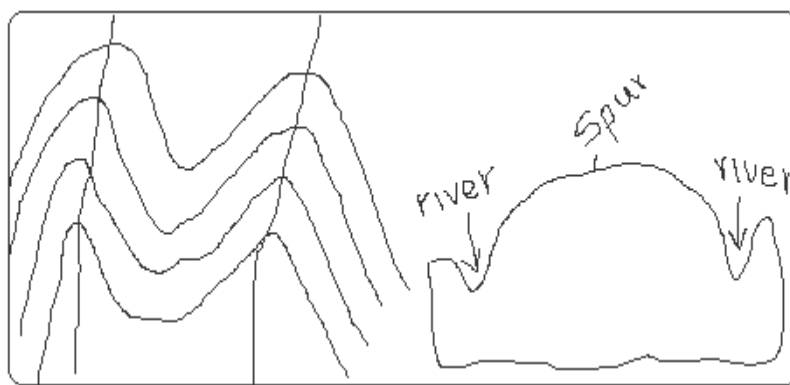
### A Valley

- A low area between higher grounds.
- Indicated by U-shaped contours pointing towards a higher ground.



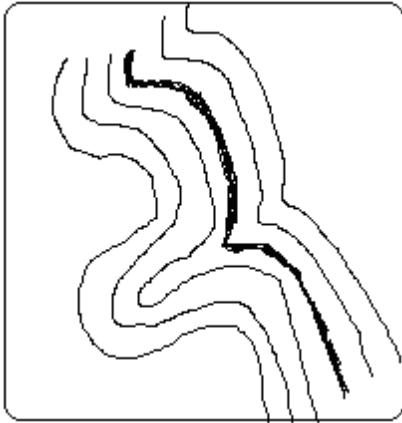
### A Spur

- Land which is projected from high to low ground.
- Indicated by U-shaped contours bulging towards lower ground.



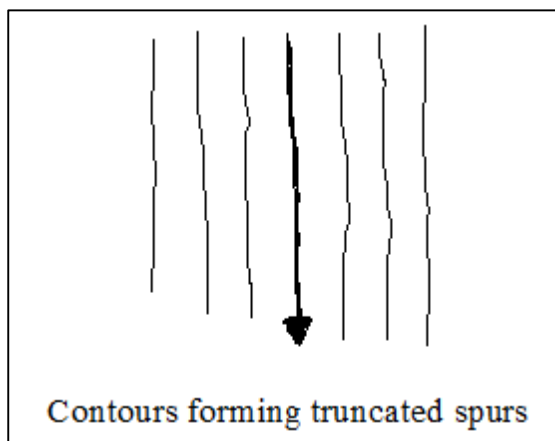
### Interlocking Spurs

- Spurs which appear as if to fit together.



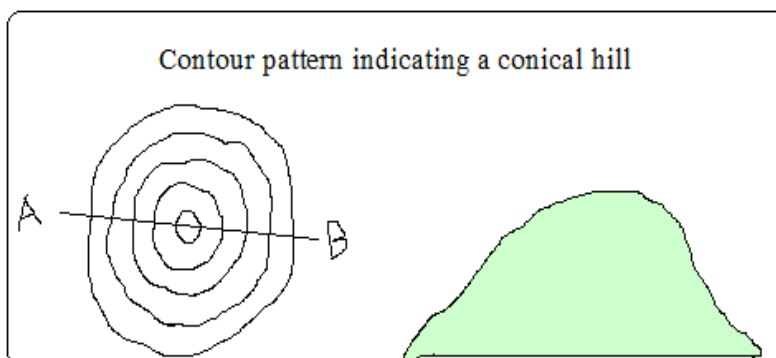
### Truncated Spurs

- Spurs in glaciated highlands whose tips have been eroded and straightened.



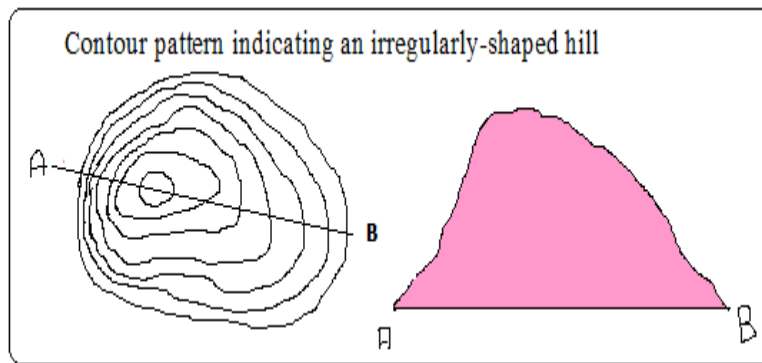
### Conical hill

- Hills are uplands which rise above relatively lower ground.
- Conical hills are small rounded hills.



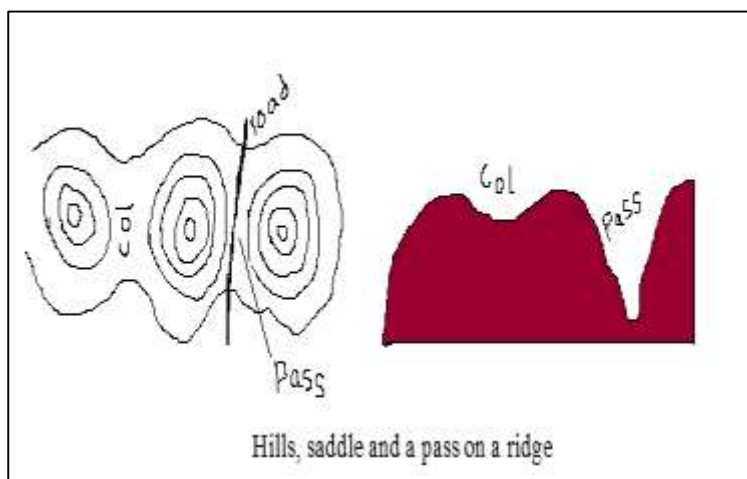
### Irregular Shaped Hills

- A hill with some sides with uneven gentle and others with uneven steep slopes.



### Ridges

- A range of hills with steep slopes on all sides.
- A ridge can contain hills, cols, passes or water shed.



### A Col

- A low area which occurs between two hills.

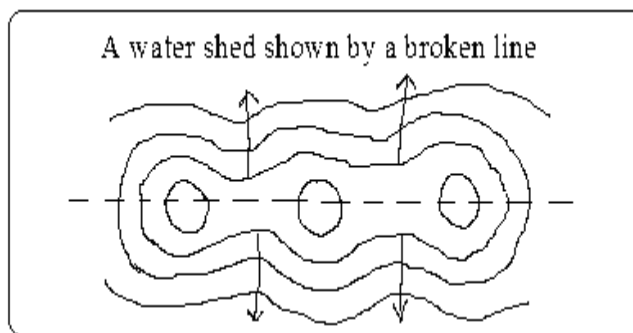
### A Pass

- A narrow steep sided gap in a highland.

### A Water Shed

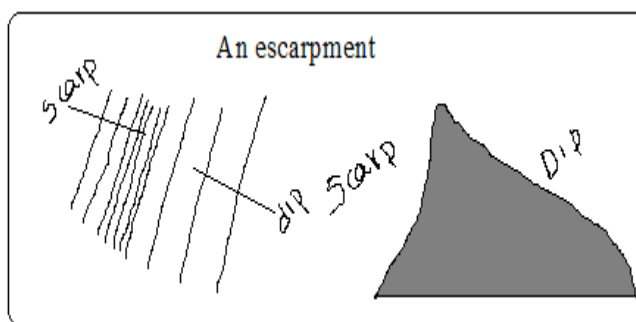
- The boundary separating drainage systems which drains into different directions

Escarpment and ridges often form water sheds.



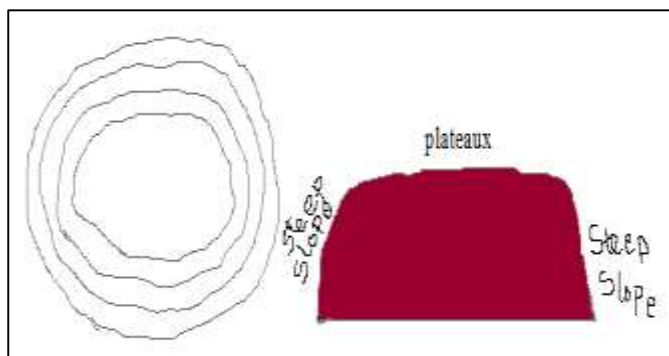
### Escarpment

- A relatively continuous line of steep slopes facing the same direction
- Has two slopes: a long gentle slope (dip slope) and short steep slope (scarp slope).



### A Plateau

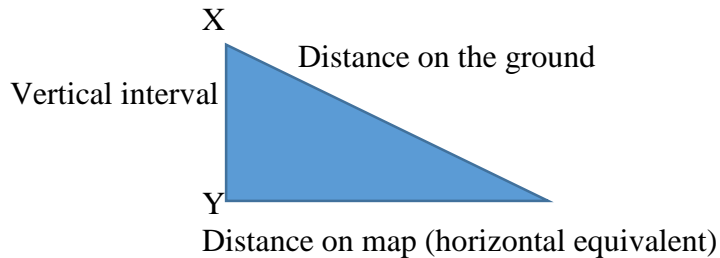
- A high flat land bound by steep slopes.



### Gradient

- ✚ This is the steepness of a slope, and is represented as a ratio e.g. 1 : 50, 1 : 500 or fraction as  $\frac{1}{15}$
- ✚ 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 ( Difference in height between two points)

- HE = Measure the distance between the 2 points in cms, and convert to metres (Distance between two contours expressed as horizontal measurement).
- 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.



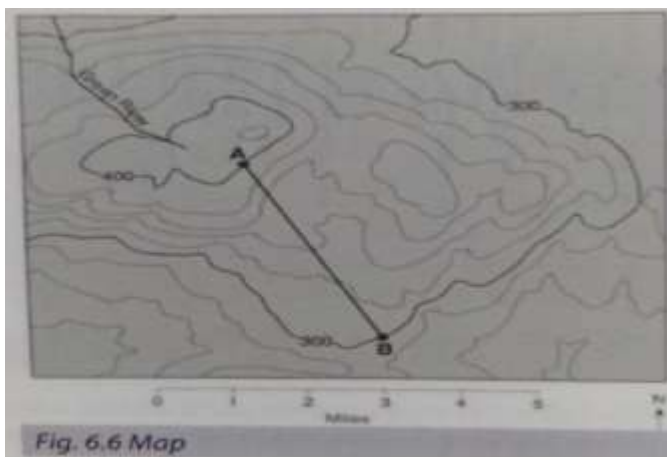
Example 1:

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. =  $\frac{H}{D}$

$$\begin{aligned}
 &= 97,3\text{m} \div 1300\text{m} \\
 &= \frac{97,3}{1300\text{m}} \div \frac{97,3}{97,3} \\
 &= 1 \div 13,36 \\
 &= \underline{1:13,36}
 \end{aligned}$$

Example 2



$$\begin{aligned}
 \text{Gradient} &= \frac{VI}{HE} \\
 &= \frac{(400-300)}{5}
 \end{aligned}$$



100  
5  
20m

### **Land use Patterns**

- Land refers to an area of the earth`s surface which includes the biosphere above and below the earth`s surface.
- Land use concerns the functions or purpose for which the land is being used by the population to meet all their needs.
- Humans have changed the land in various ways for example forests have been cleared to agricultural and grazing land etc.
- QN: Identify some ways the land has been altered by humans.

### **Types of land use**

1. Residential land use – land used as places where people live.
2. Commercial land use – buildings used for selling goods e.g. shops and banks.
3. Central Business District -
4. Industrial land use- buildings used for manufacturing of goods.
5. Transport land use-land used for road and rail construction.
6. Agricultural – land used for growing of crops or raising of animals for a purpose.
7. Recreational land use -
8. Institutional land use – land for schools, colleges and universities.
9. Forestry – areas for plantations of trees.
10. Mining -

### **Factors influencing land use patterns**

The factors include:

- Soils
- Relief
- Capital
- Markets
- Population size
- Technology
- Land tenure
- Government policies

### **Land use patterns on a map**

- Land use can be identified using symbols, key, colour and contour lines.
- Learners should explain why certain land uses are where they are in relation to landforms such as mountains, valleys and rivers i.e. settlements can be nucleated around a wet point, cultivation can be done on mountainous regions or steep slopes and roads pass through passes.

### **Types of land use patterns**

- Geographic Information Systems can be used to show land use patterns.

Most land use shown are represented using Vector data such as points, lines and polygons.

#### **1. Polygon**

Polygon form boundaries of areas. Land masses, islands, water features and frequency forest are shown using polygons. Different colours and patterns can be used to show the difference between polygon features.

#### **2. Point data**

Points represents true points on a map for example towns and cities though they have an area.

#### **3. Line data**

Linear features such as roads, rivers, railway lines and power lines are represented using line data. In Geographical Information Systems (GIS), line is called arc`line and has coordinates or points along it.

### **Processes influencing land use patterns on maps**

- Irrigation is usually located near water sources such as dams and rivers. Save-Limpopo region has vast land under irrigation with Triangle, Hippo Valley and Mkwesine estates.
- Dairy farming usually close to towns and cities due to the nature of product.
- Highlands are suitable for tea, coffee and trees.
- Mining is done in ragged terrain due to various methods of mining used. Minerals occur everywhere on the earth surface depending on soil type and geological formations.
- The dry regions of Zimbabwe has been reserved for cattle ranching and wildlife due to low agricultural potential.

## TOPIC 7

### MINERALS AND MINING

#### Mining

- Mining refers to the extraction of valuable minerals, liquids and gases from the earth surface which are present as ores, seams, veins or liquids.
- Mining is of great importance to economies of many countries such as Zimbabwe, Zambia and South Africa.

#### Factors influencing mining in Zimbabwe

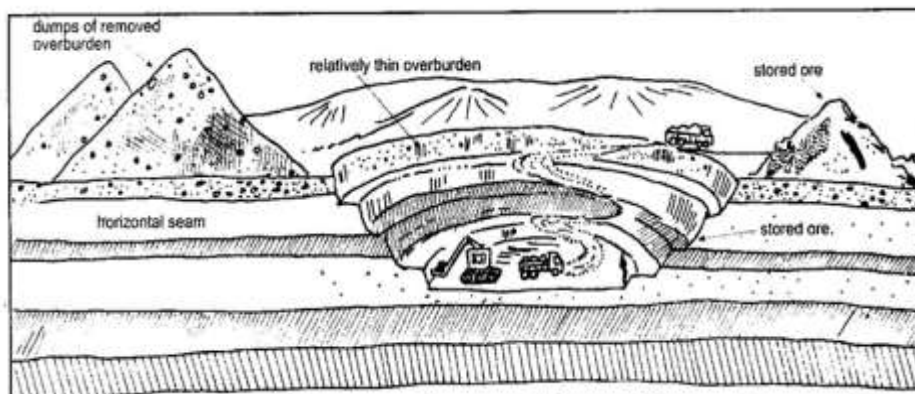
- Availability and size of mineral deposits.
- Quality of deposits / grade of the ore
- Availability of capital to extract minerals.
- Technology.
- Transportation system.
- Availability of labour forces.
- Methods used to exploit resources.
- Market prices for minerals.
- Availability of water supply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

#### Mining Methods

1. Surface Mining- extracts minerals that are near the surface of the earth. It includes open cast, strip mining and quarrying.

##### 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.

### Strip mining

Involves use of graders to scrape off the ore just below the top soil like chrome ore in Mutorashanga in Zimbabwe. Steps for extraction are similar to open cast mining.

### Advantages

- a. fairly cheap and simple to extract using it
- b. working conditions are safer for miners.
- c. the open pits allows for easy access for humans and machinery.

### Disadvantages

- a. Blasting of rocks causes damage to buildings and cause noise pollution.
- b. Use of explosives is a danger to miners.
- c. Land degradation i.e. land left scared.
- d. Deforestation leads to soil erosion.
- e. Mine dumps destroy the natural beauty of the land and landslides may occur.

### Quarrying

Is the cutting or digging of stone and related minerals, from an excavation site or pit and leaves a large hole in the ground. It supplies dust, headstones and rocks. Black granite in Mutoko is mined using quarrying method.

### Advantages

- a. Creates employment to local people.
- b. Brings in foreign currency which limestone is exported.

### Disadvantages

- a. Causes noise pollution.
- b. Destroy habitat for wildlife.
- c. Quarries spoil sceneries.

QN: Describe steps taken when extracting mineral ores using open cast or strip mining. (8)

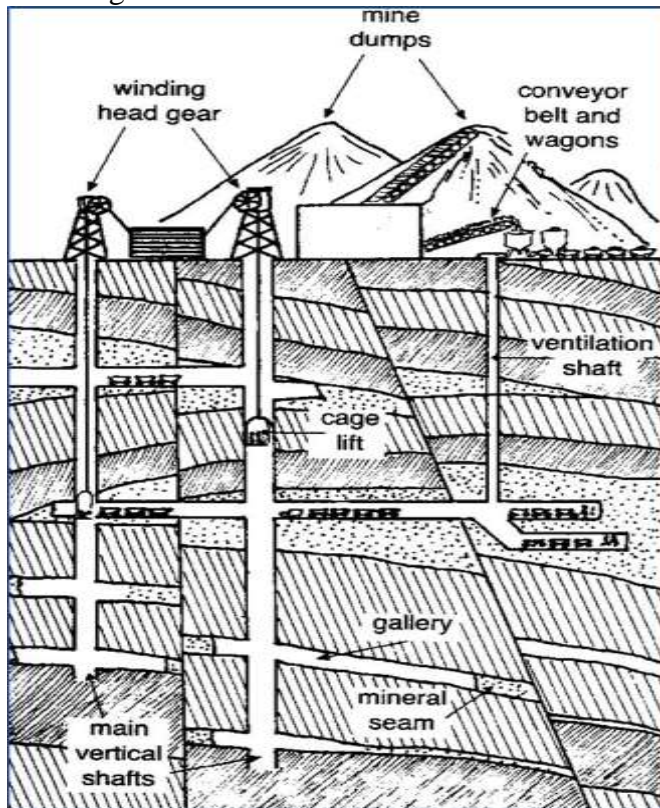
## 2. Underground mining methods

Used to extract ores that are just very deep into the earth surface

### 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

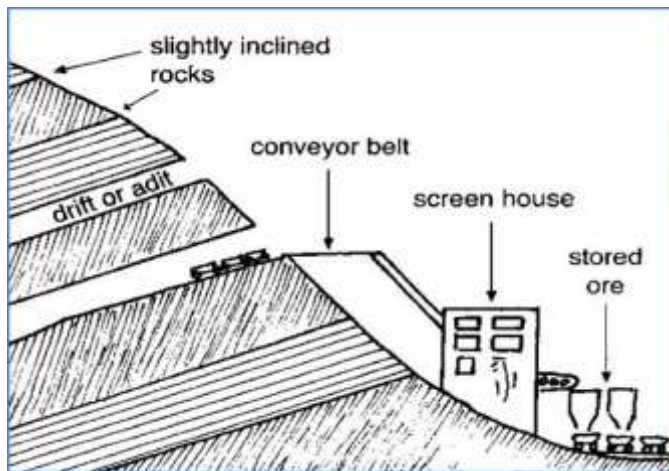
- a. There is less deforestation.
- b. It allows extraction of deep seams.

#### 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.

### Mineralogy

Is a branch of geology which involves the study of minerals. A mineral is any naturally occurring material extracted from the earth. These minerals can be metals, non-metals or liquids such as crude oil.

### Methods used in prospecting for gold

- Prospecting is the physical search for minerals, fossils, precious metals and other mineral specimens.
- Modern prospecting requires training, study of geology and prospecting technology.
- Gold prospecting make use of metal detectors for detecting gold deposits within the soil.

#### 1. Scientific methods

The first step is that the prospector studies reports, geologic maps and cross sections of a place to pinpoint areas where there are structures, rocks. Minerals among others. These areas require exploration to assess the size, shape, location and economic value of the deposits.

#### 2. Geochemical prospecting

Is based on measurement of chemical properties of rocks, soil, stream sediments, water or plants. The amount of a key trace element will be measured. Products of weathering can be taken as samples and tested.

#### 3. Magnetic prospecting methods

Rocks containing magnetite cause a needle magnetic compass to behave in a certain way because the earth's magnetic field is changed by the magnetic field of the rocks. Rocks contain minerals such as magnetite are magnetic enough to be recorded by magnetic instruments. A magnometer can be used to search for gold or heavy metals present in black sand. Today, air borne or marine magnetic surveys are used. Instruments such as gradiometers measure the vertical gradient which is used to locate rocks and geological formations.

#### 4. Indigenous Knowledge Systems (IKS)

These are a body of knowledge of the indigenous people which have survived for a long time.

Indigenous Knowledge Systems of prospecting gold include the following:

1. Knowledge of spirit mediums, dreams, oral traditions.
2. Growth of acacia, occurrence of dry soil and poor heritage and occurrence of small clover herbs were indicators of gold in particular areas.
3. Test panning along rivers is also used to identify gold panning areas. Growth of some plants associated with gold bearing was noted.
4. Visible signs of erosion in gold prospecting is widely used in Mutoko.

#### Physio-chemical properties of alluvial minerals

- Physical properties include colour, lustre and streak, hardness, cleavage, fracture and tenacity.

Cleavage and fracture – cleavage deals with how a mineral breaks. Rocks break in one, two or more directions. Cleavage can be described as perfect, good or poor. Fracture is breakage that is not flat, can be shell shaped and uneven for example in quartz.

Crystalline structure - mineral crystals occur in various shapes and sizes. The shape is determined by the arrangement of atoms, molecules or ions that make up the crystal.

Transparency- this is the ability of light to pass through.

Tenacity –is describes how the particles of a mineral hold together or resist separation.

Lustre- it shows how the surface of the mineral reflects light. Minerals can be metallic, sub-metallic, waxy, silky and glassy.

#### Mining Methods of alluvial minerals

- Gold panning is known as alluvial gold mining, named Chikorokoza in Zimbabwe.
- It is a manual technique of separating gold from waste materials.
- Methods include sluicing, dredging and marine mining.

Home work:

- a) Describe with aid of diagrams the three methods of alluvial mining identified above. (9)
- b) State and explain any five effects of mining to the environment. (10)

#### Gold panning

The extraction of gold from alluviums and river valleys.

##### Benefits of gold panning

- Income and wealth generation.
- Raw materials for industries.
- Foreign currency earnings.
- Employment creation.
- Creates a market for informal traders.
- Development of towns and cities.

##### 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. Umzingwane in Matabeleland.
- Loss of life due to collapse of tunnels.
- Social pathology.

### **Measures to control problems of gold panning**

- Close monitoring of mining activities and police patrols to monitor and reduce violence and crime.
- Licencing of panners.
- Enforcing environmental laws to encourage good working conditions.
- High penalties to those not observing the laws.
- Education and training of panners on environmental friendly methods of mining.

### **Rehabilitation of Mine Areas**

- Planting trees to stabilise dumps.
- Where dragline is used, overburden is dumped into previous quarry site and that's the land is reclaimed as mining progresses.
- Large quantities of fertilizers and irrigation water are required in the revegetation of dumps.
- Gully reclamation by filling.
- Regrassing.
- Fencing off the area.
- Levelling of the waste dump.
- Use of the waste material in construction.
- Education
- Legislation.
- Converting to recreational sites.
- 

### **Problems of Rehabilitating Mine Dumps**

- Planted vegetation may die due to droughts.
- Lack of capital to buy irrigation equipment.
- A lot of time needed for research on suitable tree species to be grown in that particular area
- Soils are sterile or they contain toxic acids which retard the growth of plants

### **Conservation of Mineral Resources and Protection of Resources and the Environment**

- Recycling.
- Reuse.



- Replace / use of alternative resources.
- Modern technology in processing of ores to reduce loss.

## **TOPIC 8**

### **ENVIRONMENTAL MANAGEMENT**

#### **Environmental Management**

-Are the effective and active measures geared towards the protection, conservation and preservation of the environment by a government, organisation or individual.

Environmental degradation refers to the deterioration of the environment through depletion of resources such as water, air and soil, destruction of ecosystems, extinction of species and pollution.

#### **Forms of Environmental degradation**

##### **1. Destruction of wetlands**

Wetlands are areas covered by water for example, marshes, ponds and mouth of a river.

Causes of wetland degradation

- Mining in the wetland
- Overfishing
- Discharge of chemicals and pesticides from agriculture
- Toxic pollutants from industries
- Commercial and residential development
- Drainage schemes
- Introduction of alien species/invasive species.

Effects of wetlands destruction

- Increased flooding and droughts
- Water pollution
- Loss of wildlife habitat.

Solutions to destruction

1. Legislation
2. Environmental education
3. Land use planning
4. Direct storm water into the wetlands
5. Avoid non-native and invasive plants.

##### **2. Poor waste management practices**

Litter and solid waste dumped everywhere e.g. on open land, streets and wetlands.

Causes of poor waste management

- Unregular collection of wastes by city councils or responsible authorities
- Rapid urbanisation versus the infrastructure
- Absence of waste minimisation strategies.

Effects of poor waste management

- The open dumpsites are breeding sites for houseflies, rodents, mosquitos and other vectors the spread diseases.
- Odours from dump sites makes environment uninhabitable.
- Solid waste reduce aesthetic value of the environment.
- Hazardous chemicals pollutes soil and water due to leaching and runoff.
- Fumes from incineration causes air pollution.

#### Solutions

- 3Rs- Recycle, Reuse and Replace.
- Disposing solid wastes in proper landfills.
- Making composts using biodegradable wastes.
- Wastes should be separated into biodegradable and non-biodegradable plastics, glasses and cans. Etc.
- Education.

### 3. Veldfires

Are blazes that got out of control, become wild and destroy the environment, people and property.

#### Causes of veldfires

- Reckless disposal of cigarettes stubs.
- Smoking out bee for honey harvesting.
- Land clearing using fire.
- Arson or deliberate lighting of fire.
- Lightning.
- Vehicles accidents.
- Collapse of electric poles/ power lines.
- Lighting fires at road servitudes whilst waiting for early morning buses.
- Children playing with matches
- Improper household ash disposal.
- Cooking or camp fires at overnight stops, e.g., bus stops
- Rubbish dumps around homesteads, hunting camps and mines and waste dumps

#### Effects of veld fires

- The growth of green grass which provides grazing for animals in the dry season.
- The removal of old and normally less useful dry plant material.
- The control and reduction of **bush encroachment**.
- The stimulation of germination of some useful species of grass,
- The limitation of **animal parasites (e.g. Ticks)**.
- Leads to soil erosion and siltation.
- Crop, pastures and plantation loss.
- Air pollution and global warming.
- Loss of life.
- Loss of property.
- Loss of wildlife and other animals.

## Solutions to veldfires

- Education.
- Fire guards – Qn: How do you construct a fire guard? (5)
- Training people in fire fighting techniques.
- Ensure availability of fire fighting equipments such as rubber brooms, sprayers.

## 4. Soil erosion

What is soil erosion?

- When a raindrop hits soil that is not protected by a cover of vegetation and where there are no roots to bind the soil, it has the impact of a bullet.
- Soil particles are loosened, washed down the slope of the land and either end up in the valley or are washed away out to sea by streams and rivers.
- Erosion removes the topsoil first. Once this nutrient-rich layer is gone, few plants will grow in the soil again.
- Without soil and plants the land becomes desert like and unable to support life.

Causes of soil erosion

- Erosion occurs when farming practices are not compatible with the fact that soil can be washed away or blown away. These practices are:
- Overstocking and overgrazing
- Inappropriate farming techniques such as deep ploughing land 2 or 3 times a year to produce annual crops
- Lack of crop rotation
- Planting crops down the contour instead of along it.
- Intense rainfall/ heavy rainfalls.
- Deforestation.
- Uncontrolled sand abstraction.

Effects of soil erosion. QN: outline the effects of soil erosion. (7)

Solutions to soil erosion

Some of the following measures can be implemented to prevent soil erosion:

- The use of contour ploughing and windbreaks.
- Leave unploughed grass strips between ploughed lands (strip cropping).
- Make sure that there are always plants growing on the soil, and that the soil is rich in humus.
- Avoid overgrazing.
- Allow indigenous plants to grow along riverbanks.
- Conserve wetlands.
- Cultivate land, using a crop rotation system.
- Minimum or no tillage.
- Encourage water infiltration and reduce water runoff.

## 5. Water pollution

### Causes

- Industrial effluent –water discharged from industries into nearby streams
- Pipes of raw sewage bursting and releasing the sewage into rivers e.g. Shaghashe in Masvingo.
- Fertilizers and slurry also cause the eutrophication of dams and rivers e.g. Lake Chivero
- Use of herbicides and pesticides e.g. DDT pollutes nearby streams and dams thus killing aquatic life.
- Thermal pollution-occurs when industries release hot water into nearby streams thus causing pollution
- Oil spillages from vehicles at bus terminus and oil mining accidents.
- Dumping of radioactive waste materials and testing of nuclear weapons in the sea.
- Acid rain also acidifies lakes and rivers resulting in the death of aquatic life

### Effects

- Polluted water lacks oxygen thus leading to the death of plant and animal life
- The water becomes dark, foul smelling and unusable.
- Polluted water lead to sickness and diseases outbreaks.
- Oil spills kill a lot of aquatic life like birds and fish and also stains beaches thus reducing income from tourism.
- Acidification of streams and rivers causes the death of aquatic life.
- Eutrophication causes the growth of algae e.g. water hyacinth in Lake Chivero which takes up the oxygen from the water thus causing the death of aquatic life.
- Poisoning of water reserves e.g. cyanide from mines is dangerous to humans
- Water shortages due to siltation of dams and rivers.

### Mitigation of water pollution

- Re-cycling of sewage water however this water cannot be used for drinking but for watering, building etc.
- Desalinisation of sea water however this is a very expensive process that is only afforded by very few countries.
- Passing out of strict laws and fines that prohibit the releasing of industrial effluent into nearby streams however this has been widely unsuccessful as the fines are too little and affordable.
- Treat oil slicks and spills with dispersants or burn the oil however this causes air pollution
- Use biological control of pests instead of using chemical control e.g. DDT however this slow and less effective.

## 6. Air pollution

### Causes of air pollution

- Exhaust fumes from vehicles and industries.
- Mining releases a lot of dust into the atmosphere during the process of blasting e.g. phoenix mine.
- Burning of waste materials (dump fires).
- Large scale veld fires also cause air pollution.
- Volcanic eruptions also release large amounts of toxic gases and ash into the air e.g. MT Pinatubo.

### Effects

- Reduces visibility by creating smog hence the occurrence of accidents.
- Causes respiratory diseases e.g. emphysema, bronchitis etc.
- Makes urban areas to become hotter 'urban heat island' than the surrounding areas.
- Causes the destruction of the ozone layer.
- Causes acid rain that then destroys large areas of forests, acidifies lakes and corrodes metal structures.
- Creates the 'green house phenomenon' which results in global warming.
- It destroys the aesthetic image of buildings by giving them a 'sooty' appearance.
- The dust from mines and quarries turns nearby vegetation into a sickly grey-white colour e.g. cement side.
- Nauseating and choking smells from burning garbage dump sites.
- Destruction of the ozone layer.

### Solutions

- Use alternative sources of fuel e.g. solar powered cars in Japan however this has been partly successful because these cars are very expensive hence only a few can afford them.
- Use catalytic converters that oxidize pollutants before they are released into the air.
- Use environmentally friendly chemicals and eliminate the use of cfc's that cause the 'green house phenomenon' through the Montreal Protocol and Rio Earth Summit 1992 however the heavy polluters e.g. USA are reluctant to subscribe to these conventions.
- Impound unroadworthy cars that release a lot of smoke however this is not successful as these drivers easily bribe the police.
- Water spraying at mines to keep the dust down.
- Use dust filters and gauzes at mineral refineries.
- Build tall chimneys of about 30m high to release poisonous gases up into the upper air however this has been partly successful as it causes pollution of air at greater heights.
- introduce 'carbon tax' e.g. Zimbabwe however this has not been successful as this money is diverted and used for other purposes and not to reduce air pollution
- Pass legislation e.g. 'Cleaner Air Acts' and 'Polluter Pays Principle' to curb air pollution.
- Encourage the use of 'green fuels' e.g. bio-diesel instead of fossil fuels however these are very expensive.
- collect refuse regularly
- replace or repair broken sewer pipes
- use scrubbers to remove pollutants from effluent gases
- use of mass transit and 'park and ride' systems
- Use education and environmental campaigns e.g. Environment 2000.

## 7. Land pollution

### Causes

- Littering e.g. plastics, boxes thus destroying the aesthetic value of the land.
- Dumping of solid waste materials in undesignated areas.
- Poor irrigation methods that lead to salinisation
- Use of pesticides and herbicides in farming
- Sewage sludge from burst sewer pipes
- Solid particles from exhausts and chimneys

### Effects

- The land becomes an ‘eyesore’ as they will be litter everywhere.
- Unpleasant and putrid smells coming from rotting and over spilling garbage in bins and landfill sites.
- Leaching from the dumpsites pollute underground water supplies.
- Pesticides and herbicides used in farming kill a lot of living organisms in the soil.
- People who live near dumpsites suffer from diseases like pneumonia, typhoid, and cholera. Etc.
- Dumpsites are breeding sites for vermin e.g. rats, cockroaches that also spread diseases.

#### Solutions

- Dispose of solid waste by either composting, compaction or incineration however incineration is partially successful as burning results in air pollution.
- Re-cycling of used materials like metal cans, plastics etc. e.g. national waste company.
- Banning the use of harmful pesticides e.g. DDT however this is not successful as DDT is very effective in controlling malaria.
- Pass strict laws to avoid littering and the dumping of wastes in undesignated areas.
- Ensure an efficient system of refuse collection and dumping however this is a failure e.g. in Bulawayo as there is a shortage of fuel for the refuse trucks.
- Use bio-degradable containers that decay without endangering the environment.

### 8. Noise pollution

#### Causes

- Sounds from many vehicle engines.
- Moving trains and flying aeroplanes.
- Electronic gadgets e.g. radios, discos.
- Noise from industrial machines.
- Hawkers peddling their wares.
- Touts competing for passengers.

#### Effects

- Urban areas become noisy places and unpleasant to live in.
- People become stressed and lose concentration.
- Those who operate noisy machines become partially deaf.

#### Solutions

- Build industrial areas and airports away from residential areas however this is not successful as the residential areas are ever expanding and finally reach these areas.
- Impound all unroadworthy vehicles however this is not possible as the police are bribed.
- Arrest and remove all touts from motor ports e.g. Mbare in Harare.
- Educate people on the dangers of noise pollution.
- Replace all noisy and inefficient industrial machines.

### 9. Visual / Sight pollution

#### Causes

- Writing on walls of buildings (graffiti).
- Old advertisement posters.
- Litter from over spilling bins.
- Old and derelict buildings.
- Squatter settlements (shanty towns).
- Soot from car exhausts and industries.

### Effects

- The walls of buildings become 'sooty' and ghastly in sight.
- Accidents may occur as some posters obscure important road signs.
- Loss of aesthetic value of the land from litter.

### Solutions

- Arrest and put heavy fines on people found writing graffiti on walls.
- Remove refuse bins regularly for proper garbage disposal.
- Pass by-laws to control the period advertising posters are to be displayed on walls.

## 10. Deforestation

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

### Causes

- Slash and burn (shifting cultivation)-the local people clear land in order to grow crops.
- Road building-vegetation has been cleared to create roads to access the forests. This has caused increased destruction as the forests become more accessible e.g. Trans- Amazon Highway.
- Commercial logging – commercial exploitation of wood is the major cause for forest destruction especially in South America, East Asia and Africa. Landless people enter the land that has been previously logged for settlement and farming.
- Cattle ranching – contributes to vegetation destruction in Central and Southern America. In Central America two thirds of lowland tropical forest has been turned into pasture since 1950.
- Hydroelectric power – plenty of water has led to the development of HEP stations and this has contributed to forest destruction.
- Farming -The government in Brazil has cleared large areas of the Amazon Rain forest and encouraged people to move there. Farmers stay in the same area but soil becomes infertile and nothing will grow (why?)
- Mining -Mining of iron ore, gold etc. has led to destruction of rainforest e.g. The Amazon.

### Effects of deforestation

- Ecosystem- the ecosystem is affected, the nutrient cycling process is affected because nutrients come from the plants and trees i.e. 80% of the nutrients come from the plants and trees and leaving 20% in the soil. The rainforest will never fully recover. - Wildlife and plant life is reduced. (Upset the ecosystem).
- Soil erosion- Removal of vegetation left the soil exposed and this is eroded and washed away. - Removal of the top soil means little vegetation will grow.



-Soil erosion will lead to: siltation of rivers.

- -Flooding as soil is deposited in rivers bed reducing its capacity to hold more water.
- Loss of natural resource for ever.
- 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.
- 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.

#### Causes of Environmental degradation

1. Overpopulation and over-exploitation of resources
2. Agriculture.
3. Landfills.
4. Deforestation.
5. Environmental pollution.
6. Earthquakes.
7. Tsunamis.
8. Heavy rainfall.
9. Natural fires.
10. Tropical cyclones.

#### Effects of environmental degradation

- Pollution of the air, land and water.
- The creation of urban heat islands.
- Different diseases such as cancer, bronchitis etc.
- Decaying of buildings due to chemical corrosion especially those made from limestone rock.
- Eutrophication
- Increased number of flies and rodents such as rats which spreads diseases.
- Increased incidences of waterborne diseases such as cholera as was the case in Harare recently.
- Refuse heaps on undesignated places and litter distort the aesthetic value of the environment.
- Noise pollution from vehicles, planes and trains affects the ear.
- Water weeds (hyacinth) infestation chokes rivers and dams.
- Murky/dirty/muddy water unsafe for drinking.

#### Mitigation of environmental degradation

#### Home work

Qn: 1. What are the mitigation strategies to environmental degradation in your local community? (8)

### **Impacts of climate change on the environment**

- Climate change refers to long-term fluctuations in temperature, precipitation, wind and other elements of the earth's climate system.
- Climate change is caused by natural and anthropogenic/human factors.
- Human/anthropogenic factors include burning of fossils, deforestation, agricultural, industrial practices through emission of greenhouse gases.
- Natural factors include volcanic eruptions, and plate tectonic and others as shall be discussed in the Ordinary level notes.

Impact of climate change on land/soil

Since water and temperature largely influence the processes that take place in soils, climate change will cause changes in world soils.

### **Extreme events causing environmental degradation**

Climate change leads to frequent occurrence of extreme weather conditions such as heatwaves, floods and tropical cyclones. These extreme weather conditions have negative effects on the environment. Excessive temperatures lead to over evaporation of water bodies and wilting of vegetation. Tropical cyclones lead to rockfalls and severe soil erosion.

- **Extinction of species**

Climate change leads to extinction of plant and animal. Increasing or decreasing temperatures and rainfall amounts affects animal and plant species. Some of them fail to adapt to the changing climatic conditions hence they get extinct.

- **Rising sea level**

The changing climate leads to the melting of glaciers. The melting waters flows to the sea where it increases the volume of water in the seas. The level of the sea rises and the coastal areas are flooded by sea waters. The rising sea level leads to deposition in rivers and flooding of coastal regions.

- **Drying of water bodies**

Climate change has led to a fall in the water levels in some water bodies. High rates of evaporation and decreasing rainfall amounts leads to the reduction of the levels of water bodies. For example, Lake Chad shows a great reduction in the water levels. The different markings at the sides of the lake shows that the lake's water levels have decreased. The lake used to receive more rainfall during wetter periods.

- **Stunted growth of vegetation**

Tree rings are a major source of evidence on climate change. The growth of trees in areas receiving high rainfall is high. The trees therefore develop different rings than those in areas receiving low rainfall. Where there is high rainfall the tree rings are broad signifying rapid growth. A change in the size of the tree rings shows that the conditions did not favour rapid growth in those years. Due to climate change specifically the reduction in amounts of rainfall, trees grow slowly as show by their tree rings. This affects their sustainable exploitation as they can not regenerate faster after exploitation. An increase in rainfall amounts leads to rapid growth of vegetation.

- **Desertification**

Desertification is the spread of arid conditions to non-arid area. It is caused by climate change. A reduction in the amount of rainfall causes changes in terms of vegetation as the vegetation adapts to arid conditions. Vegetation dies and the soil becomes bare and susceptible to wind erosion. Wind landforms becomes common hence areas which where once wet becomes deserts.

### **The advantages or pros of climate change are:**

- It makes cold regions warmer and therefore increase the rate of plant growth
- It leads to an increase in rainfall amounts received by certain areas
- It makes some places habitable by making conditions favorable, for example, areas once covered by glaciers
- It leads to inventions as people fight the effects of climate change, for example, new farming methods
- It makes some areas more accessible, for example thick forests becomes less dense due to reduced amounts of rainfall
- It opens up new areas for exploitation of resources, for example, the provision of more land where glaciers melt

### **The disadvantages or cons of climate change are:**

- The disappearance of islands and low-lying areas due to rise in sea levels
- Extinction of animal and plant species
- Death of people, and animals from extreme events such as floods
- A fall in the amounts of rainfall
- Prevalence of diseases such as skin cancer due to heat waves
- Food insecurity due to droughts and other extreme events such as floods
- Some plants find it difficult to grow due to increase in temperatures, for example, deciduous trees which need frost
- Increasing temperatures reduces frost which kills fungi and pests
- Death of people due to weather hazards such as floods, tropical cyclones and heat waves
- Rise of sea level; it has been estimated that by 2100 the sea level will have risen by 1m

### **Climate change mitigation strategies**

The negative effects of climate change can be reduced through a number of ways. These ways include:

- **Construction of dams**

Constructing dams helps to store water for use during the dry spells. The small amounts of rainfall received due to climate change in some areas is



- **Constructing greenhouses**

Greenhouses help to improve conditions for growing crops. In areas receiving very low temperatures, greenhouses create better conditions for growing crops. Temperatures inside green houses are warmer hence where climate change has led to fall in temperatures are controlled to enable the growing of crops.

- **Cloud seeding**

Cloud seeding involves the spraying of gases into the atmosphere such that they aid the formation of clouds. For rainfall to form there is need for condensation nuclei. Condensation nuclei is present in form of hygroscopic substances which have affinity for water. The substances attract water droplets allowing them to grow leading to rain. Without such substances the chances of rainfall formation are slim. Spraying gases such as Sulphur increases the amounts of rainfall received therefore reducing a reduction in rainfall amounts owing to climate change.

- **Afforestation and reforestation**

Afforestation is the growing of trees where there were no trees whereas reforestation is the planting of trees where trees have been removed. Planting trees assist in reducing temperatures and providing a source of water for transpiration.

- **Growing drought resistant crops**

Where rainfall amounts are being reduced by climate change and droughts are becoming frequent, growing drought resistant crops and keeping drought resistant animals will assist in averting food shortages. Such crops include rapoko, millet and sorghum.

- **Changing methods of farming**

A shift in the methods of farming can be necessary to reduce the effects of climate change. The methods used when high amounts of rainfall were received may not work where low amounts are now being received. Methods such as zero tillage may be proper.

- **Disaster preparedness**

There is need for comprehensive disaster preparedness systems climate change has led to the frequent occurrence of weather hazards such as tropical cyclones and floods. This helps to reduce the number of deaths and loss of property in case of the hazards.

## TOPIC 9

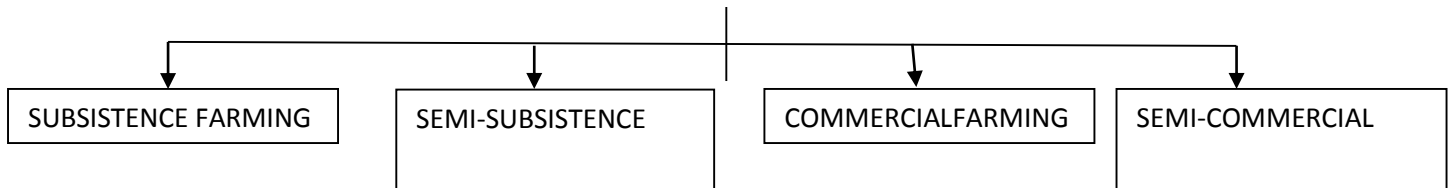
### AGRICULTURE AND LAND REFORM

#### Agriculture (Farming)

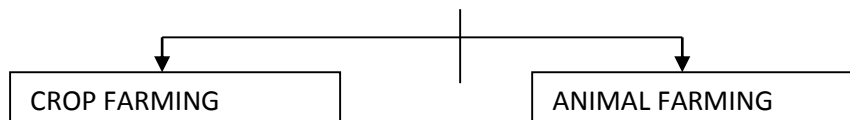
Refers to the growing of crops and rearing of livestock for a purpose.

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.

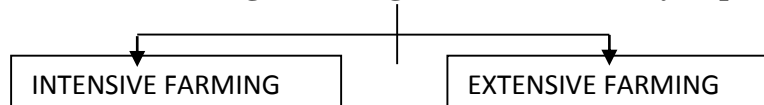
Classification of farming according to purpose or use of farm produce



Classification of farming according to type or nature of land use



Classification of farming according to scale or intensity of production



#### Types of agricultural systems

##### Shifting Cultivation / Chitemene System.

- 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 slash and burn in the Amazonian forests of Brazil.
- In Zimbabwe no longer practiced.
- It is practiced where population is very sparse.
- It involves the following stages.
  - Cutting down trees and stumps 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 too long for daily walking.
- Availability of space due to low population pressure in area where it is practiced.
- The rudimentary type of housing used makes it easier to build new houses than to repair the old ones.

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 practiced 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**

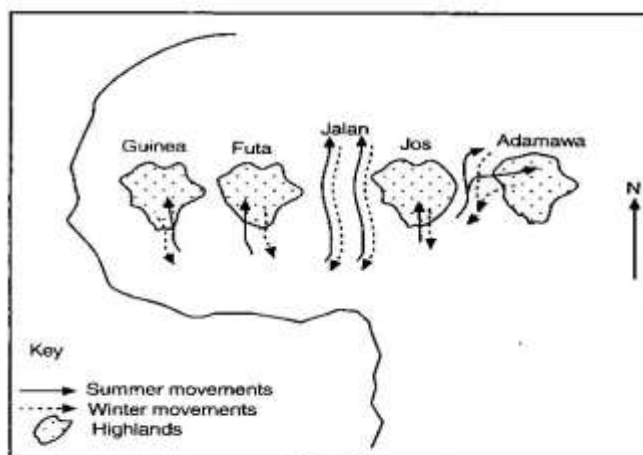
- Nomadism is practiced in the Sahel region which stretch from Atlantic coast to Ethiopian Highlands in the east.
- Sahel means fringes (edges) of Sahara desert.
- Sahel includes countries Mali, Niger, Sudan and Burkina Faso.
- The region is hot, dry with short wet conditions and subjected to dust storms 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 is 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 to 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 buy fertilizers to maintain fertility. (make fertilizers 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 contract 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, etc.
  - Export.

### Distribution of Plantations in Zimbabwe



- Most are along 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, Tsfovane, 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 practicing 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.

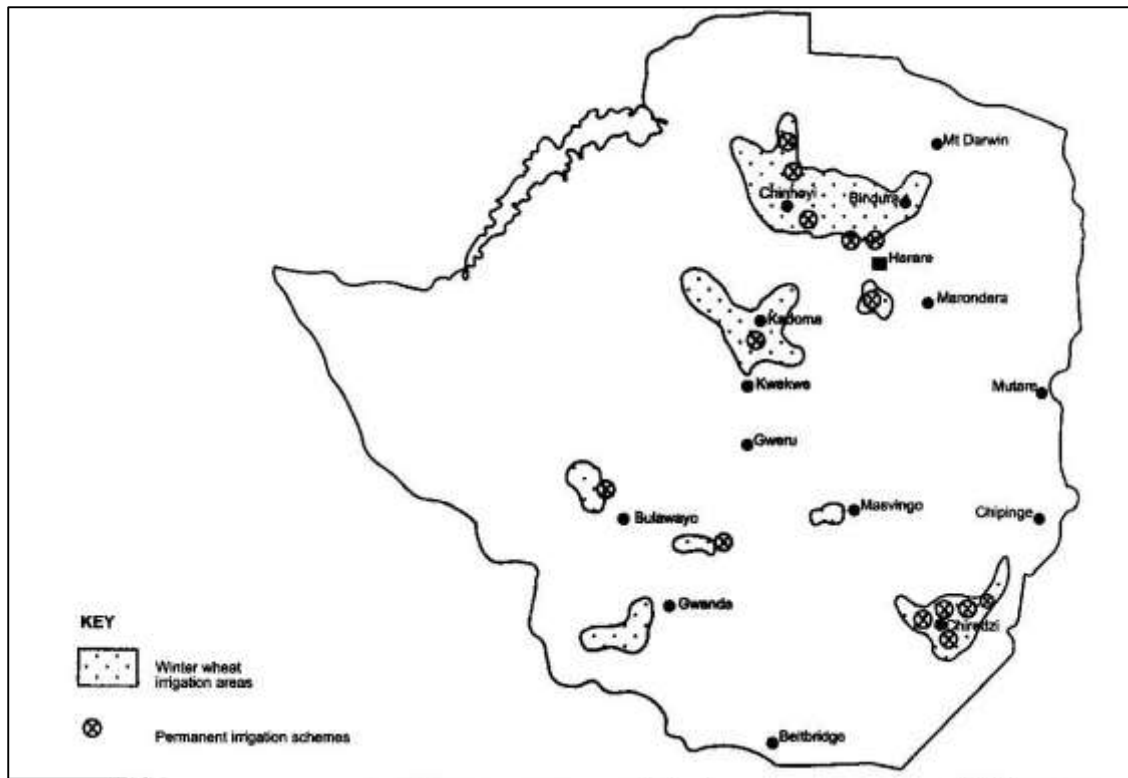
(e) Canal irrigation

- 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.

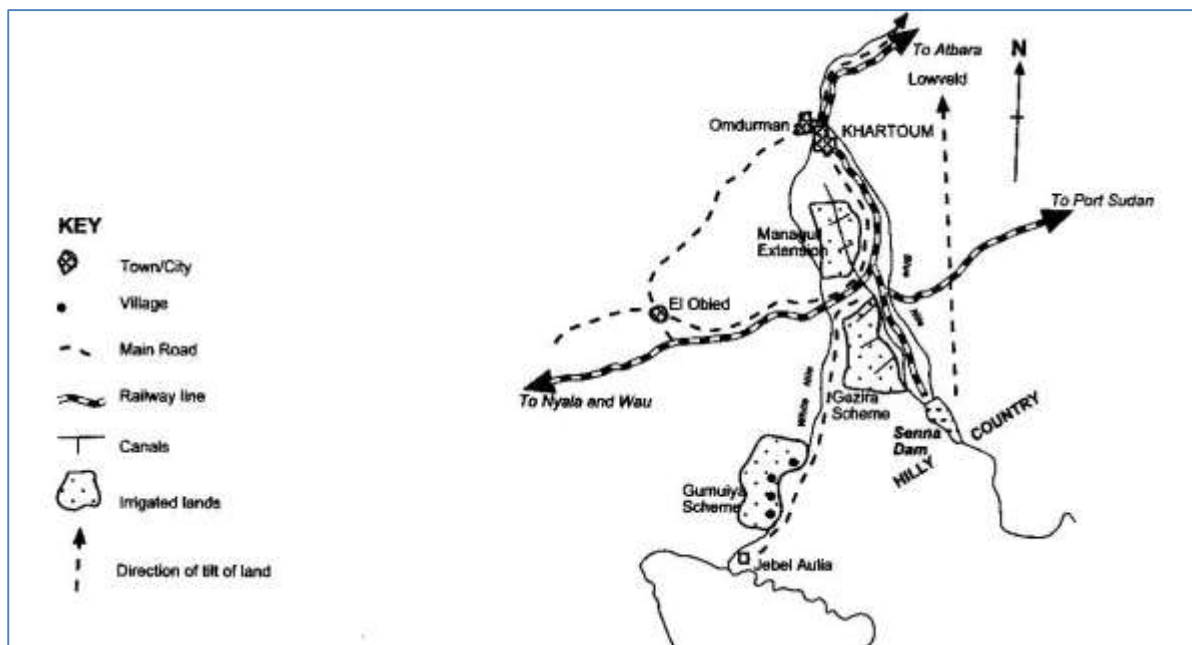
Question 1. Describe and explain the distribution of irrigation schemes in Zimbabwe shown. Dynamics of O'level Geography page 131 [8].



## 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 White 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.

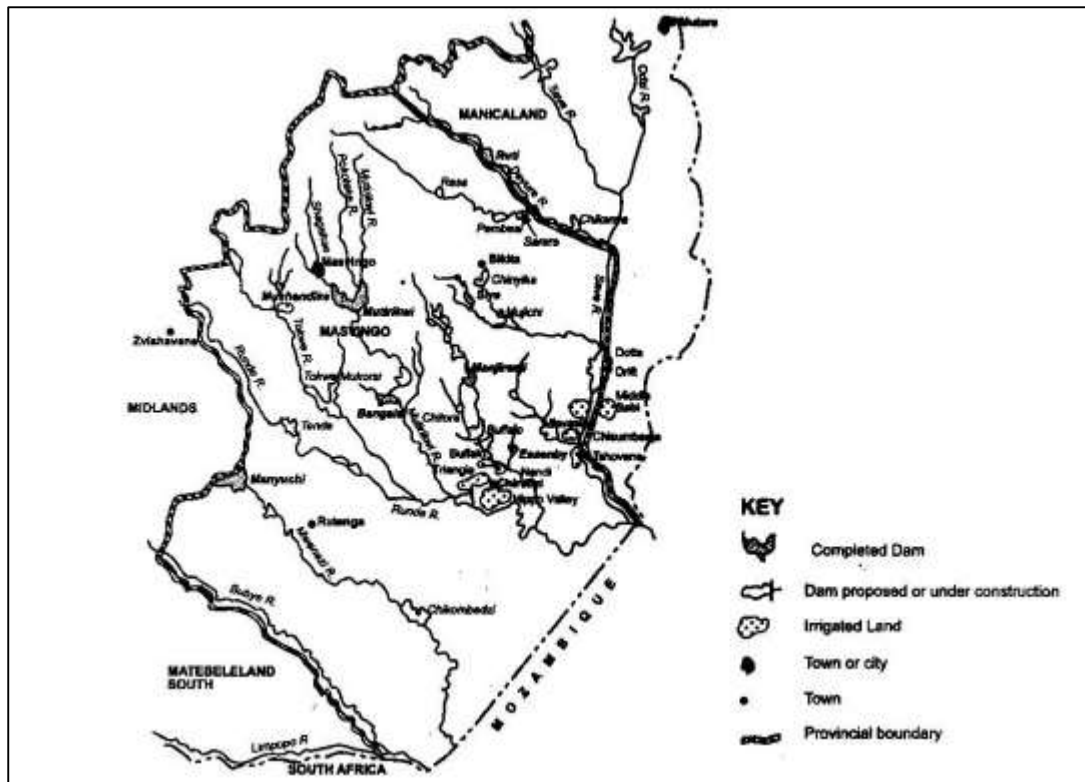
#### Successes and problems

- 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 harvesters, 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, fertilizers, 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

- 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.
- High outputs due to the complementary nature of raising animals and food crops.
- 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.

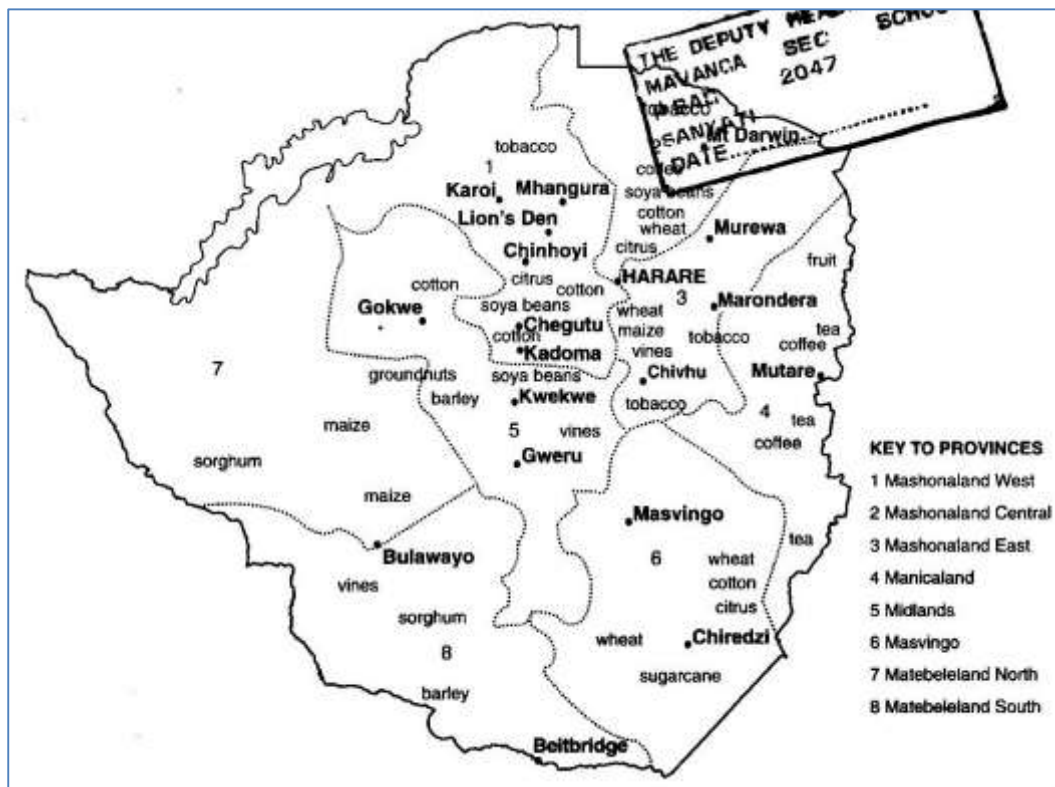
Inputs-1 manager, 1 mechanic. 30 workers, 6 tractors, 3 lorries and 4 trucks

Seeds, fertilizers, 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. QN: How do you construct a paddock? (4)
- 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 practiced 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

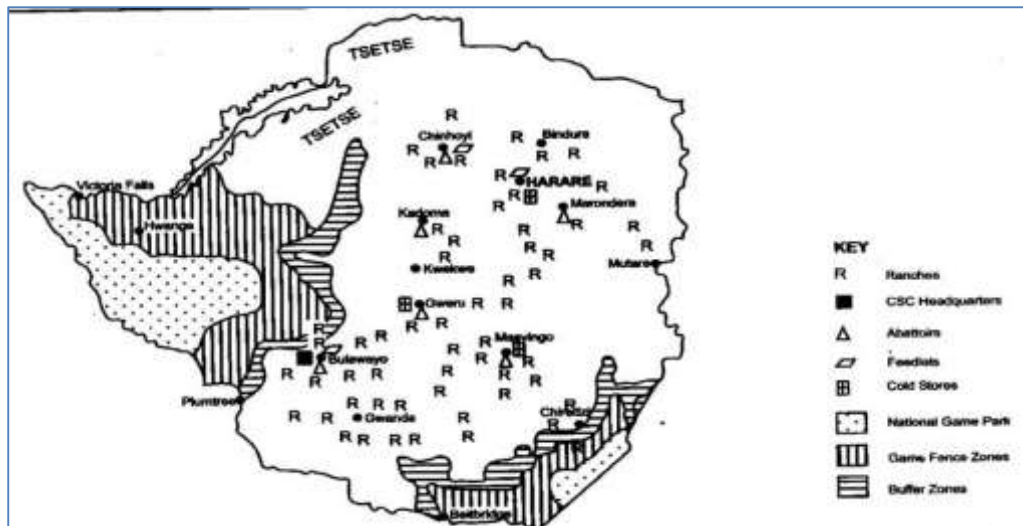
### **Advantages**

- 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.

## 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 grown- 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

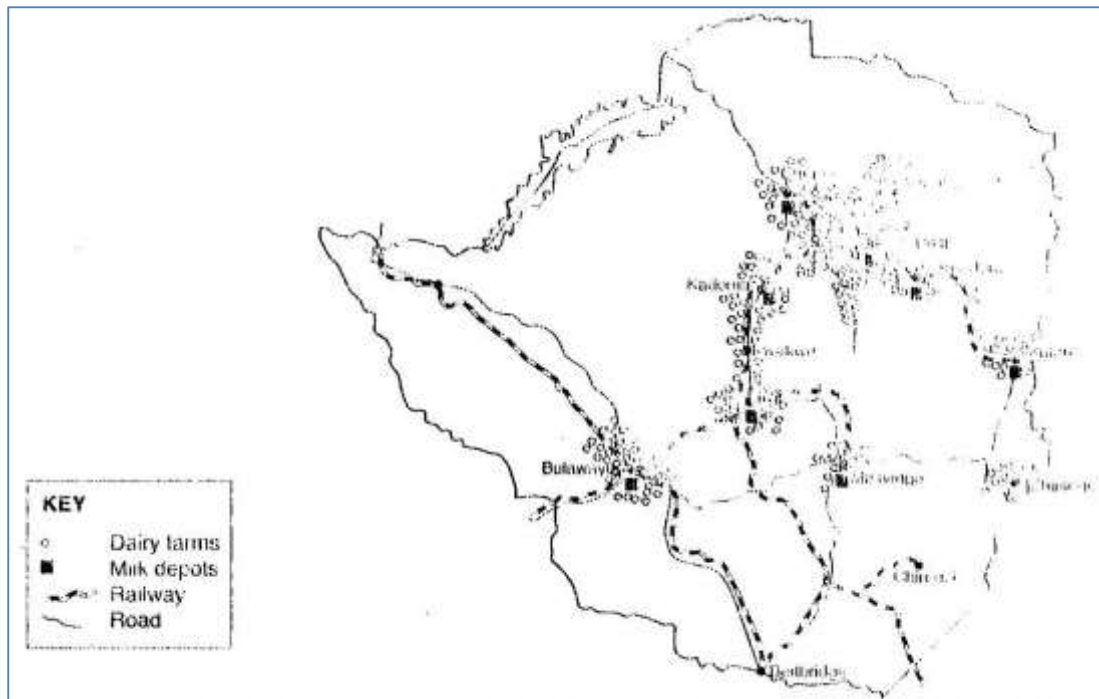
Guernsey- golden yellow to red with white marks second to jersey in milk fat.

- 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 practiced 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 Kintyre 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.

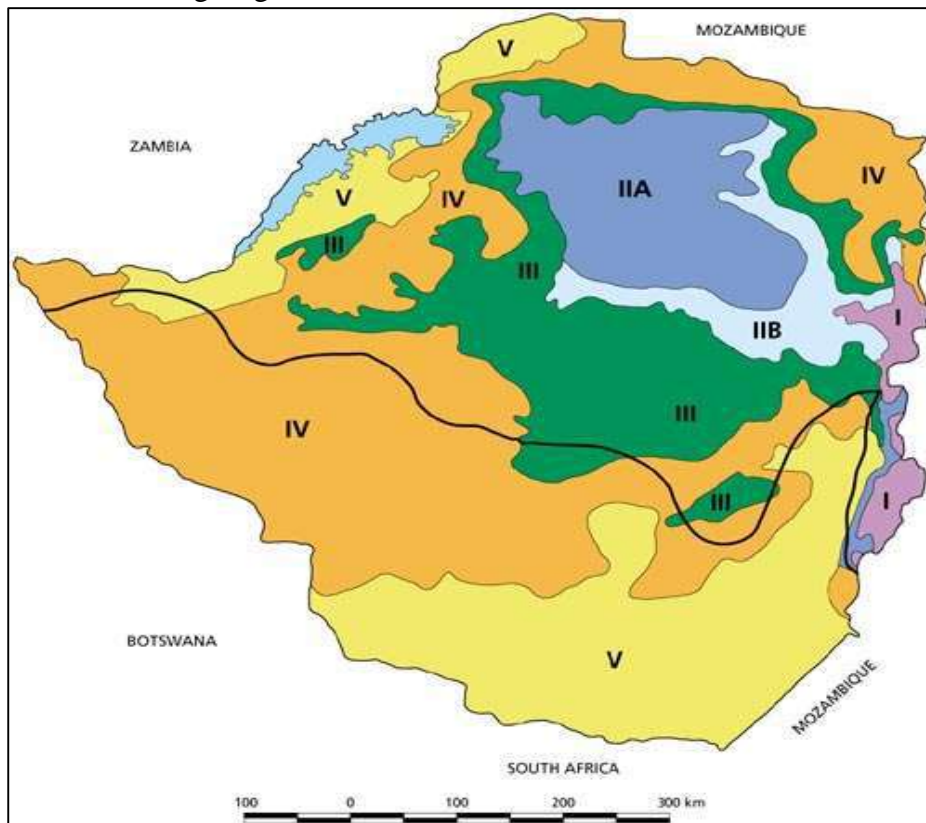
#### Agriculture in Zimbabwe

- Zimbabwe is a landlocked country in the Southern Africa region with an area of over 390 000 km<sup>2</sup>. 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 VI

- 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 (AREX 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 fertilizers 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 fertilizers.
- 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 saves 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.

## **TOPIC 10**

### **INDUSTRY**

#### **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.

#### **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.

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.

#### Types of Industrial Locations

- Raw materials based/material oriented industries

These are located on the source of the raw materials.

Such raw materials are bulky and costly to transport.

Some of the raw materials could be perishable and lose most of their weight during the manufacturing process.

The least cost location of such industries is near the source of raw materials.

- Market oriented industries

These are located close to the market.

Such industries produce perishable goods e.g. bakeries and therefore it is cheaper to transport the raw material over long distances.

Costs of transporting finished goods are reduced because the industry is near the market.

A break of bulk-port industries

These are industries located on the port and most raw materials are imported

Good examples are oil refining and iron or processing

Raw materials are bulky thus giving coastal locations more advantage than interior location.

- Labour based industries

These are near the source of labour especially if the industries require a lot of skilled labour.

- Power/fuel based industries

These are located close to power or fuel supplies.

Most industries in the UK and the USA were located near coal fields because it was the only source of power. (NB\*No longer common\*\*\*)

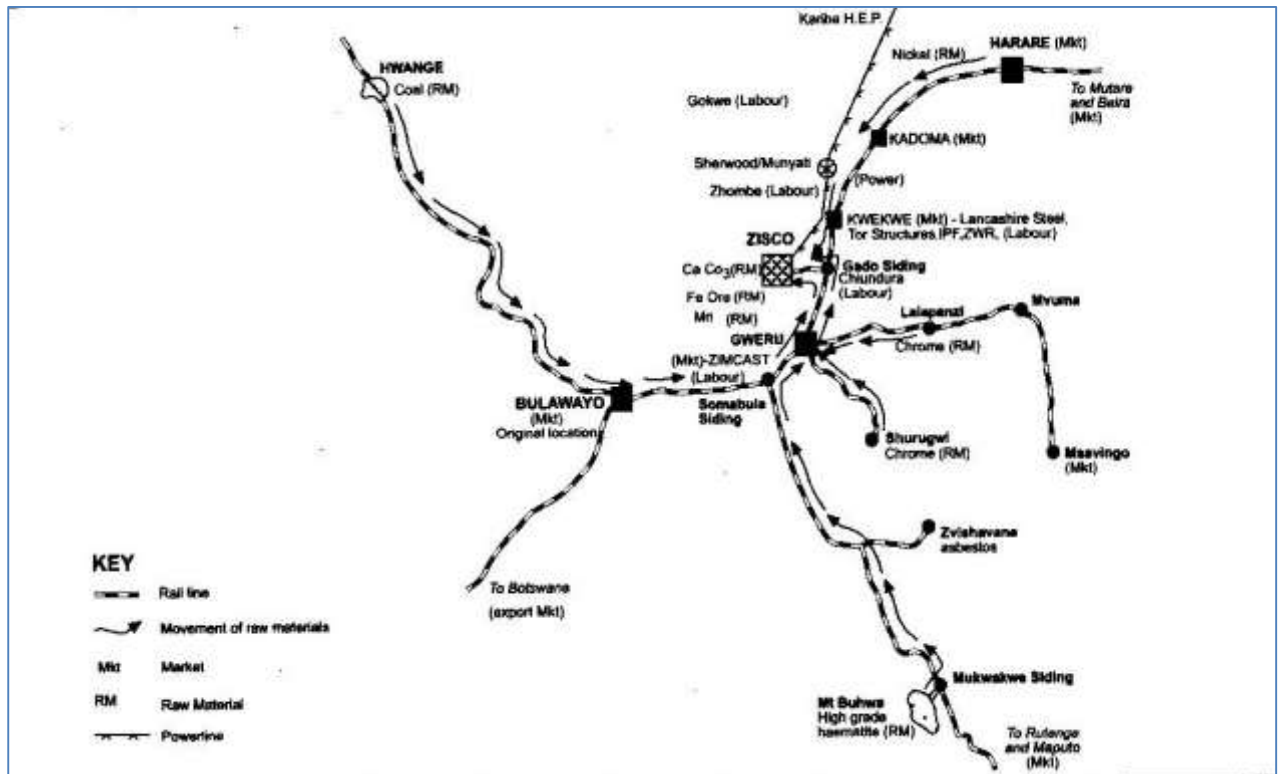
- Footloose industries

This refers to industries that can be located anywhere without the effect from factors such as resources or transport. An industry not tied to any particular location, it is not tied to a fixed location. The cost of transporting both raw materials and finished products is not important for the location of the industry/firm.

#### 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.

### Problems Caused by Industries

- Pollution of air, water, land and noise
- Exploitation of labourers
- Encroaching on to agricultural land.
- Repatriation of profits
- Corruption/mismanagement

#### Solutions

- Locating away from residential areas.
- Educating people on problems caused by pollution.
- Introduction of carbon tax.
- Impose strict laws against pollution.
- Introduction of labour unions.
- Percentage share to government for products sold outside the country.
- Putting tariffs against imports.

### 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.

#### 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.



## TOPIC 11

### POPULATION AND SETTLEMENT

#### 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.

#### Causes of urbanisation

- Rural to urban migration in search of jobs
- Better educational facilities
- Better health facilities
- Entertainment
- Political instability
- Natural population increase in urban areas.

#### Effects of urbanisation

- High unemployment and under employment.
- Shortage of accommodation/residential housing
- Rapid spread of diseases
- High crime and robbery
- Rise of shanty settlements/squatter settlements.
- Increase in cost of living
- Shortage of food
- Pressure on water resources
- Loss of cultural values
- Pressure on social services
- Transport congestion
- Pollution of water air and land increases
- Urban sprawl
- Limited space of expansion.

Activity suggest solutions to the above problems

#### Benefits of urbanisation

- Human power supplies.
- Enlarged market for goods and services.
- Growth of industries.

#### Ways to reduce urbanisation

- Developing rural areas to reduce migration.
- Decentralisation of industries to rural areas.
- Reduction of birth rate in both rural and urban areas.
- Increased investment in rural and urban areas.
- Skills training to have more entrepreneurs

- Promotion of growth point policy so that services are offered in rural areas
- Traffic 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.
- ❖ Traffic lights / robots
- ❖ Round about.
- ❖ Fly overs.
- ❖ 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.

#### 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.

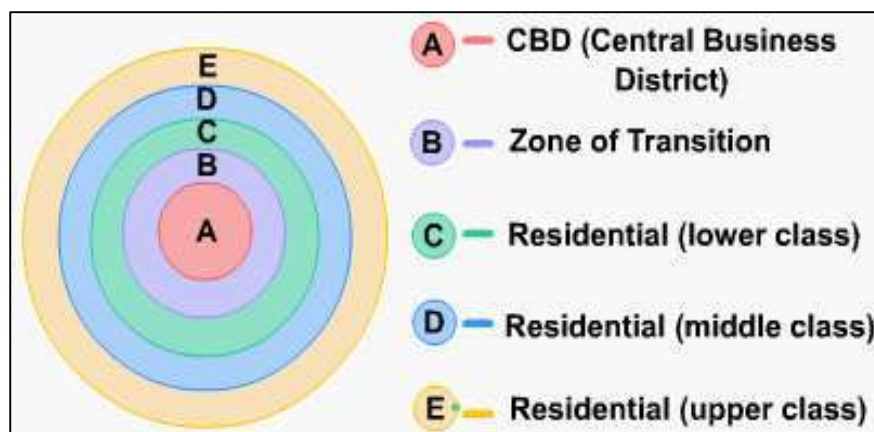
### Factors that affect land use in urban areas

- Communication and roads.
- Accessibility.
- 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:
  - A. The Central Business District
  - B. The Zone of transition

- C. The Zone of workingmen's houses
- D. The Zone of middle income or medium density housing
- E. 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 example 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

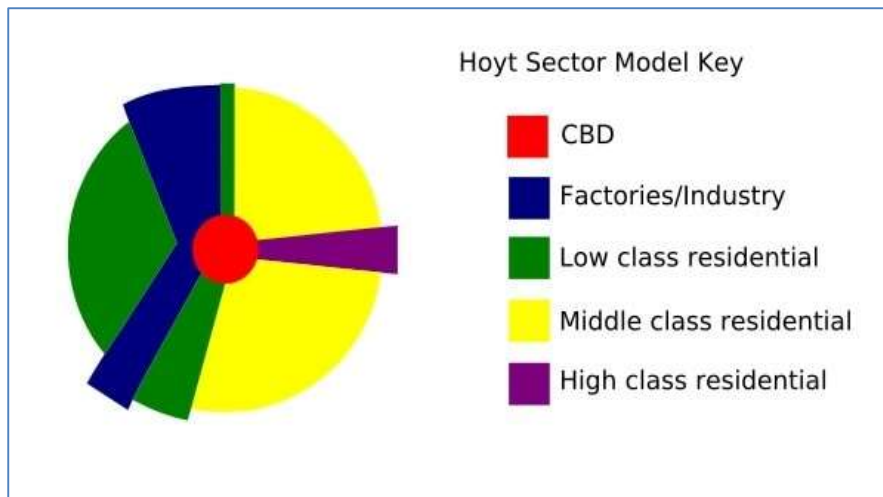
- This is characterised by large houses, with gardens and broad tree-lined streets.
- A small commercial centre and greenbelts can be found within this zone.
- Social centres like pre-schools and schools can also be found in this zone.
- Examples are Hillside and Cranborne suburbs in Harare.

#### 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

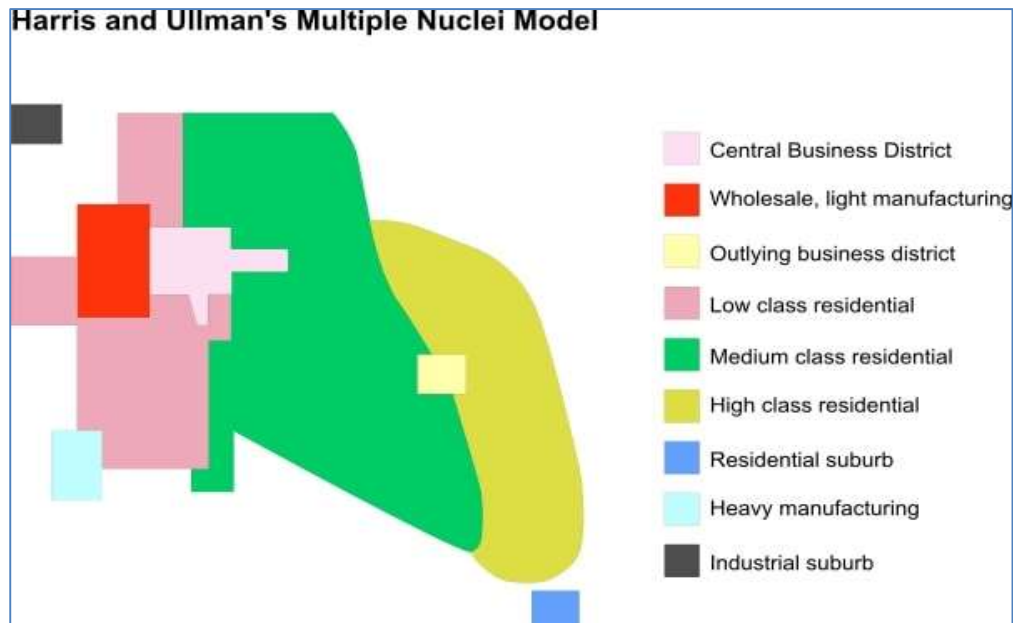
- In making the model Hoyt made some assumptions
- The model assumes wealthy people who can afford the highest rentals and rates chose the best sites.
- Wealthy residents can afford private cars or transportation thus they live further from industry and near main roads.
- Similar land uses attract each 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 etc.
- ❖ 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.
- It 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 Housing**

**Council Housing:** This is government housing which is usually given to people that are unemployed and have a low income. The rent on council houses are lower than the rent on private property.

**Detached Housing:** A single house that is not attached to any other house. A detached house will normally have a garden and a drive. These types of houses are normally found in the suburbs.

**Semi-Detached Housing:** Two houses that are joined together. They will probably have individual gardens and drives. These types of houses are normally found in the suburbs.

**Terraced Housing:** A long line of attached houses. These are typical in old industrial cities of the UK.

They are normally found in the transition zone area and they would have been housing for people working in the factories. They were very basic houses, often with no electricity and an outside toilet. Many have now been knocked down or improved.

**Bungalow:** This is a house with only one floor. They are very popular amongst old people who find it hard to use stairs. Bungalows can be detached or semi-detached. They are normally found in the suburbs.

**Flats or Apartments:** These are buildings with multiple levels. Normally a flat or apartment will only be on one floor within the block of flats or the apartment building.

### **Shanty/Squatter Settlements**

These are unplanned illegal settlements located on the periphery of high density residential areas without services like piped water, toilets, electricity, roads etc.

#### **Characteristics of shanties**

- Towns are unplanned ,homes are built in a disorderly fashion
- Poor housing made of plastics ,wood, cardboardes, metals and iron rods
- Most of the residents are informally employed, so there are poor living standards
- Poor levels of hygiene and health, poor sanitation usually one communal tap a shower and block of toilet
- Because of shortage of water they use unprotected water sources
- Overcrowded leading to outbreak of diseases e.g. tuberculosis

- More problems of crime ,theft and illegal acts
- Social problems like prostitution is more
- More environmental pollution as litter is dumped everywhere.

#### **Problems caused by the growth of shanty settlements**

- Overcrowding
- Crime e.g. increased drug abuse, theft
- Anti-social behaviour e.g. prostitution
- Quick spread of diseases
- Poor sanitation
- Shortage of water etc.
- Pollution
- The area become an eyesore

#### **Possible solutions to the problems of shanty settlement**

- Increase police patrol
- Construct cheap houses
- Educate people on the problems and also built schools
- Provide loan facilities
- Introduction of housing co-operatives
- Provide clean water facilities and sanitation
- Improve waste disposal methods\
- Introduce new settlements

#### **Disaster resilient infrastructure**

- Resilience refers to a system`s ability to anticipate, absorb and recover from a hazardous event in a timely and efficient manner.
- Infrastructure such as building, roads, should withstand hazards, failure will leads to crisis hence the is need to develop disaster resilient infrastructure as mitigation against natural and technological disasters.

#### **Features of disaster resilient infrastructure**

- a) Robustness- is the strength or ability to withstand the impacts of hazards events like effects of earthquakes, strong winds, and wildfires. Robustness depends on the building codes and standards.
- b) Redundancy- the availability of alternative housing for disaster victims such as safe shelter during flooding.
- c) Resourcefulness- refers to the ability of the authority`s business and industry to improve when disasters strike. They should make materials for restoration and recovery available.
- d) Rapidity- refers to the time taken to restore lifeline services, (time between impact and early recovery).

#### **Factors considered when siting a settlement**

- a) Water supply.
- b) Flood avoidance.
- c) Availability of building materials.
- d) Relief- flat low lying land is idle for construction than steep rugged terrain.
- e) Defence.

- f) Nodal and bridging points.
- g) Availability of land for agriculture and resources.
- h) Harbours.
- i) Fuel supply.

## **TOPIC 12**

### **TRANSPORT AND TRADE**

#### **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 Agreements-agreements made between countries regarding which commodities are exported or imported from specific countries.

□ Total Ban-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.

### **Patterns of world trade**

| <b>RICHER COUNTRIES<br/>MEDCs</b> | <b>advantages</b>  | <b>disadvantages</b>  |
|-----------------------------------|--|---|
| Socio-economic                    | Cheap imports of foodstuffs and raw materials.<br>Expensive of manufactured goods .Trade surplus | Often obtainable from considerable distances –high transport costs            |
| Environmental                     |  | Manufacturing goods can create air ,water, noise and visual pollution         |
| Political                         | Can exert pressure on LEDCs  | -   |
| <b>POORER COUNTRIES<br/>LEDCs</b> |  |   |
| Socio economic                    | Raw materials have a ready market in MEDCs. Source of work                                       | Limited range of exports.<br>Trade deficit as imports costs more than imports |
| Environmental                     | -  | Problems created by mining ,deforestation and overgrazing                     |
| Political                         | May be able to obtain seas aid   | Often tied /dominated by MEDCs  |

- LEDCs provide primary goods such as foodstuffs and raw materials, which they sell to MEDCs and the goods are usually sold at low and fluctuating prices.

- MEDCs process primary goods, either bought from LEDCs or available within their own Country into manufactured goods these are sold at a high and usually steady price. MEDCs can introduce a quota system.

## REFERENCES

1. Doro, C., Chimanikire, S. and Muzvidzani, M. A (2019) Practical Approach to Geography Form 2. Secondary Book Press. Harare.
2. Gariwe, S. , Jerie, S and Madondo, M. (2018) Step Ahead Geography Form 2. Pearson Education Africa. Cape Town.
3. Gariwe, S. , Jerie, S and Madondo, M. (2018) Step Ahead Geography Form 3. Pearson Education Africa. Cape Town.
4. Bunnet, R.B. (2011) Physical Geography in Diagrams for Africa. Longman Group Ltd. UK.
5. Gocha, N.T., Moyo, S. N.T., Ncube, R. and Nembaware, L. (2007) Dynamics of O`Level: Human and Economic Geography. College Press. Harare.
6. Dzoma, G. (2015) ZIMSEC Geography Online Free Notes.

*END OF TEACHING NOTES*

PAGE OFFICIALLY LEFT BLANK