REST OF AFRICA

Africa is one of the world's continents i.e. it is the second largest after Asia. Africa extends to about 30300,000km^2 (30.3 million km^2). Africa is about 3 times the size of Europe.

Africa's shape is rather unbalanced, in that, the northern half is very bulky and wide, while south of the equator it is much thinner, narrower in appearance.

POSITION/ LOCATION

The equator almost divides Africa into two halves , and it is approximately 3800km between cape Agulhas in the south and the equator whereas between the coast of Tunisia and the equator , it is about 4100km. Africa is the only continent where both the tropics ; cancer and Capricorn cross the landmass.

To the north, Africa is bounded by the Mediterranean Sea separating it from Europe, to the west it is bounded by the Atlantic Ocean and in the east by the Indian Ocean. It is separated from Asia by the red sea.

A Sketch map showing the position of Africa

RELIEF / PHYSICAL REGIONS OF AFRICA

The topography/ landscape of Africa includes highlands, lowlands, basins, plateaus etc. the relief is basically divided into:

1. The plateau
2. The rift valley
3. Basins
4. The highlands/ mountains

5. The coastal lands

The plateau

Africa has a series of plateau/ plateaus, higher in the east but gradually declining towards the west. The plateau surfaces vary between 500 and 2000metres above sea level. These result from long periods of erosion, which removed vast quantities of soil and rocks from the continental surfaces to the sea beds.

The Great Rift Valley

A rift valley is an elongated depression of land between a series of parallel faults. The great rift valley of Africa extends for over 7200km, of which 5600km is Africa , from near Beira in Mozambique , northwards through Ethiopia into the Red Sea, and then via the gulf of Suez and the gulf of Aqaba , into Jordan. At Lake Malawi the system divides into two parts; the eastern arm/ section that passes through Tanzania, where it contains several lakes, and the western arm/section that passes through lakes Tanganyika and Albert, after which it gradually fades out. The eastern arm has lakes like Magadi and Turkana, after which it enters Ethiopia finally dividing into gulf of Eden and the red sea.

A sketch map of Africa showing the Great Rift Valley and Plateaus

Formation of the rift valley

A. TENSIONAL FORCE THEORY

(Research)

B. COMPRESSIONAL FORCE THEORY

(Research)

Basins

These are interior lowlands/ large depressions formed as a result of large scale down warping. Today some basins are occupied by major lakes and rivers of Africa. Some are however dry. These basins include the Congo basin, Kalahari basin, Niger basin, Senegal basin, Gabes basin, Chad basin, El Djouf basin, Victoria basin, Karoo, Libya basin, Sudan basin etc

The basins are either separated by plateaus or mountains.

A sketch map of Africa showing basins and mountain ranges

Highlands/ mountains

In Africa, the mountains are categorized as follows:

- Fold
- Volcanic
- Block/ horst
- residual

Fold Mountains

Africa does not have many fold mountains because of basement rocks. However, the notable examples are found at the northern and southern extremes. At the extreme north of Africa, there are the atlas ranges (of Algeria and morocco). At the extreme South Africa, there are the cape ranges (forming a complex system).

Fold Mountains are formed as a result of compressional forces acting on the layers of young sedimentary rocks. Compressional forces push together masses of landscape from either sides, causing the rocks to develop anticlines and synclines. The anticlines form the Fold Mountains while synclines form the valleys separating them.

Illustration

Volcanic mountains

Africa has a number of volcanic mountains including Ethiopian highlands, Mt. Cameroon, Tibesti and Ahaggar Mountains of the Sahara, Drakensburg Mountains in South Africa.

Formation

Volcanic mountains were formed as a result of volcanicity, where molten rocks/ magma from the centre of the earth/ earth's interior forced its way towards the earth's surface through the vents or lines of weakness / fault lines. On the surface, the magma accumulated and solidified into lava and ash layers to form volcanic highlands.

Earth movements lead to the development of cracks/ faults within the earth's crust.

Illustration of volcanic mountain

Influence of highlands/ mountains on climate

The highlands act as barriers to the prevailing winds/moist winds which are forced to rise, cool, condense, form clouds and result in rains on the windward side of the highland.

The rains are heavy, relief rainfall (orographic rainfall). On the leeward side of the highland, the winds are dry descending winds, making the area to be dry with little rainfall. That side of the highland lies in a rain shadow.

Illustration

Influence of highlands on human activities (value of mountains to man)

1. Windward sides of highlands are wet / receive heavy rainfall, which supports farming such as coffee in Ethiopia highlands, citrus fruits in South Africa, dairy farming in the Drakensburg. (A combination of fertile soils and heavy rainfall).

2. Lee ward sides of highlands are dry, which supports animal rearing where there is short grass for grazing.

3. Mountains are sources of rivers which provide water for livestock, irrigation of crops, fishing and for domestic use.

4. Highlands promote wildlife conservation since they act as suitable habitats of wildlife (flora and fauna).

5. Highlands promote tourism practices such as mountaineering/ mountain climbing and photography due to impressive scenery; and this brings in foreign exchange.

6. Due to heavy rainfall many mountain slopes are covered by forests giving rise to forestry and lumbering.

7. Promote mining activities since they are important sources of minerals like iron ore, oil and cobalt in the Atlas Mountains, chromium in the Ethiopian highlands, nickel and uranium in the Drakensburg.

8. Mountains are used for recreation activities such as mountain climbing and animal viewing in Drakensburg.

9. Highlands / mountains contain rocks which are quarried to provide construction materials (stones and gravel).

Problems faced by people living in highland areas

1. The steep / rugged terrain restricts / limits settlement and crop farming especially mechanized farming.

2. High costs of constructing transport and communication routes such as roads have to wind to avoid very steep gradients covering much longer distances.

3. Drought conditions (little rainfall) on the leeward side of the highlands, which limits crop farming activities.

4. Too much rainfall on the windward side leading to soil erosion and flooding which destroys farmlands and other property.

5. Landslides and rock falls (mass wasting) due to steep slopes and heavy rainfall resulting into loss of human life and property.

6. Risk of volcanic eruptions and earthquakes which are destructive to life and property.

7. Land fragmentation due to dense settlement on the lower slopes and this limits commercial farming especially use of machines.

8. Very cold temperatures are experienced in the high altitude areas and this limits settlements and other land uses.

9. Some mountains harbor wild animals which are a threat to human life and crops

10. Some mountains act as hideouts for rebels who destabilize peace.

Steps that can be taken to solve problems above

1. Practicing irrigation farming on the leeward side to increase crop farming.

2. Constructing roads to follow contour or on low slopes of the mountain regions.

3. Advising people to avoid settling in areas which suffer from earthquakes, volcanic eruptions and landslides.

4. Avoiding settlement and cultivation on steep slopes to reduce the danger of erosion and landslides.

5. Building terraces, practicing contour ploughing, afforestation and reaforestation.

6. Construction of tunnels through the mountains/ highlands to shorten distances.

7. Land consolidation to solve land fragmentation (small plots of land are brought together to support commercial farming such as using machines).

8. Resettlement of people in safe areas to avoid steep slopes.

Coastal lands

Africa's coastline is almost very smooth with few indentations in it unlike North America or Europe. As a result there are not many good natural harbors in Africa and as such artificial harbors are common especially in West Africa (Africa has very few gulfs and bays unlike North America or Europe, making port development very difficult).

Artificial harbors are very expensive such as port Tema and port Takoradi in Ghana, port Beira in Mozambique, port noire in Zaire (DRC), Abidjan in Ivory Coast. This factor also partly explains the limited fishing development around Africa.

Africa also has a narrow continental shelf, which has also limited the extent of fishing in Africa unlike other continents like Asia, North America or Europe. This means that there is limited ground for fish breeding, feeding and growth of planktons.

The typical / common features along the African coast include deltas, lagoons, sandbars, mangrove swamps, coastal sand dunes, coral reefs, estuaries etc

A DELTA

A delta is large flat, low-lying plain of river deposits located where a river enters into the sea or lake.

Formation of a delta

A delta develops when the river in its old stage has its speed greatly reduced due to low gradient, as it enters the fairly calm sea/ocean. The river deposits its load/ large quantities of silt, sand, gravel, alluvium and other material within the mouth (during the flood times). If there are no strong sea currents to erode the material, it gradually piles up until the river's path is blocked; and the river is forced to sub-divide into distributaries (several channels) to avoid the deposited load of sediments.

As deposition continues, lagoons are filled and the delta gradually extends further into the sea and becomes colonized by vegetation.

Examples of deltas in Africa are Niger delta on river Niger and Nile delta on river Nile.

Illustration of a delta

Conditions necessary for delta formation

a) The river must have a large amount of load in order to deposit across a large area which causes formation of distributaries

b) The velocity of a river must be sufficiently low to allow most of the load to be deposited in the river's mouth.

c) The river's load must be deposited faster than the rate of removal by action of sea tides and currents, for distributaries to be formed.

Value / importance of coastal lands in Africa

1. The deltas have fertile soils due to river deposition and thus support crop farming such as cotton and rice growing in the Nile delta.

2. Coastal lands support dense settlements such as Niger delta and this promotes trade and industry.

3. The lagoons formed within a delta act as fishing grounds and hence increased incomes tom people.

4. Coastal features such as coral reefs, lagoons, deltas, promote tourism and thus generating foreign exchange.

5. Coastal areas have important mineral resources such as oil in Niger delta and limestone from coral reefs; hence support mining.

6. Coastal areas have swamp vegetation, which is a source of raw materials for the local craft

industry.

Problems faced by people living in river valley areas/ coastal areas

1. Flooding since most coastal lands are low-lying areas and this destroys life and property.
2. Coastal floodplains create ideal conditions for the breeding of pests and disease-causing vectors such as mosquitoes which spread malaria.
3. The soggy ground limits settlement and the development of transport routes.
4. The silting of the river mouths limits entry of large water vessels and thus difficult water transport/ navigation.
5. The dense settlements in the delta areas result into congestion and thus easy spread of diseases, limited land for expansion etc

Steps being taken to solve the above problems

1. Regular/ constant dredging to control the problem of silting.
2. Resettlement of people from the densely populated areas to reduce congestion.
3. Construction of artificial levees or embankments to control flooding.
4. Spraying with chemicals to control pests and diseases. There is also treatment of the associated diseases.
5. Planting of trees to reduce the water in the ground such as eucalyptus.
6. Construction of water channels / canals to drain away excess water to control flooding.
7. Etc

DRAINAGE IN AFRICA

Drainage refers to the removal of excess water from an area. The drainage features include lakes, rivers, streams, wetlands/ swamps.

A river refers to a mass of water flowing in a particular channel over the land surface. Africa has thousands of rivers both big and small, all of which rise somewhere in the huge plateau and highlands / mountain areas. The Nile is the longest of Africa's rivers and possibly the most important. Other major rivers are the Congo River (the Zaire), Zambezi, Niger, Limpopo, orange, Okavango (Cubango), Volta, Senegal, Gambia, etc

A lake refers to a hollow / depression on the earth's surface occupied by water. *(It is defined as a body of water occupying a hollow / depression on the earth's surface).* Some lakes are small while others are of great size. Africa has many lakes of diverse characteristics. The lakes of tectonic origin include Lake Malawi, Lake Tanganyika, Lake Albert; and small lakes located at the centre of drainage basins such as Lake Chad. Still Africa has several large

artificial lakes that were created by damming of major rivers and these include Lake Volta on river Volta, Lake Kainji on the Niger River, Lake Kariba on river Zambezi, and Lake Nasser on River Nile.

A sketch map showing the major rivers and lakes of Africa

Stages of a river course

A. Youthful stage/ torrent/ upper course

This is the initial stage in the development of a river course, the river is very fast due to a steep gradient, it has a deep and narrow valley (V-shaped valley). At this stage, vertical erosion is dominant (*down cutting of the riverbed)* and the major features are gorges (deep valley), rapids, waterfalls, and interlocking spurs *(where the river twists and turns around obstacles of hard rock).*

B. Middle course/ mature stage

This is the second stage in the development of a river course and at this stage, lateral erosion is dominant. There is reduced/gentler gradient (hence reduced vertical erosion). The river bends are more pronounced and spurs disappear. The river has a widened valley/ U-shaped valley due to lateral erosion.

C. Old stage/ lower course/ senile stage/ plain stage

This is the third stage in the river course and deposition is dominant due to over widened valley. The river speed is very low because of much reduced gradient/ low gradient as the river approaches the sea. There is meandering action of the river in the over widened

valley. The major features include floodplains, river meanders *(with bluffs and slip-off slopes)*, ox-bow lakes, braided channels, levees, delta, etc

Some features

1. **Gorge**

This is a steep sided narrow and deep valley found along a river in the youthful stage. It is formed due to vertical erosion of the riverbed by fast flowing water over the soft underlying rock between hard rocks. It is formed when waterfalls retreat upstream.

Illustration of a gorge

2. **Water fall**

This is a break in the channel bed of a river. It occurs in the upper course / youthful stage of the river. It forms when a band of resistant rock overlying less resistant rock is exposed at the surface by river erosion. The river course becomes suddenly steepened that the water flows from a higher level to a lower level and forms a plunge pool at the base.

A waterfall is also formed where there is a fault scarp created during faulting to form a sharp edge. Examples of waterfalls are Victoria falls on river Zambezi (110m), Livingstone falls on river Congo, Inga falls on river Congo.

Illustration of a waterfall

3. Flood plain

This is a gently sloping plain of alluvium covering the valley floor down which the river flows in a meandering channel. (It is a wide/ broad valley covered with layers of alluvial sediments). It is formed in the old stage of the river course when the speed of the river greatly reduces and deposition takes place on the bed of the river, making it shallow and wide.

When the river is in flood, it spills over its channel and often covers the whole flood plain depositing sediments. The floodplain eventually becomes so wide that the meanders no longer reach the sides of the valley.

Note: The river plain often has marshes and numerous lakes (ox-bow lakes) which are formed when the meander loops have been cut off.

Illustration of a flood plain

4. Delta (refer back)

Factors limiting the effective utilization of rivers as waterways in Africa

1. Presence of waterfalls, rapids and gorges along the courses of rivers, and therefore the rivers are not navigable throughout their length.
2. Presence of floating islands and vegetation along the courses such as papyrus rids, limiting the movement of vessels / makes the rivers unnavigable throughout their length.
3. Presence of rock outcrops along rivers, which prevent the movement of water vessels in such areas.
4. The rivers are also fast flowing in the highland areas, and hence a higher risk of accidents.
5. Fluctuation in volume of some rivers seasonally (river regime) i.e. Water levels fluctuate between wet and dry seasons. At low water, the rivers may not be navigable yet at flood it may be too dangerous.

6. Shallowness and narrowness of rivers, making it hard for vessels to use them especially the rivers flowing in mountainous regions.
7. Some rivers flow through remote and sparsely populated areas and hence water transport uneconomical such as river Congo.
8. Rivers tend to meander in their flood plains making the distance covered by the river much longer than a similar journey on land.
9. Low level of economic activity in the immediate hinterland (empty and unused land), thereby making the rivers uneconomical to use due to limited cargo like river Congo.
10. Silting of many large rivers especially at their mouths, which increases the shallowness of channels.
11. Strong winds on some rivers causing accidents in certain times of the year. This limits the use of the rivers for transport for fear of losing life and property.
12. Presence of predators such as crocodiles, and hippos, which at times over turn boats /threaten the lives of the travelers on water.
13. Limited capital to develop the rivers as water ways such as Canal construction, the streamlining of rivers, and establishing ports.
14. Low levels of technology and limited skilled labour to modernize the rivers as waterways such as to develop ports and related facilities, and this limits the volume of cargo handled.
15. Political differences between countries through which the rivers pass, which prevents the development of river transport such as Senegal and Gambia (Gambia River), Uganda and Sudan (the Nile River).
16. Political instability in areas with rivers such as along river Congo and this puts the lives and property of the travelers at risk all the time. (Eventually the number of people using river transport reduces).
17. Competition with faster means of transport such as by road and railway which are more convenient and quicker, and these limit the number of people using river transport.

Solutions to the above problems

1. Construction of locks to regulate the water level.
2. Construction of some canals to bypass rapids and waterfalls.
3. Constant dredging to maintain the depth and width of the water channels/ rivers.
4. Construction of dams/ barrages to hold back water and give greater depth to solve flooding and shallowness.
5. Use of blasting with explosives on some rivers to shatter rocks into small pieces , which are easily removed (to make rivers deep and wide for navigation).

6. Removal of floating vegetation in some areas, to open up the rivers for navigation.

7. Acquiring loans to develop the rivers as waterways such as better ports. Also attraction of foreign investors to invest more capital.

8. Limiting/ restriction of settlement along the river banks to control silting (settlement—free zones).

9. Planting of trees / vegetation along the river to control silting.

Importance of lakes and rivers

1. Modifying of climate (formation of rainfall) by enhancing evapo-transpiriation process; which in turn facilitates the growth of forests and agricultural production.

2. Generation of hydroelectric power due to the presence of waterfalls such as Aswan high dam on river Nile, Orange power project on river Orange. This in turn facilitates industry and other activities.

3. Promote tourism due to attractive features like flood plains, rapids; and aquatic life, hence generating foreign exchange.

4. Promote recreation activities which include beach activities—beach football, beach volley ball, boat racing, water rafting, swimming etc; hence improving people's standards of living.

5. Provide a source of water for domestic and industrial use in the surrounding urban and rural settlements. Water is used for cooking, cooling machines and as a raw material in industries.

6. Provide a cheap means of transport (navigation) for passengers and goods, using canoes, motor boats, and steamers; which in turn promotes various economic activities like trade.

7. Promote fishing activities, hence a valuable source of proteins and essential minerals for both humans and livestock.

8. Provision of water for irrigation to supplement the rainfall received such as Gezira irrigation scheme on River Nile, hence promoting agriculture for a large part of the year.

9. Generation of employment opportunities to many people such as fishermen, transporters, boat makers, fishnet makers, tourism operators etc. This in turn raises people's incomes/ standards of living.

10. Promote research studies such as students from colleges and universities visiting the rivers and lakes; which is a foundation for economic development.

11. They act as boundaries between countries such as River Ubanji between DRC and CAR.

12. Some lakes contain minerals and therefore promote mining industry such as salt from rift valley lakes, clay and sand from lakeshores and river valleys.

13. Riverbanks, river deltas and lakeshores have fertile soils which promotes crop farming such as the Niger delta in Nigeria, banks of River Senegal.

Problems associated with lakes and rivers

1. They harbor disease-causing vectors such as mosquitoes causing malaria and snails causing bilharzia.
2. Hinder the construction of transport and communication lines, and hence act social and economic barriers to people of the opposite sides.
3. The water levels rise during the heavy rains and this causes flooding of the surrounding areas, destroying life and property.
4. Lakes and rivers are habitats of dangerous animals such as crocodiles, hippopotamus, which attack man and his animals.
5. They occupy large land which would have been used for various activities such as agriculture, industry.
6. The marshy and boggy grounds around lakes and rivers hinder settlement due to difficult construction and this limits associated activities.
7. Water vegetation such as papyrus, water weed, limit fishing and navigation.
8. The lakes encourage smuggling of goods across the borders, and this limits government revenue.
9. Conflicts over water bodies shared between countries, limiting trade relations /leading to destruction of life and property.
10. Pollution of the water bodies due concentration of activity and congestion on the lakeshores and this causes health problems.

Possible solutions to the above problems

1. Resettlement of the people away from the congested lakeshores and riverbanks.
2. Enforce laws against water pollution.
3. Employ security personnel to fight cross-border smuggling of good via lakes and rivers.
4. Reduce the floating vegetation by removal and chemical spraying.
5. Construction of dams to regulate water flow and control floods.
6. Construction of embankments to control flooding.
7. Encourage cooperation between countries sharing rivers and lakes to reduce conflict and tensions.

CLIMATE OF AFRICA

Climate refers to the average weather condition of a place studied and recorded over a long period of time, usually 30 or more years.

Climate and weather has various elements and these include:

- Rainfall (precipitation)
- Temperature
- Sunshine
- Humidity
- Cloud cover
- Wind direction and speed

Note: Climate is an important natural resource, which greatly influences man and his activities. For example sunshine and warmth are abundantly enjoyed almost everywhere in Africa. This is mainly because of Africa's location along the equator and crossed by tropic of cancer and tropic of Capricorn. However, rainfall is unevenly distributed, some areas receiving very heavy rainfall yet other areas receive very little rainfall.

Major climatic Zones/ Regions of Africa

- Equatorial climate
- Tropical continental/ savanna climate
- Desert and semi-desert climate
- Mediterranean climate
- Mountain/ Montane climate
- Warm temperate / Highveld warm continental

A sketch map showing the major climatic zones/ regions of Africa

EQUATORIAL CLIMATE

This type of climate occurs in the lower latitudes, within 6^0—7^0 north and south of the equator. It covers the Congo basin, the southern parts of West African countries (like Ghana, Togo etc). It also occurs in the eastern coasts of Madagascar.

Characteristics of equatorial climate

1. Very heavy rainfall is received usually 1500mm and above per annum.
2. Rainfall is received throughout the year.
3. There is a double maxima i.e. two rainfall peaks are received in the year following the movement of the overhead sun.
4. The type of rainfall is mainly convectional resulting from the heating of the earth's surface (evaporation).
5. Rainfall mainly falls in the afternoons and often accompanied by lightning and thunderstorms.
6. Hot temperatures are experienced and even throughout the year.
7. The annual temperature range is very small less than 3^0c.
8. The diurnal temperature range is small about 7^0c
9. High relative humidity throughout the year due to high levels of evaporation and transpiration. (This prevents day temperatures from rising to high over 30^0c).
10. A dense cloud cover (which prevents too much sunshine during day and too much cold at night).
11. Low pressure all the year round, and hence attracts trade winds to converge over the region.
12. The climate is hot and wet throughout the year.
13. It receives abundant sunshine throughout the year.

Factors that lead to equatorial climate

- Location astride the equator leading to a double maxima of rainfall
- Location on the windward side of mountains leading to very heavy rainfall
- Influence of thick forest vegetation which increases the rate of evapotranspiration
- Influence of prevailing moist winds such as the westerlies which bring in moist conditions in equatorial regions
- Influence/ nearness to large water bodies which increase the rate of evaporation
- Influence of warm ocean currents i.e. warm guinea current which recharges onshore winds

Economic activities taking place in the equatorial region

1. Growing of perennial crops/ plantation farming due to heavy rainfall received throughout the year such as oil palm in Nigeria, sugarcane, coffee, tea.
2. Forestry and lumbering due to heavy rainfall and hot temperatures favouring the growth of forests.
3. Tourism due to forest vegetation and wild animals/ birds acting as tourist attractions.
4. Fishing due to the many water bodies facilitated by heavy rainfall received in these regions.
5. Hunting due to the many wild animals in the dense forests.
6. Charcoal burning due to the dense forest cover.
7. Growth of industries due to agricultural and forest raw materials.
8. Trade activities since heavy rainfall leads to dense settlement.
9. Food gathering such as fruits collected from the dense equatorial forests.

Problems facing people living in the equatorial region

1. Pests and diseases attacking man, animals and crops due to hot temperatures and damp conditions (which favour the breeding).
2. It is difficult to establish and maintain transport routes in densely forested areas due to the heavy rainfall received.
3. High rate of weed growth due to heavy rainfall which limits crop growing / increases the costs of farming.
4. Presence of dangerous wild animals in the dense equatorial forests which attack man and crops.

5. Loss of soil fertility due to leaching resulting from heavy rainfall.
6. High rate of soil erosion where land has been cleared for farming due to heavy rainfall.
7. The forests are dense and hence difficult to clear to carry out other activities such as farming.
8. Occasional floods especially in the low-lying areas, during heavy rainy seasons, hence destroying life and property.

Steps taken to improve conditions in equatorial regions

1. Use of population control measures to minimize deforestation.
2. Licensing forest workers to reduce over exploitation.
3. Ensure political stability in the forest regions through peace talks.
4. Spray using chemicals to control pests and diseases in some areas.
5. Construct better and rehabilitate transport routes connecting the forest areas to reduce remoteness.
6. Re-afforestation programmes in areas where forests have been depleted/exhausted to increase forest cover and control soil erosion.
7. Gazetting areas as forest reserves to conserve forests and thus control environmental degradation.
8. Diversifying of exports such as by encouraging cash crop production to reduce over dependence on timber exports.
9. Use of protective gear to guard against accidents when feeling trees

TROPICAL CONTINENTAL CLIMATE/ SAVANNA CLIMATE

This occurs between 5^0 to 15^0 North and South of the equator. It is found in abroad zone on either side of the equatorial climatic region i.e. west, east and central Africa. (The countries with savanna climate include Cameroon, Nigeria, Rwanda, Burundi, Zambia, Zimbabwe, parts of DRC, etc).

Characteristics of savanna climate

1. The summers are hot (with temperatures above 26^0c) while winters are warm (with temperatures usually above 15^0c).
2. The annual temperature range is moderate between 7—10 ^{0}c.
3. There is a large diurnal range of temperature (14—17^0c).
4. Rainfall varies in amount from 1000mm and above towards the equator and about 500mm towards the semi-desert margins.

5. Rainfall is mainly received in summer and winters normally dry.
6. Alternate wet and dry seasons are experienced.
7. Humidity is high during the wet season and low during the dry season.
8. Heavy cloud cover towards the equator and less cloud cover towards the semi-desert.

Factors that lead to savanna/ tropical continental climate

- Latitudinal location – areas nearer to the equator receive more rainfall (1000mm) while areas towards the semi desert have drier conditions
- Absence of large water bodies leading to moderate rainfall/ dry savanna climate
- Influence of natural vegetation cover-woodlands and grasslands leading to moderate rainfall
- Influence of human activities such as deforestation, bush burning, over grazing which destroy original forest vegetation and hence limited evapo-transpiration
- Low altitude leading to warm to hot temperatures
- Long distance from the coast (winds travel for long distances)
- Effect of prevailing winds such as north east trades and dry harmattan winds leading to the dry savanna climate

Economic activities that take place in savanna regions

1. Clearing of land through bush burning and digging during the dry season while planting/ sowing, weeding and pruning are done during the wet season.
2. Growing of mainly seasonal crops such as millet, maize, beans, cotton, simsim due to the alternate wet and dry seasons (Annual crops).
3. Livestock rearing due to the natural vegetation consisting of mainly grasslands (during the dry season the animals move searching for pasture and water while in the wet season there is settled grazing).
4. Lumbering from the woodlands and scattered trees.
5. Growth of industries due to agricultural raw materials such as maize, milk, cotton etc
6. Charcoal burning in the savanna woodlands and scattered trees.
7. Hunting of wild animals from the woodlands
8. Tourism and wild life conservation since the savanna vegetation provides a natural habitat for many species of wild life. Some areas are gazette as national parks or wildlife reserves.

9. Bee keeping due to hot temperatures and dry months in the savanna woodlands.

Problems facing people living in savanna climate regions

1. Widespread bush fires during the dry season, leading to soil erosion at the onset of the wet season.
2. Occurrence of pests and diseases especially during the wet season such as tsetse flies causing Nagana/ sleeping sickness.
3. Shortage of pasture for livestock during the dry season leading to over grazing and thus soil erosion.
4. Poaching of wild animals/ birds in the national parks and wildlife reserves, which negatively affect the tourism industry.
5. Low and unreliable rainfall leading to crop failures after planting (the dry season limits crop growing).
6. Rapid growth of weeds during the wet season, which limits farming / increases the costs of farming.
7. Inadequate capital to develop the economic activities in the savanna regions.
8. Environmental degradation due to increased deforestation for charcoal burning, settlement and agriculture.
9. Underdeveloped transport and communication network hence remoteness and low levels of economic development.

Possible solutions to the above problems

1. use of chemicals to control pests and diseases
2. Construction of valley dams and underground tanks to store water for the dry season.
3. Establish ranches to act as demonstration farms for the livestock farmers to reduce overstocking.
4. Extension of veterinary services to reduce animal diseases.
5. Construction of better roads to increase accessibility.
6. Provision of soft loans to reduce capital shortage to develop the regions.
7. Control weeds by spraying using herbicides, physical removal/ weeding or biological control.
8. Putting and enforcing strict laws against poaching of wild animals in the national parks and reserves.
9. etc

DESERT AND SEMI-DESERT CLIMATE

This mainly occurs in the sub-tropical high-pressure belts between 20^0 and 30^0 north and south of the equator. The northern desert extends from the west coast across the continent into Southwestern Asia and it is the famous Sahara desert. The Sahara desert covers Morocco, Algeria, Tunisia, Libya, Egypt, Mauritania, Mali, Niger, Chad, and Sudan. Others are the Kalahari and Namib deserts in the south. Kalahari covers most of Botswana and parts of northern South Africa and eastern Namibia. Namib Desert occurs along the coast of southwestern Africa – mainly Namibia.

Note: The Sahel region is the zone of transition between the arid Sahara in the north and the wetter tropical parts of the south.

Characteristics

1. Rainfall is little and unreliable usually less than 250mm per annum in the deserts and less than 500mm in case of semi-deserts.
2. Rare torrential downpours leading to temporary flooding.
3. Very high rates of evaporation due to very hot temperatures.
4. Temperatures are very hot usually above 30^0c during day.
5. Large diurnal / daily temperature range (temperatures above 30^0c during day but can fall to 4^0c at night).
6. Low relative humidity
7. Absence or low cloud cover, hence explaining the very hot temperatures during day and very cold nights.
8. The climate is hot and dry/ very dry.

Note: The coastal areas of the Namib Desert receive cool onshore winds which blow over the Atlantic Ocean. The wind is made cool by the cold Benguela current i.e. air over it picks the cool conditions and reaches as cool on shore wind , giving rise to the formation of fog or mist and at times very light rains.

Factors that lead to a desert type of climate

1. Latitudinal location far away from the equator where rainfall is little and unreliable.
2. Absence of large water bodies in the interior which limits evapo-transpiration and thus low rainfall totals.
3. Rain shadow effect / leeward effect i.e. some areas are on the leeward side of highlands and thus experiencing dry descending winds.
4. Presence of scanty vegetation which limits evapo-transpiration leading to low rainfall totals.

5. Presence of off-shore winds leading to dry conditions along the coastal areas.
6. Influence of dry winds such as the northeast trade winds causing dry conditions since they carry less/ no moisture.
7. Influence of cold ocean currents such as Benguela and canary currents leading to pre-mature condensation.
8. Human activities such as deforestation, bush burning etc which destroy vegetation and limit evapo-transpiration.

Economic activities / land use in desert and semi-desert regions

1. Nomadic pastoralism due to scanty pastures and shortage of water for livestock (also due to sparse population).
2. Growing of drought resistant or fast maturing crops due to low and unreliable rainfall.
3. Tourism due to the landscape and desert features such as sand dunes, inselbergs, etc which attract tourists and hence generate foreign exchange.
4. There is also cultivation of crops around desert oasis (wet zones of the desert).
5. Irrigation farming is a common practice such as around oases and Nile valley due to low and unreliable rainfall.
6. Mining activities such as petroleum in Libya and Algeria, diamonds in the Namib Desert as an alternative land use.

Problems faced by people living in desert and semi-desert regions

1. Dust storms causing airborne diseases and thus poor health.
2. Infertile soils leading to poor crop performance / limits crop growing and hence frequent famine.
3. Very hot temperatures during the day leading to high rate of evaporation and making settlement difficult.
4. Droughts are frequent, hence shortage of water for livestock and people.
5. Overcrowding near rivers, oases and other water points due to shortage of water.
6. Little and unreliable rainfall limits growing of crops and rearing of livestock (e.g. shortage of pasture for animals).
7. Temporary flooding after torrential downpours, destroying life and property.
8. Shortage of labour and market due to sparse population, hence limited economic activity.
9. Underdeveloped transport infrastructure and other social amenities due to small population i.e. it discourages government from putting up such social facilities.

Possible solutions to the above problems

1. Establishing ranching schemes to promote settled farming.
2. Construction of permanent water points such as valley dams, tanks to encourage settled farming.
3. Planting fast maturing trees to facilitate rainfall formation.
4. Planting drought resistant trees that can survive in the extremely hot temperatures.
5. Introducing irrigation farming to improve productivity.
6. Mechanization where possible to minimize labour shortage.
7. Enforcing environmental laws such as limiting overstocking and deforestation.
8. Emphasize soil management strategies such as terracing, contour ploughing , use of ridges
9. Encourage tourism to acquire revenue to develop social services.
10. Etc

MEDITERRANEAN CLIMATE (WARM TEMPERATE CLIMATE)

This type of climate occurs in the extreme north and south of the continent. It occurs between 30—45^{0}north and south of the equator such as northern parts of Algeria, Morocco, and Tunisia; found around the cape region of South Africa.

Characteristics

1. It experiences cool to mild wet winters
2. Warm to hot dry summers
3. Moderate amount of rainfall ranging between 500mm—1000mm per annum (depending on the location and altitude of the areas).
4. Annual temperature range is moderate (about 6^{0}c)
5. Summers are generally sunny.

Note: There are warm to hot, dry summers and cool to mild, wet winters. This is mainly because in winters there are onshore winds while in summer winds are offshore. (The wind and pressure belts move slightly north and south with the sun during the course of a year).

Summers in the Cape Town area are cooler than normal because temperatures are lowered by the Benguela Ocean current which flows northwards along South Africa's west coast.

(Centres: Algiers, Cape Town)

Economic activities in Mediterranean climate regions

1. The climate favours cultivation of cereals such as wheat, oats, barley,; fruits such as citrus fruits, lemons, oranges, grapes, apples
2. The vegetation can support livestock rearing such as sheep and goats.
3. The forest vegetation (Mediterranean woodlands) produces cork and other timber products like woodcarvings.
4. Tourism due to alternate dry and wet conditions, which favour beach activities such as swimming.

Problems faced by people living in Mediterranean climate regions

1. Unreliable rainfall / little rainfall during winter limits production especially agricultural.
2. Soil erosion during the wet season leading to soil infertility.
3. Soil exhaustion due to intensive farming
4. Pests and diseases which also leads low crop production.

MONTANE CLIMATE

This is experienced in areas like Drakensburg Mountains, Ethiopian highlands, Cameroon and atlas mountains i.e. highlands or mountain regions.

Characteristics of Montane climate

1. Temperatures decrease with increase in altitude / height above sea level.
2. They receive heavier rainfall than the surrounding areas.
3. Relief/ orographic rainfall is received on the windward side of highlands.
4. The upper slopes do not receive as much rainfall as the lower slopes.
5. Windward slopes are often wetter while the leeward slopes are often dry due to rain shadow effect.
6. Lower slopes are warmer than the higher slopes.

Economic activities carried out in the Montane climate areas

- Tourism due to the existence of snow and glacial features which attract tourists
- Lumbering especially from the mountain forests
- The lower slopes have fertile soils and receive heavy rainfall, which supports crop growing especially on the windward side.
- Nomadic pastoralism especially on the leeward side due to low rainfall totals / short

grasses.

- (Refer to highlands)

FACTORS AFFECTING THE CLIMATE OF AFRICA

1. Latitudinal location/ the apparent movement of the overhead sun

(This influences the ITCZ)

Africa is located astride the equator and crossed by the tropic of cancer and Capricorn. These are the major latitudes of the world over which the sun is always overhead. The sun is overhead the equator in march , over head the tropic of cancer in June and in September it comes again over the equator and overhead tropic of Capricorn in December.

The location influences the climate in the following ways:

- It results into abundant sunshine in most parts of Africa
- Areas around the equator have almost equal hours of sunshine and night.
- Temperatures are generally hot throughout Africa apart from a few spots such as highlands.
- Areas around the equator are never far from the overhead sun and hence temperatures are hot throughout the year.
- The hot temperatures around the equator explain the rainfall received throughout the year.
- Rainfall patterns occur following the movement of the overhead sun. The equatorial regions receive two rainfall peaks in March and September (double maxima).
- The hot temperatures and abundant sunshine result into low-pressure belts in different areas over Africa. For example, the low-pressure belt develops over the equatorial region in March and September and in southern Africa in December. These low-pressure zones attract winds from high-pressure zones to replace warm air rising.

  Note: This low-pressure zone in which the winds converge is called the Inter Tropical Convergence Zone (ITCZ).

2. Relief

Africa has varied relief i.e. highlands, plateaus, plains and low lands. Highlands tend to wetter than the surrounding areas and this is because highlands force warm moist winds to rise resulting into cooling, condensing into clouds and forming rainfall on the windward side of the highland. However, the leeward sides of the highlands experience dry descending winds and hence have dry conditions (lie in a rain shadow).

For example, the Eastern slopes of the Drakensburg Mountains in South Africa are wetter than the western slopes. The Ethiopian highlands are wetter on the northeastern slopes than the south and western slopes. The Atlas Mountains are wetter on the northeastern slopes than the southern slopes.

3. **Altitude**

Altitude refers to the height of land above sea level. Temperatures decrease with increase in altitude and this is called the temperature lapse rate *(the higher you go the cooler it becomes*). Temperatures decrease at an average rate of 6.5^0c for every 1000m of vertical ascent. The highland areas of Africa like the Drakensburg, Atlas, Ethiopian highlands, Mt. Cameroon experience cool temperatures than the surrounding areas due to high altitude *(leading to modified equatorial type of climate).* However, the coastal areas have hot temperatures due to low altitude.

4. Influence of vegetation

Areas with thick vegetation cover for example tropical rain forests receive heavy rainfall due to the process of evapo-transpiration. These areas are wetter than areas with savanna vegetation. Areas with scanty vegetation (desert and semi-desert areas) experience dry/ very dry conditions due to limited/ low levels of evapo-transpiration.

5. Influence of water bodies

Africa has a number of large water bodies and surrounding oceans which affect the climate. This can be through the sea and land breeze.

Sea breeze

During day, land heats up faster than the sea/ oceans/ lake. The air above the land becomes warmer and expands until it is at a lower pressure than the air above water. Eventually cool moist air begins to move towards land to replace the warm air rising. This movement of cool air from the sea to the land is called sea breeze.

The warm air over land rises to the atmosphere, cools, condenses, forms clouds and result into rains in adjacent areas (the sea breeze causes rainfall over land especially in the afternoons and in the evenings).

Illustration

Land breeze

At night, land cools much faster than the sea. The temperatures therefore are cooler over the land than the sea which retains much of its heat. A low-pressure zone is created over the sea and high-pressure zone is created over the cold land. Air blows from the land to the lower pressure zone over the sea and this is called land breeze. The land breeze cools the temperatures on the sea and the cooling also causes fog formation.

Illustration

6. Influence of ocean currents

An ocean current is a large drift/ stream of water of water with uniform characteristics especially temperature that moves with in oceans in a definite direction. There are two types of ocean currents i.e. warm ocean currents and cold ocean currents.

Warm ocean currents flow from the warmer region to the colder regions i.e. from the equator towards the poles (from low to high latitudes). They are characterized by high temperatures and tend to raise temperature along the adjacent land/ coastal lands. For example the warm Mozambique current raises temperatures along the eastern coast of South Africa *(this helps to raise winter temperatures which would otherwise be very cold*). Also the warm Guinea current helps to modify temperature of the West coastal lands. Warm ocean currents lead to increased amount of rainfall along the coast.

Cold ocean currents flow from a colder region to a warmer region i.e. from the poles towards the equator. They are characterized by lower temperatures and they tend to lower the temperatures along the coast. For example the Cold Benguela current flowing northwards along the coast of Namibia. The cold canary current which affects the northwest African coast (countries like Senegal, Gambia etc). The cold ocean currents contribute to the aridity along the coast (such as Namib Desert).

7. Wind systems/ trade winds

The climate of Africa is affected by a number of wind systems:

(a) ***The northeast trade winds***. These are dry winds which originate from the Arabian Desert. They bring dry conditions to much of northern Africa. When they cross the red sea, they pick up moisture which is dropped on the Ethiopian highlands causing rainfall on the north eastern slopes. They continue to northern and northeastern Africa as dry winds hence causing dry conditions.

(b) ***The southeast trade winds***. these blow from the Indian ocean carrying much

moisture hence causing rainfall in the southern parts of Africa such as Mozambique , south east Africa. The winds continue as dry winds in the interior of South Africa.

(c) ***North easterly Harmattan winds***. These lead to dry conditions in northwestern Africa since the little moisture is dropped on the northeastern slopes of the Atlas Mountains.

(d) ***Westerlies***. These originate from the Atlantic Ocean with a lot of moisture and blow towards the Congo basin leading to wet conditions.

(e) ***The monsoon winds***—which are seasonal mainly affecting the eastern coast of Africa and bring in rain along the East African coast down upto Durban in South Africa.

Major ocean currents and wind systems affecting the climate of Africa

8. **Influence of human activities**. Human activities influence climate both positively. However today the negative impact is more observed resulting into dry conditions and increasing temperatures.

Activities like deforestation , bush burning , swamp reclamation, drilling of bore holes , over grazing, industrial pollution etc have negatively affected the climate for example by reducing evapo-transpiration causing aridity.

However some human activities influence climate positively such as afforestation, reafforestation, etc which increase evapo-transpiration.

OCEAN CURRENTS

An ocean current is a general drift/movement of a mass of surface ocean water in definite direction. It is a body of warm or cold ocean water flowing while carrying energy. There are both warm and cold ocean currents.

Warm ocean currents

Warm ocean currents originate from the tropics and move pole wards such as the warm Mozambique current along the Eastern Africa coast.

Characteristics of warm ocean currents

- Originate from the regions of low pressure to regions of high pressure, that is, from the tropics to the poles.
- Transport warmth from the tropics into high latitudes which results into increase in temperatures of adjacent areas.
- The adjacent land washed by the warm ocean current usually receives plenty of precipitation (rainfall).
- As the warm ocean current flows pole wards it gets cooled especially in the mid-latitudes and high latitudes before it is completely changes into a cold ocean current.
- Located especially on the eastern coast of the continents.

Effects of warm ocean currents on the climate of Africa

- Warm ocean currents cause increase in temperatures of adjacent areas
- Ocean surfaces where the flowing ocean currents are warm are associated with relatively high evaporation brought by the high temperatures. This increases the moisture content of prevailing winds like the south east trades which bring a lot of moisture content to the eastern coast of Africa.
- The warm ocean currents gives rise to warm rainy climates like on the east African coast the on-shore winds passing over the warm Mozambique current bringing heavy rainfall because their relative humidity is increased.

Effects of warm ocean currents on the human activities in Africa

a) The high rainfall received at the coast has influenced crop farming such as growing of cloves, coconuts and bananas at Mombasa, Zanzibar and Pemba islands. There is also fruit growing like oranges, passion fruits among others.

b) The climate has influenced commerce and trade. The temperatures which do not go below 20^0c at the coast have made commerce and transport activities to be developed such as developed ports.

c) The warm conditions have encouraged the development of coral reefs, hence a major source of tourist attractions thus the development of the tourist industry; and also supporting mining of limestone which is a raw material for cement. However the coral reefs provide a shipping problem on the coast which hinders navigation.

d) Industrialization due to the abundance of raw materials such as timber , coral, water and labour from the dense coastal settlements accompanied by warm-wet coastal climate.

Cold ocean currents

Cold ocean currents originate from the poles and drift towards the tropics such as the cold Benguela current flowing northwards on the western coast of Africa.

Characteristics of cold ocean currents

- Originate from high pressure regions to low pressure regions, that is, from the poles towards the equator.
- Transport cold conditions from the high latitudes to the tropics, which lowers the temperatures of the adjacent areas.
- As the cold ocean current flows towards the tropics it is warmed and thus its temperatures keep on increasing until it is completely a warm ocean current.
- Cold ocean currents are found especially on the western coast of continents.

Effects of cold ocean currents on the climate of Africa

- Cold ocean currents lower the temperatures of the adjacent areas/ coastal areas.
- Cold ocean currents reduce the relative humidity of the place where they come across because temperatures are suddenly lowered.
- Cold ocean currents induce aridity over the nearby coastal areas. This is because their coldness induces pre-mature condensation in their on-shore winds near the cold ocean currents, reducing rainfall totals considerably such as the desertification effect of Kalahari and Namib.
- When a cold ocean current interacts with an on-shore dry wind, foggy conditions are usually caused especially at the Namibia coast.

Effects of cold ocean currents on human activities in Africa

a) The low rainfall in the cold environment leads to growth of grasslands and thicket which encourage tourism.

b) The low rainfall leads to grasslands which also encourage grazing.

c) Cold currents cause upwelling of water which offers conducive conditions for plankton growth and this favours fishing.

d) Formation of fog hinders navigation on water; land and air transport.

INFLUENCE OF CLIMATE ON AGRICULTURAL ACTIVITIES

Positive

1. **During the wet season , farmers engage in activities like:**
    - Planting due to adequate water for crop germination.
    - Weeding to remove the unwanted plants that compete with the crops.
    - Pruning to reduce excess branches from the crops for proper growth.
    - Spraying against pests and diseases that lower crop yields
    - Settled grazing due to abundance of water and pastures for feeding animals.
2. **During the dry season , farmers engage in activities like:**
    - Nomadic pastoralism due to absence of surface water and pasture for feeding animals
    - Ploughing the land to prepare it for the planting season.
    - Clearing land to prepare it for the planting season.
    - Digging of dams to store water.
    - Ripening of crops which favours harvesting.

Negative

1. **During the wet season , climate leads to:**
    - Rapid growth of weeds due to presence of surface water
    - Flooding which leads to loss of soil fertility
    - Excessive soil erosion which leads to loss of soil fertility
    - High spread of pests and diseases due to humid conditions
2. **During the dry season, climate leads to:**

- Inadequate water supply for animals leading to death.
- Water shortage also leads to aridity and desertification
- Shortage of pastures for animals
- Wind erosion which also leads to loss of soil fertility
- Shortage of food leading to famine and hunger.
- Movement of nomads over long distances in search of water and pastures.

VEGETATION IN AFRICA

Vegetation refers to the plant cover on the earth's surface. It is either natural or artificial vegetation (planted). The classification of natural vegetation greatly depends on climate and the dominant plant species in a given area *(plants, bushes, trees).*

The major types of natural vegetation in Africa include:

a) Equatorial vegetation (tropical rain forests)

b) Savanna vegetation

c) Desert and semi-desert vegetation

d) Mountain / Montane vegetation

e) Mediterranean vegetation

f) Temperate forests

g) Mangrove vegetation (along the coastal areas of west and East Africa)

Note: There is a close relationship between the climate of an area and the natural vegetation which exists in that area (i.e. Climatic conditions greatly determine the natural vegetation much as there are other factors which influence vegetation distribution)

A Sketch map showing the major natural vegetation types in Africa

EQUATORIAL VEGETATION (TROPICAL RAIN FORESTS/ TROPICAL EVERGREEN FORESTS)

These forests are located astride the equator extending approximately 10^0N and 10^0S of the equator, i.e. in the areas experiencing an equatorial type of climate such as the Congo basin (former Zaire), low lands of West Africa such as Sierra Leone, Ghana, Cameroon, and Gabon.

Characteristics of tropical rainforests

1. They are thick forests and with much luxuriant foliage/leaves *(leaves grow well and look very healthy)*. This is due to heavy rainfall and hot temperatures.
2. The majority of the trees have broad leaves to release excess water through transpiration.
3. The forests are heterogeneous in nature—the trees do not appear in pure stands of a single species but valuable tree species are widely scattered/ mixed up with other trees.
4. The forests have distinct layers called canopies – the top layer, middle layer, and bottom layer.
    - The top layer mainly consists of tall trees (giant trees) with buttress roots – generally over 46m in height.
    - The middle layer mainly consists of clinging plants that cling on strong trees, tree ferns, lianas (thick stemmed creepers) and trees between 19 and 34 m tall.
    - The bottom layer consists of mainly under growth of ferns, herbaceous plants (herbs), with trees of upto17m tall.
5. The forests are dominated by hard wood trees and yield valuable hardwood timber(such as mahogany, rose wood, iron wood, ebony)
6. The tall trees are characterized by buttress roots extending for several meters above the ground (up to 10m), which support them and the trees have long straight trunks ideal for timber.
7. The forests have little or no under growth because the dense canopies shut out sunlight from the lower layers/ floor of the forests.
8. There is a variety of climbers /lianas, creepers, parasitic and epiphytic plants.
9. Palm trees exist especially along shores or muddy coasts.
10. The trees are evergreen throughout the year because the areas receive rainfall throughout the year (shed at different times of the year—most trees retain their leaves for most of the year so that the forest appears evergreen).

11. The trees have a long gestation/ maturity period; most trees take over 60 years to mature (Mvule takes over 70 years).

Examples of tree species in the tropical rain forests are Mahogany, Iron wood, Red wood, Red heart, Green heart, Mvule, Ebony, Teak, African cedar among others.

Factors which have favoured the growth of the equatorial vegetation/ tropical rain forests

1. Heavy rainfall of over 1500mm per annum and which is well distributed throughout the year. There is a double maxima leading to luxuriant tree growth.
2. Hot temperatures all the year round, ranging from $25^0$to 29^0c, which also supports growth of tropical trees.
3. High humidity throughout the year (which helps to reduce evaporation rates) giving rise to tropical rainforests.
4. Low altitude. Tropical rainforests grow in areas with low altitude (of less than 2000m ASL) hence hot temperatures for proper growth of the trees.
5. Well drained fertile soils (high mineral content and water retention) which favour the growth of equatorial trees.
6. Supportive government policy of forest conservation by gazetting forests reserves and national parks, which also enables the growth of tropical rain forests.
7. Low population density which favours the growth of forests without interruption / encroachment.
8. Remoteness of the forest areas with under developed infrastructure/ not easily accessible, which also favours the growth of luxuriant forests.

Economic activities taking place in equatorial forest areas

1. Lumbering activities due to the existence of a variety of hardwood trees such as mahogany.
2. Charcoal burning and fuel wood collection due to the tropical hard wood trees.
3. Growing of perennial crops such as coffee, oil palm, sugarcane, due to the heavy rainfall associated with the equatorial vegetation.
4. Tourism activities due to the flora and fauna in the equatorial forests which attract tourists (some tropical rainforests are also gazette as national parks or national reserves).
5. Hunting of wild animals which stay in the thick forests (their habitat) for food and skins.
6. Fruit gathering due to fruits that grow within the forests.
7. Small-scale fishing from the rivers and streams that flow through the forests.
8. Rearing of animals due to the heavy rainfall associated with the forests leading to growth

of pastures.

9. Manufacturing industries due to the existence of raw materials such as timber from the forests.

Problems associated with tropical rain forests

1. Pests and diseases attacking man, his animals and crops.
2. It is difficult to establish and maintain transport routes in the densely forested areas/ remoteness due to absence of transport and communication lines.
3. Dense forests harbor dangerous wild animals which attack man and his animals.
4. The forests are dense and hence difficult to clear for settlement or cultivation.
5. The trees do not appear in pure stands, making the selection and removal of the valuable tree species difficult.
6. Long gestation period of the tropical hard wood trees, making the trees difficult to replace.
7. The forests act as hideouts for rebels and other criminals who destabilize peace.
8. The tropical rainforests contain many species of less present economic value.
9. Accidents occur during the exploitation of forests, leading to loss of life and property.
10. Population increase leading to disappearance of the tropical rain forests. etc

Possible solutions to the above problems

1) Use of population control measures to minimize deforestation.
2) Licensing workers to reduce over exploitation.
3) Ensure political stability in the forest regions through peace talks.
4) Spray using chemicals to control pests and diseases.
5) Construct better and rehabilitate transport routes connecting the forest areas to reduce remoteness.
6) Re-afforestation programs in areas where forests have been depleted/exhausted to increase forest cover.
7) Diversifying of exports such as by encouraging cash crop production to reduce over dependence on timber exports.
8) Use of protective gear to guard against accidents when feeling trees

SAVANNA VEGETATION

This vegetation type exists in areas receiving a savanna/ tropical continental type of climate.

Savanna lands are the widest spread (dominant) type of natural vegetation in Africa.

General characteristics of savanna vegetation

1. It is divided into savanna woodlands and savanna grasslands
2. Vegetation is mainly dominated by natural grasses (grassland) and this includes thatch grass, elephant grass, and spear grass.
3. There are scattered trees in the grasslands. These are scattered drought resistant trees amidst tall grasses like baobab trees, euphorbia and acacia. These store water for use during the dry season.
4. The trees are umbrella shaped and are mostly hard wood.
5. The trees are deciduous, that is, they shed off their leaves during the dry season.
6. During the dry season, most grass turns yellow brown and can easily burn in case of fire.
7. During the wet season, most grass grows very fast, forming a green cover over the earth's surface.
8. The tree roots are deep extending to tap the underground water (trees are deep rooted).
9. The trunks of the trees are deformed/ twisted and the bark usually thick to reduce moisture loss (and trunks are resistant to local fires).
10. The height of the grass depends on the amount of rainfall received. It is rich and tall towards the equator (about 2m), but short and thin towards the arid zones (dry savanna).
11. Near the desert margins where the dry season is longer, thorny bushes and shrubs exist.

Conditions favouring the growth of savanna vegetation

1. Moderate rainfall ranging between 750—1400mm per year, which is higher towards the equator and reduces northwards and southwards (towards the desert).
2. Seasonal nature of rainfall, with alternating wet and dry seasons, hence deciduous nature of trees.
3. Hot temperatures throughout the year (24^0 to 30^0c) favouring grasslands and woodlands.
4. Moderate temperature range of 6-12^0c annually.
5. High humidity during the rainy season and low humidity during the dry season.
6. Soils are of moderate to high fertility (especially lowlands) for the growth of tall grasses and scattered trees.
7. Human activities such as bush burning, deforestation, animal grazing and settlement which limits forest vegetation.

Savanna vegetation is categorized as follows:

(a) Savanna woodland vegetation

This is composed of a combination of trees forming a continuous canopy above the ground vegetation (which is characterized of grass mixed with shrubs and herbs). It covers areas of moderate rainfall (1000-1400mm p.a). The trees are 8 to 16m tall, mainly hardwood s, they are deciduous (shedding off their leaves during the dry season almost once). The trees include acacia, baobab, musizi, euphorbia and other drought resistant trees. In parts where there are trees, dense grass and shrubs do exist. *(I.e. there is a dense undergrowth in form of short trees, bushes, and grasses between taller trees)*

Savanna woodlands have more trees than grass.

(b) Savanna grassland (bushland vegetation)

This occupies drier environments and such areas receive rainfall for 3-5 months a year. The grassland consists of relatively taller grass *(such as elephant grass)* of about 1 metre in height particularly where there is little or no human interference. These areas receive moderate rainfall of about 750-1000mm per annum. Bushland vegetation is deciduous and dominated by thorny trees, Acacia and thin vegetation cover. It is mainly consists of bushland -thicket or thorny bush. The trees are scattered/ very rare and usually their root systems are very extensive so as to attract maximum amounts of moisture during the prolonged droughts.

Savanna grasslands have more grass with few scattered trees.

Note: Towards the desert / arid zones, the vegetation is called **dry savanna vegetation.** These areas receive rainfall of about 500mm, seasonal rainfall, temperatures of 30^0c and above, long drought season, poor farming methods like over stocking and over grazing, bush burning etc which have transformed the original natural vegetation.

(Thicket – an area with a lot of bushes and small trees growing very close together)

Economic activities taking place in the savanna vegetation areas

1. Livestock rearing due to the natural vegetation consisting of mainly grassland.
2. Lumbering from the savanna woodlands and the scattered trees.
3. Charcoal burning from the savanna woodlands and scattered trees.
4. Hunting of wild animals from the woodlands and grasslands.
5. Tourism activities since the savanna vegetation provides a natural habitat for many species of wildlife, which attract many tourists. (Some areas are gazetted as national parks or reserves)
6. Bee keeping in the savanna woodlands (apiculture).
7. Growing of seasonal crops (like maize, millet) since savanna vegetation is easy to clear.

8. Growth of industries due to agricultural and timber raw materials.

Problems associated with savanna lands

1. Widespread bush fires during the dry season, leading to soil erosion at the onset of rainfall.
2. Poaching of wildlife in the national parks and national reserves.
3. Over growth of weeds during the wet season.
4. Over grazing due to large numbers of livestock / shortage of pastures especially during the dry season.
5. etc

Solutions to the problems associated with savanna vegetation

1) use of chemicals to control pests and diseases
2) Construction of valley dams and underground tanks to store water for the dry season.
3) Establish ranches to act as demonstration farms for the livestock farmers.
4) Extension of veterinary services to reduce animal diseases.
5) Construction of better roads to increase accessibility.
6) Provision of soft loans to reduce capital shortage to develop the regions.
7) etc

DESERT AND SEMI-DESERT VEGETATION

The vegetation of the desert and semi-desert lands extends in many places from the borders with savanna lands deep into the desert.

The major areas with desert vegetation are the Sahara, Namib and Kalahari while the semi-desert vegetation occurs in the Sahel region.

Characteristics of desert and semi-desert vegetation

1. The vegetation consists of mainly thorny bushes, coarse grasses (and flowering herbs). The grass is very short, coarse and hard – rarely green.
2. Many plants have long/ deep roots which penetrate underground tapping/ in search of water.
3. Many plants have tiny thorny leaves which are often waxy or hairy to reduce the rate of transpiration. *Waxy (smooth and shiny-like)*
4. Some trees exist such as the cactus tree, acacia but short in height, with thick leaves to help store water during the long dry conditions.

5. Some plants have swollen trunks to help store water during the long dry season (*such as baobab*).

6. Many plants produce seeds which remain/ lie dormant for many years until a little rain comes and they germinate.

7. The vegetation is scanty and with a variety of plants. There is a small cover of vegetation (bush type), with much of the area being bare ground (either rocky or sandy).

8. Near to the wet areas of the desert known as oases, some green vegetation exists and palm trees are common.

Note: It is always very difficult to decide where savanna lands (rangelands) end and where the desert/ semi-desert begins i.e. there is no clear-cut line which divides them. (But perhaps the semi-desert / desert vegetation begins where a continuous vegetation cover becomes discontinuous – where bare patches of soil begin to appear and grow larger in area).

Conditions favouring the growth of desert and semi-desert vegetation

1. Very hot temperatures in the regions (above 30^0c) and a wide diurnal range of temperature, making the vegetation dominated by bushland and thicket.

2. Little and unreliable rainfall about 500 to 750 mm in the semi-desert and less than 250mm in the desert lands, (*leading to hard, coarse grasses and scattered trees).*

3. Long drought period / season leading to coarse and scanty vegetation.

4. Poor farming methods such as over stocking and over grazing which transform the original natural vegetation.

5. Infertile, rocky or sandy soils leading to short, scanty vegetation (soils with poor water/ moisture retention).

Economic activities taking place in the desert and semi-desert vegetation areas

1. Growing of drought resistant and quick maturing crops.

2. Irrigation farming since the areas are associated with low and unreliable rainfall.

3. Tourism activities since the desert vegetation (stunted vegetation) acts as a tourist attraction.

4. Nomadic pastoralism due to the scanty pastures for livestock, movement with animals looking for pasture.

5. Mining as an alternative land use.

6. Film industry and research studies due to the desert vegetation.

Problems facing people in utilizing arid and semi-arid vegetation areas

1. Long distances moved in search of pastures for the animals

2. Infertile soils due to soil erosion given the limited vegetation cover.
3. Shortage of labour and market due to the sparse population , hence limited economic activity.
4. Dust storms due to sand and bare ground causing airborne diseases.
5. Under developed infrastructure due to low population.
6. Poor quality pastures since they are coarse and hard.
7. Over grazing and death of animals due to shortage of pastures.

Solutions to the problems faced in utilizing desert vegetation

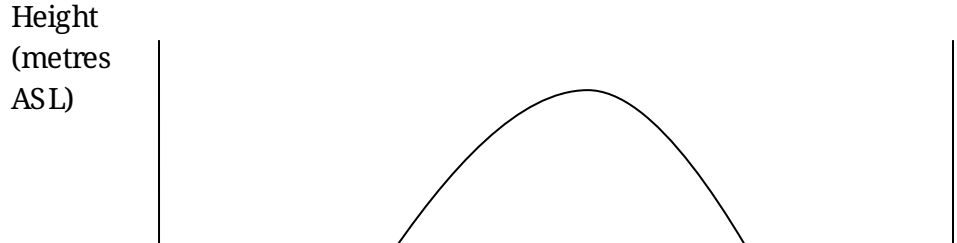
- Establishing ranching schemes to promote settled farming.
- Construction of permanent water points such as valley dams, tanks to encourage settled farming.
- Planting fast maturing trees to facilitate rainfall formation.
- Planting drought resistant trees that can survive in the extremely hot temperatures.
- Introducing irrigation farming to improve productivity.
- Mechanization where possible to minimize labour shortage.
- Enforcing environmental laws such as limiting overstocking and deforestation.
- Emphasize soil management strategies such as terracing, contour ploughing , use of ridges
- Encourage tourism to acquire revenue to develop social services.
- Etc

MONTANE / MOUNTAIN VEGETATION

This type of vegetation occurs in mountain / highlands. The vegetation types vary along the slopes of mountains and such vegetation types are a response to the amount of rainfall received, temperature change with increase in altitude, soils and human activities.

At the lower slopes there is savanna vegetation (including woodland and bushland). After this there are tropical rainforests lying upto 2500m. The temperate and bamboo forests follow lying at the height upto 3500m. Next, is the heath and moorland upto about 4000m, and above which is the snow and bare rocks.

Illustration of mountain vegetation



Snow and
bare rock

Heath and
moorland

Temperate and Bamboo
forests

Tropical rain forests

Savanna

_____ _____

(a) Savanna lands

This is found at the lowest level of the mountain and consists of dry grasses and shrubs grading upwards into savanna grasslands and woodlands.(it is partly due to man's interference by clearing tropical rainforests.

(b) Tropical rainforests

This occurs above the savanna vegetation and consists of a close cover of trees which are evergreen and luxuriant. Hardwood tree species exist. (In this zone, there is abundant rainfall of over 1500mm per annum and deep soils conducive for plant growth).

(c) Temperate and bamboo forests

At this level temperatures fall and the amount of rainfall. The temperate type of climate gives rise to temperate forests and bamboo. The forests are ever green with softwood species. The trees of temperate forests include podocarp, camphor, cedar etc. the bamboo vegetation also facilitates handcrafts, furniture, decorations etc. the vegetation becomes shorter as rainfall and temperature decrease.

(d) Mountain heath and moorland

At this level, the temperatures are very low and the rainfall reduces. The vegetation consists of mosses, lichens, ferns and shrubs which can withstand the cold temperatures.

The vegetation is also not continuous due to very low temperatures.

(e) Snow peaks and bare rock

Above 4000m above sea level, temperatures are extremely cold, hence existence of snow and bare rocks. No vegetation grows at this level. Tourism is the most important activity here due to the snow-capped peaks and associated features. The zone also has high potential for the development of the film industry and research.

Mosses—soft green or brown plant that grows in a layer on wet ground

Lichen—small soft plant that grows on surfaces such as trees and walls

Ferns—plant with leaves shaped like feathers and no flowers

Conditions for the growth of montane vegetation

1. Variation in rainfall distribution along the slopes / as one ascends up the mountain. (Also the heavier rainfall on the windward side and dry conditions on the leeward side).
2. Temperature differences. Temperatures decrease with increase in altitude (lapse rate). For example, lower temperatures favour temperate forests and bamboo vegetation.
3. Variation in soil characteristics / soil types along the mountain slopes, which favours different types of vegetation and activities.
4. Influence of human activities. Most of the population is settled on the lower slopes where more food crops can be grown and settlement reduces as one moves upwards a mountain. (Therefore more settlement and crop farming in the savanna lands – hence destroying the original vegetation.

Note:

1. **Economic activities in montane vegetation areas (*refer to montane climate)***
2. **Problems faced in utilizing montane vegetation and possible solutions (*refer to highlands)***

MEDITERRANEAN VEGETATION

This type of vegetation occurs in the extreme north of Africa (Algeria, Tunisia, morocco, and small parts of Libya), and the extreme south of Africa (Cape region).

Characteristics of Mediterranean vegetation

1. It is characterized by open ever green woodlands
2. There are a variety of tree species such as the cork oak, chest nut trees, green oak, juniper.

3. The trees have deep taproots (which enable them) to reach the water table during the dry season.
4. The trees have thick barks to reduce water loss.
5. There are trees with shinny waxy leaves which reduce transpiration (conserve the limited water supply).
6. Some plants have large fleshy bulbous roots which also store water.
7. The trees are cone-shaped.
8. Coniferous trees occupy the wetter areas of the Mediterranean lands.
9. In the drier areas, the vegetation consists of open, short patches of grasses (which are scrub-like).
10. There are many plants with a sweet smell (such as rosemary)
11. The Mediterranean tree stands/ woodlands have thorny plants co-existing with them).

Fleshy—covered with more than the usual amount of flesh (soft and thick)

Bulbous—big and round or shaped like an onion

Conditions favouring the growth of Mediterranean vegetation

1. Mild, wet winters. The rain comes in the winter months but these months are frequently too cold for much vegetation growth to take place.
2. Hot dry summers—temperatures are high and ideal for growth but there is little rain.
3. Fertile well drained soils (soils are alluvial and sedimentary).
4. Moderate amount of rainfall to support vegetation growth (coniferous forests)
5. Influence of human activities that support tree growing such as fruit growing.

Mild—warm and pleasant / warmer than usual for wintertime of the year

Economic activities carried out in Mediterranean vegetation areas

1. Cultivation of cereals (wheat, oats, barley) and fruits since the vegetation is easy to clear.
2. The vegetation supports livestock rearing such as sheep and goats.
3. The Mediterranean woodlands produce cork and other timber products like wood carvings
4. Tourism activities due to the Mediterranean woodlands and grasslands which attract tourists.

Highveld / temperate grassland

This type of vegetation occurs in the continental interiors of the temperate latitudes. It is located in the southern Transvaal and the orange free state of South Africa.

Characteristics

1. There are temperate grasslands and grasses grow to short or medium size of 1—2 metres
2. There are few scattered trees
3. Grasses wither in the cool dry winters
4. There are warm temperate forests in low altitude areas

Conditions favouring the growth of Highveld vegetation

1. High altitude favours the temperate grasslands
2. The moderate summer rainfall also favours temperate grasslands
3. Warm to hot summer temperatures and cool winter temperatures
4. High summer humidity and low humidity in winter
5. Intensive farming such as crop growing and livestock (sheep rearing) favouring the growth of temperate grasslands

Economic activities in the Highveld

1. Crop growing especially fruits (oranges and apples) since the grasslands are easy to clear
2. Animal rearing such as improved exotic breeds supported by the temperate grasslands
3. Small scale lumbering from the scattered trees
4. Industrialization due to the existence of raw materials such as timber and agricultural products.

MANGROVE VEGETATION

This type of vegetation occurs along the coastal areas of west and east Africa. It is also common along rivers like Niger and Congo.

Characteristics of mangrove vegetation

1. The trees are evergreen throughout the year
2. The trees are medium height usually less than 10m due to high damp coastal temperatures
3. The trees grow close together making the forests thick (and have fibrous roots and straight stems)

4. The trees have broad leaves and characterized by hardwoods
5. Some trees have twisted trunks
6. It also consists of palm tree species and papyrus

Conditions favouring the growth of mangrove vegetation

1. Very low altitude or at sea level
2. Presence of salty muddy clay soils
3. Hot coastal temperatures of over 20^0c
4. High humidity to ensure constant water supply
5. Poorly drained coastal soils that have stagnant water

Economic activities carried out in mangrove vegetation areas

1. Art and craft industry such as baskets and mats from papyrus
2. Hunting especially wild kobs and gazelles
3. Tourism due to many tourist attractions such as swamp vegetation
4. Growing of crops that survive in swampy conditions such as sugarcane, yams, rice , coconuts
5. Mining especially extracting sand and clay.
6. Research and study purposes especially geographical and biological research.

Factors influencing vegetation distribution in Africa

1. **Climate**

   This influences vegetation as follows:

   - Tropical rain forests grow in areas receiving heavy and reliable rainfall of over 1500mm per annum, which is well distributed throughout the year.
   - The rainfall amount in savanna lands varies from the areas near the tropical rain forests to the margins / fringes of the deserts from 1000mm to less than 500 mm; hence the variation of the savanna vegetation—woodlands, grasslands and dry bushland.
   - Desert and semi-desert vegetation is found in areas with low rainfall (of less than 250mm and less than 500mm) which is also unreliable. This explains the shrub and dry bush which are dominant.

2. **Altitude *(height above sea level)***

   As altitude changes, other characteristics also change especially temperatures and amount of rainfall alongside human activities, which in turn changes the vegetation.

   Tropical rain forests, mangrove forests and savanna vegetation grow in low altitude areas where as montane forests, heath and moorland grow in high altitude areas.

3. **Drainage**

   Equatorial forests and savanna vegetation grow in well-drained soils/ areas. However water logged areas (salty, swampy conditions) tend to promote the growth of mangrove forests and riverine trees.

4. **Edaphic factor/Nature of soils**

   Less luxuriant vegetation occurs on young soils unlike deep mature soils. The fertile-moisture retaining soils are conducive for the thick equatorial and mangrove vegetation. Soils with poor water / moisture retention such as sandy soils explain the occurrence of semi-desert and desert vegetation.

5. **Biotic factor**

   Some areas are infested with pests, which scare away settlement creating favourable conditions for the growth of dense vegetation or savanna woodlands—with tsetse flies. However, areas without pests attract settlement and hence easily cleared. Areas infested with locusts and armyworms have scanty vegetation because these pests destroy the existing vegetation.

6. **Relief**

   The nature of the landscape also affects vegetation zonation/ distribution. Areas of high relief rainfall with special reference to the windward side of mountains have effective vegetation growth. However, the leeward side of the mountains are dominated by grasslands due to lower/ unreliable rainfall

7. **Human activities**

   Large areas of forests have been cleared for timber and to create room for settlement and cultivation. Also large areas of savanna vegetation have been turned into scrub and thickets due to over stocking and over grazing, bush burning. Other human activities affecting vegetation distribution include road construction, mining, quarrying, and cultivation on steep slopes. However, some human activities like afforestation, reafforestation, effective irrigation in some parts, and other environmental conservation measures increase vegetation cover.

IMPORTANCE OF NATURAL VEGETATION

(Research)

FORESTRY IN AFRICA

A forest refers to a large tract of land covered extensively by trees. Forestry involves a scientific process of exploitation, plating, and conservation of forests.

In Africa, the most important forests are tropical rain forests (ever green forests) are found in the Zaire basin (Democratic Republic of Congo), Gabon, Ghana, Cameroon, Sierra Leone, Ivory Coast, Guinea, Nigeria, Central African Republic etc

There are also man-made (planted) forests in Africa such as in Swaziland.

Factors which have favoured the growth of tropical rainforests

1. Heavy rainfall of about 1500mm per annum enabling the growth of the trees. The rainfall is also well distributed throughout the year for steady water supply for tree growth.
2. Hot temperatures of about 20-30^{0}c which favours proper tree growth.
3. Deep and well drained fertile soils which support tree growth
4. Low altitude which also leads to hot temperatures that favour growth of forests.
5. Low population density which ensures continued tree growth without encroachment.
6. Supportive government policy of forest conservation such as setting up forest reserves.
7. Remoteness/ inaccessibility of some forest areas which also ensures continued growth of natural forests.
8. Low levels of technology which limits the rate of exploitation of the forests, hence continued growth.
9. etc

General importance of forests

1. **Provision of raw materials** for industries such as timber which is used in boat making, furniture making, paper industries.
2. **Provision of medicine** and herbs for certain diseases such as quinine extracted from cinchona tree; hence improving the health conditions.
3. **Forests provide food** in form of a variety of wild fruits and roots which are gathered such as ivory nuts, mangoes, guavas, oil palm, mushrooms and yams; hence improving health

conditions.

4. **Protection of water resources/ forests act as catchment areas for streams and rivers** such as Congo river in Congo forests. The canopies break the force of rain making it percolate slowly generating streams and rivers.

5. **Forests modify the climate** of the surrounding areas through evapo-transpiration, hence leading to formation of convectional rainfall. *(Many dense forests have the heaviest rainfall world over such as Congo River).*

6. Forests clean the environment by absorbing carbon dioxide and giving off oxygen; hence lessening the impact of global warming.

7. **Promote soil conservation** by controlling soil erosion since tree roots bind the soil particles together. The tree roots also allow rainwater to percolate into the soil.

8. **Forests act as a habitat for wild life,** which *include: elephants, buffalo, chimpanzees, monkeys, flamingos, falcons in tropical rain forests.* The forests in turn act as laboratory for research and educational studies.

9. **Promotion of the tourism sector** since many forest areas have been gazetted as national parks and wild life reserves; hence generating foreign exchange and provide market for the local products.

10. **Generates government revenue** through taxing the forest companies, workers and forest-related activities; and the revenue is invested in other sectors of the economy such as health and, education.

11. **Generates foreign exchange** through the exportation of forest products such as timber, sawn wood, and plywood. The foreign currency generated is used to pay foreign debts and import foreign goods.

12. **Provision of employment** opportunities to many people such as lumberjacks, forest guards, fire fighters, supervisors, transporters, industrial workers; hence increasing incomes/ improving their standards of living.

13. **Diversification of the economy** by acting as an alternative source of income for the respective countries instead of over depending on a few sectors like mining, agriculture.

14. Forests are a source of fuel in form of firewood and charcoal for domestic and other uses such as smoking fish.

15. **Forestry is an economic use of land where other activities are limited**. For example areas of little agricultural value – the steep slopes, thin soils, infertile stony or sandy soils, and water logged areas.

Negative effects / shortcomings of forests

1. **Occupation of land that would be used for other activities** such as settlement, industry and agriculture, yet many countries have a rapidly growing population.

2. **Harbor dangerous wild animals** which attack man , his animals and crops such as black mamba, cobras, python, chimpanzee, lions, and buffalo.

3. **Forests harbor dangerous pests and diseases** such as mosquitoes that threaten the people living near them, animals, and crops.

4. **Forests hinder development of transport and communication networks** since the forest vegetation grows rapidly and the heavy rainfall that destroys the road networks. *(For example the Trans-African highway has problems in DRC).*

5. Some forests act **as hiding places for rebels/ anti-government forces** and other criminals who destabilize peace.

6. Some forests have **few valuable/commercial tree species** and thus their exploitation is uneconomical.

7. **Industrial – related problems**. The development of sawmills, pulp and paper industries has caused pollution of the environment, due to the wastes and emitted gases.

8. Some forests act as **social and economic barriers** between people of the opposite sides.

FOREST EXPLOITATION IN AFRICA

Forest exploitation refers to the extraction of timber and other products from the forests for the benefit of a given area/ country.

Large-scale economic exploitation of forests in Africa is not yet well developed but it can be seen in a few countries such as Gabon, Democratic Republic of Congo, Ghana, Ivory Coast, Cameroon, Guinea, where tropical rain forests exist.

In Swaziland, there is major exploitation of man-made forests (coniferous)..

Most timber from the tropical rain forests is hardwood from species like mahogany, ebony, rose wood, green heart, iron wood, sapele, edinam, makore; while that from the temperate/ coniferous forests is softwood.

Problems facing the forest products exporting countries

1. Bulky nature of the forest products which limits transport to the export markets.

2. Competition from other forest products producing countries, hence price fluctuations on the world market.

3. Competition from alternative raw materials such as plastics and metals which also limits the market available.

4. Underdeveloped technology employed in exploitation, which limits the export volume.

5. Long maturity period of the tropical rain forest trees once cut (reduction in valuable tree

species) which makes the market difficult to sustain.

6. Over exploitation of the forests leading to exhaustion, which also limits the export volume/ threatens future timber supplies.
7. Long distance to markets abroad especially for the land locked countries, hence high transport costs.
8. Inaccessibility to valuable hardwood trees in the equatorial areas (and the high altitude softwood forests) which limits production for export.
9. High taxes by the government which increases the cost of production/ increases the export prices for timber products and thus marketing problems.

FORESTRY IN DEMOCRATIC REPUBLIC OF CONGO

In Africa, the largest tropical rain forests occupy parts of the (Congo) Zaire basin. Although the forests are not as luxuriant and extensive as those in the Amazon basin, it is one of the worlds thickest. The main tree species include**: Mahogany, Ebony, Iron wood, Rose wood, Mvule, African cedar, Iroko, Teak, Limba, Green heart**

The main forested areas are: Kasai area in the south, Equatuer, Bandundu, and Orientale provinces. The main lumbering forests are: **Ituri forests, Great Congo forests, pygmy forests, Stanley forest**. The Coastal region was the major production area at first but after exhaustion lumbering moved to the interior. The Simba forests have been replaced by Eucalyptus forests.

A sketch map of DRC showing the major forested areas

Problems/ factors limiting the exploitation of tropical rain forests in the Congo basin/ in Africa

physical

1. **The impure stands of the trees**, with the valuable species widely scattered and mixed up with less valuable trees, which makes selection, felling and removal of logs from the forest difficult.

2. **Some of the most densely forested areas are impenetrable** with many creepers and climbing plants; which limits accessibility to the valuable species/ which makes cutting and movement of logs difficult.

3. **Tropical hardwoods are bulky and too heavy** and thus difficult to be floated on rivers from the forests to processing centres.

4. **Most tropical trees have buttress roots** extending outwards from the base of the trunk, which also makes the process of felling difficult and time consuming.

5. **Long maturity period of tropical hardwood trees** (ranging from 60 to 100 years) hence not easily replaceable/ which hinders continued exploitation. *(This leads to quick depletion of forest species since the rate of cutting is far more than the rate of growth).*

6. **The tropical rain forests have hot humid weather throughout the year**(hot temperatures and very heavy rainfall), making the ground damp and impassable. *(These conditions also favour the breeding of mosquitoes causing malaria – which scares away forest workers).*

7. **The tropical rain forests harbor dangerous wild animals** for example lions, chimpanzees, cobras, black mambas, which scares away forest workers.

8. **Limited variety of commercial tree species in particular forests,** which limits exploitation in such forests.

<u>Human factors</u>

9. **underdeveloped transport in the forested areas (***such as poor roads and railways)* limiting exploitation and marketing. The roads are difficult to construct and maintain due to rapid re-growth of vegetation and very heavy rainfall.

   Besides some rivers/ streams are less navigable due to presence of waterfalls, rapids and floating vegetation and hence hard to use to float logs.

10. **Inadequate/limited capital** to invest in the forest sector such as to develop infrastructure, purchase modern machinery and set up processing factories; which limits production.

11. **Underdeveloped technology**/ Rudimentary tools used in the exploitation of forests in some areas such as handsaws, axes, and pangas, which are time consuming and wasteful.

12. **Shortage of labour both skilled and unskilled since** the densely forested areas are sparsely populated leading to low quality and quantity of timber.

13. **Political instability in many forested areas such as** Democratic Republic of Congo (DRC) , Central African Republic (CAR) which limits forest exploitation by scaring away workers and investors.

14. **Unfavorable government policy / limited government support** by giving priority to other sectors such as mining and agriculture. This limits the purchase of modern machinery and

carrying out research.

The government has also gazetted some forest areas for wild life conservation as national parks and reserves—hence limiting the area available for forests.

15. **Limited local market for tropical hardwood** due to location of the forests in sparsely populated areas/ remote areas.

16. Tropical hard woods compete with coniferous forests /softwoods which have a variety of uses and this leads to lower prices for tropical hardwood. (*Competition from softwood producing countries like Sweden, Norway, which limits the available market).*

17. **Limited research to improve the lumbering methods** and this leads to careless destruction of valuable tree species through charcoal burning and firewood collection**.**

18. **Many accidents occur** during the felling and transportation of timber, leading to death of workers.

19. **Over exploitation of forests** leading to exhaustion of some forests, hence limiting future supplies of timber/ making the forests less sustainable.

20. Competition from other sectors of the economy such as mining, industry and agriculture for land and government funding, which undermines forestry investment.

21. Population encroachment on forest areas due to rapid population increase, leading to reduced forest area.

22. Limited power supply to be used in the forestry industry such as saw mills hence limiting forest exploitation.

23. Hostile tribes like pygmies in DRC who mainly operate in forest areas and scare away exploiters of forests.

FORESTRY IN GABON

Gabon is one country located in the Equatorial region of Africa and its economy greatly depends on the exploitation of forests. Gabon is largely covered by dense tropical rain forests (equatorial forests).

The major tree species include: **Okoume (**used for making plywood**), Mahogany, Ebony, Kevazingo, Rose wood, Azobe, Ozigo, Iron wood, Kavaninga, and Green heart**.

The main lumbering areas include:

- **The coastal strip along the coast of the Atlantic ocean** running from cocoa Beech North of Libreville to Sette- cama in the south,
- **Interior lands along Ogooue (Ogowe) river, Owendo, Okonja, Moanda, Mekambo, Makokou, Koula - Moutou, and Kango**.

Note: Lumbering especially along the coastal strip is almost ended due to exhaustion of forests and today most lumbering takes place in the interior and along the Ogooue River.

A sketch map showing forest areas in Gabon

Factors which have favoured the development of forestry in Gabon

Physical

1. **Heavy rainfall** of over 1500mm and which is well distributed throughout the year favouring the growth of forest trees.
2. **Hot temperatures** of about 26^0c and above—which encourage the growth and maturity of the tree species.
3. **Presence of many valuable/commercial tree species** such as Okoume , mahogany, ebony, which have high demand/these provide valuable timber and thus encouraging exploitation.
4. **The sparse population/ low population density**—which favours continued existence of forests. (Vast/large areas of natural forests due to sparse population which encourages growth of forests and lumbering activities.
5. **Presence of rivers** like Ogowe/ Ogooue and its tributaries which have enabled the transportation of light logs *(using Tug-boats)* to factories at the coast and inland workshops.
6. **The relatively flat nature of the landscape** which facilitates the construction of transport routes such as road network and railway which connect lumbering centres to processing centres at the coast.
7. **The fairly fertile soils**—which have supported the growth of various tree species like Okoume, and Ebony; in turn facilitating lumbering.

Human

8. **Cheap supply of power in form of hydro-electricity** generated from the rivers which helps to run machines in the saw mills and other factories.
9. **Availability of large sums of capital for commercial exploitation of forests** such as to

purchase modern machinery, setting up processing facilities, and carrying out research. This is provided by government and large companies from Europe particularly France.

10. **The use of improved technology in the forest sector** such as using power driven saws for felling and trimming, and hauling using tractors for hauling logs.
11. **Availability of skilled and specialized labour** used in tree selection, felling, trimming, hauling and timber processing; leading to high quality output.
12. **Availability of cheap labour** provided by the local people to work in the forestry industry such as in tree felling, loading and unloading.
13. **Availability of improved transport network** such as the Trans—Gabon railway, and roads connecting to the processing centres/ which has increased accessibility to the forested areas.
14. **Availability of a large/ ready market** for timber and timber products in Gabon and foreign countries such as China, Japan, and the rest of Africa. China is the largest importer of Gabonese timber products today.
15. **Supportive government policy** such as allowing foreign companies in forest exploitation, constructing the railway lines connecting lumbering areas and sawmills at the coast.
16. **The development of various forest-based industries** including sawmills, plywood factories, furniture workshops and boat making factories which add value to forest output / which provide immediate market for wood.

Note: The forest products from Gabon include:

- Timber
- Furniture
- Tanning materials
- Plywood
- Logs
- etc

Importance of forestry to the economy of Gabon

(Research)

Problems facing the forestry industry in Gabon

1. **Over exploitation of forests** due to increasing demand for timber and improved technology, leading to exhaustion of forests near the coast. Presently exploitation is further inland and the revenue from forestry has been declining.

2. **Underdeveloped transport routes to the interior** making some forest areas inaccessible. It is also hard to maintain roads and railway due heavy rainfall.

3. **Long maturity period of the hardwood trees** such as Mahogany, Ebony, taking over 60 years to mature and this limits sustainable forest exploitation.

4. **The trees are heavy and bulky** which makes it difficult to cut and transport on water.

5. **The heterogeneous nature of trees species**/ the trees occur in impure stands, scattered and mixed up with other currently useless species which makes selection and removal of valuable species difficult.

6. **Buttress roots extending outwards from the trunk of the trees,** making tree cutting difficult.

7. **Accidents occur** during the felling of trees, leading to destruction of equipment and loss of lives of the workers**.**

8. **The forests harbor dangerous wild animals** such as cobra snakes, black mamba snakes which scare away workers in the forestry sector, hence limiting effective exploitation.

9. **Pests and diseases** which affect the trees and reduce the quality of timber.

10. **Poor methods of exploitation in some parts of the forests / low level of technology** such as pangas, axes, hand saws; which limits the quality and quantity of timber.

11. **Competition from other forest product exporters** mainly West African countries like Ghana, Cameroon, and Nigeria; which limits the available market.

12. Price fluctuations on the world market which leads to unstable incomes.

13. Profit repatriation by foreign – owned companies from Europe which limits the rate of re-investment in forestry

Problems resulting from forest exploitation

1. Exhaustion/ depletion of forests due to over cutting of trees, hence limiting sustainable exploitation.

2. The over exploitation of forest resources/ forest vegetation leads to reduction in evapo-transpiration, hence reduced amount of rainfall.

3. Pollution of the environment such as water bodies by logs and wastes from timber industries

4. The concentration of forestry activities has led to the neglect of other activities such as agricultural sector, which undermines the development process.

5. Severe soil erosion due to the removal of forest cover leaving land bare, hence reduced soil productivity.

6. Overdependence on timber exports which are subject to price fluctuations and thus

leading to fluctuations in foreign exchange earnings.

7. Results into urban-related problems such as high crime rate, congestion and unemployment, which are costly to solve.

Steps being taken to solve the above problems

1. Exploitation of forests further inland due to exhaustion of forests near the coast.
2. Re-afforestation programmes in areas where forests have been depleted/exhausted to increase forest cover.
3. Growing fast growing / maturing trees such as eucalyptus which have a gestation period of 12--15 years.
4. Diversifying of exports by the government and encouraging cash crop production like cocoa, coffee, ground nuts , rice to reduce over dependence on timber exports.
5. The government also emphasizes mineral exploitation such as uranium, manganese, and iron ore, to reduce over dependence on timber exports.
6. Construction and rehabilitation of roads and railway lines to increase accessibility to forest/ lumbering areas.
7. Use of protective gear to guard against accidents when feeling trees
8. Spraying with chemicals to control pests and diseases.
9. Carrying out market research to widen the external market for timber and timber products.
10. Attracting foreign investors with enough capital and better technology.

FORESTRY IN GHANA

Ghana is also a major lumbering country (and ranks second among west African timber exporters). Timber is the second foreign exchange earner after cocoa. The main tree species in Ghana include: makore, utile, edinam, mansonia, wawa, fuavea, ebony, mahogany among others.

Forest exploitation in Ghana is done using both local and modern methods. After cutting the logs are hauled by tractors or logging arch to the nearest road and railway, and moved to saw mills. The major sawmills are located at Sekondi, Accra, Tema, and Takoradi. More than half of Ghana's timber is shipped for export in log form and exported through Takoradi port. Other products from forestry include plywood, veneers, furniture etc

A sketchmap showing the major forest areas , saw mills, and transport routes in Ghana

Factors which have favoured forestry in Ghana

Physical

1. The presence of extensive forestlands of hardwood species, due to the sparse population/ which encourages exploitation.
2. Presence of valuable / commercial tree species such as makore, mansonia, ebony
3. Heavy rainfall in the south west region and which is well distributed throughout the year favouring growth of forest fires
4. Hot temperatures of over 20^0c favouring the growth of forest trees.
5. Fairly fertile soils in the southwest region such as alluvial soils along the coast favouring growth of trees.
6. Relatively flat landscape which facilitates the construction of transport and communication routes.
7. Presence of rivers and tributaries which facilitates the transportation of light logs from the interior to the coastal sawills.
8. The rivers are also used to generate hydro-electric power for running machines in the saw mills.

Human

9. Availability of adequate capital provided by the government and large companies to invest in the forestry sector.
10. Modern/ Improved technology which facilitates felling of trees, transporting of logs and processing of timber.
11. Presence of cheap and abundant labour provided by the local people and skilled labour especially from foreign countries to work in the forestry sector.
12. Presence of a large/ wide market, both local and foreign for timber and timber products

13. Supportive government policy towards the forestry sector by providing necessary capital and controlling forested areas, licensing large companies, encouraging research.

14. Etc

Note: The problems facing forestry in Ghana are similar to those of Gabon

Steps taken to solve the problems

1. Afforestation and reafforestation to increase area under forest cover.
2. Market research to widen the market for timber.
3. Training of more manpower to provide the required skilled labour to work in the forestry industry.
4. Attraction of both local and foreign investors to increase capital investment in the forestry sector such as in processing.
5. Construction of more road and railway routes to access forested areas and ease transportation of timber.
6. Mechanization where possible to minimize the problem of labour shortage (such as use of power driven saws).
7. Constructing of platforms to enable cutting of trees with buttress roots.
8. Spraying with chemicals to control pests and diseases.
9. Etc

FORESTRY IN SWAZILAND

Swaziland is a small country found in southern Africa. Most of the forests are man-made / artificial coniferous forests which have been planted since the 1940s. Many years ago, Swaziland had many great forests which were unfortunately greatly destroyed for fuel and to create more farmland. Over grazing and heavy rainfall of the Drakensburg caused severe soil erosion.

However, since the 1940s much reafforestation and afforestation has taken place. There are now vast/ large coniferous forests in the hilly and mountainous region.

The major forested areas include:

a) Mondi peak (formerly Piggs peak forest)—north west of Swaziland covering about 32,000ha

b) Sappi Usutu (formerly Great Usutu forest)—further south near Mbabane exceeding

40,000ha

c) Shiselweni (formerly Nhlangano forest)—in the south west (which is the most recent)

The country has carefully planned a rotational system of afforestation to ensure that timber is maintained to support the economy. The forests mainly consist of pines, and to some extent eucalyptus

Sketch map showing the major forests of Swaziland

Advantages of planted forests in Swaziland

1. They grow and mature very fast, taking about 15 years.
2. The trees occur in pure stands, which makes their exploitation easy.
3. They produce softwood, which has a variety of uses.
4. They lead to effective use of land that otherwise would be lying idle due to being rugged.
5. The forests conserve the environment by controlling soil erosion and protecting water catchment areas.
6. They yield valuable softwood products which have a variety of uses, hence generating revenue.
7. They modify the climate through evapo-transpiration which favours rainfall formation.
8. The planted forests are used for research and educational purposes.

Factors/ conditions which have favoured forestry in Swaziland

<u>Physical</u>

1. Moderate to heavy rainfall ranging from 1000mm to 2200mm (tropical to sub-tropical climate) for quick maturing of softwood forests.
2. Cool temperatures due to high altitude of over 1000m above sea level which favours the growth of softwood species.
3. The rugged nature of the landscape which cannot support settlement and agriculture, hence occupied by forests.
4. The need to preserve hilly slopes from erosion and protect the water catchment areas by planting trees.
5. Presence of valuable/ commercial tree species which grow and mature very fast such as pines favouring sustainable forest exploitation.
6. The short maturity period of the softwood tree species such as pines; which encourages steady supply.

Human

7. Availability of adequate/ large sums of capital provided by Swaziland government, local and foreign investors *(the Common Wealth Development Corporation)* to invest in the forestry industry such as financing the pulp mill at Bunya on R. Busuto.
8. Availability of skilled labour to work in the forestry industry such as careful felling trees, timber processing.
9. Availability of a ready/ large local and foreign market for the forest products such as pulp , plywood
10. Availability of developed / improved transport network by road, railway and water linking to processing centres and markets.
11. Advanced/ Improved technology used in the forestry sector such as in felling trees and processing (mechanical saws, tractors to haul logs which increases the quality of output.
12. Supportive / positive government policy of afforestation and reafforestation to ensure sustainable forest utilization.
13. Availability of ready supply of hydro-electric power to process timber into various products.

The forest products from Swaziland include:

- Softwood timber
- Sawn wood
- Tanning materials
- Plywood

- Telegraph poles and telephone poles
- Pulp
- Paper
- Furniture
- Etc

Problems facing the forestry sector in Swaziland

1. Fire outbreaks destroying forests and thus limiting production.
2. Pests and diseases which destroy the trees and thus limit production.
3. Poor transport network due to the rugged nature of the landscape which limits accessibility to some forested areas.
4. Competition for market with other soft wood producing countries which limits export earnings.
5. Over dependence on foreign companies which repatriate the profits to their home countries.
6. Limited capital to invest in the forestry industry such as purchasing modern equipment and funding research, and this limits production.
7. Long distance to markets abroad, which increases the costs of production.
8. Shortage of skilled labour due to the small population in most areas which limits production.
9. Price fluctuations on the world market which discourages production/ leads to fluctuation in export earnings.
10. Competition from alternative raw materials in the industrialized countries such as plastics, metals; which reduces the demand for timber.
11. Rapid population increase which creates more land for settlement and farming, hence encroachment on forestland.

Steps being taken to solve the above problems

1. Carrying out regular patrols to control fire outbreaks
2. Spraying with chemicals to control pests and diseases
3. Constructing more roads and railway lines to improve accessibility to forest areas and markets/ to ease transportation of timber.
4. Training of local manpower to increase skilled labour supply for forestry.

5. Encouraging mechanization to reduce the problem of labour shortage.
6. Attracting more foreign investors with the required capital to invest such as the common wealth countries.
7. Carrying out market research to widen the export market for softwood.

Note: Other African countries with planted forests include: Nigeria, Gabon, Ethiopia, south Africa, Botswana, Lesotho, etc

FOREST DESTRUCTION/ DEPLETION IN AFRICA

CAUSES OF FOREST DEPLETION IN AFRICA

Note: Deforestation refers to the gradual removal / destruction of forested lands to be converted into other uses.

There is continued decline of forest cover in Africa greatly by clearance for settlement, agriculture or during exploitation process. The causes of forest depletion in Africa include:

1. ***Rapid population growth*** which increases the need for settlement and cultivation land thereby encroaching on the forests.
2. ***Increasing demand for timber and timber products*** such as making plywood, furniture, construction, and boat building. There is also increasing demand for fuel wood and charcoal for smoking fish, curing tobacco, and domestic cooking.
3. ***Careless felling of trees/ poor harvesting methods*** leading to a lot of wastage such as non-selective cutting of trees for timber, charcoal, firewood including even the young trees and the general failure to replace the cut down trees.
4. ***Low level of power and energy development in Africa/ Limited alternative sources of energy*** in many areas, making people to resort to cutting down forests for charcoal and firewood.
5. ***Poor farming methods*** like shifting cultivation (practiced by the Bemba in Northern Zambia and Azande in the Congo basin forests) and bush burning for cultivation which ends up destroying the forests.
6. ***Increasing need for infrastructural development and industrialization*** (such as transport networks, schools, hospitals, recreation centres, industries) leading to the destruction of large forest areas to expand the sites. The process requires large quantities of poles, and timber.
7. ***Mining activities*** in forest areas leading to deforestation especially with use of open cast mining such as copper mining in the Shaba province of Congo and the Zambian copper belt.
8. ***Forest/wild fires***, especially during the dry season caused by careless smokers, hunters,

or cultivators (*intentionally or accidentally*) hence destroying large areas of forests.

9. ***Damage by wild animals*** such as elephants especially where many of such animals exist in a given area, destroying large forest area.

10. ***Pests and diseases which*** destroy the forest trees such as aphids destroying soft wood trees. There is also cutting down of trees in order to control the pests and diseases.

11. ***Political instabilities in many parts of Africa*** for example in parts of the Congo basin forests, Nigeria, Togo, Ivory coast, Liberia leading to bombing or cutting down of forests suspected to be hiding places for rebels.

12. ***Government negligence to conserve forest resources*** such as poor law enforcement against forest encroachers. There is also inadequate funding and high degree of corruption in the forest departments, leading to continued destruction of the forests.

13. ***Prolonged drought conditions*** such as in the northern parts of the Congo forests which are turning into woodlands. There is a general reduction in the amount of rainfall received.

Effects of forest depletion in Africa

1. ***Brings changes in local climate*** by bringing low and unreliable/ irregular rainfall due to reduced evapo-transpiration. This leads to desert conditions.

2. ****Greenhouse effect/ global warming***—increased carbon dioxide is released into the atmosphere causing a rise in temperatures.

3. ***Decline in agricultural productivity*** which leads to famine. Because most Africans are farmers they have been affected by increasing poverty due to declining crop and animal performance.

4. ***Decrease in timber products*** because of the long regeneration/ maturity period and less reforestation, hence negatively affecting the survival of Africa on timber produce.

5. ***Causes severe lack of fuel resources*** especially in the areas of increasing population such as southern Ghana and southern Nigeria, thus low standard of living.

6. ***Destruction of habitats for wild animals and birds*** for example monkeys, buffalo, elephants, eagles, cranes—causing extinction/ limiting the tourist potentials in various parts of Africa.

7. ***Leads to severe/ massive soil erosion*** because the ground is left bare. This leads to low crop yields due to reduce soil fertility and poverty due to reduced earnings from farming.

8. ***Results into mass wasting (landslides)*** especially highland areas due to clearing of forests *(which would bind soil particles together)* – leading to loss of life and property.

9. ***Leads to increased incidence of economic refugees*** such as due to drought and famine which make people to migrate to other areas that are productive.

10. ***Increases government expenditure*** such as through reforestation and afforestation

programs, the need to import food to feed the affected people; hence straining the government budget.

11. ***Leads to loss of foreign exchange*** due to importation of forest products to meet domestic demand because of forest depletion.

12. ***Decline in water table*** since forests would act as bases/ catchment areas for streams and rivers, and reducing run off.

MEASURES TO CONSERVE FORESTS IN AFRICA

1. ***Afforestation*** which involves planting of trees in areas which have not been previously covered with forests. It mostly involves panting quick maturing trees especially conifers—like pines.

2. ***Re-afforestation*** which involves replacing the trees which have been cut down. The new trees may or may not be the same as those removed. Conifers are preferred due to shorter gestation period and more useful such as pines, Cyprus.

3. ***Encouraging improved tree cutting practices*** such as selective cutting of trees making the forests to stand a better chance of regeneration and survival. It involves removing only the mature trees or the diseased ones.

4. ***Forest protection*** against pests or fires. This involves a close system of inspection using towers and patrols around the forests.

5. ***Reducing wastage at the industrial level*** i.e. effective use of the trees cut down to reduce the cutting of more trees. For example the re-use of waste paper in the production of newsprint and other inferior paper products. Encouraging the use of plastics rather than paper for packaging purposes.

6. ***Gazetting areas into forest reserves*** to reduce on the encroachment of people on forests for other activities like farming. There should also be eviction of encroachers by the forest department.

7. ***Encouraging use of alternative sources of energy*** such as biogas, agricultural wastes (coffee husks, sugarcane husks, banana peelings) , use of HEP, etc to reduce forest destruction.

8. ***Use of energy saving stoves***—which reduce on the demand for fire wood and charcoal, and hence reduction in forest destruction.

9. ***Training of more forest workers*** such as forest rangers, supervisors and other people to manage the forests in various departments, hence reducing destruction.

10. ***Government legislation/ putting up laws*** against forest encroachment, regulating the issuing of licenses /permits to reduce careless cutting down of trees.

11. ***Emphasizing Population control measures*** such as family planning—to reduce the cutting down of forests for settlement and cultivation in various areas.

12. ***Ensuring peace and stability*** in all areas such as through peace talks to reduce forest destruction.

13. ***Education/sensitization of the masses*** about the value of forests and the need to conserve nature.

14. ***Encouraging agro-forestry*** which combines demands of agriculture and elements of forestry.

POPULATION IN AFRICA

Population refers to the number of people living in a given area in a given period of time.

POPULATION GROWTH IN AFRICA

Population growth refers to the change in the number of people in a given period of time. It is a result of natural population growth and net migration. Africa's population has been rapidly increasing over the years.

Causes of high/rapid population growth in Africa

1. **High fertility rates among women**, in that, many women produce more children in their child bearing years about 5-7 children per woman.

2. **Low/ reduced death rate** due to improved medical services, causing high population growth rate.

3. **Low levels of education**. Many people do not know the value of small families and there is also a large number of school drop-outs leading to a long child-bearing period for girls.

4. **Strong belief in traditions and culture (value attached to many children).** Many people see children as a source of wealth and prestige or insurance in old age, a source of labour in the field, dowry from girls – hence producing more children.

5. **Early marriages**, which lead to a longer child bearing period / which increases teenage pregnancies causing a high population growth rate.

6. **The practice of polygamy in many societies**, which promotes competition among the women who produce more children to please the husbands – leading to a high population growth rate.

7. **Low levels of income/high level of poverty**. Most people do not have productive economic activities to occupy them and resort to producing many children—causing a high population growth rate. Many people cannot afford the family planning control devices such as pills.

8. **Low status of women in Africa**. Many women are poor and many are full-time house wives lacking viable economic roles outside home, which causes high birth rates.

9. **Strong influence of religion**. Some religions work against population control measures like family planning using contraceptives. Still some religions encourage polygamy, leading rapid population growth.

10. **Limited use of family planning methods**. There is limited access to birth control devices due to limited sensitization and being expensive; thus the high population growth rate.

11. **Improved nutritional levels** involving a more balanced diet in many areas and steady food supply which encourages large families.

12. **Increasing rate of immigration**. Many people enter Africa from various parts of the world such as Asia, Europe due to many factors such as need for jobs, wars, displacements etc. This leads to high population growth rate.

Advantages of rapid population growth/ large population size

1. Results into increase in market potential/demand for goods and services. The size of the market increases as the population increases.

2. Increases/ widens the labourforce of the country. More people participate in productive activities which promotes the production process. Labour also becomes cheap for investors.

3. Increases pressure on government to undertake development programmes. The government is encouraged to provide social and economic infrastructure like roads, schools, and hospitals to cater for the increasing population.

4. Promotes investment/setting up of more production units to cater for the requirements of the population. This in turn increases national income.

5. Promotes hard work, innovation and invention among the population. The individuals work harder in order to survive in the competitive environment such as through agricultural modernization—intensive farming methods

6. Encourages exploitation of idle resources such as minerals, water resources, in order to sustain the increasing population.

7. Reduces the social overhead costs per person in the country. It becomes more economically cheaper to provide social services since they are utilized by many

8. Increases the tax potential, thus increasing government revenue for social services like providing health and education services. (There are more people and activities to tax).

9. Encourages urbanization / development of towns as population increases. Population concentrates in some areas leading to the setting up of transport networks, medical

facilities, banking facilities; hence growth of towns.

Population as a liability/ Negative effects

1. It increases the dependence burden. The many unproductive people/ children depend on the small productive population. There is high expenditure on education, food, housing, medical care, clothing etc

2. Rapid population growth limits the rate of investment due to reduced savings and thus limiting the development process.

3. Strains the government budget / leads to increase in government expenditure on social services such as education, medical care, and this results into dependence on external donations and loans.

4. Increases income inequality by widening the economic gap between the rich and the poor. People with resources become richer while those without become poorer.

5. Increases the level of unemployment; because the rate at which the population increases is higher than the rate of job creation and this leads to increased poverty.

6. Results into over exploitation of natural resources like minerals, water resources. This leads to quick exhaustion and denies the future generations a chance to use them.

7. It increases rural-urban migration. Many people move to the urban areas in search for jobs and hence associated problems like increased crime, social unrest among others.

8. It leads to increase in cost of living due to high competition for the scarce resources / goods and services. *(It results into inflation- increase in general price level)*

9. Leads to excessive reliance/ dependence on foreign aid in form of food, medical services, grants, loans in order to support the rapidly growing population.

10. Leads to increase in brain drain since many qualified professionals /highly skilled workers continue leaving the country to look for better opportunities in other countries.

11. It increases pressure on land/ shortage of land for settlement and cultivation. This leads to land conflicts and land fragmentation.

12. Leads to reduced productivity of land. The over-use of land for cultivation leads to a decline in its productive value and thus lower yields.

13. Leads to the growth of slums and associated problems like high crime rate, poor housing/ accommodation, poor health facilities, alcoholism, drug abuse.

14. Leads to overcrowding which results into easy spread of diseases. There is crowding of social public places such as schools, health centres.

15. Results into environmental degradation such as through pollution, deforestation and swamp reclamation.

Measures to control population growth

1. Encouraging education of children especially girls. For example through universal primary education to allow children to spend more years in school to reduce early marriages.
2. Sensitization / education of the public about the dangers of large families.
3. Promoting the status of women/women emancipation such as by recognizing their rights, providing them with public responsibilities to reduce birth rates.
4. Encouraging the use of methods of family planning such as pills, condoms, to reduce unnecessary pregnancies.
5. Setting/enforcing laws regarding childcare and responsibility over children. For example every parent must educate his/her children and provide essentials of life—such that parents produce children they are able to look after.
6. Marriage age legislation/ raising the marriage age to reduce early marriages (raising the age of consent / fight early marriages).
7. Emphasize sex education in schools to reduce teenage pregnancies and improve the quality of life among school-going children.
8. Encourage income—generating activities such as modern farming, industry to reduce early marriages and fertility rates.
9. Controlling immigration rate using laws and a tight clearing system, which limit on the number of immigrants.

POPULATION DISTRIBUTION IN AFRICA

Population distribution refers to the way people are spread over the earth's surface in a given area.

In Africa the densely populated areas include: the Nile valley, Nile delta, Niger delta, Maghreb of north west Africa, Johannesburg industrial areas of south Africa, west African coastal region etc

The moderately populated regions are:

- Ethiopian highlands
- Margins of the densely populated areas

The sparsely populated areas include:

- Sahara desert areas
- Namib and Kalahari desert areas
- Hot-wet forests such as the Congo basin areas

A sketch map of Africa showing population distribution

Factors influencing population distribution in Africa

Physical factors

1. Climate

    - Areas which receive heavy and reliable rainfall favour arable farming/ crop growing hence attracting dense population settlement such as south east Nigeria.

    - Areas which receive little and unreliable rainfall discourage arable farming leading to sparse population such as Kalahari desert areas.

2. Soils

    - Areas with deep / well drained fertile soils promote crop growing hence attracting dense population such as the fertile alluvial soils South West and South East Nigeria

    - Areas with thin /infertile soils limit crop growing hence leading to low population density such as the Sahel region.

3. Altitude

    - Areas of low altitude have warm conditions which attract dense settlement such as the coastal regions.

    - Areas of high altitude have cool temperatures which attract low population settlement.

4. Relief

    - Areas with rugged relief/ mountainous landscape are inaccessible/ limit construction and mechanization leading to low population settlement.

- Areas of fairly/ relatively flat relief/ gentle slopes encourage construction and mechanization hence leading to dense settlement.

5. Vegetation

- Areas with thick vegetation cover hinder transport routes/ are not easy to clear, and thus have low population settlement such as the Congo basin with tropical rain forests.
- Areas of savanna grasslands are easy to clear for various activities such as farming and thus have dense settlement.

6. Biotic factors

- Areas infested with diseases causing vectors such as tsetse flies and mosquitoes etc scare away people leading to sparse population settlement such as the areas occupied by the Fulani in Nigeria.
- Areas free from disease causing vectors attract more people to settle and carry out various activities leading to dense settlement.

7. Drainage

- Water logged areas/ Poorly drained areas/ areas with periodic flooding have low or moderate population density due to problems in cultivation and construction.
- Well-drained areas encourage construction and growing of various crops leading to dense population.

Human factors

8. Economic activities such as industry

- Areas with more economic activities such as mining, industry provide more job /employment opportunities and hence attract dense settlement.
- Areas with limited economic activities such as mining and industry have less chances of employment, hence have low population density.

9. Transport and communication routes

- Areas with developed transport system/ along main roads and coastal areas are easily accessible/ promote economic activities, hence attracting dense settlement.
- Areas which are remote / far from main roads are less accessible / limit economic activities leading to sparse population settlement.

10. Duration of settlement/ ancient political kingdoms

- Areas of ancient kingdoms / with long history of settlement with strong kingdoms attract more opportunities upto today such as trade, jobs; and thus dense settlement.

- Areas of relatively recent settlement/ which had weak kingdoms have fewer opportunities for development leading to sparse population settlement.

11. Government policy

- Government policy of forest conservation (such as national parks, forest reserves) discourages settlement in such areas leading to sparse population.
- Government policy of resettlement schemes, infrastructural development attract settlement leading to moderate to dense settlement.

12. Political climate/situation

- Areas which are politically stable encourage productive activities such as trade, farming leading to dense settlement.
- Areas which are insecure/ unstable discourage productive activities like trade leading to sparse settlement.

Population density

Population density refers to average number of people per unit area/ per square kilometer.

$$\text{Population density} = \frac{\text{Total population}}{\text{Total land area}}$$

General causes of high population density

1. Heavy and reliable rainfall encourages crop farming / arable farming hence attracting dense population.
2. Presence of deep and well-drained soils / fertile alluvial soils which promote crop growing such as rice and maize growing leading to dense settlement.
3. Low altitude leading to warm conditions which attract dense settlement.
4. Relatively flat/ gently sloping landscape which encourages mechanization / construction leading to dense population.
5. Presence of abundant mineral resources which offer more chances of jobs and thus dense population.
6. Presence of many economic activities such as developed industry and trade which offer more jobs leading to dense population settlement.
7. Efficient / developed transport by road and railway which increase accessibility/ promote various activities leading to dense settlement.
8. Long duration of settlement in some regions with strong ancient kingdoms such as Yoruba

land in Nigeria.

9. Favourable government policy of building industries, power stations and other infrastructure in some areas attracts dense population there.

10. Political stability which favours various economic activities such as trade leading to dense settlement.

Advantages of high population density

(Refer back)

Disadvantages/problems of high population density

(Refer back)

Possible solutions to the problems of high population density

1. Use of birth control practices such as family planning devices to cut down the rate of population growth.

2. Development of more natural resources such as soils, power, forests to support the bigger numbers of people.

3. Carry out agricultural modernization/ Ensure higher foods supplies /yields from the existing farmland such as through agricultural research, farm technology, swamp reclamation , desert irrigation etc

4. Encourage out-migration to relieve population pressure. However today fewer governments are prepared to accept immigrants.

5. Discourage rural-urban migration through putting up more social services in the rural areas such as modern schools, high grade hospitals.

6. Strengthen education to change/ decampaign traditional attitudes to reduce birthrates.

7. Exportation of labour force such as expatriates to other countries (export skilled labour which is unemployed).

8. Address poverty so as to improve income and general standards of living. This involves encouraging organizations with anti-poverty programs.

9. Population control policies / legislations should be undertaken to limit large families such as one child per family policy, marriage age legislation.

10. Encourage celibacy and late marriages among the people to reduce population increase.

11. Women empowerment programs should be undertaken such as enhancing their education, political and economic opportunities.

12. Set up resettlement schemes for the people from the densely populated areas.

13. Encourage vertical expansion of cities/ towns using storreyed buildings/ sky scrapers.

14. Land reform policy like land consolidation to control land fragmentation.

General causes of low population density

1. Little and unreliable rainfall which discourages crop farming and thus leading to low population density.
2. Presence of infertile soils which discourage crop growing, hence limiting settlement such as desert sandy soils.
3. High altitude leading to cold temperatures which discourages settlement.
4. Rugged relief/ mountainous landscape/ steep slopes which limit construction/ mechanization and hence limiting settlement.
5. Thick forest vegetation such as dense tropical forests of Gabon and Congo basin which hinders transport routes and contrition, hence discouraging settlement.
6. Presence of Pests/ disease causing vectors such as mosquitoes in dense forests which scare away people.
7. Low-lying areas subject to flooding/ water logged areas / poor drainage like swampy areas which limit farming/ threaten life and thus discourage population settlement.
8. Limited economic activities especially industry and farming, hence few job opportunities which limits settlement.
9. Remoteness with no developed transport routes which limits economic activities/ limits accessibility, thus causing sparse settlement.
10. Political instability which discourages construction of permanent structures/ discourages productive activities such as farming, industry.
11. Government policy of forest conservation through creating forest reserves, national parks and game reserves—hence discouraging population settlement.

Advantages of low population density

1. Resources are not over exploited and this benefits the future generations.
2. There is a high potential for employment opportunities.
3. Reduced/ low government expenditure especially on social services due to limited number of people.
4. The standards of living are easily increased by increasing resource exploitation.
5. There are less social costs such as pollution.
6. Political and social instabilities are minimized.

Disadvantages of low population density

1. There is underutilization of resources such as mineral, forest, water due to the small population. Many resources remain idle.
2. Results into limited market size for goods and services due to small population. This undermines agricultural and industrial development.
3. Leads to labour shortages due to the small population, hence low level of a development and industrial development.
4. It is / uneconomical / very expensive for the government to develop infrastructure and provide social services like education, medical services.
5. Results into low tax revenue and this undermines the provision of social services.
6. Encourages rural-urban migration leading to under development of rural areas. Many people leave the remote rural areas attracted to the few urban areas.
7. Leads to regional imbalance in development due to uneven population distribution. People tend to stay in the most favoured areas and hence infrastructure is also concentrated in those areas.
8. Results into dependence on other countries , in terms of labour supply, market, capital, and the supply of essential goods.

Possible solutions to the problems of low population density

1. Provide incentives for large families such as free housing, free education.
2. Encourage people to settle in less populated areas such as by developing the necessary infrastructure.
3. Encourage foreign investors to finance development projects in various regions.
4. Gazette under populated areas into national parks and reserves as an alternative landuse.
5. Ensure political stability through peace talks and better international relationship with the neighboring countries.
6. Controlled/ restrictive immigration policy with a view of developing the sparsely populated areas *(immigrants directed such areas. However, they should possess the required skills).*

POPULATION DISTRIBUTION IN NIGERIA

Nigeria is located in West Africa and is the most populated country in Africa with about 140 million people.

The population distribution is described as below:

a) The densely populated regions include:

- Southern parts along the coast
- Delta states , Ibo land
- Urban centres and the extreme north

The highly populated towns are : Lagos, Benin, Port Harcourt, Abuja.

b) The moderately populated regions are located in the northern part particularly around Sokoto, Kano and Katsina. Also the margins of the densely populated regions.

c) The lowly/ sparsely populated regions include: the middle belt, desert margins of the north and the forested areas of the south.

A sketch map showing population distribution in Nigeria

POPULATION DISTRIBUTION IN EGYPT

Egypt is located in North Africa. The most densely populated areas are the Nile valley and delta areas plus some of the large oases. The highly populated towns include Alexandria, Cairo, Aswan, Suez, Al Mahallah el Kubra, and Ismailiya. Throughout the rest of the country, there is a very sparse population.

A sketch map showing population distribution in Egypt

Causes of a high population density in the Nile valley and delta areas

1. Fertile alluvial soils of the Nile valley and delta which promote crop farming such as cotton and rice growing , hence attracting settlement.
2. Abundant/ Reliable water supply from the Nile River for irrigation, domestic and industrial use.
3. Gently sloping landscape which encourages construction of facilities / mechanization, hence attracting dense settlement.
4. Efficient / developed transport by road and railway which increases accessibility.
5. Presence of many economic activities such as industry which provide employment to many people.
6. Favourable government policy of building of industries and power stations in the area , hence attracting many people to provide labour.
7. Long duration of settlement and historical development in the regions such as early civilizations in Alexandria and Cairo.
8. etc

Causes of low population density in other parts of Egypt

1. Little and unreliable rainfall of less than 250mm per annum discouraging crop farming.
2. Limited/ no water supply since it is only limited to the desert oases, hence limiting economic activities and settlement.
3. Presence of infertile soils which are sandy and rocky limiting crop farming and thus discouraging settlement.
4. Remoteness / underdeveloped transport routes which limit accessibility and thus discourage settlement.
5. Limited economic activities such as industry and thus limited job opportunities.
6. Absence or limited mineral resources hence limited job opportunities leading to sparse population settlement.

MULTI-PURPOSE RIVER DEVELOPMENT PROJECTS IN AFRICA

A multi- purpose project refers to a project set up to serve many purposes.

They are examples of how rivers can be fully used to yield benefits for that particular country. It involves a large and a man-made lake (reservoir) behind it.

Examples of multi-purpose river development projects in Africa

1) Aswan high dam on river Nile in Egypt.
2) The Volta river project(Akasombo dam)
3) Kainji dam on the Niger river in Nigeria
4) Kariba dam between Zambia and Zimbabwe on Zambezi river
5) Cabora Bassa dam on the Zambezi river (Mozambique)
6) The Orange River scheme in South Africa.
7) Lesotho highlands water project.
8) Inga dam on Congo River in DRC.

A sketch map showing the major river dam projects in Africa.

KAINJI DAM PROJECT (NIGER DAM PROJECT)

The project is located in the northwestern part of Nigeria across the Niger River at Kainji. The project was opened in 1969 and lies in a remote, thinly populated and very poor part of Nigeria. The dam is 66 meters high and 55 meters long and has produced a manmade lake behind it, known as Lake Kainji (130 km long and 1300 km^2).

A Sketch map showing the location of Kainji dam project.

Objectives of the Kainji dam project

- To generate hydroelectric power (the main aim of building the dam)
- To control flooding of the Niger River.
- To promote irrigation, there by facilitating farming to increase food production.
- To promote the industrial sector

Factors which have favoured the establishment of Kainji dam project.

1. Presence of the Niger River with large volumes of water that is, sufficient water supply to generate power.
2. Presence of waterfalls – fast flow of water to turn the turbines and generate power.
3. Presence of a narrow gorge at the place (that is a narrow gap as the Niger River flows through a low line of plateau)—which increases the water pressure behind the dam to generate power.
4. Presence of a hard basement rock which offered a firm foundation for the construction the dam.
5. The sparse population of the area, allowing cheap /easy compensation of the displaced people.
6. The need to provide hydroelectric power for domestic and industrial use. There was a large market for Hydroelectricity.
7. Presence of adequate/ large sums of capital for the construction of the project from the government of Nigeria World Bank, Italy, Britain, USA, Netherlands.
8. Presence of skilled labour used in the construction of the dam project especially from abroad and cheap labor provided by nationals.
9. High level of technology used in the setting up of the project such as the use of large turbines.
10. Supportive government policy to develop the multipurpose scheme to promote economic growth such as by mobilizing funds for the construction.

Contribution of the Kainji dam project to the development of Nigeria

1. Generated hydroelectric power for the country. The dam produces over half of the country's generation capacity. This increases the standards of living.
2. Promotion of the industrial sector due to the production of the hydroelectric power to run machines in industries.
3. The dam has controlled flooding of the Niger River since the huge reservoir holds back a lot of water; hence better living conditions.
4. Generation of employment opportunities for the people of Nigeria such as at the dam and the industrial sector—hence improving the standards of living.
5. Fishing has been promoted by Lake Kainji behind the dam, hence increasing people's incomes.
6. The depth of the water in the reservoir has increased navigation (water transport) yet the depth of the water in the Niger up – river from Lake Kainji has also increased navigation, thus promoting trade activities.
7. The project has promoted irrigation farming such as the **large sugar plantation at Bacita**, rice and vegetables.
8. Promoting of the tourism sector since the project is a tourist attraction, and hence generating valuable foreign exchange.
9. Promotion of urbanization/ development of urban centres such as Yelwa is a flourishing inland port, this is associated with various facilities like banks, schools.

Problems created by the establishment of the Kainji dam project

1. Displacement of people by the formation of the Kainji lake reservoir. Many villages were submerged and over 60,000 people were displaced, hence costly relocation.
2. High costs of resettling and rehabilitating the displaced people – hence increased government expenditure.
3. Loss of grazing land since a large area was drained by Lake Kainji.
4. Has led to a decline in farming activities in some parts of the Niger delta, due to loss of silt which used to maintain fertility since it now settles in the lake and yet currents are eroding its edge.
5. A large/vast would be cultivation land has been drowned by the reservoir lake, thus limiting farming activities.
6. Pollution of the environment due to development of the industries, which in reduces the quality of life.
7. Stagnation of water leads to easy spread of pests and diseases that is, waterborne

diseases like bilharzia.

8. Salination causing infertile soils especially in the Niger delta zone and this limits farming activities.
9. The reservoir lake is a barrier to easy communication in the area, since it occupies a large area.

Steps being taken to solve the above problems

1. Resettling of the displaced people in other areas, with careful planning.
2. Spraying to control pests and diseases
3. Treating of wastes before disposal / emphasizing environmental laws to regulate careless dumping.
4. Regular dredging to remove the silt from the water body.
5. Introducing of a ferry, lake steamers to ease communication around the lake formed.
6. Carrying out afforestation in other areas, to compensate for the destroyed vegetation.
7. Enforcing of law and order to control urban-related problems such as the high crime rate.

ASWAN HIGH DAM PROJECT

This project is found in Egypt near the country's border with Sudan, and it is one of the biggest multipurpose river projects in Africa, together with Lake Nasser-the man-made lake behind the dam.

There are two dams at Aswan and both have power stations. The first dam was constructed in 1902 at Aswan to control flooding. But this was totally inadequate and in 1956 a new dam was set up south of Aswan called the **Aswan high dam**. This Aswan high dam was completed in 1970. It is 3600m long and 111m high. At the top its 40m wide and its base is almost a km wide yet it is a very strong dam. Behind the dam is Lake Nasser (500kmlong nearly 150km into Sudan).

A sketch map showing the location of the Aswan high dam in Egypt

Aims for the construction of the Aswan high dam

- To control flooding along the Nile river (therefore when the original dam was inadequate anew high dam was put up)
- To provide water for irrigation (since Egypt is largely a desert country).
- To generate hydroelectric power
- To create a reservoir for water supply for domestic and industrial use.
- To improve navigation by increasing the water level of the Nile river.
- To create employment for the people.

Note: The dam was financed Russian capital and expertise, and Egyptian labour was used in great part.

Factors that favoured the establishment of the Aswan high dam project

1. Presence of the Nile River with large volumes of water that is, sufficient water supply to generate power.
2. Seasonal floods of River Nile which made it necessary to control floods by constructing a dam.
3. Presence of waterfalls – fast flow of water to turn the turbines for generating HEP power. (strong head of water/ force to turn the turbines)
4. Presence of a narrow gorge which offered a suitable site for river damming (and also which increases the water pressure behind the dam to generate power).
5. Presence of a hard basement rock, which offered a firm foundation for the construction the dam.
6. Little and unreliable rainfall, which necessitated storing of water for use during the dry season.
7. Vast/ large tracts of land to accommodate the reservoir / man-made lake upstream. This is due to the sparse population of the area, allowing cheap /easy compensation of the displaced people.
8. The need to provide hydroelectric power for domestic and industrial use. There was a large market for Hydroelectricity.
9. Presence of adequate capital/large sums of capital for the construction of the project from the government of Nigeria World Bank, Italy, Britain, USA, Netherlands.

10. Presence of skilled and unskilled/ cheap labour used in the construction of the dam project especially from abroad and cheap labor provided mainly by nationals.

11. High level of technology / modern technology used in the setting up of the project such as the use of large turbines to produce quality work.

12. Supportive government policy to develop the multipurpose scheme to promote economic growth such as by mobilizing funds for the construction and encouraging investors.

Benefits of the Aswan high dam

1. The dam has controlled flooding of the Nile in Egypt which used to threaten life in the lower Nile, since the reservoir holds back a lot of water.

2. The project has promoted irrigation, hence increasing cultivable land. This has increased food and cash crop production such as rice, cotton, maize, orchards, and wheat.

3. Generation of hydroelectric power which has promoted a number of activities such as trade/service sector.

4. Promotion of industrial development due to hydroelectric power and water supply such as the aluminium plant, grain mills.

5. Generation of employment of opportunities to the people of the region such as at the dam, farm lands and industry—hence increasing incomes.

6. Promotion of tourism development and hence valuable foreign exchange. The dam, lake Nasser and irrigated farmlands are all tourist attractions.

7. Promotion of urbanization such as as Luxor, Qena, and Cairo, and associated infrastructural development such as banks, commercial buildings and roads.

8. Fishing has been developed due to presence of Lake Nasser behind the dam, hence increasing incomes of the people.

9. Lake Nasser and the dam also supply water for domestic and industrial use.

10. Diversification of the economy by developing many economic activities in the region such as farming, trade, industries—hence increasing national income.

Problems caused by the Aswan high dam project

1. Has led to the displacement of many people who used to live in the area now covered by Lake Nasser.

2. The project has led to expensive resettling of the displaced people (the nomads). They had to be given double hectorage of their former land/ increasing government expenditure.

3. Pollution of the environment due to many industries setup in the region.

4. It has led to a decline in farming in some parts of the upper Nile delta region, due to the

loss of silt which used to maintain soil fertility as it now settles out in Lake Nasser.

5. Decline in fishing industry at the coast due to loss of silt deposits now settling out in the lake, which would support plankton growth.
6. Due to loss of water through evaporation and irrigation, the fresh water in the soil near the mouth is being replaced by salty/saline sea water and some rendered unfit for cultivation.
7. The extension of perennial irrigation is resulting into spread of diseases especially bilharzia due stagnant water.
8. The delta has reduced in size as it is not receiving significant silt deposits, and hence currents are eroding the edge of the delta, and this limits coastal/delta activities such as tourism.
9. Resulted into urban related problems in the developed towns such as high crime rate, traffic congestion.
10. The manmade lake is a barrier to communication in the area around it, since it occupies a large area.

Steps being taken to solve the above problems

1. Resettling /re-locating of the displaced people in other areas.
2. Getting loans to rehabilitate the displaced people.
3. Treating of industrial wastes before disposal. The government is also putting up environmental laws to regulate pollution.
4. Applying of artificial fertilizers/ manure to increase soil fertility in the delta zone.
5. Regular spraying with chemicals to control water borne diseases.
6. Improving medical services to control water borne diseases.
7. De-silting of the lake and canals through regular dredging.
8. Introducing of a ferry, lake steamers to ease communication around the lake formed.
9. Strengthening policies and law enforcement to control urban related problems.

THE AKASOMBO DAM PROJECT (VOLTA RIVER PROJECT)

The Akasombo dam project was opened in 1966 and was built across the Volta River where the river passes through a narrow gorge. The project was funded by Ghana, USA, Britain, and the World Bank.

Objectives of the Akasombo dam project

- To generate hydro electric power especially for smelting aluminium and other industries.

- To control and regulate the flow of river Volta which was characterized by seasonal fluctuations in the water level.
- To improve inland water transport / navigation.
- To improve agriculture through providing water for irrigation.
- To store water for industrial and domestic use.
- To create a lake behind the dam to act as a fishing ground and a tourist attraction.

Note: The Volta dam complex includes a power dam and station on the west bank and a flood control dam and saddle dam on the east bank. Lake Volta is the man-made lake which has developed behind the dam.

Ghana has also developed other dams such as:

- Bui dam project on black Volta
- Kpong dam near Akasombo dam

A sketch map showing the Akasombo / Volta river project

Factors which have favoured the establishment of the Akasombo dam project

1. The seasonal fluctuation of river Volta and therefore the need to regulate the flow such as controlling of flooding during the rainy season.
2. There was need to generate hydro electric power , to replace thermal which was consuming a lot of foreign exchange through oil imports.
3. Presence of a narrow gorge (deep narrow valley) for easy construction of the dam.
4. Presence of river falls—hence fast flow of water to turn turbines.
5. Presence of a hard basement rock which provided a firm foundation for the construction of the dam.

6. Presence of a large /extensive land behind the hills due to sparse population, which could accommodate a large reservoir behind the dam.
7. Presence of adequate capital to establish the dam provided by Ghana, World Bank, Britain.
8. High level of technology employed to put up the project, provided by especially Britain and USA; such as use of large turbines to generate power.
9. Presence of skilled labour used in the construction and maintenance of the dam project.
10. Presence of a large market for power in the area and surrounding countries, which encouraged investment in the dam project.

Problems resulting from the establishment of the Akasombo dam project

1. Resulted into displacement of many people from their land, since many villages were drowned by the lake water.
2. Led to high costs of resettling the displaced people and disruption of families.
3. Pollution of the environment due to development of many industries such Aluminium smelting at Tema.
4. Resulted Loss of agricultural land since large areas were covered by the lake water.
5. The lake formed effectively divided Ghana into two providing a barrier to east-west communication.
6. Loss of biodiversity – vegetation and animal life when setting up the dam project.
7. Decrease in the delta size due reduced silt deposits and this negatively affects costal/ delta activities such as tourism.
8. Resulted into urban related problems such as slum growth, unemployment and high crime rate.
9. Siltation of the lake which necessitates constant dredging which is expensive.
10. Reduction in farming activities in the delta region due to loss of fertile alluvial soils.
11. Stagnation of water leading to water leading to water borne diseases such as bilharzia.

KARIBA DAM PROJECT

The Kariba dam is located on the Zambia—Zimbabwe border on River Zambezi.

Factors which favoured the establishment of the Kariba dam project

1. Presence of a permanent river with waterfalls, hence fast flow of water to turn the turbines.
2. High volume of water in River Zambezi, hence sufficient water supply for generating power.
3. Presence of a narrow gorge called Kariba—that enabled construction of the dam.

4. Existence of a hard basement rock which provided a firm foundation for constructing the dam

5. The need to control the seasonal floods of the river, by regulating the volume of water.

6. Presence of a wide valley to act as the reservoir for water behind the dam.

7. Availability of adequate capital provided by governments of Zambia and Zimbabwe to set/construct the dam.

8. Presence of skilled labour that helped in the construction of the dam.

9. Increased demand for hydro-electric power, due to growing population, the Zambian copper belt and the mines in Zimbabwe—encouraging dam construction.

10. High level of technology employed when constructing the dam such as the use of large turbines.

11. Supportive government policy towards the construction of the dam in order to develop the region such as by providing power.

12. Presence of raw materials such as rocks used in the construction of the dam.

13. Extensive/large tracts of land available for the dam project/ to be occupied by the reservoir due to low population density

Benefits of the construction of the Kariba dam

1. Provision of adequate power for the mining industry in Zambia and Zimbabwe.

2. Provision of hydro electric power for industrial and domestic use.

3. Rive r flooding has been controlled, since a lot of water is held back in the reservoir lake.

4. It has provided employment opportunities to the people of the area, thus increasing incomes/ improving the standards of living.

5. Generation of government revenue through taxation of the dam project and workers' incomes, and hence supporting the provision of social services.

6. Has led to the growth of towns /urbanization such as Lusaka and Harare—with associated facilities.

7. It has led to the reduction in the price of energy, since it reduced the importation of coal for power.

8. Promotion of the tourism sector, since the project is a tourist attraction. This generates foreign exchange to Zambia and Zimbabwe.

9. Promoted international cooperation between the governments of Zambia and Zimbabwe, hence more trade contacts.

10. Lake Kariba created behind the dam has promoted fishing activities, thus increased incomes of the people.
11. Lake Kariba is also used for navigation / water transport—hence promoting trade activities.
12. Promoted environmental protection / reduced deforestation for fuel energy, since more people use hydro electricity.

Problems which resulted from the construction of the Kariba dam

1. Displacement of many people from their land, since a large area was downed by the lake (due to back ponding of water to form Lake Kariba).
2. Led to high costs of resettling of the displaced people and disruption of families.
3. Pollution of the environment due to the development of the industries in the area.
4. Led to loss of agricultural land since a large area/the valley was covered by the lake.
5. Resulted in urban-related problems such as high crime rate, prostitution, and slum growth.
6. Lake Kariba is a habitat for mosquitoes and snails which are disease causing vectors /pests.
7. Loss of biodiversity – vegetation and animal life when setting up the dam project.
8. High costs of establishment of the project, hence diverting resources from other sectors.
9. The lake is a barrier to communication between Zambia and Zimbabwe, since it occupies a large area.
10. Loss of fertile soils behind the dam/in the man-made lake, hence limiting agricultural production.

CABORA BASSA DAM

Cabora Bassa dam is located on river Zambezi in Mozambique, and it was completed in 1975.

A sketch map showing the location of the Kariba dam and the Cabora Bassa dam

Factors which favoured the establishment of Cabora Bassa dam

1. Presence of the Zambezi River with waterfalls/ fast flowing water to turn turbines.
2. The need to control the fluctuations of the Zambezi River such as controlling floods during the rainy season.
3. Presence of a narrow gorge (called Quebrabasa) for easy construction of the dam.
4. Existence of a hard basement rock which offered a firm foundation for constructing the dam.
5. Low population density of the area, hence availing extensive/ large tract of land to be occupied by the reservoir lake.
6. Availability of adequate capital to set up the dam provided by the governments of Portugal and South Africa.
7. Presence of a large market for hydro-electric power in South Africa and Mozambique (local and foreign)—hence encouraging the dam project.
8. High level of technology employed when setting up the dam such as the engineering technology to fix the turbines.
9. Presence of skilled labour to construct and maintain the dam project.
10. Presence of raw materials such as rocks used in the construction of the dam.
11. Supportive/favourable government policy to promote economic growth by the multi-purpose scheme such as by financing the project.

Contribution of the Cabora Bassa scheme to the development of Mozambique

1. Provision of power for industrial and domestic use—hence better standards of living.
2. Hydro electricity is exported to South Africa, hence earning Mozambique foreign exchange.
3. Facilitated development of inland water transport by the man-made lake behind the dam—hence enabling trade activities.
4. Provision of water for irrigation, hence supporting crops like cotton, sugar cane, rice among others.
5. The man-made lake behind the dam has also promoted fishing activities, hence increasing people's incomes.
6. The tourism sector has been promoted, since the dam project (dam and lake) is a tourist attraction—hence generating foreign exchange.

7. Provided employment opportunities to the people of the area, hence increasing incomes/ improving the stanrdardsm of living.
8. Floods of River Zambezi have been controlled by the reservoir created which holds back a lot of water.
9. It has promoted development of towns such as Tete, Blantyre, Moatize and Zobue—with associated facilities.
10. Generation of government revenue through taxation of various activities supported by the dam project, and the revenue supports the provision of social services.

AGRICULTURE IN AFRICA

Nomadic pastoralism

This is a subsistence form of animal rearing where a herder moves from place to place with his animals in search for pastures and looking for water.

The nomads are categorized into two:

(a) **True nomads**—these move constantly with their animals, with no specific direction.

(b) **Transhumants**—these migrate seasonally between wet season and dry season for pastures and water (transhumance).

Nomadic pastoralism is the simplest form of animal rearing and it is common in areas of low and unreliable rainfall-where arable farming (crop growing) is very difficult unless irrigation is employed. Grazing lands are distributed in grasslands and shrub lands for example the dry grasslands of East and West Africa.

Examples of nomadic pastoralists in Africa include:

- The Fulani of northern Nigeria and other parts of the Sahel region
- The Dinka and Nuer of Southern Sudan
- The Berbers and Tuaregs of the Sahara desert
- Somalis of Somalia
- Nama-Herero of Kalahari desert(Namibia)
- Hottentots of south Africa,(and the southern part of Namibia)

Characteristics of nomadic pastoralism

1) Pastoralists occupy areas of low and unreliable rainfall, which also experience a marked dry season (such as Sahara desert, Sahel zone, and Kalahari deserts).

2) The most valued animals are generally cattle although sheep and goats are also common. Camels are kept in the drier areas because they can live for several days without water.

3) Traditional breeds of animals are kept which are usually of low quality and have low milk yields and poor quality meat.

4) The livestock depend on natural pastures which comprise of hard and fibrous grasses and this is attributed to the prolonged drought conditions.

5) The animals are mainly kept for subsistence and the herders do not want to sell off any surplus animal, but this is gradually changing.

6) Large numbers of animals are kept since the pastoralists regard livestock as a source of wealth and prestige /status in society; for performance of social functions (such as paying bride wealth). Large herds offer security against drought, famine or even disease outbreak (some can survive).

7) There is over stocking resulting into over grazing.

8) Grazing is mostly communal, that is, there is no individual ownership of land – land belongs to the whole community.

9) A large amount of grazing land is required to support to support a single herd due to low carrying capacity (number of animals per unit area) of the grazing area.

10) No permanent settlements are put up by herders, since they are ever on the move in search of good pastures and water supply; which movement can be constant or in form of transhumance.

11) No modern scientific methods of animal rearing are used such as spraying against pests and diseases, controlled grazing. Seasonal movements are necessary to ensure sufficient water supply and pasture for animals. During the dry season the pastoralists move near water sources (like rivers, wells).

12) Burning of grass is common during the dry season in anticipation of fresh pastures at the onset of the wet season.

Note: Nomadism is usually confined to the drier regions due to the fear of being interfered with by cultivators who prefer well watered areas for cultivation.

Factors favouring nomadic pastoralism in Africa

(Reasons for persistence of nomadic pastoralism in parts of Africa)

1. **Little and unreliable rainfall** of about 250-750mm per year making cultivation of crops very difficult (unless irrigation is practiced) and hence nomadic pastoralism being the best alternative land use.

2. **The prolonged drought** (lasting beyond 9 months in the Sahel) leading to shortage of water and pasture, necessitating movement from pace to place.

3. **The short savanna grassland/vegetation**, which is open and favours movement of pastoralists with their animals such as the savanna zones of the Fulani in West Africa.

4. **Infertile soils** which limit arable farming (growing of crops), making pastoralism the best alternative land use. For example the sandy soils in Botswana and Namibia.

5. **Generally flat relief/landscape**; which allows easy movement of pastoralists and their animals over a large area.

6. **Sparse population of the pastoral areas** and thus leaving a large area for the pastoralists to keep on shifting from one place to another.

7. **Traditional/cultural conservatism of the pastoral communities** that is, looking at nomadism as the best way of life and considering themselves as cattle keepers and are not willing to change their practices away from pastoralism.

8. **Dependence on animals as a Source of livelihood** such as milk, meat and blood; clothing in form of hides and skins; and transport (in case of camels). According to them, therefore their animals can provide almost everything they need.

9. **The value attached to the animals**. The pastoralists look at the animals as a basic payment of bride price, a symbol of wealth, prestige and power in society; making them to keep large herds of livestock regardless of the quality.

10. **Hostility of the nomads**. The pastoralists resist any foreigners into their areas because they take it as a threat their land and animals. This has also forced many people and organizations to ignore the pastoral areas.

11. **The land tenure system – communal ownership of land in the pastoral areas,** which encourages their free/constant movement from place to place with their animals.

12. **Remoteness/Poorly developed transport network**, which has prevented them from entering the main stream economy such as selling off animals.

13. **Government neglect of the pastoral areas.** The governments have not done much to change the ways of life such as by setting up the required infrastructure.

THE FULANI OF WEST AFRICA

The Fulani are the largest group of cattle keepers in Africa and they are pastoralists scattered over a wide area in the Sahel and savanna zones of West Africa from Senegal to Lake Chad. They are therefore transhumants occupying countries of Senegal, Mauritania, Mali, Niger, Northern Nigeria, Chad, and parts of Cameroon.

Note: Sahel zone is the region of transition between the desert and savanna lands, where rainfall is unreliable and periodic drought is common.

The life of the Fulani is adapted to natural conditions of the area characterized by a long dry

season. The dry season is brought by the dry north easterly Harmattan winds. Rainfall here averages between 750—900mm per annum. In the southern Sahel, rainfall is lower being 500-700mm per annum .The areas also have poor/infertile soils, scarce surface water ,poor pastures and generally remote.

The climate supports scattered palms, butter trees, shrubs and during the rainy season short grass. In the southern Sahel the region is more open, trees smaller and vegetation is dominated by thorny bushes. The Fulani are basically cattle keepers although often sheep and goats as well. However in very arid areas, camels are also reared since they can go for several days without water such as in towards (such as in Sahara desert).

The Fulani are called **transhumants** because of their seasonal movements between latitudes. Therefore transhumance refers to the seasonal movement of pastoralists and their animals (between latitudes) in search of grazing pasture and water.

A sketch map showing the Fulani lands of West Africa

Activities of the Fulani during the dry season

During the dry season they move southwards in order to look for water and pasture. At the onset of the dry season they move together but as the dry season progresses, they divide into small groups grazing far and wide. In the grazing they move closer to the watering points and often send out scouts to find out where there is grass and water before they can advance. The movement southwards takes place during the dry season because the tsetse flies will also have migrated further southwards.

[*However they do not move up to the coastal belt due to the threat of tsetse flies and too much rainfall which conditions are not favourable for cattle keeping].*

Also during the dry season roots and berries are collected. Wells are dug and cattle spread out in search for water. Burning grass is common as they move in anticipation/expectation of fresh pastures at the on-set of the wet season.

Activities of the Fulani during the wet season

During the wet season, when the rains start coming, the Fulani start moving northwards. When rains come, the condition of the cattle improves. The Fulani move northwards following

the movement of tsetse flies northwards, yet the conditions in the north are at least better. They may also seek tsetse fly free uplands of Futa Jalon, Bauchi and Cameroon highlands.

Note: In their movements, the Fulani try as much as possible to avoid contacts with diseased herds. The Fulani do not undertake any crop cultivation and they engage in barter trade with cultivators.

* ***Traditional importance of pastoralism to the Fulani people***

a) Source of food i.e. milk, meat and blood

b) Bridal wealth and prestige , that is, for social and cultural functions

c) Stock of wealth and creates a sense of responsibility

d) Hides and skins used for shelter e.g. clothing and beddings, footwear etc

e) Transport to some extent in case of camels in the Sahel region.

***contributions of the Fulani to the economy of Nigeria**

1) Provide food especially in form of milk and meat.

2) When the animals are sold , they get income to improve welfare

3) Offer employment such as in demonstration ranches

4) Provision of raw materials for industries such as hides and skins

5) Lead to agricultural diversification

6) Foreign exchange is earned when the cattle products are exported.

7) Utilization of the would be idle land due to little rainfall and poor infertile soils.

Problems facing nomadic pastoralists in Africa

1. Shortage of water for their animals due to low and unreliable rainfall. The areas receive rainfall of less than 500mm per annum, hence losing a large number of animals.

2. The pastures are naturally poor in quality, dominated by coarse grasses which are less nutritious and cannot support large of herds of cattle and therefore even poor products are realized.

3. Diseases which affect the animals such as Nagana (trypanosomiasis) caused by tsetse flies, leading to loss of large numbers of animals/ poor quality animals.

4. Periodic invasion of locusts in the pastoral areas, which cause wide spread destruction of pastures which would support animals/which leads to loss of livestock.

5. The native breeds of cattle reared are of poor quality taking long to mature and producing poor quality meat and low milk yields.

6. Long distances moved by the pastoralists with their animals, in search of water and pasture, making the animals lose weight.

7. Occurrence of wild animals (predators) especially in the savanna zones such as hyenas, lions, wild dogs, and fox—which attack the pastoralists and their animals especially as they migrate.

8. Persistent famine among the pastoralists due to prolonged drought conditions and failure of the nomads to settle down and grow food crops/ hence frequent food shortages.

9. Over stocking resulting into over grazing, vegetation destruction and soil erosion.

10. The practice of burning grass during the dry season leaves the soils bare, exposing it to soil erosion and leads to the growth of resistant/tough grasses-less nutritious to livestock.

11. Conflicts between the nomads and other people especially cultivators over land. This is because nomads do not respect boundaries or other people in their search for pasture and water supply.

12. Hostile attitudes of other people towards the nomadic pastoralists. This has made the nomads fail to change since they look isolated as a group and they choose to preserve their primitive norms and values instead of focusing on modernity.

13. Illiteracy/lack of education among the pastoralists. Education services have not been effectively extended to the nomadic pastoralists and therefore they are one of the most illiterate communities.

14. Remoteness / poor infrastructure in pastoral areas. The pastoralists are remote and far from trading centres. They lack good transport networks to the market their animal produce.

15. Inadequate/limited capital to carry out improvements in their animal rearing such as constructing bore holes for water supply and buying drugs.

16. Government neglect for example the governments have gazetted large areas of dry lands for national parks, game reserves and other activities. Extension services and model/demonstration farms have not been extended into many pastoral areas.

17. Clay soils which are waterlogged during the rainy season making movement of nomads and animals difficult.

18. Rapidly growing population in many parts of Africa, which increases pressure on the pastoral areas (to get settlement land) and hence limiting their movement from place to place.

Suggested solutions to the problems faced by the nomadic pastoralists (measures being taken to improve the livestock industry in Africa)

1. Establishing ranching schemes to promote a more settled way of life such as at Katsina near the Niger—Nigeria border.

2. Setting up demonstration schemes/farms for the pastoralists to copy better methods of livestock rearing.

3. Setting up processing plants to offer market for pastoral animals. For example milk separators and butter processing facilities in Nigeria.

4. Improving transport infrastructure such as feeder roads and railways constructed to enable marketing of animals.

5. Introduction of exotic breeds and cross—breeding to upgrade the quality of local animal breeds.

6. Encouraging pastoralists to settle down and cultivate crops on small scale to minimize famine.

7. Encouraging the pastoralists to sell off excess animals to reduce over stocking such as the Fulani selling in southern Nigeria.

8. Constructing permanent water points like bore holes, valley dams and water tanks to encourage settled livestock rearing.

9. Providing extension services such as controlling diseases using dips, and artificial insemination to improve quality of animals.

10. Educating the farmers about better methods of animal rearing such as Paddocking /controlled grazing and the need to emphasize quality instead of quantity.

11. Establishing and encouraging pasture irrigation schemes to avoid constant movement from place to place in search of pastures.

12. Formation of cooperatives for easy acquiring of credit facilities to improve livestock rearing.

13. Changing /modifying the land tenure system in order to encourage individual ownership (instead of communal ownership) and hence settled animal rearing.

14. Encouraging cattle keepers to use alternative feeds to animals such as seed waste, fodder crops to avoid dependence on only natural pastures.

RANCHING IN AFRICA

Ranching refers to the rearing of animals for beef production. Ranching involves keeping animals/livestock on a defined piece of land called **a ranch.**

In Africa model ranches are found in Botswana, Zambia, Bie plateau of Angola, Zimbabwe, Nigeria, grass land of South Africa, Kenya and Tanzania.

Characteristics of livestock ranching

- Many animal types are kept depending on the region. In Africa breeds like improved Zebu and Boran are kept co-existing with goats.

- The pastures are improved such as re-sawn alfalfa , Lucerne, clovers among others; nutritious for livestock
- Grazing is on permanent farms called ranches (implying that there is limited movement from place to place).
- Paddocking is practiced using wire fences or wooden barriers. This facilitates rotational grazing since the animals graze from paddock to paddock.
- There is strict following of the carrying capacity of land and therefore there is no over grazing.
- There is high capital investment to procure the required machinery, veterinary services, and feed troughs.
- The major aim of livestock rearing is commercial.
- There is scientific management of ranches; involving selective breeding for high quality beef, wool, mutton among others.
- It involves regular disease control for example using spraying, dipping, vaccination, de-worming.
- There is individual, cooperative or state ownership of land.
- Record keeping is very important.
- The ranches are large farms covering many hectares.

Differences between ranching and nomadic pastoralism

1. The nomadic pastoralists mainly rear animals for subsistence and less motivated to selloff any while ranchers have their primary goal as commercial.
2. Under nomadism there is communal ownership of land while under ranching there is clear/definite ownership of land (individual, cooperative, state).
3. The ranchers keep improved herds for meat and meat products while the pastoralists are concerned about quantity rather than quality.
4. Under ranching fattening is considered important before slaughtering unlike under pastoralism.
5. Under ranching there is controlled grazing and movement using the Paddocking system while the pastoralists have their movements influenced by seasonal changes, with uncontrolled grazing.
6. Under ranching scientific methods are dominant such as spraying, dipping. The rancher also in most case specializes in rearing one type of animal. All these are non-existent under pastoralism.

7. Improved pastures are used under ranching while the nomadic pastoralists depend on natural pastures.

8. Activities under pastoralism are majorly dictated by the environment they live in especially in the arid and semi-arid areas. However the ranchers depend on individual preference although dominant in well-watered areas.

9. Record keeping is very important under ranching while it does not exist under pastoralism.

RANCHING IN BOTSWANA

Botswana is located in southwest part of Africa. The economy greatly depends on cattle and cattle products for her export earnings. It has the most extensive ranching in the whole of Africa and its ranching system has been modernized with the help of the European Union (EU).

The physical characteristics of the country make it difficult to engage in other economic activities other than animal rearing. Most of the country receives low and unreliable rainfall plus frequent droughts. The soils are less fertile not favouring large scale cultivation. Accordingly many people are involved in animal rearing.

Therefore in order to modernize the livestock industry, demonstration ranches were set up. The ranches vary in size from 1600ha to 2800ha which are then sub-divided by fences into large paddocks. Each demonstration ranch is provided with a water supply system. Most of the ranches were set up at **Kanye** because:

- It is near the market centres like Gaborone city, Lobatse.
- Nearness to transport routes especially railway line
- Presence of a large land area with low population density
- Closeness to the large abattoir and meat factory at Lobatse.

The government, NGOs and private investors improved provision of water to farms and transform nomadism to modern ranching. The demonstration farms were set up with the following major objectives:

- To demonstrate modern beef cattle ranching practices such as paddock grazing, building simple dams and dips, and the need for their regular use.
- To allow farmers to participate in ranching by using acquired techniques.
- To allow farmers to bring a maximum of 6 heads of cattle to the demonstration farms for purposes of comparison after fattening.

In general the farmers are taught to value quality rather than quantity such as by considering carrying capacity of the land.

A sketch map of Botswana showing ranching areas

Factors/ conditions which have favoured the establishment of demonstration ranches in Botswana

1. Little and unreliable rainfall (of about 300mm per annum) which does not favour crop cultivation and hence favouring animal rearing under ranching.
2. The relatively flat landscape which favours easy movement of animals and construction of facilities.
3. Availability of extensive land to set up ranches due to the low population density.
4. The herds contained poor local breeds since there was no selective breeding and these had to be improved through ranching.
5. Limited surface water which caused the establishment of valley dams to support cattle ranching.
6. Serious cattle diseases which affected cattle keepers and thus resettlement for efficient veterinary services was necessary.
7. Limitedness of other viable land uses such as absence of big water bodies limits fishing , limited viable mineral resources , hence the need to modernize animal rearing as alternative.
8. The need to teach farmers modern methods of livestock rearing such as Paddocking, using simple dams.
9. Supportive/encouraging government policy towards ranching, intended to improve the production of beef and its management.
10. Availability of adequate capital required to set up demonstration ranches provided by the government and European Economic Community (now European Union).
11. Presence of improved transport routes especially the railway and roads through ranching areas for easy movement of farm inputs and output.
12. Availability of large market both domestic and foreign for beef. Botswana exports to UK and other countries.

13. Availability of skilled labour to work on the demonstration farms. These were initially from Europe, but later local people were also trained.

14. Availability of cheap labour on the demonstration farms, since the local people had prior experience as cattle keepers in Botswana.

Contributions /benefits of demonstration ranches in Botswana

1. There is increased productivity in the livestock, that is, production of more meat to supply food proteins to the people.

2. Many farmers have been taught modern methods of animal rearing such as spraying and Paddocking; and this has helped them to establish their own farms.

3. Ranching has generated employment opportunities to the people on and off the demonstration farms, hence improving the standards of living.

4. Farmers incomes have increased hence improving the standards of living.

5. Generation of foreign exchange to the country through exportation of beef and beef products to other countries like United Kingdom, and this is used to import foreign goods.

6. Ranching promotes economic diversification, hence increasing national income/ reducing over dependence on a few sectors.

7. Ranching has promoted the development of factories/ industries by providing raw materials such as meat packing factory at Lobatse

8. Ranching has improved transport infrastructure such as roads and railways connected to market centres, making transport easy.

9. Promoted urbanization such as Lobatse, Kanye and Francis town, and assoicited facilities like banking, education and medical facilities.

10. Utilization of land which is not fit/good for other activities such as crop growing, forestry.

11. It has led to better use of the environment by controlling the carrying capacity through rotational grazing, fencing etc.

12. Ranching has promoted international relationship between Botswana and other countries which import the beef products such as UK, hence a basis of further trade and investment.

Marketing animal products for Botswana

The Botswana meat commission (BMC) is responsible for buying cattle from farmers. The cattle are moved by railway to the Lobatse abattoir – the biggest in Africa and comparable to those in Europe. Here is a large abattoir and factory for meat packing and freezing.

Botswana exports most of its meat to United Kingdom via South African railways. Botswana also exports beef to South Africa, Zambia, Britain, Germany and Arab countries.

Note: Apart from beef, Botswana also exports other items such as diamonds and copper. The major problems faced by Botswana when exporting its products are:

- The country is landlocked with no easy access to the sea/ocean
- Export routes are long and hence high transport costs.
- Transport routes are not well developed.
- Etc

Problems faced by demonstration ranches/ livestock industry in Botswana

1. Long periods of drought resulting into shortage of water for livestock.
2. Limited surface water bodies resulting into heavy dependence on underground water which is costly.
3. Pests and diseases such as diseases caused by ticks affecting the animals / reducing the quality of production.
4. Poor and insufficient natural pastures for livestock due to low and unreliable rainfall; hence low quality livestock.
5. Conservatism / resistance by some farmers to change from traditional methods of animal rearing to modern ways, hence poor quality production.
6. Limited domestic market for beef due to the small population, which also limits production.
7. Competition with other countries such as Argentina, Nigeria on the world market, hence reducing the available market.
8. Poor transport and communication networks since many ranches are remotely located, which limits accessibility to market centres.

Possible solutions to the above problems

1. Government should construct more permanent water points such as boreholes, valley dams, and underground tanks to minimize the problem of water shortage.
2. More farmers should use spraying and dipping to control pests and diseases.
3. Planting of improved pastures should be done such as fodder crops to support the ranches.
4. There should be continued education to the farmers about modern cattle rearing to improve quality of output.
5. The government should carry out more market research in other countries to minimize the problem of limited domestic market.
6. Government should extend transport routes to many areas where ranches are located.

7. There is need to establish more ranching schemes with irrigated pastures to support the livestock industry.

PLANTATION FARMING

Plantation farming refers to the growing of a single crop (one crop) on large scale using scientific methods, basically for commercial purposes. (*The system is at times referred to as extensive agriculture)*. Plantations range from hundreds to thousands of hectares.

Examples of big plantations include:

- Rubber growing in Nigeria, Liberia and Ghana.
- Sugarcane growing Natal province of South Africa.
- Tea growing in Malawi.
- Oil palm in Zaire (DRC), Gabon, Cameroon, Nigeria and Ghana.
- Tobacco growing in Zimbabwe

Characteristics of plantation farming

1. Crops are grown on large scale. The plantation estates cover hundreds to thousands of hectares of land.
2. Plantations usually specialize in the production of a single crop for a long time (monoculture). In some cases however two or more crops are grown on the same plantation depending on the level of organization.
3. Large numbers of workers are employed – skilled, semi-skilled and unskilled labour.
4. Involves heavy capital investment to set up the plantation infrastructure such as constructing transport routes, housing estates, setting up processing plants among others.
5. Plantation crops have long gestation periods for example sugarcane—1.5 years, oil palm—3 years, Cocoa—5 years, and rubber—7 years.
6. Many plantations are owned by foreigners for example the French own coffee and cocoa estates in Cameroon.
7. Plantation farming is characterized by high output because large areas of land are cultivated using improved seeds.
8. The plantations are scientifically managed, involving application of fertilizers and farm chemicals for quality and quantity output.
9. The plantations are highly mechanized involving use of tractors, bulldozers, combined harvesters, sorters, and processors among others.
10. Plantations crops are intended for sale, that is, it is commercial-oriented either for

domestic or foreign markets.

11. Plantations are mainly confined to the tropical latitudes such as tropical Africa.

Advantages of plantation farming

1. High output is realized because large areas are cultivated using scientific methods and thus ensure regular supply of produce.
2. Provision of many employment opportunities to the skilled, semi-skilled and unskilled workers since plantations are large enterprises; hence the standards of living improve.
3. Acquisition of skills by workers on the estates. For example skills in maintenance of machinery, application of fertilizers and farm chemicals, identifying diseased crops, picking and sorting skills.
4. Promotion of out growers, since plantations provide market, advice and inputs to the farmers.

   Note: **Out growers** are farmers outside /near the plantations who grow the main plantations who grow the same crop grown on the plantations (and sell output to the plantation).
5. Promotion of research to generate high quality varieties of crops which are fast growing, disease resistant and high yielding leading to higher incomes.
6. Generation of government revenue through taxation of the plantation estates, workers' incomes, export duties and land rent. OR The tax revenue helps to support several sectors of the economy such as health, education.
7. Development of infrastructure such as roads, housing estates for the workers, schools for the children of the estate workers, medical facilities, and recreation facilities. These facilities also benefit the surrounding people.
8. Foreign exchange generation through exportation of plantation output to other countries.
9. Promotion of international relations between producing and importing countries or the countries from where the companies originate which is a basis of trade contacts, investment, foreign aid inflow
10. Marketing of output is easy. This is because the estates are operated on large scale production and hence constant supply throughout the year to satisfy the markets.
11. Promotion of industrial development by providing raw materials for the industries such as sugarcane used in the making of sugar (and the sugar is used in the making of confectionary products).
12. Promotion of urban development with associated facilities such as hospitals, banking facilities, market centers, and other facilities.
13. It is easy to acquire and extend credit because of the large assets which are used as

collateral security for obtaining loans.

14. Plantations ensure that there is no wastage since everything is controlled through administration. For example crushed sugarcane stems are used as fuel; coffee husks used as fertilizers.

Disadvantages of plantation farming

1. Leads to soil exhaustion/decline in soil fertility due to growing of a single crop year after year and therefore lower yields.
2. Associated with price fluctuations on the world market due over concentration on a single crop leading to unstable incomes.
3. High costs of starting and maintenance of the plantations and the infrastructure. It is for this reason that estate farming is dominated by foreign investors.
4. There is greater risk of spread of pests and diseases due to growing of a single crop over a large area; yet these are less likely to spread on small peasant holdings.
5. There is profit repatriation since most plantations are owned by foreigners. They send most of the profits out to their home countries which undermines further investment.
6. Employing a lot of labour leads to diminishing returns and eventual profit decline. Still the effort put in by workers is less than if they were managing their own small plots/farms.
7. Many plantation crops take long to mature which increases the costs of production such as rubber taking 7 years, cocoa – 5 years.
8. Plantations require large land area which results into displacement of people.
9. There are problems of clearing and maintenance of access roads to various parts of the plantations since many plantations occur in tropical areas/ due to rapid vegetation growth.
10. There is a likelihood of famine since the plantations and out growers are concentrating on cash crops such as coffee, tea, palm oil, rubber.
11. Plantations have been one of the major causes of population movements especially the young able-bodied men who seek employment on the estate farms and this reduces rural production.

SUGARCANE GROWING IN NATAL

Natal is one of the provinces of the republic of South Africa, and it is a coastal area just outside the tropic of Capricorn which at the moment is the most important sugar cane producing area in Africa.

Sugarcane growing is confined to a narrow strip of land extending rarely 25km from the coast. Most of the sugar is grown on the coastal plain between Margate and Lake St. Lucia a distance of 400km.

Note: The other large sugar producers in Africa include: Egypt, Swaziland, Tanzania, Uganda, among others.

A sketch map showing sugarcane growing areas in Natal—South Africa

Factors which have favoured sugarcane growing in natal

1. Hot temperatures along the Natal coast due to warming effect of the Mozambique current, which favours sugarcane growing.
2. Moderate rainfall of about 1000mm per year, due to onshore winds blowing over the warm Mozambique current, which also makes sugarcane growing and maturing possible.
3. The general high water table levels, which compensate for the low rainfall, received favouring sugarcane growing.
4. Availability of ready / regular water provided by rivers like Umkuse, Umgeni, Tugela, Umfolosi; to supplement rainfall through irrigation for the growth of sugarcane.
5. Low altitude/ low-lying coastal land keep the temperatures hot at the Natal coast (avoiding frost) hence favouring the growing of sugarcane.
6. The generally flat landscape of the natal region, which promotes mechanization (such use of tractors) and also favours the development of infrastructure.
7. The deep, dark, fertile alluvial soils (Well drained) washed from the Drakensburg mountain ranges favouring sugarcane growing.
8. Presence of extensive land for sugarcane growing. The plantations cover over 360,000 hectares; and occupy the coastal plain of about 400km.
9. Presence of abundant cheap labour to work on the plantations such as planting , weeding, harvesting; provided by the Indians, black Africans and migrant workers from surrounding countries (like Lesotho, Malawi, and Swaziland).
10. Presence of skilled labour / trained labour used in the operation and repair of machines, managerial work.
11. Presence of adequate/large sums of capital to invest in the sugar industry provided by the South African sugar Association (SASA), big companies and individual farmers.
12. Availability of a large/ ready market for sugar, both domestic and abroad. For example the large urban centres, COMESA/neighboring countries like Namibia, Botswana.

13. Presence of developed transport facilities in the area, especially the railways and roads along the coast which enable the transportation of sugarcane to the processing plants.

14. Increased research to develop better varieties of sugarcane; which are quick maturing, high yielding and disease resistant.

15. Presence of improved/ developed technology used for example in planting, and processing of sugarcane has also improved quality and quantity of output. Tractors and irrigation facilities are used.

16. Supportive/encouraging government policy towards the sugar industry for example by reducing taxes on machinery used and fertilizers, availing loans for sugarcane growers, carries out market research.

Organization of sugarcane growing in Natal

In Natal province, sugar cane growing involves extensive use of machinery, fertilizers and manual labour especially on large estates. Land is first ploughed and re-ploughed to make it ready for planting. There is regular spraying to control pests and diseases. Sugarcane takes 18-20 months to mature. Cutting /harvesting goes on for about nine (9) years, before the land if left to fallow.

The canes are transported by lorry and rail to factories, where it is weighed, chopped and crushed. Juice is extracted (by giant pressers) and it is chemically treated, heated, clarified, brought to boiling point and cooled. Then the crystals are separate from the brown molasses. The sugar is allowed to dry and then graded and bagged/packed.

There are well over 362,000 hectares of Natal's farmland devoted to the growing sugarcane. The 25 vast/large estates are owned by big companies. Sugarcane industry is administered by the South African sugar association (SASA). In addition there are very big farms owned by individual farmers and about 10 % of the natal sugarcane production is produced by single (small scale) farmers.

Note: Most of Natal's sugar is exported to USA, Japan, Canada and UK through the port of Durban. It is also exported to the neighbouring countries like Swaziland, Lesotho, Zambia, and Namibia.

Uses of sugarcane/sugar

- Sugar is used for sweetening such in tea, cold drinks
- Sugar used in baking as a raw material such as biscuits, chocolate, sweets
- Use in coating drugs / pharmaceuticals
- Manufacture of alcoholic drinks at jiggery or spirits
- Molasses (remaining liquid after sugar has crystallized) is used to make cattle feeds, manure, polishes, food yeast

- bagasse (remaining cane stalk after removing juice) is used to make straw boards
- bagasse is also used to provide fuel
- Sugarcane tops and trash are also used in the making of animal feeds, paper boards and packing papers.
- Green and dry leaves provide manure.

Importance of sugarcane growing to the economy of Natal (South Africa)

1. Promotion of infrastructural development especially transport routes (roads and railway) intended for easy movement.
2. Generation of foreign exchange through the exportation of sugar to other countries, which supports the importation of foreign technology and consumer goods.
3. Generation of employment opportunities to the people of South Africa; which improves their standards of living.
4. Promotion of industrial development by providing raw materials such as Sugar processing plants and secondary industries.
5. Generation of government revenue through taxation of sugar companies and workers' incomes, and hence provision of social services.
6. Facilitated diversification of the economy hence avoiding over dependence on a few sectors.
7. Strengthened international relations between South Africa and other countries which import its sugar and sugar products such as USA, UK, Japan, Canada, and African countries.
8. Promoted growth of urban centres such as Durban, Shepstone, Sezela, Stanger, and Margate; and associated with various facilities such as recreation, hospitals, and educational facilities.
9. Promotion of out grower schemes/ individual farmers outside the main plantations growing sugarcane who get advice and inputs from main plantations; hence increasing production and people's incomes.
10. Promotion of crop research which develops new varieties of canes, experiments with pests and disease control, sol improvement and fertilizer application techniques.
11. Sugarcane growing has facilitated technological progress. For example scientific methods used in the growing of sugarcane, maintenance of machinery and industrial processing technology.
12. Promotion of tourism development which brings in foreign currency to the country.

Problems facing sugarcane growing in Natal

1. Pests and diseases which affect the sugarcane especially during the dry season such as stem borers, yellow wilt; leading to poor quality output.
2. Calamities such as floods by rivers, severe drought; make the whole wealth of the plantations to be destroyed.
3. Inadequate supply of labour required for certain activities such as during the busy periods of weeding and harvesting. With the stopping of apartheid many Africans are looking for better jobs away from the sugar plantations.
4. Labour strikes are common on the estates; hence destroying the plantations and plantation infrastructure/ bring work to a standstill.
5. Competition from other sugarcane growing countries on the world market such as Brazil, India, china, Thailand and African producers which affects sugarcane production/ reducing the available market.
6. Fluctuations in the world market prices of sugar, which limits production/ leading to unstable incomes.
7. Sometimes there is delay in delivery of canes to processing plants especially from out growers, which also undermines productivity and efficiency.
8. The high costs of producing sugarcane , due to increasing costs of acquisition and use of fertilizers; use of costly irrigation facilities.
9. Soil exhaustion due to monoculture, leading to low yields.
10. Soil erosion leading to loss of soil fertility and eventually reduced yields.
11. Fire out breaks which sometimes destroy large areas of the plantations

Steps which have been taken to solve the above problems

1. Mechanization has been adopted to minimize the problem of labour shortage.
2. Use of chemicals to control pests and diseases has been done.
3. Market research has been done/ started to expand the export market foe sugar.
4. Use of fertilizers and manure has been done to restore/maintain soil fertility.
5. Irrigation has been adopted where rainfall is inadequate.
6. Regular patrols have been done to control outbreak and spread of fires.
7. Contour ploughing has been done to control soil erosion.

RUBBER GROWING IN LIBERIA

In tropical Africa the most important country with plantation agriculture is Liberia and the most important crop is rubber.

Other crops grown are: coffee, cocoa, oil palm, sugarcane.

The major company which started rubber plantations is Firestone Company from USA. Others are: Alan L. Grant Company, The Liberia Company, Salala Rubber Corporation etc

The largest plantation was established at **Harbel** on the Farmington River with approximately 25km from the coast, and the other at **Covalla** in the extreme south east of Liberia (about 40km inland on Covalla River). In addition to the plantations, there are out growers/individual farmers producing rubber.

Note: other rubber producing countries in Africa include: DRC (former Zaire), Nigeria, Cameroon, Ivory Coast among others.

A sketch map showing major rubber growing areas in Liberia

Factors for the establishment and development of rubber plantations in Liberia

Physical

1. The heavy rainfall averaging over 2500 mm per annum and evenly distributed throughout the year favouring rubber growing/ for production of much latex/sap.
2. Hot temperatures throughout the year ranging from 24-27^{0}c, favouring the growth of rubber trees.
3. Presence of well drained fertile soils which also favours growth of rubber trees.
4. Low altitude which is also partly responsible for the high temperatures in Liberia, which in turn favour the growth and maturity of the rubber trees-to produce a lot of latex.
5. The generally flat landscape/relief which enables mechanization where rubber growing takes place.
6. The nature of vegetation—tropical rain forests, which trees provide shade for the rubber

seedlings, which are later transplanted.

7. Availability of extensive land for rubber growing and setting up the necessary infrastructure.

Human factors

8. Presence of adequate capital to establish plantations/rubber estates provided by large companies such as the Firestone Company from USA.

9. Large supply of both skilled and unskilled labour to work on the rubber plantations such as skilled tappers, spraying, industrial workers, mangers, engineers.

10. The developed/improved transport infrastructure for example the road and railway networks to transport farm inputs, workers, and output.

11. Presence of a large market for rubber both local and foreign such as USA and the European Union (like Britain).

12. Increased research in rubber growing /production to produce of fast maturing, high yielding and disease resistant varieties, and in soil improvement.

13. Presence of many factories which process the latex (the milky liquid rubber), hence increase the quality of output.

14. Supportive government policy towards the rubber growing industry for example encouraging local and foreign investors and rubber research.

How rubber is tapped

A slanting cut is made in the bark of the rubber tree trunk, and each cut is V—shaped. The milky white latex bleeds out from the bark and runs down into a cup fixed below the slanting cut. The tappers tap every morning and collect the latex every day in the afternoon. After the same trees have been tapped for 6(six) months, they are given a long rest period and the other trees take their turn.

Processing of rubber

The latex at the factory is put into a tank of water and to this mixture a certain amount of acetic acid is added. This turns the latex into a spongy coagulated mass known as coagulate rubber. This is then rolled into flat sheets which squeezes out a lot of the moisture and then dried on racks in a smoking shed. The coagulate rubber is rolled between two rollers moving at different speeds and then air dried.

Marketing of rubber

The milky liquid (latex) is transported to factories by mainly road and railway. At each factory the latex is processed either for home use/consumption or for export. The major export port is Monrovia. Rubber is exported to countries like USA, and Britain.

Uses of rubber

- Making of tyres
- Making soles of shoes
- Making rubbers which rub out mistakes on paper
- Making cable/electric insulators
- Making water proof materials
- Making balloons
- Making sports equipment
- Making gloves, plastics, rubber toys ,and rubber carpets

Problems facing rubber growing in Liberia

1. Fluctuation of world market prices; which leads to uncertain incomes to the rubber growers.
2. Profit repatriation by foreign companies to their home countries, hence limited re-investment in rubber growing.
3. Competition from artificial synthetic rubber on the world market *(which is produced from oil in the developed countries)* which has reduced demand for natural rubber.
4. Competition from other natural rubber producing countries such as Indonesia, Thailand, Malaysia, Nigeria, Brazil, DRC, Ivory Coast—which reduces the market available.
5. Severe weather conditions such as very heavy rainfall in some years, which disrupts the rubber tapping schedules and reduces production.
6. Poor feeder roads which become flooded during the rainy season, and this limits the accessibility to the plantations.
7. Inadequate labour supply due to low wages offered on the plantations. This especially affects the busy periods like weeding and harvesting.
8. Competition from other sectors of the economy for government funding. For example the government is now emphasizing iron ore production which today is the main foreign exchange earner; and this limits investment in rubber growing.
9. Political instability which negatively affects rubber production such as by destroying various infrastructures.
10. Pests and diseases which attack rubber trees and are difficult to control because of large scale farms.
11. Soil exhaustion due to monoculture, hence decline in yields.
12. Forest fires which at times destroy large parts of the plantations.

Steps that should be taken to solve the above problems

(Research)

ARABLE FARMING IN NIGERIA

The most important crop grown in Nigeria is oil palm. Other crops grown include: yams, cocoa, groundnuts, rubber, cotton, tobacco, cassava, rice etc

Map of Nigeria showing major crops grown

OIL PALM

It is the most important crop grown in Nigeria and widely grown in the Nigerian coast and delta villages (the area bounded by the towns of Port Harcourt, Onitsha and Oron).

Note: Other important producers of oil palm in Africa (equatorial Africa) include: Ivory Coast, Ghana, DRC, Guinea, Liberia, Togo, guinea Bissau, Benin, and Sierra Leone.

Conditions which have favoured oil palm growing in Nigeria

1. Low altitude (from about 300m above sea level) which creates warm conditions favouring oil palm growing.
2. Heavy rainfall of 1500mm and above per annum which is also well distributed throughout the year favouring oil palm growing.
3. Hot temperatures of 21^0c and above throughout the year favouring the growth of palm trees. (A mean annual temperature of about 24^0c).
4. High humidity throughout the year for rapid palm tree growth.
5. Presence of fertile well drained soils favouring the growth of palm trees.
6. Presence of extensive/large tracts of land for oil palm growing on large scale.
7. Availability of cheap labour to work on oil palm farms such as planting, weeding and harvesting.
8. Developed transport routes especially road and railway connecting palm farms and processing oil mills.

9. Availability of adequate capital to set up large plantations, purchase machinery and paying of labour.

10. Positive/encouraging government policy such as encouraging quality production for the export sector.

11. Increased research in oil palm growing such as to improve the palm trees and soils.

Harvesting and processing of oil palm

In order to harvest the fruit, the farmer usually climbs the trunk with aid of a rope and cut down the ripe bunches.

The traditional method of obtaining oil from the pericarp is to pick the fruit from the bunch and then boil it and pound it. After, the oil is squeezed out from the pericarp by hand. Inside the fruit itself there is a hard nut which contains kernel. The nuts are dried and then cracked by hitting them with a hammer or stone so that palm kernel oil is extracted.

Today a number of oil mills have been established in the oil palm growing areas of Nigeria. These extract about 85% of the oil content.

Note: Apart from being consumed locally, palm oil is exported to USA, Germany, Belgium, Holland, and Italy among other countries.

Uses of oil palm

- Used in making cooking oil
- Used in making soap, cosmetics and margarine
- Used in making hair oil
- Making of candles
- Making palm wine
- Dried shells and fibre are used as fuel
- The leaf ribs are used for local building purposes and decoration

Problems facing oil palm farmers in Nigeria

1. Pests and diseases for example anthracnose and freckle disease which destroy the plants/ affect the quality of output.

2. Competition with other vegetable oils such as sunflower, groundnuts, soya—which reduces available market.

3. Price fluctuations on the world market, which discourage producers due to uncertain incomes.

4. Shortage of labour especially during busy periods of planting and harvesting attracted to

other activities.

5. Poor transport routes/ Remoteness of the producing areas and hence limited accessibility to the markets.
6. Soil exhaustion due to monoculture leading to low yields.
7. Soil erosion due to heavy rainfall which also affects soil productivity.
8. Low levels of technology used such as climbing trees with a panga to harvest oil palm—limits production.
9. Growth of deep rooted weeds such as Siam which limit the quality of oil palm production.
10. Political unrest/ insecurity which also limits oil palm production.

Steps being taken to solve the above problems

1. Regular spraying using chemicals to control pests and diseases.
2. Carrying out research to produce high yielding oil palm varieties that can compete favourably on the world market (*at Nigerian institute of oil palm* research).
3. Diversifying of crop farming to reduce the effects of price fluctuations such as by growing rubber and groundnuts.
4. Hiring of more labour during the busy periods such as weeding and harvesting.
5. Constructing of more feeder roads to increase accessibility to markets.
6. Application of fertilizers to restore soil fertility and increase the yields.
7. Using soil erosion control measures such as mulching, use of ridges.
8. Restoring of political stability in various parts of the country such as through peace talks, promoting democracy.
9. Formation of cooperatives to encourage production and disseminating research findings.

COCOA GROWING IN GHANA

Cocoa production in West Africa is essentially a small farm activity and it is more typical in Ghana. Other important cocoa growing countries include: Ivory Coast, Nigeria, Cameroon, Sierra Leone, Togo, and Liberia.

Ghana's main cocoa lands are found in the southwest of the country where rainfall is heavier and the land a little higher than elsewhere. There is another cocoa area to the east of Lake Volta on the border with Togo.

The major cocoa growing areas in Ghana specifically include: Ashanti, Brong Ahafo wets of Kumasi—in the western region. Akwampin east of Lake Volta on the border with Togo. Cocoa farms are on average between 2.5 and 4 hectares in area. They are often found in groups

which are based near or around a small village.

Note: Other crops grown in Ghana include: oil palm, maize, coffee, bananas, yams, kola nuts, groundnuts among others.

A sketch map showing cocoa growing lands of Ghana

Qn. why is cocoa growing limited/ restricted to the south unlike the north in Ghana?

- The north has insufficient rainfall for cocoa growing.
- The influence of the dry Harmattan winds in the north, yet cocoa growing requires high humidity.
- Presence of sandy soils above the Mampong escarpment, yet cocoa requires deep fertile loamy soils.
- etc

Factors which have favoured cocoa growing in Ghana

1. Hot temperatures throughout the year with a mean annual temperature of about 24^0c favouring cocoa growing.
2. Heavy rainfall of over 1300mm per annum and which is evenly distributed throughout the year (*at least 1000mm per annum*) favouring cocoa growing.
3. High humidity throughout the year favouring growing of cocoa.
4. Presence of deep well drained fertile soils favouring cocoa growing.

5. Presence of large tracts of land to establish and expand cocoa farms.
6. Availability of large sums of capital to invest in cocoa growing such as purchasing farm inputs and paying of wages.
7. Presence of skilled and unskilled labour used on the cocoa farms.
8. Improved/developed transport routes such as road and railway connected to the ports of Accra, Tema and Takoradi to transport farm output.
9. Availability of large market for cocoa both internal and external like in Europe.
10. Positive/ encouraging government policy towards cocoa growing such as giving soft loans to small holder cocoa farmers.
11. Increased/intensive research to come up with better seedlings which are high yielding and disease resistant.

Harvesting and processing of cocoa

The cocoa pods grow from the trunk and main branches of the tree. Pods are yellow—orange when ripe. The cocoa trees begin bearing fruits between 3 to 5 years. In Ghana there are two harvests each year between September and January, and between April and august. Harvesting is done by cutting pod using sharp knives. The pods are split open with a knife (matchet), and then the seeds are scooped out by hand and heaped on the ground.

The beans are covered with leaves to ferment. The fermentation process takes about 5 to 6 days. The fermented beans are washed and dried on raised platforms (under the sun). When the beans are thoroughly dry, they are packed into sacks and taken to buying centres.

Marketing of cocoa

The whole crop is bought by the state /government cocoa marketing board (which fixes prices to be paid to the farmers). The main collecting centres include: Kumasi, Sunyani and Kade. Much of the crop is exported through ports of Takoradi and Tema. Exports go to Europe (like Germany and Britain), Russia, china, and Japan.

Uses of cocoa

- Cocoa is used as a beverage
- Making of chocolate
- Making cocoa butter
- Making biscuits ,ice cream and sweets

- Making cosmetics

Problems facing the cocoa farmers in Ghana

1. Pests and diseases for example capsid pest destroying pods, black pod disease, swollen shoot disease leading to low yields.
2. Poorly developed transport routes such as flooded roads during the rainy season, making the marketing of cocoa difficult.
3. Uncontrolled bush fires which destroy cocoa farms especially during the dry season.
4. Shortage of labour especially during the busy periods of planting and harvesting which affects production.
5. Price fluctuations on the world market which results into unstable incomes to farmers.
6. Competition from other beverages/ cocoa substitutes like tea, coffee, soya—hence reducing the available market.
7. Competition from other cocoa producers such as Nigeria, and Ivory Coast which limits the market for output.
8. Soil exhaustion due to mono-cropping leading to reduced yields.
9. Occasional prolonged dry season and at times floods – which also limit cocoa production.
10. Hailstorms which also destroy cocoa trees and hence low production.
11. High costs of production such as expensive pesticides and fertilizers which also limits production.
12. Land shortage which limits the expansion of cocoa farms due to growing population in southern Ghana.
13. High land rent since most farmers do not own their farmlands.
14. Political unrest in some years which also limits cocoa production and marketing.

Measures being taken to solve the above problems

1. Spraying with pesticides control pests and diseases. The government is selling cheaper sprays and spraying machines to farmers.
2. Cutting down the affected trees to minimize the spread of diseases to other trees.
3. Improving on the transport networks that is, construction of better feeder roads to ease marketing of cocoa.
4. Providing more incentives to persuade labourers especially during the busy periods of planting and harvesting.

5. Diversifying of crop farming to reduce dependence on cocoa whose prices are declining/ fluctuating such as by growing palm oil and maize.

6. Applying fertilizers and manure to improve soil fertility.

7. Processing or semi—processing of the crop before export / setting up more cocoa processing factories to increase the cocoa export earnings.

8. Practicing irrigation where rainfall is inadequate (dry season) to increase production.

9. Providing credit to small holder famers through the financial institutions to enable them to afford the farm inputs.

10. Restoring political stability in various parts of the country such as by promoting democracy and peace talks.

11. Encouraging farmers to join cooperatives to enable easily access farm inputs and better markets.

12. Carrying out research to breed more disease resistant and high yielding cocoa varieties.

LARGE-SCALE IRRIGATION PROJECTS IN AFRICA

Irrigation is the artificial supply of water to support plant growth in areas which have insufficient rainfall. Irrigation is either permanent or temporary, and it is carried in areas of insufficient rainfall and where flooding is common.

Under irrigation, the extra amount of water needed depends much on the type of crops grown, the prevailing temperature and humidity, the kind of soil and other conditions in the area.

Advantages of irrigation

a) The supply of water by irrigation is regular and reliable, where as rainfall is often seasonal or unpredictable. In the desert areas, the use of irrigation allows cultivation to take place where it could otherwise be difficult.

b) Irrigation water supplied by rivers during flood times carries much silt which adds to soil fertility and hence increasing crop yields.

c) Under irrigation, cultivation can be done all year round and not only during the rainy season. This implies better use of land.

d) In desert areas the constant flow of irrigation water through the soil helps to reduce the salinity of the soil. When the water evaporates in the fields the salt content increases.

e) Modern multi-purpose dams not only support irrigation but also help to control floods, generate power, and improve the navigability of rivers.

Note: Irrigation may involve artificial application of water permanently or temporarily. Irrigation is mainly in areas of low rainfall and where flooding is common. Irrigation is one of the oldest agricultural techniques practiced by man, although it has been done at different

levels at different times. It deals with water management to enhance agricultural development.

Irrigation is majorly in the semi-desert or desert areas of Sub-Saharan Africa.

Examples of major irrigation schemes in Africa include:

- Gezira irrigation scheme in Sudan
- Richard toll scheme in Senegal
- Awash valley authority in Ethiopia.
- Irrigation on Niger river

GEZIRA IRRIGATION SCHEME IN SUDAN

The Gezira scheme is located between the Blue Nile and the White Nile, north of Sennar dam but south of Khartoum in Sudan. The region receives low and unreliable rainfall less than 500mm per annum. There was need for irrigation in order to grow crops. The Sennar dam was built in 1925 in order control water and various canals leading water to the fields were constructed.

The Gezira scheme was started in 1911 by the British and Sudan government nationalized it in 1950 and set up the Sudan Gezira board to manage it up to date. The Gezira scheme is about 480,000 hectares which was earlier set up. Later in 1962, the Managil extension was completed and farmland increased. This Managil extension is about 324,000 hectares.

There are two main canals from which thousands of kilometers of smaller channels developed on rectangular system carrying water throughout the whole scheme.

A sketch map showing the location of Gezira irrigation scheme

Organization of the Gezira scheme

The Sudan government and the Gezira board jointly own the Gezira scheme. The Sudan government provides the land and is responsible for its irrigation. The tenants (over 10,000 today) work on the land and produce crops **especially cotton**. They use the land rent-free only to work satisfactorily. There are also grow other crops for food as well as cash. These crops include: groundnuts, Dura, maize, lubia (a bean for food and cattle fodder), rice, sorghum, and sugarcane.

The Sudan Gezira board manages the processing and selling of crops, supplies seeds, fertilizers and gives advice to farmers. It also looks after the light railway system, farm machinery and distribution of profits. The income depends on the price of cotton. After all expenses have been deducted the distribution is as follows: 36% into government, 50% to the tenants, 4% to village councils and social services, and 10% to the Sudan Gezira board.

Objectives of the Gezira irrigation scheme

- To open up more land for both settlement and farming
- To provide water for irrigation all year round.
- To modernize the economy from pastoral nomadism to settled agriculture
- To diversify the agricultural sector(to grow food crops in addition to cotton)
- To control flooding from the blue Nile.
- To encourage economic development of Sudan.

Factors which have favoured the establishment and development of Gezira irrigation scheme in Sudan

1. Availability of ready water supply for irrigation from the Blue Nile and White Nile throughout the year for growing of cotton, maize, rice, lubia, groundnuts.
2. The gently sloping landscape from the Blue Nile towards the White Nile, and therefore both irrigation and drainage can be done using gravity flow, hence low irrigation costs, and thus large-scale production.
3. The gently sloping landscape has also favoured the construction of transport network and mechanization of farming made possible such as the use of tractors.
4. Availability of vast/extensive land due to sparse population and hence a large expanse of land was put under irrigation farming.
5. Presence of fertile alluvial soils (dark brown clay soil rich in minerals) of the Gezira plain from seasonal flooding of the Nile favouring the growth of crops. However today artificial fertilizers are applied to maximize production.
6. The soils have high clay content and hence impervious to water sinking away and this saved the construction of water-proof lining (concrete channel) when canals were filled with water.
7. The land is well above the water table and so water-logging never occurs.
8. The arid climate of the area also favoured irrigation farming because there was no expensive clearing of bush/forests. (The arid climate necessitated use of irrigation so as to make the fertile land productive by supplementing the little unreliable rainfall for supporting the growing of crops like cotton).

9. Availability of cheap labour in the area to work is irrigation farming because people were already in the area cultivating poor cereals (on the mercy of rains) and herders with skinny cattle such as nomadic Dinka and Nuer.

10. Presence of skilled labour initially provided by the British and Egyptian experts who were used in the construction of the dams, canals, operation of machinery, grading, textile industries and ginneries.

11. Availability of adequate capital provided by the government and the British to set up the Gezira scheme, purchase of agricultural machinery like tractors , irrigation systems , payment of research personnel and establishment of infrastructure like labour camps ,road network.

12. Availability of large supply of electricity especially hydro-electric power generated by Sennar dam and Jabel Aulia dam(Roseires dam) for pumping water from the reservoirs into the canals / fields and running machines in the ginneries and textiles.

13. Presence of improved transport infrastructure such as the railway and triangular road network. This provides accessibility to ginneries and helps in moving inputs into the fields leading to the development of the scheme.

14. The introduction of modern machinery such as caterpillars and tractors for digging channels and large scale cultivation; multiple seed drills for large scale planting ; also gravity flow irrigation, over-head irrigation, and tank irrigation.

15. Availability of ready market for crops grown both local and foreign. There are ginneries and textile industries at Khartoum, Hasa Heisa, and export markets in Germany, Italy, UK, Japan, and India.

16. The desire to achieve self-sufficiency in food production and reduce food imports also explains the development of large-scale irrigation in Sudan.

17. Supportive/ favourable government policy such as by setting up the scheme to allow people to settle down to produce food and cash crops for economic development of Sudan and establishing the necessary infrastructure.

Contribution of the Gezira irrigation scheme to the economy of Sudan

1. Promotes agricultural modernization within the Gezira plains and throughout Sudan by enhancing highly mechanized scientific farming based on irrigation, application of fertilizers and pesticides on a large scale.

2. Increased production of both food and cash crops by the farmers such as cotton, lubia, maize, dura, and thus increased incomes to the farmers leading to a higher standard of living.

3. The scheme has promoted education and training for the people in the area such as training centres, adult education benefiting the local people to enhance farming and also improve the general welfare.

4. Generation of employment opportunities to many people on the scheme both the skilled and the unskilled labourforce such as managers, extension offcers, hence improving the standards of living.

5. Promoted development of social services such as sporting and leisure facilities, educational facilities, health facilities, piped water in many areas such as Sennar, Wadi Medani, Kosti These have resulted from the revenue accruing from the Gezira scheme.

6. Development of transport infrastructure especially within the Gezira plain for example the railway line and road net work for transporting cotton and other farm products to the factories and to the market.

7. Promoted development of the industrial sector for example the high quality cotton produced has promoted the growth of ginneries and textile industries, grain milling and fertilizer industries

8. The Gezira scheme generates foreign exchange to Sudan through the export of crops particularly cotton to the outside countries like Germany, Italy, UK, J apan, and India.

9. The scheme has promoted the growth of urban centres in the Gezira plains such as Wadi Medani, Kosti, Sennar, Hasa Heisa, and Al Husa Ayhisah by attracting a large population.

10. The Gezira scheme has also emphasized the planting of forests of eucalyptus trees and the afforestation program carries a number of benefits such as providing building wood/poles, natural beauty.

11. The scheme has promoted cooperation among the tenants and therefore cooperatives have been introduced for marketing the produce and advising farmers.

12. Promoted international cooperation between Sudan and the countries which import the products, which promotes international harmony and peace.

13. Diversification of the economy hence reducing over dependence on a few sectors like mining.

14. Promotion of the tourism sector due to irrigation canals and farmlands, hence generating foreign currency.

Shortcomings of the Gezira irrigation scheme

1. Silting of the irrigation canals since irrigation water deposits its suspension material in them and regular dredging is quite costly.

2. Salination due to the high rates of evaporation in the Gezira scheme and this has limited plant root growth, limiting yields of crops like cotton and sugarcane.

3. The reservoirs are shallow leading to flooding of farmlands and this has increased the spread of pests and diseases such as Bilharzia.

4. Displacement of people as land was being set aside for the scheme such as Dinka and

Nuer nomads who used to graze their animals in the area.

5. The Gezira scheme was very expensive to undertake such as high costs of establishing farmlands, irrigation channels, dams, plus high costs of maintaining the irrigation scheme.
6. Industrial—related problems such as pollution from the ginneries, textiles, grain milling at Omdurman, Khartoum, and Wadi Medani.
7. Urban—related problems such as slum growth, alcoholism, robbery in the urban centers which have developed like Barakat, Sennar, Omdurman.

Problems facing the Gezira irrigation scheme

1. Silting of the irrigation canals and man-made lakes, leading to the flooding of farmlands. Reservoirs are shallow resulting into the flooding of crop fields.
2. Excessive evaporation due to hot temperatures leading to increased soil salinity in the central valley and thus poor yields.
3. It has encouraged the spread of waterborne diseases such as bilharzia in the central valley due to stagnant water.
4. Soil exhaustion due to over cropping leading to low land productivity.
5. Over use of farm chemicals fertilizers and pesticides leads to pollution of rivers and thus creating health problems.
6. Irrigation farming encourages the spread of water weeds such as rhizomes which compete with the crops and thus low yields.
7. High costs of production / maintaining the irrigation projects such as constant dredging of the canals; and this reduces the profit levels.
8. Fluctuations in water flow along the rivers during the dry season which leads to low yields.
9. Growth of weeds such as rygenis which compete with the crops and thus reducing yields / increases the costs of production.
10. Shortage of labour on the irrigation farmlands, which limits the agricultural activities.
11. Fluctuations in the prices of the crops grown on the world market, leading to fluctuations in incomes.

Note: Other irrigation schemes in Sudan include:

- Kenana sugar scheme (south of Sennar)
- The Rahad river scheme (for mainly cotton, grounds nuts , dura, maize and vegetables)
- Danazin scheme.

IRRIGATION FARMING IN EGYPT

More than 90% of Egypt is desert, which is divided into two by the Nile River. The Nile Valley and delta are main centres of settlement and cultivation. Less than 10% of the land area is suitable for cultivation and hence the need for irrigation.

A sketch map of Egypt showing irrigated areas

Conditions favouring irrigation farming in Egypt

1. The area is arid/ receives low and unreliable rainfall necessitating irrigation farming. More than 90 % of Egypt receives less than 250mm of rainfall.
2. Presence of extensive/ large/ vast and cheap land to establish the irrigation farms due to the low population.
3. Low incidence of pests and diseases due to hot temperatures which supports growth of crops.
4. Relatively flat landscape/ gently sloping landscape in the central valley which allows the use of machines like tractors on the farms and allowing irrigation under gravity flow.
5. Large/ constant supply of water for irrigation from the Nile river and the large oases such as Baharia, Farafra, Dakhla ; and lagoons especially in the Nile delta.
6. Presence of well-drained and fertile alluvial soils deposited during flooding to support the growing of crops.
7. Large supply of skilled labour to work on the irrigation farms such as drivers, harvesters and managers.
8. Modern technology employed on the farms such as refrigerated trucks, cold rooms, construction of canals.
9. Presence of modern transport network by railway, road, air, foe easy marketing and distribution of crops to market centres.
10. Large sums of capital to invest in irrigation farming such as purchasing farm machinery,

chemicals, and fertilizers.

11. Large/Ready market for farm produce within the urban centres of Egypt and other countries.

12. Supportive/ positive government policy towards irrigation farming through giving tax incentives and encouraging farm research.

13. Formation of cooperatives which reduce the costs of production such as through collective buying of farm inputs.

Contributions of irrigation farming to the economy of Egypt

13. It has increased the production of both food and cash crops and this improves incomes / improves the quality of life.

14. Promotion of infrastructural development such as dams, roads, railway, and canals intended for easy movement, irrigation.

15. Generation of foreign exchange through the exportation of the some cash crops such as cotton to other countries, which increases export earnings.

16. Generation of more employment opportunities to the people, which improves their standards of living.

17. Promotion of industrial development by providing raw materials such as such as textiles using cotton, grain milling using grains.

18. Generation of government revenue through taxation of farming companies and workers' incomes, and the revenue is used to provide social services.

19. Facilitated diversification of the economy hence avoiding over dependence on a few sectors/ as an alternative foreign exchange earner.

20. Strengthened international relations between Egypt and other countries which import its farm products such as UK, Germany, and USA, which promotes further trade/ capital inflow.

21. Promoted growth of urban centres such as Cairo, Qena, Asyut, Aswan; and associated facilities such as recreation, hospitals, and educational facilities.

22. Promotion of crop research which develops new varieties of canes, experiments with pests and disease control, soil improvement and fertilizer application techniques.

23. Promotion of tourism development since the irrigation schemes attract many tourists, which brings in foreign currency to the country.

24. The schemes have enabled the provision of water for both domestic and industrial use.

25. Irrigation farming has converted wasteland into productive use.

Problems resulting from/ Shortcomings of the irrigation scheme

1. *Silting of the irrigation canals* as irrigation water deposits its suspension material in them. Regular dredging is necessary which is quite costly.

2. *Irrigation has led to salination* (increased saltiness of the soil) due to the high rates of evaporation in the irrigation scheme and this limits plant growth which in turn has limited yields.

3. *Some reservoirs are shallow leading to flooding of farmlands* and this has increased the spread of pests and diseases such as Bilharzia; which undermines the standards of living.

4. *Displacement of people as land was being set aside* for the scheme such as the nomads who used to graze their animals in the area. it was also costly to relocate such people.

5. *The scheme was very expensive to undertake* such as high costs of establishing farmlands, irrigation channels, dams, pumps plus high costs of maintaining the irrigation scheme—hence straining the government budget.

6. *Irrigation encourages environmental pollution such as from* the chemicals used in controlling crop pests and diseases and the emission of fumes and disposal of wastes from the processing factories.

7. *Urban—related problems* such as slum growth, alcoholism, robbery, gambling and these problems are very costly to eradicate.

8. By encouraging settlement in the formerly dry areas, *irrigation has created a problem of land scarcity.* Today there is competition for land between farmers and industrialists.

Problems facing irrigation farming in Egypt

1. Excessive evaporation due to hot temperatures leading to increased soil salinity in the central valley and thus poor yields.

2. It has encouraged the spread of waterborne diseases such as bilharzia in the central valley.

3. Soil exhaustion due to over cropping leading to low land productivity.

4. Over use of farm chemicals fertilizers and pesticides leads to pollution of rivers and thus creating health problems.

5. Irrigation farming encourages the spread of water weeds such as rhizomes which compete with the crops and thus low yields.

6. High costs of production / maintaining the irrigation projects such as constant dredging of the canals

7. Fluctuations in water flow along the rivers during the dry season which leads to low yields.

8. etc

Steps taken to improve irrigation farming in Egypt

1. Construction of water reservoirs to supply water for irrigation.
2. Reclaiming of dry land for crop farming to increase production.
3. Extension of canals and aqueducts to transfer water to the farms.
4. Practicing mixed farming to encourage interdependence between crops and livestock.
5. Specialization of farming activities and thus increase in the quality of output.
6. Constant dredging of canals to allow efficient flow of water for irrigation.
7. Carrying out market research / international cooperation to widen the export market for farm output.
8. Increasing research into better yielding, fast maturing and disease resistant varieties.
9. Hiring labour during the peak periods such as harvesting.
10. Formation/ strengthening of cooperatives to easily acquire loans to expand the farms.
11. Controlling weeds using herbicides and thus increasing the farm yields.
12. Intensive cultivation to increase the yields and thus offset the high costs of irrigation.

IRRIGATION FARMING IN SENEGAL

River Senegal forms the boundary between Mauritania and Senegal, which are West African, countries bordering the Atlantic coast. In this area, annual rainfall is about 400mm or less. However, most of the northern areas are in a desert. Therefore because of river, there was need to establish irrigation schemes to increase food production. The major schemes are the Richard toll scheme and the delta scheme. The major crops grown are maize, tomatoes, sorghum, sweet potatoes, sugar canes, millet, rice, cucurbits, and beans.

A sketch map of the Richard Toll irrigation scheme in Senegal

Conditions favouring irrigation farming in Senegal

1) The area is semi-arid/ receives low and unreliable rainfall necessitating irrigation farming.

2) Presence of extensive/ large/ vast and cheap land in the area to establish the large irrigation farms.

3) Low incidence of pests and diseases due to hot temperatures which supports growth of crops.

4) Relatively flat landscape/ gently sloping landscape which allows the use of machines like tractors on the farms and also allowing irrigation under gravity flow.

5) Large/ constant supply of water for irrigation from river Senegal and its tributaries like Doue, and Taoue

6) Presence of fertile alluvial and silt soils deposited in the area due to annual flooding to support the growing of crops.

7) Availability of large sums of capital provided by the government to construct canals, pumping stations and crop farms.

8) Large supply of skilled labour to work on the irrigation farms such as drivers, harvesters and managers.

9) Modern technology employed on the farms such as use of tractors for farming, construction of canals.

10) Presence of modern transport network by railway, road, air, foe easy marketing and distribution of crops to market centres.

11) Large sums of capital to invest in irrigation farming such as purchasing farm machinery, chemicals, and fertilizers.

12) Presence of a large market for farm produce within the urban centres of Senegal, and other countries like Gambia, Mauritania among others.

13) Supportive/ positive government policy towards irrigation farming through giving tax reductions and encouraging farm research.

THE AWASH VALLEY AUTHORITY IN ETHIOPIA

This was established by the Ethiopian government to transform an arid area into an agriculturally productive area. The valley through which the Awash River flows stretches for about 1200 km long from the mountains of Addis Ababa to Lake Abe on the Djibouti border in the Danakil desert. In this area rainfall varies year to year between 250mm and 750mm and this area was formerly devoted almost entirely to nomadic pastoralism.

This project consists of various schemes which are:

a) Wonji scheme mainly for sugar canes

b) Malka- Amibara scheme for cotton, maize, tobacco, vegetables

c) Tendaho scheme in the Danakil desert for cotton.

A sketch map showing the location of Awash Valley Authority

Factors which favoured the establishment of the Awash valley authority

1) The area is semi-arid/ receives low and unreliable rainfall (250-750mm per annum) necessitating irrigation farming.

2) Presence of extensive/ large/ vast and cheap land in the area due to the low population to establish the irrigation farms.

3) Low incidence of pests and diseases due to hot temperatures which supports growth of crops.

4) Relatively flat landscape/ gently sloping landscape in the area which allows the use of machines like tractors on the farms and also allowing irrigation under gravity flow.

5) The sunny arid climate that favours the ripening and harvesting of crops.

6) Large/ constant supply of water for irrigation from River Awash.

7) Presence of well-drained and fertile alluvial soils deposited during the times of flooding to support the growing of crops.

8) Large supply of skilled labour to work on the irrigation farms such as drivers, harvesters and managers.

9) Availability of modern technology employed on the farms such as construction of dams such as koka dam just north of wonji , Tendaho dam and Kesem dam and construction of canals.

10) Presence of modern transport network by railway, road, air, foe easy marketing and distribution of crops to market centres.

11) Availability of large sums of capital to invest in irrigation farming such as purchasing farm

machinery, chemicals, and fertilizers.

12) Presence of a large market for farm produce within the urban centres like Addis Ababa and other countries.

13) Supportive/ positive government policy towards irrigation farming through giving tax reductions and encouraging farm research.

MINING IN AFRICA

Mining is the extraction of minerals / rock ores and natural gas from the earth's crust.

The extraction of minerals plays an important role in the economic life of most African countries because the account for the bulky of export earnings.

Different methods are used to extract minerals depending on the type and depth. The major methods are:

Open cast: this is the easiest and cheapest way of extracting minerals that occur close to the surface. It involves the removal of overburden earth and other rock bend lying above the mineral bearing rock. Sometimes blasting is done to loosen the rock. Extraction is done in successive layers until the mineral content becomes too small or too deep to be mined.

Underground mining: it is used where the ores lies deep below the surface with the very thick over burden rock that is too thick to be removed by mechanical shovels. Underground mining has two categories namely:

(a) **Adit mining**: this is where horizontal / slightly inclined tunnels are dug into the hill side. Adit mining is used where the mineral ores occur in gently sloping veins on the side of a hill.

(b) **Shaft mining**: where Adit mining cannot effectively reach the mineral, vertical shafts are to be used. The vertical shafts may be extended downwards for several hundred kilo meters from the surface.

Vertical shafts / horizontal tunnels are dug to reach the mineral bearing rock. The tunnels are supported by either timber or steel or concrete beams to prevent the roof tops from falling in and must be ventilated and kept free of water.

Explosives may be used to loosen the mineral bearing rock. The mineral ore is then transported by conveyor belts or high railway and brought to the surface lift cages.

(c) **Placer mining / panning**: this method of mining is used where the mineral bearing rock has been broken by erosion, transported and deposited by running water. For

example particles of gold, tin and platinum that may occur in sand gravel on the beds of some rivers.

In this case, the sand and gravel are dug out and mixed with water in a a shallow circular pan. It is the tilted in such a way that the lighter sand is washed over side leaving the heavier material on the bottom. It is from this material that mineral is extracted.

Major mineral in Africa

These include:

I. Copper: in Zambia, DRC, south Africa, etc.

II. Iron ore: South Africa, Liberia, Mauritania, Nigeria Angola, Gabon Guinea, Senegal, etc.

III. Petroleum: Nigeria, Namibia, Egypt, Libya, Algeria, Morocco Angola, etc.

IV. Diamonds: south Africa, DRC, sierra Leon, Tanzania, etc.

V. Uranium: south Africa, DRC, CAR, Nigeria, etc.

VI. Gold; Zimbabwe, Ghana, South Africa, DRC, etc.

VII. Coal: south Africa, DRC , Botswana, Namibia sierra Leon, etc.

MINING IN ZAMBIA

Mining is the most important economic activity in Zambia and the dominant mineral is copper. Zambia's deposits are found in a 50km wide belt extending from Ndola– Luanshya areas north westwards to Bancroft. These deposits are continued into Zaire through Lubumbashi.

Mining started in the old mines of Roan-Antelope, Nkana, Mufulira, and Chibuluma. Copper mining is the largest customer of railway transport and power.

Other minerals in the Zambian copper belt include:

- Cobalt in Chibuluma and Nkana
- Gold and silver are removed during copper processing
- Zinc, manganese, and lead mined at Kabwe.

NOTE: other copper producing countries in Africa include: Democratic Republic of Congo, South Africa, Zimbabwe, Namibia, and Morocco.

A Sketch map showing the Zambian copper belt

Factors which have favoured the development of the mining sector in Zambia

1. Presence of extensive/large deposits of copper. The copper belt covers 50km wide and 110 km long, hence economically viable to exploit for a long time.
2. Nearness of some minerals to the surface, making the use of the cheap open cast method possible.
3. Presence of cheap labour to work in mining sector provided by nationals, since there is no gainful employment in agriculture.
4. Presence of skilled labour provided by foreign companies for high quality production in refining and processing. Even local people have been trained.
5. Availability of large quantities of power supply necessary for processing and smelting mainly got from Kariba dam on river Zambezi and Kafue power station.
6. Presence of large sums of capital mainly provided by foreigners who invest money in extraction and processing of copper.
7. Presence of a large market for copper such as United Kingdom and Japan. Copper is used in making electrical appliances, armaments, minting coins among others. .
8. Improved transport infrastructure such as the completion of the Tazara railway connecting the copper belt to Dar- es-salaam port for export.
9. Improved technology (such as the use of caterpillars) brought in by foreign companies to increase efficiency, making mining relatively cost-effective/increasing efficiency.
10. Supportive/positive government policy towards the mining sector. The Zambian government has a controlling interest in the mines administered by the Zambian consolidated copper mines company/corporation.

Methods of copper mining

There are two types of mining used:

- Open cast mining
- Underground mining

Open cast mining

This method is used when the copper ore is near the surface. The top soil is removed and the

copper ore is blasted using explosives. The copper ore is then crushed to reduce the size. It is then loaded into trucks and taken to the processing plants.

Open cast mining exists at Kalengwa, Baluba, Bwana mkubwa, Nchanga mines.

Shaft/ underground mining

A large part of Zambia's copper production comes from underground mines, and therefore underground/shaft mining is greatly used. Vertical shafts are dug into the ground to appropriate levels. From these, horizontal tunnels leading to the ore body are constructed. Supporters are provided from the roof to the floor of the tunnels. The copper ore is then blasted using explosives causing shattering. The ores are crushed and loaded on small wagons and taken to the vertical shaft, and lifted to the surface, and taken to processing plants.

Underground mines exist at Nchanga, Konkola, Mindola (Ndola), Mufulira, Chibuluma.

Uses of copper

- Making household utensils
- Making wires for electrical equipment
- Minting of coins(money)
- Making military weapons(like bullets)
- Making machinery bearings
- Good alloy with zinc to form brass.

Export routes

- Tanzam /Tazara railway – most of the copper is transported by railway to the port of dare s salaam for export.
- Railway to Lobito port in Angola.
- A combination of road and railway through Malawi to port Nacala in Mozambique.

The Zambian copper is exported mainly to United Kingdom, J apan, Germany, and Canada.

Environmental problems resulting from mining sector in Zambia

1. Pollution of the environment in form of noise, dust from the mines and the discharge of toxic wastes from the copper refineries, which causes health complications.
2. Destruction of vegetation where minerals are being extracted and hence destroying the habitat of wild life.

3. Destruction of the soil structure/disfiguring of the landscape. It is also associated with soil erosion, and slides and general land degradation.
4. There is stagnant water in the hollows/depressions created, hence breeding of disease causing vectors. There is also flooding of the mines.
5. Destruction of what would be agricultural land due to large quantities of waste rock debris deposited allover covering the soil.
6. Influx/movement of people from rural areas to the mining centres which has also reduced agricultural production.
7. Displacement of people due to development of large open cast mining with less or no compensation.
8. Urban—related problems result such as traffic congestion, high crime rate, drug abuse.
9. Emergence of ghost towns where minerals are exhausted and hence the towns abandoned.
10. Regional imbalances in development in terms of infrastructure, since the areas without minerals are given less attention by government.
11. Mining accidents occur leading to loss of life and property.

Ways of solving the above problems

1. Environmental laws /standards put up to control pollution of the environment.
2. Emphasizing reforestation and afforestation programmes to reduce vegetation depletion.
3. Refilling of the mining pits/hollows to avoid stagnant water and possible accidents.
4. Spraying with chemicals to kill disease causing vectors and medical treatment of the affected people.
5. Resettling /re-location of the displaced people elsewhere.
6. Strengthening urban authorities and police to control urban problems like drug abuse and high crime rate.

Problems faced by the miners when extracting copper

1. Suffocation due to too much dust leading to diseases such as lung cancer
2. Flooding of the mines at times which limits their work
3. High underground temperatures (too much heat) unfavourable for workers.
4. Collapsing roofs and flying stones leading to loss of life
5. Noise pollution during mining reducing the quality of life.
6. There are too many tunnels that sometimes the miners get lost. This is compounded by

darkness of the mines which affects their work.

Problems resulting from over dependence on one dominant export commodity (copper) in Zambia

1. Price fluctuation on the world market which greatly affects the economy by leading to uncertain incomes, and this was especially during the 1970s.
2. Restrictive international commodity quotas which reduces the available market.
3. Over exploitation leading to quick exhaustion of the copper.
4. Neglect of other sectors of the economy such as diverting labour and funds from agriculture to copper mining.
5. The closure of some mines leading to the problems of unemployment.
6. Competition from other producing countries leading to narrow market
7. Competition from synthetic substitutes which also reduces the demand for copper.
8. Large scale exploitation of copper leads to environmental degradation such as ugly landscape created.

Steps being taken to solve these problems

1. Efforts of diversifying the economy such as the growing of tobacco and maize; and developing the industrial sector.
2. Zambia is now a member of regional and international agreements which is widening the market potential.
3. Improving of the processed mineral quality to the acceptable international standards to expand its market.
4. Importing of more food especially maize in order to supplement the available food supply.
5. Controlling production to reduce price fluctuations.
6. Opening up of new mines after the exhaustion of some old mines.

General Problems facing the mining industry in Zambia

1. Exhaustion of some mines, since mining has taken place for long such as in Bwana Mkubwa and Roan- Antelope, this limits production.
2. Due to exhaustion of minerals and closure of some mines, ghost towns have emerged with redundant infrastructure.
3. Fluctuation of copper prices on the world market leading to uncertain incomes yet Zambia greatly depends on copper exports.

4. Accidents occur during mineral exploitation leading to loss of life such as due to falling rocks.
5. Limited power supply for the mines and this has resulted into importation of coal from Zimbabwe.
6. Landlockedness of Zambia with no direct and easy access to the sea. It has to export through other countries which are often in political unrest such as Zimbabwe, Angola, and DRC.
7. Increasing costs of mining due to increasing depth of the copper bearing rocks (seams/layers).
8. Profit repatriation by the foreign owned companies (such as Anglo-American company) resulting into loss of revenue.
9. Competition from other countries producing copper such as USA, DRC, and South Africa which limits the market for Zambian copper.
10. Limited labour supply to work in the mines and the poor working conditions there which limits copper production.
11. Underdeveloped technology and use of depreciated machinery in some areas, which limits efficiency in mining sector.

Possible ways of solving those problems

1. Opening alternative routes for copper exports.
2. Building political relations with the neighbors for easy exportation of copper.
3. Opening up new mines where some are exhausted.
4. Carrying out market research to widen the export market for copper.
5. Recruitment of labor from the neighboring counties such as Angola, DRC, Malawi to work in the mines.
6. Replacement of the old and outdated machinery with new modern machinery to increase production.
7. Emphasize processing of mineral ores into manufactured goods to minimize the effects of price fluctuations on the world market.
8. Pumping fresh air into the mines to reduce suffocation.
9. Supporting tunnels to prevent collapsing.

The Shaba—Zambia copper belt

MINING IN SOUTH AFRICA

South Africa is gifted /blessed with plenty of mineral resources and the country has the most developed mining sector in Africa. Minerals mined in South Africa include: gold, diamonds, coal, iron ore, tin, manganese, platinum, uranium, chromium, phosphates, copper, asbestos, limestone, zinc, and nickel among others.

Gold mining

Gold is a heavy, fairly soft yellow metal and easily molded. It is greatly valued by man since it is the world's money (international currency). South Africa has the world's largest known reserves of gold. Gold mining takes place on the Rand (Witwatersrand) covering parts of the Orange Free State and Transvaal.

The main gold fields of the Rand include:

- Johannesburg
- Springs
- Krugersdorp
- Klerksdorp
- Vierfontein
- Odendalsrus

Gold mining started in 1886 and many people came in to dig/exploit this precious metal and eventually big companies.

A sketch map showing the gold fields of South Africa

Method of gold mining in South Africa

Gold mining in South Africa is similar to copper mining in Zambia (using the underground / shaft method). The rocks which contain gold are called reefs.

Illustration

NB: The minerals which occur with gold include: uranium and silver.

Other African countries with significant gold deposits include: Ghana, Zimbabwe, and Democratic Republic of Congo (DRC).

Conditions which have favoured gold mining in South Africa

1. Presence of large gold reserves /deposits which encourage investment in the mining sector/making mining economically viable.
2. High quality of the gold mines, with gold being a very precious metal used as international currency encourages mining investment.
3. Presence of cheap labour to work in the mines provided by local people and migrants from neighboring countries.
4. Presence of skilled labour to carry out extraction and processing provided by foreigners and locally trained people.
5. Presence of sufficient/adequate capital to invest in the mining sector provided by foreign and local companies.
6. Presence of a ready market for gold both locally and internationally.
7. Availability of large power supply for mining and processing such as hydroelectricity, coal and oil.

8. High level of technology used by mining companies such as use of caterpillars, shaft /underground mining to increase production.
9. Efficient transport and communication system such roads and railway to transport gold to processing centres and markets.
10. Positive/supportive government policy such as encouraging local and foreign investors, controlling the mining activities.
11. Increased research to discover more valuable gold fields and advancing the mining technology.
12. Political stability of South Africa which encourages many investors in mineral exploration, extraction and processing.

Uses of gold

- Mainly used in jewelry industry.
- Used in gold craft industries
- Internationally used as money and hence a medium/standard of exchange.

Diamond mining

Diamonds are formed beneath the ground by great heat of volcanic activity and occur in rocks called **kimberlite**.

The leading producers of diamonds in Africa include: DRC, South Africa, Botswana, Ghana, Namibia, Sierra Leone, Tanzania, and Angola.

In South Africa diamond has the greatest deposits in **Kimberley** and **Hope town** in the Rand. Other mines include: the premier mine near Pretoria, Bultfontein, Jagersfontein, and Koffiefontein.

Most industries connected with diamonds are found in Johannesburg—with most of the diamond cutting factories plus diamond research centre.

Note: diamonds are a hard material, form of carbon and look like pieces of ice. When cut they glitter and shine beautifully. But they are difficult to find , mine and recover from parent rock.

Method of diamond mining

Diamond mining is done using:

- Open-cast mining
- Shaft/underground mining

South Africa also has alluvial deposits. These are found along the Vaal—Hartz—Orange valleys,

in stream beds, dried up river courses and on river terraces. It is believed that these deposits were removed from their original pipes many years ago by riverine and rain-wash erosion and hence deposited. Such deposits are also located along the coastal margins in marine sands and gravels between Fort Nolloth and Walvis Bay.

Such alluvial diamonds are mined using a method called **placer or alluvial mining**. In this method a steel dredge or a gravel pump is used to dig up the alluvial deposits (waterlogged alluvium). The alluvium is mixed with a great deal of water. The mixture is rotated and in the process the lighter particles (sand, mud, dust) are washed off, leaving the heavier ores (diamonds settled down.

A sketch map showing the diamond fields of South Africa

Uses of diamonds

- Used in making jewelry
- Making industrial equipment like drill bits and abrasive drilling wheels.
- Cutting tools in industries
- White sparkling diamonds are cut into pyramidal gems.

Coal mining

Coal is a major industrial mineral especially for iron and steel industries. It is also used to generate electricity alongside other sources of power. Southern Transvaal is the leading coal producing state in South Africa. Huge deposits occur at Witbank and Vereeniging.

Iron ore mining

Iron is possibly the most useful metal. In South Africa large deposits occur in Pretoria, Middleburg, Waterburg, Vryburg and north western Cape.

Problems facing the mining sector in South Africa

1. Shortage of labour to work in the mines and related industries which undermines production.
2. Shortage of water needed in processing of minerals especially in the Rand which also limits production.
3. Price fluctuations of minerals on the world market leading to uncertain incomes.
4. Competition with other mineral producing countries like Ghana, DRC producing gold which limits the available market.
5. Long routes to the coast which increases the transport costs.
6. Labour unrest which often leads to strikes and hence limiting production. This is due to poor working conditions and racial segregation.
7. Accidents occur during mining leading to loss of life such as due to falling rocks.
8. Suffocation due to lack of fresh air and flooding of the mines which scares away many potential workers.
9. High costs of mining due to increasing depth of the mines.
10. Exhaustion of some high grade mineral deposits due to over exploitation.

Solutions to the problems facing the mining sector in South Africa

1. Recruiting labour from neighboring countries such as Swaziland, and Mozambique to minimize labour shortage.
2. Construction of dams to trap water such as Vaal dam and Vaal Barrage on Vaal River. Underground sources are also tapped to minimize water shortage.
3. Carrying out market research in order to expand market for the minerals.
4. Emphasis on processing the minerals into finished goods to minimize the effects of price fluctuations on the world market.
5. Controlling production to reduce price fluctuations.
6. Abolition of apartheid which has reduced racial segregation and labour unrest.
7. Emphasis on production of high value minerals such as gold and diamonds to offset the high costs of mining.
8. Pumping fresh air into the mines to reduce suffocation and tunnels are supported to prevent collapsing.

MINING IN NIGERIA

Nigeria is the largest producer of oil south of the Sahara. Oil mining started in 1937, but commercial production started in 1956. Large scale oil fields / deposits exist in the Niger delta

and offshore in the ocean. Refineries exist at Port Harcourt, Warri, and Kaduna.

In Nigeria many companies both domestic and foreign are engaged in the oil industry such as shell—BP, Gulf, Mobil, Texaco, Nigerian national oil corporation. Most foreign companies originate from Britain, USA, France, Italy, Japan, and Germany.

Apart from oil/ petroleum, Nigeria produces natural gas, a cheap clean industrial fuel. Other important minerals in Nigeria include:

- Iron ore at Enugu and Itakpe near Lakoja
- Coal mined at Lafia and Enugu supplying power
- Tin in Baunchi on Jos plateau

A sketch map showing the distribution of minerals in Nigeria

Note: other countries producing oil in Africa include Libya, Algeria, Egypt, Angola, Namibia, Ivory Coast, Sudan, among others.

Process of oil drilling

- The basic equipment for oil drilling is a derrick—which is a steel tower about 40m high.
- Exploration /prospecting/survey of the oil is done and installing of the derricks/oil rigs follows.
- The derrick carries a drill stem on which steel drilling pipes are screwed /attached, having a drilling bit. The drilling bit is used to drill into/cut through the rock strata/layers to reach the oil well below.
- Lubricating mud is pumped into drilling pipe to lubricate the bit and to bring up rock samples.
- Once the bit reaches the oil stratum/layer, crude oil rushes out by natural pressure or pumped out to the surface using oil pumps if natural pressure is weak.
- The oil is then transported through pipes, fuel tankers, trucks to the refinery.

Illustration

Transportation of oil

(a) Pipe lines

This is the cheapest and most efficient way of transporting oil. The initial cost in laying the pipes is high but cheap in the longrun and simple to operate and maintain.

(b) Tankers

These are special cargo vessels designed to carry oil only.

(c) Oil trucks

These are more used for important delivery of the refined oil.

Marketing of oil

Oil from African countries (like Nigeria) is exported to countries like USA, United Kingdom, Italy, France, Germany and Belgium. Nigeria became a member of OPEC (Organization of petroleum exporting countries) in the late 1970s.

Uses of oil/ petroleum

1. Providing fuel for transport vehicles, airplanes, ships, railway transport
2. Used to generate thermal electricity used in industries, homes, and institutions
3. Oil is a lubricant in vehicles, machinery and other appliances (Greece, engine oil)
4. Used in making plastics, fertilizers, insecticides, drugs, perfumes, detergents, acids, synthetic rubber and fibres
5. Making tar (Asphalt),
6. Making gases , and spirits

Problems of over depending on crude oil as an export

1. Price fluctuations leading to unstable incomes
2. Over exploitation of crude oil leading to quick exhaustion

3. Closure of some mines leading to problems of unemployment.
4. Over production leading to a fall in prices and low incomes
5. Competition from other producing countries leading to narrow market
6. Restrictive international commodity quotas reduce market hence low export earnings
7. Neglect of other sectors hence limited resource base
8. Competition from alternative sources of energy which limit income/ market
9. Large scale exploitation leads to environmental degradation such as by disfiguring the landscape.

***Factors which have favoured the development of the mining sector in Nigeria**

1. Presence of large reserves of minerals in the country. For example large reserves of oil at Oloibiri, port Harcourt and offshore deposits.
2. Presence of adequate capital to invest in the mining sector such as oil drilling, oil refining—provided by local and foreign investors.
3. Large supply of skilled and semi-skilled labour to work in the mining sector, brought in by the foreign companies and those trained locally such as engineers , geologists
4. High level/improved technology employed in mining such as oil drilling pipe technology and refining technology.
5. Presence of a large market, both domestic and foreign. Nigeria mainly exports oil to USA, United Kingdom, Italy, France and the rest of Africa.
6. Efficient transport system. Nigeria is not landlocked and is lucky to have oil reserves at the coast which minimizes the transport costs to export markets.
7. Large quantities of power in form of hydro-electric power at Kainji dam on Niger River, oil and natural gas to support the mining industry.
8. The setting up of various processing industries such as the port Harcourt refinery, at Warri, and Kaduna, to increase the quality of output.
9. Positive/ supportive government policy such as encouraging many companies to invest in the mining sector.
10. Nigeria is also strategically located reasonably close to the markets in Western Europe, USA and South America which leads to easy exportation.

Problems resulting from oil mining (negative effects of mining sector)

1. Pollution of the environment, involving water, air and noise pollution from the mines and

processing industries.

2. Results into underdevelopment of rural areas. Distant people have been attracted to the mining areas, hence neglecting rural activities like agriculture.
3. Dereliction of land, disfiguring of the landscape where mining has taken place. After exhaustion of minerals, wasteland is left behind.
4. Profit repatriation by the foreign—owned companies such as shell, Texaco. These send profits back to their home countries.
5. Resulted into income inequalities. High wages are paid to workers in the sector unlike other sectors.
6. Results into regional imbalance in development, in terms of infrastructure. Mining zones are more developed than other areas.
7. Urban—related problems such as unemployment, high crime rate, slum growth, among others.
8. Results into destruction of vegetation when clearing mining sites which has damaged the landscape and water sources.
9. Displacement of people from areas where minerals (oil wells) were discovered, with les or no compensation.

MINING IN LIBERIA

Liberia has large quantities of iron ore and is currently the world's 10^{th} largest iron ore exporter. Other minerals but of little economic importance include diamonds.

Deposits of iron ore exist at: Wologisi Mountains near Voinjama, Bie hills on the border with Sierra Leone, Bomi hills.

A sketch map of Liberia showing the location of iron ore deposits

Conditions which have favoured iron ore mining in Liberia

1) Presence of large reserves / deposits of iron ore which encourage investment in the mining sector/ making mining economically viable. (estimated about one billion tonnes)

2) High quality of the iron ore which encourages mining investment by large companies.

3) Presence of cheap labour to work in the mines provided by local people and migrants from neighboring countries.

4) Presence of skilled labour to carry out extraction and processing provided by foreigners and locally trained people.

5) Presence of large sums of capital to invest in the mining sector provided by foreign and local companies.

6) Presence of a ready market for gold both locally and internationally.

7) Availability of large power supply for mining and processing such as hydroelectricity, coal and oil.

8) High level of technology used by mining companies such as use of caterpillars, shaft / underground mining to increase production.

9) Developed transport and communication system such roads and railway to transport iron ore to the coast for marketing.

10) Positive/ supportive government policy such as encouraging local and foreign investors, controlling the mining activities.

11) Increased research to discover more valuable gold fields and advancing the mining technology.

Note: The mining of iron ore is done by open cast method where it near the surface and underground mining method for that iron ore deep underground.

The most productive of Liberia's iron ore fields is run by LAMCO (Liberian American Swedish Minerals Company) on the western slopes of the Nimba mountains).

Marketing of iron ore. Liberia has no iron and steel industries and iron ore is exported mainly to Germany, USA, Netherlands, France, Belgium, and Japan.

Other countries in Africa producing iron ore include Zimbabwe, Swaziland, Sierra Leone, Nigeria, Mauritania, Angola, Guinea, Ivory Coast, South Africa and Egypt.

Challenges facing the mining sector in Liberia

1) Shortage of skilled labour to work in the mines and related industries which undermines production.

2) Price fluctuations of minerals on the world market leading to uncertain incomes.

3) Competition with other iron ore producing countries Zimbabwe, Swaziland, Sierra Leone, Nigeria, Mauritania, South Africa which limits the available market.

4) Accidents occur during mining leading to loss of life such as due to falling rocks.

5) Exhaustion of some high grade mineral deposits in some regions due to over exploitation.

6) Over dependence on foreign companies such as American companies in exploiting iron ore, which leads to profit repatriation and hence limiting further investment in mining.

7) Iron ore deposits occur in hilly areas making the development of transport routes difficult.

8) Inadequate capital to invest in the mining sector, which undermines the quality and quantity of production. High costs are involved in exploiting, setting up railway lines and developing processing centres.

9) High costs of mining due to increasing depth of the mines.

10) Continuous heavy rainfall which makes iron ore turn into mud during the rainy period.

11) Political instability in the country in the recent past characterized by civil wars.

Steps taken to improve the mining sector in Liberia

1) Campaign for national security to increase the confidence of mining investors.

2) Opening up new deposits such as the Wologosi mountain ranges in western Liberia and the Bie mountain range in north eastern Liberia.

3) Use of the conveyor belts to transport the ore down the hills to the railhead.

4) Recruiting labour from neighboring countries to minimize labour shortage.

5) Carrying out market research in order to expand market for the minerals.

6) Controlling production to reduce the effects of price fluctuations.

7) Emphasis on production of high value minerals such as gold and diamonds to offset the high costs of mining.

8) Attraction of more foreign investors to invest in the mining sector such as American companies.

MINING IN EGYPT

Egypt is located in North Africa and is Libya's eastern neighbor. It also has large oil deposits. Oil was first discovered in the delta region and later in the western desert. Today over 80% of the oil comes from fields around the Gulf of Suez. Oil production and exports have been

increasing over the years.

The leading four oil fields in and around the Gulf of Suez are: Ramadan, July, El Morgan, Belayim, Abu Rudais.

Egypt is also important producer of natural gas and the fields occur in the western desert, offshore near Alexandria and in the Nile delta.

A sketch map showing the mining areas of Egypt

The gas is transported by pipelines to the major industries such as the Talkha fertilizer plant, Helwan iron and steel industry, textile factory at Mehella el Kubra. Oil refineries also exist at Alexandria.

Oil is mainly exported to Mediterranean countries.

FISHING IN AFRICA

Fishing refers to the extraction aquatic animals from the seas/oceans and inland water bodies.

However the fishing industry in Africa is not well developed. Some countries cannot afford big ships and other equipment; but the situation is gradually changing as fishing activities increase.

Sources of fish

There are two main sources of fish: that is inland and marine fishing grounds. The greatest difference between the two is that inland waters are fresh while the marine/ coastal waters are salty.

a) Inland fisheries

This includes lakes, rivers and swamps. Important lakes include: Lake Chad, Lake Malawi and Lake Chilwa in Malawi, Lake Tanganyika, Lake Nasser, Lake Kariba, lake Volta, and Lake Kainji. The rivers are: Niger, Volta, Congo, Zambezi, and the Nile. The most important species include: Nile pearch and tilapia. Others are Dagaa, cat fish, silver fish, lung fish etc

Note: There are also artificial ponds constructed – widely used in democratic republic of Congo, Malawi among other countries. It is also known as fish farming/ aqua-culture.

b) Marine fisheries (seas/ oceans)

Africa's seas/oceans provide a good fishing ground in the world and the fishing grounds mostly used are along the coasts of south Africa, Angola, Nigeria, Ghana, morocco, Mauritania; which export fish and fish products. Other grounds are the Mediterranean Sea and red sea.

In marine fisheries there are both pelagic and demersal fish. The pelagic fish swim and live in the waters close to the surface of the sea/ ocean such as tuna, swordfish, marlin, pilchards, mackerel, cavalla, barracuda, etc

While the demersal fish live in deep waters, nearer to the sea bed such as stock fish, hake, Pollock, haddock, sole, etc

A sketch map of Africa showing the major marine fishing grounds

Conditions /reasons for low level of development of the fishing industry in Africa (especially marine fishing)

1. Most of Africa's coastline is generally straight (with few indentations) and this limits the development of fishing ports and fish breeding.
2. Presence of coral reefs such as along the east African coast, which interfere with nets and moving vessels.
3. Small continental shelf (a few kms from the coast) which limits penetration of sunlight and plankton growth.
4. Many areas of Africa receive heavy rainfall and therefore look at farming as the main source of livelihood instead of fishing

5. Most of Africa lies within the tropics with high temperatures all year round, which limits plankton growth and fish survival.
6. Limited/ few off—shore islands and this limits fishing villages.
7. Limited edible fish species for example on the West African coast, which discourages investment in the fishing industry.
8. Scattered fish species / very few species moving in shoals. This is due to scattered planktons (such that the fish also scatter in search for them), which discourages investment.
9. Limited capital to invest in fishing, processing and fisheries research, which limits the quality and quantity of production.
10. Low level of technology which limits the quality of production. For example use of poor fishing and preservation methods.
11. Limited market for fish in Africa due to small population and traditional customs which prevent fish consumption; which in turn discpourages production.
12. Stiff competition from developed countries which limits the export market of marine fish.
13. Political instability in many African countries which limits investment in the fishing industry such as by scaring investors.
14. Under developed infrastructure such as poor roads which limits the distribution / market of fish.

Methods of fishing used in Africa

Both traditional/simple and modern methods are used. The simple methods include:

1. Spearing
2. Use of baskets
3. Hook and line method
4. Beach seining
5. Use of light

(Refer)

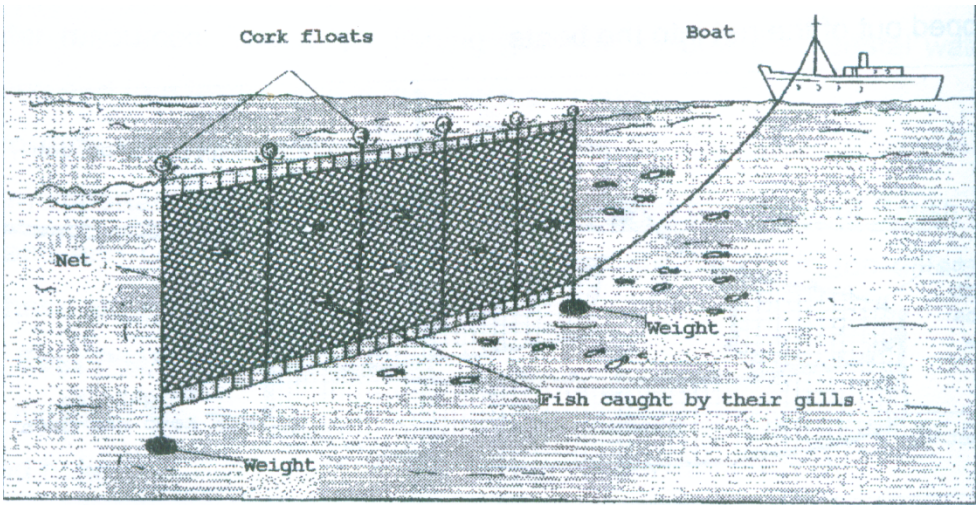
Modern / commercial fishing methods used in Africa

1. Gill netting (drifting)

This is a method used to catch pelagic fish. A net is suspended in water with floats at the top and weights at the bottom. The net hangs vertically in water and the fish are caught by their gills as they try to pass through the net. Once trapped they can move neither forward

or backward. When the fish has been caught the net is removed onto the drifter/ ship for processing.

Illustration of drifting method

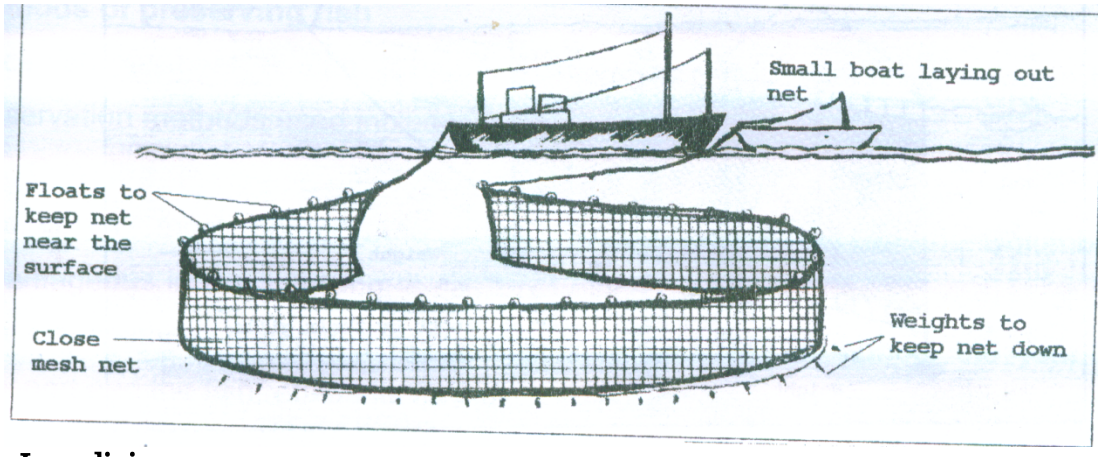


2. Purse seining

This method is also used to catch pelagic fish living near the water surface. A purse seine net is laid out in a circular form below the water to trap a shoal of fish. The fish shoals are located using an eco-sounder. At the bottom of the net a ring exists through which a rope attached to a small boat passes. The small boat is used to lay the net, which net is suspended by floats at the top and weights at the bottom. The net has a close mesh where fish are caught by gills.

After the circle has been made, the rope is pulled to close the bottom of the net thereby engulfing/ trapping the fish. The net is lifted onto the boat/ seiner.

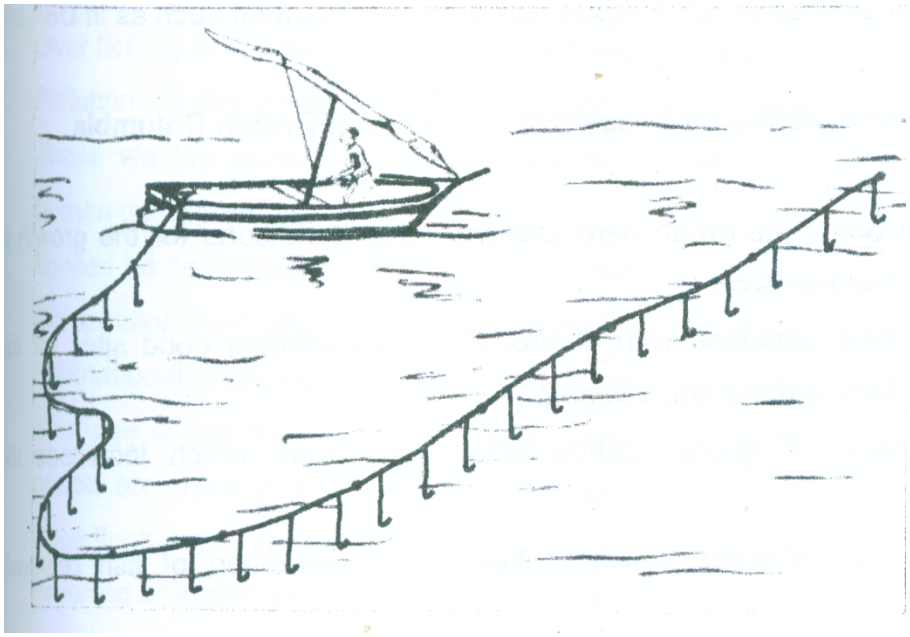
Illustration of purse seining



3. Long lining

This method is used to catch demersal fish found in deep water. It involves the use of a long main line with attached drop lines which have hooks with baits. The main line / main rope can stretch for several kilometers with about 200 drop lines. The fish are caught as they try to eat the baits. When enough fish has been caught, the line is pulled out of water onto the ship and fish removed for processing.

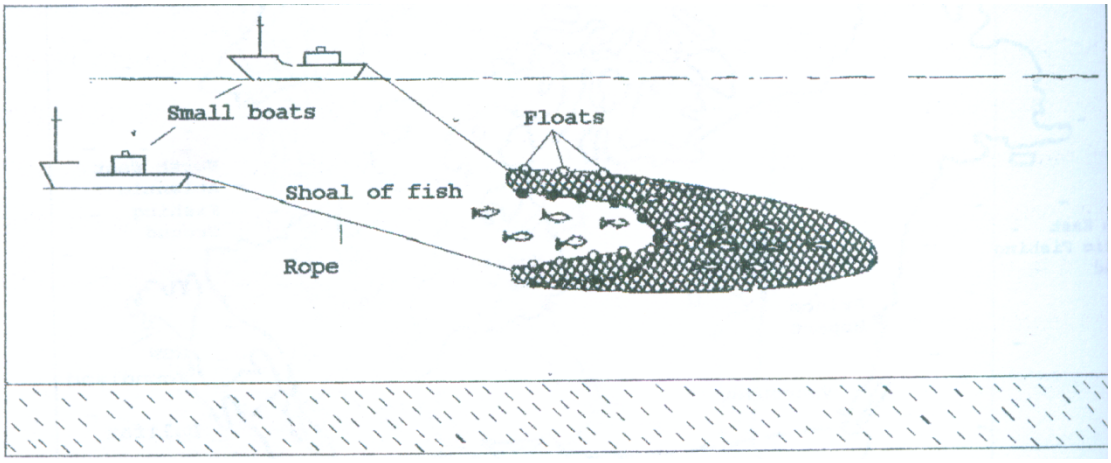
Illustration of the long lining method



4. Trawling

This method is used to catch demersal fish living in deep waters. A cone-shaped net is dragged behind a ship/ boat called a trawler. A trawl net is a bag-shaped net whose mouth is kept open by otter boards (either wooden or metal) and has weights at the bottom and a slim cod end. Any fish that enters the net is trapped at the cod end and after the trawl net is pulled out of water and emptied onto the ship for processing. The process is repeated.

Illustration of trawling method



Methods of fish preservation

Although most fish is consumed fresh, due to tropical conditions some conservation methods are used:

- Sun drying
- Smoking
- Salting
- Frying/ deep frying
- Refrigeration (such as refrigerated trucks)
- Freezing
- Fish canning

Uses of fish

- Fish is used as food providing valuable proteins and minerals (like iodine and calcium)
- Manufacture of animal feeds
- Manufacture of edible oil (used in cooking)
- Making of cosmetics and soap
- Fish skin used as leather material for shoes, belts and bags
- Making of fertilizers
- Making of fish glue
- Making of paints, ink and medicine

Marketing of fish

Much of the fish in Africa is consumed locally. However some countries are exporting fish including: South Africa, Namibia, Angola, morocco, Mauritania, Mali, Liberia, and Chad. Morocco is the leading fish processing country in Africa (such as producing canned fish, fish oil and fish meal)

Difficulties faced in the marketing of fish in Africa

1. Limited capital necessary to acquire modern preservation methods and thus limited fish marketing.
2. Limited domestic market due to small population in Africa and the taboos and traditional customs limiting eating of fish.
3. Stiff competition from the developed fishing countries which limits the export of marine fish.
4. Poor infrastructure connecting the fishing grounds and market centres, which also limits the marketing.
5. Political instability in some areas limiting marketing of fish further.
6. Limited market research and this limits the sales in fish and fish products.
7. Some species of fish are of low value on the international market such as snapper, and this also limits the sales.

FISHING IN SOUTH WEST AFRICAN FISHING GROUNDS

In Africa, the countries of South Africa, Namibia and Angola have a more developed fishing industry compared to those of West Africa. South African fisheries together with Namibia are the most highly developed on the continent. About 20% of the catch is canned and the most important canaries are found at: Cape Town, Saldanha bay, lamberts bay for South Africa. For

Namibia there is: Walvis Bay and Luderitz as the most important.

The fishing industry in South Africa and Namibia is highly capitalized with modern equipment like trawls and purse seines. The main fish species are: cape hake, cape anchovy, sardines, pilchards, stock fish and sole fish plus whales. Rock lobsters are also caught mainly for export.

In the south West African fisheries, there is Angola—which shares similar conditions in Namibia. In the South West African fishing grounds purse seining and trawling are the most important fishing methods.

Factors favouring commercial fishing in the south West African coast/ fishing grounds

1. Presence of a relatively large continental shelf which facilitates fish breeding and the growth of planktons (since sunlight easily reaches the sea bed).
2. The coastline is washed by the cold Benguela current, which offers cool conditions for the growth of planktons and the survival of fish.
3. Presence of many fish species of commercial value such as pilchards, anchovy, hake, lobsters—which have many uses.
4. Large areas of Namibia experience a desert type of climate while parts of South Africa and Angola experience a semi-desert climate. This limits economic activities such as farming making many people to resort to fishing.
5. Presence of a large fishing ground – the Atlantic Ocean favouring large scale fishing investment.
6. Large sums of capital to invest in the fishing industry provided by both local and foreign investors.
7. Availability of a large market for fish both local and foreign. There are also many fish processing plants that provide the immediate market.
8. Developed/ improved technology such as the use of modern methods of fishing (purse seining, trawling) which leads to high quality production.
9. Presence of developed transport and communication routes such as modern port facilities for export, roads connecting to market centres.
10. Availability of cheap labour to work in the fishing activities due to presence of many coastal settlements.
11. Favourable/supportive government policy of diversifying the economy such as by developing processing plants and encouraging fisheries research.
12. The development of many fish processing plants along the coast, such as making fertilizers, cooking oil—which add value to the fish produced.
13. Increased fisheries research such as at Cape Town and Saldanha bay on fish breeding,

fish feeding and maturing.

Problems facing the south West African fisheries

1. Over fishing due to foreign vessels especially Japanese and US vessels invading the South African fishing grounds, hence reducing fish stocks.
2. Pollution problems due to industrialization which reduces the quality of fish and fish products, hence marketing problems.
3. Initial apartheid and on-going elements of racial discrimination /segregation in South Africa which limits fishing activities.
4. Competition from well developed fishing countries such as Canada, USA, Japan; which reduces the market for fish.
5. Accidents associated with the fishing industry such as the capsizing of boats leading to loss of life and equipment.
6. Indiscriminate fishing which leads to reduction in valuable fish species.
7. Narrow continental shelf in some sections of the south West African coast which limits plankton growth and the fish breeding.
8. (Refer to general points.)

WEST AFRICAN FISHING GROUNDS

Fishing is an important activity along most parts of the West African coastline and in the many rivers and lakes. However the greatest catch comes from marine fishing. Deep sea fishing has been developed in Senegal, Ghana, Ivory Coast and Nigeria with modern technology. The species include: herrings, sardines, tuna, mackerel, barracuda, cavalla, anchovy and snapper.

Physical conditions favouring the development of the West African marine fishing industry

1. Presence of a relatively shallow continental shelf which facilitates penetration of sunlight to the seabed and hence favouring the growth of planktons.
2. Relatively indented coastline with sheltered harbors suitable for the construction of fishing ports and for fish breeding.
3. The meeting/mixing of the cold canary and warm guinea current providing ideal conditions for growth of planktons and growth of fish.
4. The upwelling of water important in bringing to the surface planktons and mineral salts to the benefit of fish.
5. Presence of many marketable fish species in the fishing grounds such as herrings, tuna, barracuda, cavalla, anchovy, mackerel—which have many uses.
6. Presence of large fishing grounds – the Atlantic Ocean which attracts fisheries investment

on large scale.

7. Presence of various rivers from the interior which bring in mineral salts for the growth of planktons and acting as breeding grounds for some fish species.

8. Presence of large quantities of timber from the forests for construction of fishing vessels and packaging boxes.

Problems/factors limiting commercial fishing in West Africa

1. Over fishing leading to the reduction inn fish stocks and hence limited investment in fishing.

2. Pollution problems which limits the plankton growth and limits the survival of fish.

3. Competition from developed fishing countries which limits the available market.

4. Accidents occur during fishing and this scares away potential workers/ leads to loss of the equipment.

5. Shortage of capital to invest in the fishing industry, hence the limited processing factories.

6. Low levels of technology used in some areas such as the use of basket trapping, beach seining. There are also poor preservation methods such as smoking, and sun drying; which leads to low quality and quantity of output.

7. Few edible fish species exist (for example only 1/3 of the fish species in west are edible) which discourages investment in the fishing industry.

8. Some species are of low value and this discourages fisheries investment.

9. Under developed transport routes, such that fish does not easily reach the markets.

10. Limited internal market due to small populations such as in countries like Mali, Senegal, and Ivory Coast; which also discourages investment in fishing.

11. (Refer to general points)

Steps being taken to commercialize / develop fishing in West Africa

1. Forming of local cooperatives in order to raise more capital jointly.

2. Introducing modern fishing methods such as trawling, purse seining, motorized vessels to increase the quantity and quality of output.

3. Introducing/ emphasizing fish farming such as in Nigeria to increase fish stocks/ to diversify fish sources.

4. Introducing more marketable fish species to increase fish stocks and catch.

5. Attracting foreign investors /companies to increase investment in the fishing sector.

6. Investment in the fishing industry by the respective governments such as in Ghana some vessels are operated by the state fishing corporation.
7. Establishing more fish processing plants such as Dakar in Senegal, Abidjan in Ivory Coast, and Novadhibou in Mauritania, to increase the quality of fish exports(by adding value).
8. Encouraging the exportation of fish to widen the markets for example Ghana and Ivory Coast export to neighboring countries.
9. Developing the transport routes especially roads and railway lines to improve market accessibility.
10. Introducing/ encouraging better preservation methods such as the use of refrigerators/ Cold storage which keep fish fresh for a long period of time.
11. Educating people about the value of fish to increase the internal market for fish in African countries.
12. Training more staff in the management and control of the fishing grounds to check on over fishing.

NORTH WEST AFRICAN FISHING GROUNDS

Fishing has increasingly become important to the economy and the waters off the coast of morocco are rich in fish. Conflicts developed with the European Union in the late 1990s over the European, especially Spanish fleets operating in Moroccan waters. An agreement reached with the EU reduced European fish catches to protect the endangered species /stocks of fish and boost the Moroccan fishing industry.

The chief fishing centres/ports in morocco are: Agadir, Safi, Essaouira and Casablanca. The fish species include: sardines, tuna, mackerel, anchovies, and shell fish. Much of the fish is processed – frozen or canned for export.

***Importance of the fishing industry in Africa**

(Research area)

Negative effects / disadvantages of the fishing industry

1. Results into over fishing and hence reduction in the fish stocks.
2. Leads to pollution of the environment from the fish processing industries, that is, air and water pollution.
3. Indiscriminate fishing also leads to a reduction in the fish stocks.
4. Fishing leads to conflicts among countries such as Japanese catching large quantities off the coast of West Africa against the rights of such countries.

5. Attraction of labour from other activities such as crop farming and mining, which undermines national development.
6. Fishing is associated with accidents, leading to loss of life and property.
7. The urban centres which result are associated with problems such as slum growth, high crime rate which are costly to solve.
8. Repatriation of profits by the foreign fishing companies and hence limited re-investment in Africa's fishing industry.
9. Straining of the government budget due to financing of the fishing sector; hence limited investment in other sectors.
10. Results into regional imbalance in development in terms of infrastructure. The areas around fishing ports are more developed than other areas.
11. Depletion of forest resources such as during exploitation of timber for boat making.

Guiding questions

1. Study the table below showing fish production in selected countries of West Africa in 1988

Country	**Quantity produced (tonnes)**
Chad	**134,000**
Ivory coast	**115,000**
Ghana	236,000
Mali	134,000
Mauritania	65,000
Nigeria	473,000
Senegal	357,000

(a) Draw a bar graph / pie chart to represent the information contained in the table

(b) How much fish was caught by land locked countries?

(c) Comment on the pattern of fish production as shown by the table and graph above.

(d) Describe the physical conditions that have led to the growth of the fishing industry in either Ghana or Nigeria

2. Study the table below showing the fish catch in selected African countries in 2004 (metric tonnes)

Country	Fish catch
Namibia	570,758
Nigeria	509,200
Senegal	445,467
Mauritania	199,380
Ivory coast	55,264
South Africa	581,225
Morocco	514,022
Angola	72,228

(a) Draw a bar graph to represent the information in the table above

(b) State any four facts shown by the graph and table above/ comment on the pattern of fish production as shown by the table and graph above.

(c) calculate the percentage contribution of:

(i) South West African countries

(ii) West African countries

(d) Describe :

(i) Any **two** methods used in catching fish in West Africa

(ii) The problems created by the fishing industry in West Africa

INDUSTRIALIZATION IN AFRICA

Industry involves transforming raw materials into finished or semi-finished goods. Industries are either heavy or light industries.

Many African countries have established industries which are at different stages of development. South Africa is the most industrialized country on the continent. Others are Egypt, Nigeria, Zimbabwe, Morocco, Ghana and Angola.

Industry in South Africa

Rapid industrialization has taken place in South Africa and the country is a major exporter of industrial goods.

Distribution of industries

The heart of South African industry today lies on the Rand (Witwatersrand) and Johannesburg is the heart of the Rand. Specifically the major industrial centres of the Rand are:

1) **Johannesburg**

   The major industries include iron and steel, manufacture of railway wagons, mining machinery, vehicles, farm machinery, textiles, electricals, chemical, furniture, and cement.

2) **Pretoria**

   This is the administrative capital of the country. The industries include iron and steel, glass, cement, cables, motor engineering etc

3) **Vereeniging and Vanderbijl park**

   This is a major coal mining, engineering, and iron and steel centre. There is also tin plate industry, manufacture of alloys.

4) **Germiston**

   This town is a home of the Rand's gold refinery. It produces metal goods, chemical, textiles and foods.

5) **Springs**

   The main industries are gold and coal mining, mining machinery, food processing, electrical goods, bicycles, printing machinery, glassware, paper etc

Apart from the Rand, other industrial zones of South Africa include:

a) **Cape town**

   Major industries include food processing, textiles, vehicle assembly, chemicals, leather, printing, paper.

b) **Port Elizabeth**

   Industries include food processing, vehicle assembly, tyre manufacture.

c) **East London**

   Industries include soft drinks, furniture, building materials, textiles, vehicle assembly.

d) **Durban**

   Industries include shipbuilding, oil refinery, soap manufacture, textiles, light engineering etc

A sketch map showing the industrial regions of South Africa

Factors which have favoured industrial development in South Africa

1. Availability of a wide variety /large quantities of raw materials used in industries to make goods such as mineral resources, water resources, forest resources and agricultural resources.
2. Availability of various sources of power to run industrial machinery in form of coal, HEP from Vaal dam.
3. Availability of strong capital base/ adequate capital to invest in industrial development provided by the government and private investors.
4. Presence of skilled and unskilled labour to work in industries. The unskilled labour is provided by the blacks and migrants from neighboring countries.
5. Well-developed transport system by road, railway, water and air to transport/move inputs and finished goods.
6. Presence of a ready/large market for produced goods, both domestic and foreign.
7. Availability of vast land for industrial establishment and expansion.
8. Supportive/positive government policies to promote home production instead of importation/ carrying out market research/encouraging investors etc.
9. High level of technology employed to improve the quality of output copied from Japan, Europe and North America.

10. High industrial research such as on engineering technology and industrial products; to improve the quality and quantity of output.

11. Internal competition between and among industries in South Africa; which leads to high quality production.

Problems facing industrial development in South Africa

1. Shortage of water for industrial use especially in and near the Rand, which limits production.

2. Artificial raw material shortages due to strikes leading to low output/ which increases the cost of production.

3. Racial segregation causing industrial strikes/riots which limits the quality and quantity of production.

4. Competition from other industrial countries which limits the exports market for output. There is also competition from imported industrial goods which limits the local market for the industries.

5. Inadequate supply of hydroelectric power for industries which limits production.

6. Environmental pollution which undermines the quality of production/ increases the costs of production (such as purifying water).

7. Dominance of foreign industrial investors who repatriate the profits instead of investing back in the industrial sector/ limits further investment in industry.

8. Fluctuations in labour supply due to migrant nature of labour which also undermines industrial production.

9. Shortage of land for industrial expansion in the highly industrialized zones, which also limits production.

10. High taxes imposed on industrial output and industries by government which increases the costs of production.

Steps taken to solve the above problems

1. Importation of raw materials from other countries to minimize domestic shortages and increase production.

2. Use of raw material saving technology such as recycling of waste material to minimize raw material shortages.

3. Establishment of related industries which use the products of other industries as inputs, hence increase in industrial production.

4. Government efforts of sensitization of the masses against racial segregation to minimize industrial unrest.

5. Protection of local industries from foreign competition by levying higher taxes on similar goods from abroad.
6. Strengthening regional cooperation to expand the markets such as south Africa is a member of COMESA.
7. Diversification of energy sources such as nuclear energy and HEP replacing coal to increase energy supply.
8. Emphasizing treatment of industrial wastes to reduce environmental pollution.
9. Enforcing anti-pollution laws / legislation to control pollution.
10. Adopting automation of industrial activities / more use of machines to minimize labour shortage.
11. Carrying out market research and advertising to expand market for output.

INDUSTRIALISATION IN EGYPT

Egypt is the second most industrialized country in Africa after South Africa; and most of the industries are found in Lower Egypt.

The building of the Aswan dam provided power for expansion in industrial production. This has saved the cost of importing manufactured goods.

Major industrial centres

1) Cairo

The major industries include: oil refinery, textiles, electrical engineering, iron and steel, petro-chemical, cement, food processing, sugar refining and drinks.

2) Alexandria

This is the second after Cairo city. Industries include: oil refinery, textiles, salt industry, chemicals, ship building and repair, food processing.

Other industrial centres apart from Cairo and Alexandria include:

- Helwan—with iron and steel industry expanded due to iron ore from Aswan and Bahariya oasis; textiles due to cotton growing along the Nile valley.
- Port Saidi, Giza, El Mahalla el Kubra, tenth of Ramadan, Ismailiya, Kafra and El Mansura.

A sketch map showing the major industrial regions of Egypt

Factors which have influenced the distribution/location of industries in Egypt

1. Ready /large supply of raw materials to use in industries such as cotton in the Nile delta for textiles, oil for refinery at Cairo and Alexandria.
2. Availability of large quantities of power to run the machines in industries for example hydroelectric power at Aswan and oil refining at Alexandria.
3. Presence of ready/steady water supply to use as a raw material or for cooling machines. For example water from the Nile River is used in the Delta region and along the Mediterranean coast.
4. Presence of abundant skilled and unskilled labour to work in the industries for example Cairo and Alexandria which are highly populated.
5. Availability of efficient/ improved transport network to transport raw materials to industries and finished goods to markets such as road and railway in the Nile delta region.
6. Presence of a large local market in the highly populated areas such as Cairo, Alexandria, Ismailiya, and Port Said has attracted industries/ encourages many industrial investors.
7. Availability of adequate capital for industrial investment. Many investors in industries prefer the major urban centres where capital for industrial investment is easily obtained.
8. Industrial inertia—many industries located where others exist, hence concentration of primary and secondary industries in Alexandria and Ismailiya.
9. Political stability. Areas which are politically stable attract many industries by increasing the confidence of investors such as in Cairo.
10. Availability of large / extensive land to set up industries. Many industries are located where there is available land for expansion.
11. Supportive government policy towards industrial development. The government has set aside several industrial sites in the major urban centres like cairo and Port Saidi.

Problems resulting from the establishment of industries in Egypt

1. High rate of profit repatriation due to foreign ownership of many industries, and this reduces the rate of re-investment in industry.
2. Over exploitation of resources such as minerals leading to quick depletion/ exhaustion.
3. Results into environmental pollution through dumping wastes and emission of gases, hence reducing the quality of life.
4. Results into the growth of slums due to shortage of accommodation for the many industrial workers. Slums are characterized by poor structures and poor hygiene.
5. Traffic congestion has resulted in the industrial towns, hence unnecessary delays in the movement of people and goods.
6. Results into high level of unemployment in towns due to high rural urban migration and use of capital intensive technology.
7. Results into regional imbalance in development in terms of infrastructure, since the major industrial centres are more developed.
8. Destruction of natural vegetation and swamp reclamation when clearing industrial sites, leading to environmental degradation.
9. Displacement of people to provide room for industrial establishment.
10. Reduces land for other economic activities like farming which limits the rate of economic growth.
11. Destruction of the ozone layer, leading to global warming due to emission od dangerous gases to the atmosphere.

Problems facing the industrial sector in Egypt

1. Competition from imported goods and for external markets with other industrialized countries producing relatively cheaper goods, which limits the available market.
2. Limited/inadequate raw materials for industrial development such as few minerals of importance, which limits the quantity of industrial production.
3. Limited capital to invest in industrial development, and low level of output.
4. Repatriation of profits by foreign companies which own some industries, which limits further investment in industry.
5. High cost of imported raw materials which increases the cost of production.
6. Insecurity caused by Islamic fundamentalists and the recent change of / power struggle government which undermines industrial production/ destroys industrial establishments.

7. Limited land area for industrial expansion in the industrialized cities and thus limited production.
8. Environmental pollution which reduces the quality of output.
9. Limited water supply for industrial use in many parts of Egypt which limits production.

General factors limiting industrial development in Africa

1. Inadequate capital to set up large scale industries and thus limited quantity of production.
2. Limited skilled labour to operate especially the large-scale industries, which limits the quality and quantity of output.
3. Limited market domestically due to the low incomes of the people and this discourages industrial investors.
4. Low levels of technology leading to industrial inefficiency (low quality and quantity of output).
5. Landlockedness of many countries and hence high transport costs and delays in delivery of raw materials and finished goods.
6. Underdeveloped transport routes connecting industries and market centres which discourages local and foreign investors.
7. Competition from well-developed industrial countries which limits the export market for industrial output.
8. Political instability limiting investment in industries such as DRC, Liberia, and Somalia due to reduced confidence of investors.
9. Limited industrial research and hence limited quality improvement of output.
10. Insufficient power supply to run industrial machinery and this discourages investors.
11. Limited/inadequate basic raw materials for industries, hence limiting the quantity of output.
12. High taxes imposed on industries by government, hence increased cost of production.

Strategies to encourage industrial development in Africa

1. Attraction of foreign investors to raise capital and upgrade industrial production.
2. Training more local manpower to increase the quality and quantity of industrial output.
3. Formation/ strengthening of regional integrations/organizations to expand market for industrial output.
4. Carrying out research to develop technology and increase efficiency in production.
5. Improving transport network for easy delivery of raw materials and output.

6. Carrying out market research to widen the external market for output.
7. Protection of some local industries from foreign competition by levying high taxes on similar imported goods.
8. Diversifying the sources of energy such as use of H.E.P, oil, and nuclear energy for industries.
9. Importation of some raw materials to supplement the limited domestic resources.
10. Diversification of the industrial sector to avoid over reliance on a few industrial products for exports.
11. Adopting raw material saving techniques such as recycling of scrap items.
12. Automation of industrial activities/ increase mechanization to minimize labour shortage.
13. Restoring peace and stability in various parts of the respective countries to increase confidence among industrialists.

TRANSPORT IN AFRICA

Transport is the physical movement of people or commodities from one place to another. The level of development of transport and communication network is usually shows the level of economic development in any given region.

Role of transport in economic development in Africa

1. Transport opens up new markets for produce such as highways, feeder roads. This promotes agricultural development by lowering costs, saving time,
2. Promotion of industrialization by encouraging investors and industrial location /distribution due to easy movement of raw materials to the industries and movement of finished goods to markets.
3. Promoting local, regional, and international trade and this leads to interstate cooperation and unity. This is because the agricultural products, industrial products are easily transferred from areas of production to marketing centres.
4. Promotion of tourism development such as in Republic of South Africa, Nigeria and Egypt by facilitating easy movement of tourists to various tourist potentials, hence generating foreign currency.
5. Generation of many employment opportunities such as engineers, pilots/ drivers, cargo managers, and accountants, which improves their standards of living
6. Promoting urbanization/ growth of urban centres such as Cairo, Johannesburg. Therefore transport increases population concentration in many areas such as towns and this results into expansion of urban activities like trade and commerce, banking,

7. Generation of more government revenue through taxation of the sectors using the transport systems such as agriculture, tourism, banking, and industry, hence financing the national budget.

8. Promotion of economic diversification by uplifting various economic sectors like tourism, mining and industry. This in turn increases national income and the export base of the country.

9. Promotion of international relationship between the countries connected by the transport routes.

Negative effects/short comings of transport

1. Transport is associated with accidents which are disastrous to lives of people and property. Such as crashing of planes, capsizing of vessels, collusion of vehicles.

2. It is associated with traffic congestion causing unwanted delays in the delivery of goods and services, and thus undermining the development process.

3. Results in high rates of environmental pollution, that is, air, water and noise pollution. The emitted fumes from automobiles are dangerous to the life forms of the environment like it causes respiratory diseases.

4. Results into destruction of vegetation such to construct roads, railways, and airports. This results into soil erosion and land degradation due to reduced soil stability on the road/ railway sides.

5. Transport is associated with increased crime rates, wherever they occur. For example there is highway robbery on the Trans-Africa n highway in particular sections like valley areas, and forested zones; railway station theft and of recent world terrorism evident in air transport.

6. High costs of construction and maintenance of the networks such as port facilities, railway lines, roads etc. In turn, there is increased government expenditure on the maintenance of such networks, hence straining the government budget.

7. Over exploitation of environmental / natural resources leading to quick depletion. This is through increased accessibility to various resources such as mineral resources, forest resources- working against the future generations.

8. Results urban-related problems such as congestion/ overcrowding, and slum growth. The eradication of such problems is very costly to the government.

9. Leads to regional imbalance in development. Easily accessible areas are more developed in terms of infrastructure than other areas, leading to income inequalities.

10. Results in rural-urban migration which has disastrous impacts on both the source areas (rural) and receiving areas (urban). For example decline in crop cultivation in the rural areas yet there are urban problems created (like slums).

11. Displacement of many people during transport development. As transport routes are being constructed or expanded, many people are displaced from their settlement and production areas with little or no compensation. There is also a problem of resettlement of the displaced people.

Road transport

Roads are the most developed type of transport in Africa. It involves the movement of passengers and goods by vehicles (coaches, trailers, vans, cars, buses, tractors, taxis, Lorries etc). It also accommodates the informal means such as use of a wheel barrow, pedestrians, bicycles, motor cycles etc.

Advantages of road transport

1. It is flexible in terms of route and time. It can reach most parts of the country
2. It is quicker and cheaper over short distances
3. Specialized vehicles can be designed to carry perishables
4. It does not need to move on time schedules such as air and railway
5. It can be constructed in many areas including remote areas.

Disadvantages of road transport

1. It is expensive to use over long distances
2. Limited cargo can be transported unlike railway
3. Heavy loaded Lorries, trailers etc are too slow; destroy networks, and a route cause of accidents.
4. Empty returns of vehicles make it uneconomical
5. Subject to vagaries of weather such as rainy seasons
6. High way robbery is common.
7. Roads are costly to build and maintain
8. Roads are in most cases too congested (traffic congestion especially in urban areas) causing delays and inefficiencies.
9. Prone to many accidents

The Trans-Africa highway

The Trans-Africa n highway is supposed to run from Mombasa (Kenya) through Uganda, Democratic republic of Congo, Central African Republic, Cameroon to Lagos in Nigeria. Parts of it already exist as tarmac road, but elsewhere it is still a muddy track.

Aims of the Trans-Africa highway

1. To encourage trade among the African states, by linking the individual centres of the interior and to the coast.

2. To open up landlocked countries such as Uganda and CAR in order for them to have easy access to the sea.

3. To promote political unity among African countries and hence political , social and economic development

4. To open up the remote areas in the interior

5. To promote the exploitation of natural resources such as minerals, forests.

Benefits of the Trans-Africa highway

1) Promotion of industrialization due to easy movement of raw materials to the industries and movement of finished goods to markets.

2) Promoting regional and international trade because goods are easily moved from one area to another such as between Kenya, Uganda and DRC, which in turn promotes diplomatic relations.

3) Promotion of tourism development by facilitating easy movement of tourists to various tourist potentials, hence generating more foreign currency.

4) Generation of many employment opportunities such as engineers, pilots/ drivers, cargo managers, and accountants, which improves their standards of living

5) Promoting urbanization/ growth of urban centres such as Kisangani, Bangui, Tibati, Enugu, and Lagos. Transport increases population concentration in towns and hence expansion of urban activities like trade and commerce, banking.

6) Generation of more government revenue through taxation of the sectors using the transport systems such as agriculture, tourism, banking, and industry.

7) Promotion of economic diversification by uplifting various economic sectors like tourism, mining and industry. This in turn increases national income and the export base of the country.

8) Promotion of international relationship between the countries connected by the transport routes, and this leads to interstate unity, diplomatic relations, political harmony and further trade.

9) Landlocked countries get easy access to the sea and this promotes international trade, inflow of investors.

10) It promotes technological development through the spread of ideas which is essential for the development process.

Challenges facing the Trans-Africa highway

1. Presence of dense vegetation limits the development of transport routes such as tropical rainforests in DRC.
2. Heavy rainfall limits the development of some sections of roads and bridges, making the roads impassable during the wet seasons such as in DRC and CAR.
3. Differences in political ideology which also limits the use of the highway such due to closure of borders, restricting entry in some countries.
4. Inadequate skilled labour which undermines the quality of transport infrastructure.
5. Limited capital which limits development of the road transport infrastructure in many countries.
6. Political instability in some areas such as DRC which limits the construction and maintenance of road transport routes.
7. Low levels of technology which also limits the construction and maintenance of the transport route/ highway.

Railway transport

Africa has underdeveloped railway system. It is South Africa which has a railway system comparable to Europe and North America. Railways are particularly important for long distance movement of goods.

Advantages of railway transport

1. It is relatively cheaper in transporting bulky commodities for long distances
2. It is less affected by vagaries of weather
3. It is more direct with specific schedules for services
4. It Carries more load and passengers which can be moved at a single journey compared to say, road and air transport
5. Specialized wagons are designed for goods such as liquids.
6. Railway lines are much easier to maintain once laid.

Disadvantages of railway transport

1. Railways cannot go in areas where there are no lines/ not flexible as fixed routes must be followed.
2. It is very expensive over short distances and Varied gages between countries make it inefficient
3. It is less efficient and time-consuming in developing countries yet it is still backward.

4. Time schedules also cause inefficiency and delays
5. It is costly in terms of equipment , setting up , purchase of trains and maintenance costs
6. Railways have to be built on comparatively level ground and cannot negotiate steep gradients.

Railway transport in South Africa

South Africa has the most developed railway network in Africa. The main railway routes are the Cape Town—Pretoria railway via Kimberley and Johannesburg; East coastal railway (from Umzimkulu to Empangeni via Durban); Port Elizabeth – Namibia railway; Durban—Johannesburg line.

Some rail lines are electrified such as the Durban—Johannesburg line which is the longest electrified railway lines on the globe.

A sketch map of South Africa showing the major railway transport routes

Importance of railway transport in South Africa

1. It has promoted the exploitation of minerals such as coal, gold, iron ore and diamonds in the Witwatersrand by connecting the mines and processing industries or export ports.
2. Promotion of industrialization due to easy movement of raw materials and workers to the industries and movement of finished goods to markets.
3. It has promoted agricultural production by transporting large quantities of output to distant markets or export ports such as maize, wheat and sheep from Orange Free State to Cape Town, Natal sugarcane plantations.
4. Promoting local, regional, and international trade and this leads to interstate cooperation and unity. This is because the agricultural and industrial products are easily transferred from areas of production to marketing centres.
5. Promotion of tourism development by making the tourist areas are easily accessible/ facilitates easy movement of tourists to various tourist potentials, hence generating foreign exchange.

6. Generation of many employment opportunities to the people of South Africa such as engineers, pilots/ drivers, cargo managers, and service providers at the stations, hence improved standards of living.

7. Promotes growth of urban centres and associated facilities like banks, hospitals; through distribution of commodities. The urban centres include East London, Durban, Port Elizabeth, Kimberley, J ohannesburg, Witbank, and springs.

8. Generation of more government revenue through taxation of railway transport systems such as importing and exporting companies; which in turn aids the provision of social services.

9. Promotion of economic diversification by uplifting various economic sectors like tourism, mining and industry, hence preventing over dependence on a few sectors.

10. Railway transport promotes international relations between South Africa and neighbouring countries such as Namibia, Botswana, Zimbabwe, Mozambique and this leads to diplomatic relations and trade and commerce between the countries.

Negative effects/short comings of railway transport

1. Results in high rates of environmental pollution, that is, air, water and noise pollution from the resulting industrial development which reduces the quality of life.

2. Results into destruction of vegetation such to construct railways and stations. This results into soil erosion and land degradation

3. High costs of construction and maintenance of the networks such as railway stations, railway lines. This increases government expenditure/ straining the government budget.

4. Over exploitation of natural resources leading to quick depletion. This is through increased accessibility to various resources such as minerals, forest resources

5. The expanded urban centers are associated with problems such as congestion/ overcrowding, drug abuse, and slum growth. Such problems are very costly to the government to control.

6. Displacement of many people from their settlement and production areas during railway transport development. There is also a problem of resettlement of the displaced people.

TANZAM RAILWAY / TAZARA RAILWAY

This is a great railway running from Kapiri Mposhi in Zambia to dare s salaam. It was opened in 1975 by the Chinese. It covers 1023km and it has tried to solve the problem of landlockedness and remoteness.

A sketch map showing the Tazara /Tanzam railway

Aims for the construction of the Tanzam railway

1. To open up the southern highlands of Tanzania which had great agricultural and mineral potential (coal and iron ore)

2. To open up Zambia's export trade of copper and imports of manufactured goods. Zambia wanted an alternative route since the independence struggles in Zimbabwe and Mozambique had greatly affected the only seas route at Beira.

3. To reduce transport costs in exporting and importing goods to Zambia. The Benguela railway to Lobito was too long for economical use.

Factors for the development of the Tanzam railway

1. Presence of large expanse of fertile land in southern Tanzania which needed to be opened up for farming such as the plantations, maize.

2. The existence of large deposits of copper in the Zambian copper belt which needed to be shipped overseas.

3. The increasing political unrest on the Benguela railway through Angola with rebels and apartheid in south Africa

4. Zambia's desire to import oil from Dar es salaam cheaply using railway.

5. Availability of skilled labour provided by the Chinese such as construction and site engineers.

6. Availability of large sums of capital provided by the Tanzania and Zambian governments, and interest free loan from china to purchase machinery, payment of labour.

7. Modern technology employed in the construction of the railway such as bull dozers , earth movers to break through hills and rocks of the rift valley escarpments.

8. Supportive government policy for example the Tanzania and Zambia governments accepted to secure loans from china and also availing land for the construction of the railway.

Benefits of the Tanzam railway

(Refer back)

WATER TRANSPORT

Water transport is cheapest of all forms of transport because it has an advantage of using existing routes.

Africa has two major types of water transport, that is, inland water transport and ocean/ sea transport. Inland water transport takes place on rivers and lakes such as river Zambezi, river Congo, Lake Volta, Lake Kariba, Lake Nasser. Ocean transport greatly dependence on overseas trade, and this has led to the development of large ports such as Lagos, port

Harcourt in Nigeria, Durban and cape town in south Africa, Tema and Takoradi in Ghana, Dakar in Senegal. It noted that West African ports are more developed.

Advantages of water transport

1. It is the cheapest to transport bulky and low quality goods.
2. Little time is wasted in traffic control.
3. Suitable for transporting of breakable goods such as glass with limited shaking.
4. Minimizes collection costs since the ports are on the same waterside.
5. Limited cases of robbers like it is on highways on roads and railways.

Disadvantages of water transport

1. It is slow involving a lot of loading and off-loading. As such perishable or urgently needed goods such as newspapers cannot use it.
2. Use of canals is greatly affected by the season which increases maintenance costs.
3. It is strictly restricted to water areas, not to various regions.
4. Storms and winds on water greatly interfere with shipping schedules/ cause accidents.

Factors that limit the development of inland water transport in Africa

(Refer back)

Solutions to above problems

(Refer back)

Factors influencing the distribution of transport systems in Africa

1. Economic activities

- Areas with more economic activities such as tourism, mining, industry, rich agricultural areas attract the development of transport routes particularly roads and railway.
- Areas with limited economic activities such as mining and industry limit the development of transport routes.

2. Vegetation cover

- Areas with thick vegetation cover/ dense forests hinder transport routes such as roads because they are not easy to clear, such as the Congo basin with tropical rain forests.
- Areas of savanna grasslands are easy to clear to set up transport routes.
- Floating vegetation hinders water transport.

3. **Relief**

- Areas with rugged relief/ mountainous landscape limit construction of transport routes.
- Areas of fairly/ relatively flat relief/ gentle slopes encourage construction of transport routes.

4. **Drainage**

- Water logged areas/ Poorly drained areas/ areas with periodic flooding limit the construction and maintenance of transport routes.
- Well-drained areas encourage construction and maintenance of transport routes.

5. **Weather conditions/ climate**. Heavy rainfall limits the development of transport routes such as by making roads muddy or by promoting rapid growth of vegetation.

6. **Duration of settlement/ ancient political kingdoms**

- Areas of ancient kingdoms / with long history of settlement with strong kingdoms attract more economic opportunities such as trade and dense settlement which attracts transport development.
- Areas of relatively recent settlement/ which had weak kingdoms have fewer opportunities for development and this limits transport routes.

7. **Government policy**

- Government policy of forest conservation (such as national parks, forest reserves) discourages transport development.
- Government policy of resettlement schemes and development of urban centres attract transport development.

8. **Political climate/situation**

- Areas which are politically stable encourage productive activities such as trade, farming and encourages transport routes.
- Areas which are insecure/ unstable discourage productive activities like trade limiting transport development.

9. **Urbanization**

The growth of urban centres encourages the development of more transport routes such as roads and railways due to increased economic activity.

10. **Population settlement**

Dense population areas attract the development of transport routes due to increased economic activity such as trade and commerce.

TRANSPORT IN DRC

Generally DRC has underdeveloped transport routes such as poor roads which limit the transport of crops to market. Railways are important in connecting various areas and also connecting to the Angolan port of Benguela and with southern Africa. Inland waterways are used extensively. The Congo River is navigable from its mouth upto Matadi, which is about 134km. From Matadi to Kinshasa the river is unnavigable and this is linked by a railway by 401km long.

Beyond Kinshasa navigation is possible for over 1,600km until Stanley falls which limits navigation at Kisangani.

The chief modes of rivers transport are river steamers and long canoes. The principal sea ports are Matadi and Boma on the lower Congo River, and banana at the river's mouth.

DRC has the following international airports: Kinshasa, Lubumbashi, Kisangani, Goma, and Gbadolite.

A sketch map of DRC showing major railway and water transport routes

Problems facing the transport sector in Africa

8. Mountainous landscape which limits the construction of roads and railways
9. Presence of dense vegetation limits the development of transport routes such as tropical rainforests in DRC.
10. Heavy rainfall limits the development of transport routes such as washing away sections of roads and bridges, making dry weather roads impassable during the wet seasons.
11. Presence of waterfalls and rapids along rivers such as Victoria falls on river Zambezi, which also limit the movement of water vessels.
12. Presence of floating vegetation on lakes and rivers which limits the movement of vessels.
13. Inadequate skilled labour which undermines the quality of transport infrastructure.

14. Limited capital to develop the transport infrastructure.
15. Political instability in some areas such as DRC which limits the construction and maintenance of transport routes.
16. Low levels of technology which also limits the construction and maintenance of transport routes.

Possible solutions to the above problems

10. Construction of locks to regulate the water level.
11. Construction of some canals to bypass rapids and waterfalls.
12. Constant dredging to maintain the depth and width of the water channels/ rivers.
13. Construction of dams/ barrages to hold back water and give greater depth to solve flooding and shallowness.
14. Use of blasting with explosives on some rivers to shatter rocks into small pieces , which are easily removed (to make rivers deep and wide for navigation).
15. Removal of floating vegetation in some areas, to open up the rivers for navigation.
16. Acquiring loans to develop the rivers as waterways such as better ports. Also attraction of foreign investors to invest more capital.
17. Limiting/ restriction of settlement along the river banks to control silting (settlement—free zones).
18. Planting of trees / vegetation along the river to control silting.

URBANIZATION IN AFRICA

Africa has experienced rapid urbanization in the recent years and therefore many ports and towns have been developed. The largest cities in Africa (with a population of more than 1,000,000 people) include: Cairo, Giza and Alexandria in Egypt, Casablanca in morocco, cape town and Johannesburg in south Africa, Addis Ababa in Ethiopia, Lagos and port Harcourt in Nigeria , Luanda and Lobito in Angola, Monrovia in Liberia, Kinshasa in DRC, Harare in Zimbabwe, etc

A sketch map showing the major urban centres in Africa

Case studies—ports and towns

- Lagos
- Tema

- Johannesburg
- Cairo
- Luanda
- Cape town

Factors for the growth of the of Johannesburg city in South Africa

1. Presence of a variety /large quantities of mineral resources such as coal, limestone, and iron ore acting as a source of energy and raw material in different industries making mining centers to grow into bigger towns.
2. Availability of large quantities of power in form of coal, natural gas and hydroelectricity which support many urban activities such trade, banking, education, and industry- hence the expansion of the towns.
3. Well- developed transport and communication networks by road, railway, and air which facilitates the movement of inputs and finished goods and thus increased population concentration.
4. Availability of large water supply for industrial and domestic use provided by Rivers like Vaal which supports many urban activities such as industry, recreation, entertainment.
5. Presence of adequate capital to invest in the region provided by government and private investors for reconstruction/ rehabilitation of industrial plants and other infrastructure.
6. The dense population of the region which has provided labour and provides market for the industrial and other sectors, hence expansion of the Ruhr towns.
7. Availability of large land for expansion of urban activities to the surrounding areas like industry, trade and commerce.
8. Well- developed social and economic facilities which include health facilities, banking, insurance, leading to increased population in the urban centres.
9. Political stability for a long period of time since world war, hence encouraging urban development without disturbances of war.
10. High level of technology employed to develop the urban centres such as engineering to construct railway lines and storeyed buildings.
11. Positive government policy as promoting trade and attracting investments of large companies from other countries (such as from USA, Britain). The government has also develops waterways, and railways.
12. Strategic location of Johannesburg in the centre of South Africa, giving it a large hinterland in the surrounding zones which increases the volume of trade in the region.

Functions of Johannesburg

(Refer)

CONSEQUENCES/EFFECTS OF URBANIZATION IN SOUTH AFRICA

Positive effects / importance

1. The increased population widens the market potential for goods and services produced and this encourages production such as in industry.
2. The increased population increases the labour potential such as skilled labour and this also promotes industrial production.
3. Results into cultural integration and unity due to transmission and diffusion of ideas/information, which in the end leads to balanced regional development.
4. Promotes acquiring of skills which can be used for rural transformation such as by establish small scale industries/projects in the rural areas.
5. Creation of more employment opportunities in the urban areas such as in the industrial, business and service sectors leading to increased standards of living.
6. Leads to technological development due to increased investment in various urban activities and this also increases the quality of life.
7. It increases government revenue through imposing taxes on various urban activities such as trade and industry.
8. Stimulates competition in production and this leads to increased innovativeness, thus high quality output.
9. Results into development of social services such as education, health services in order to support the increasing urban population.
10. Promotes international relationship due to increased number of foreign investors in the region and hence more foreign exchange.
11. Promotes tourism since urban centres and activities are major attractions and thus increased inflow of foreign exchange.

Negative effects (Problems resulting from urbanization)

1) Urbanization results into unemployment which in turn leads to high crime rate such as gambling, robbery. Increased movement of people to towns does not match with the available job opportunities.
2) Strains the social economic infrastructure such as roads, medical facilities, piped water- due to increasing demand by the increasing population. This lead to poor service delivery.
3) Leads to the growth of slums due to inadequate housing in the urban centres. Slums are

characterized by robbery, drug abuse, and easy spread of diseases.

4) Results into traffic congestion in the urban areas leading to unnecessary delays in the delivery of goods and services. There is increased number of vessels and commercial vehicles .

5) Pollution of the environment such as air pollution and water pollution from car fumes, factories. There is also noise pollution from factories and traffic, which reduces the quality of life.

6) Expansion of towns results in deforestation/ vegetation destruction such as for settlement, industrial sites and other business activities.

7) There is increased swamp reclamation and therefore high rate of flooding in some areas of the expanding towns.

8) Expansion of urban activities reduces the land for other activities and leads to the displacement of people who lose their settlement land.

9) Over exploitation of natural resources in the surrounding areas such as forest resources, fisheries resources, mineral resources, due to increased demand in the urbanized areas.

10) Leads to break down of traditional/ social norms and values because the urban areas become collections of various cultures from many areas.

11) Threat of terrorism in the urban areas because terrorists are mostly interested in areas of large population settlement and thus a potential destruction of life and property.

Solutions to urban problems above

1. Developing the transport system to reduce traffic congestion in the urbanities for example constructing subways, tunnels, flyovers.

2. Promoting the use of public transport means instead of personal vehicles to control traffic congestion. There is also restricting the movement of certain vehicles into the central business districts such as old vehicles to reduce pollution.

3. Strengthening patrols and police in the urban centers to control the high crime rate.

4. Recycling, treating and proper disposal of waste material to reduce pollution and contribute to a clean environment.

5. Reclamation of swampy grounds to create more room for urban expansion.

6. Setting up /creating more public facilities to such as medical centers, education centers, recreation centers, to match with the rising population.

7. Construction of skyscrapers to solve the problem of land shortage. These buildings usually have all the facilities needed by the people such as shopping, cinema etc

8. Setting up green belts in the urban centres / afforestation to reduce the rate of pollution.

LAGOS PORT AND CITY

Lagos is Nigeria's largest city, chief port and major economic centre. It was Nigeria's capital until 1991when it was transferred to Abuja in central Nigeria.

The exports handled by Lagos port include cocoa, groundnuts, cotton, rubber, timber, skins, palm oil.

The imports handled by Lagos port include cars, machinery, electronics, construction equipment, steel, sugar.

A sketch map showing the site of Lagos port

Factors responsible for the growth and development of Lagos port and city

1. Location at the head of Lagos lagoon, which provided entrance of calm waters of the lagoon and safety from the pounding surf.
2. Presence of a well sheltered harbor/ Presence of a deep dredged channel of over 8 meters deep connecting the port to the open sea.
3. The low tidal range which allows easy shipping/anchoring of vessels to the coastline. Therefore, ships easily come and go at any time.
4. Presence of islands of Lagos and Victoria; and Apapa mainland for loading and unloading facilities such as constructed sheds.
5. Presence of ice-free conditions throughout the year. This allows continued use of the port throughout the year and hence its modernization.
6. Presence of relatively flat/ gently sloping landscape and this allows easy construction of port facilities and accommodation facilities for the large population.
7. Presence of a hard basement rock which offered firm foundation for construction of the ports.

8. The Presence of a large and productive hinterland covering Nigeria, Niger and parts of Cameroon which increases the volume of cargo handled by the ports. The cargo from the interior include general merchandise, chemicals, and agricultural products.

9. The strategic location of the port at coast making the port an entry port for the region, handling imports and exports.

10. The development of many industries which include oil refineries, shipbuilding, general engineering, brewing which provide employment to many people and increase the volume of cargo handled by the ports.

11. Availability of developed technology which led to the setting up of modern port handling facilities and increased containerization at the port.

12. Availability of skilled and cheap labour in the area—to carry out modern construction and development of the port.

13. Availability of large sums of capital to develop the ports such as buying cranes, cargo carriers.

14. Political stability of the region, which has enabled the port to expand without any ravages of war—hence modern port handling facilities have been put up.

15. Developed transport systems linking the port to the interior/ easy access to the large hinterland. For example roads and railways linking to interior Nigeria, niger and part of northern Cameroon which also increases the volume of cargo handled by the ports.

16. Supportive government policy for example the need to open up the interior by easily accessing markets for the manufactured goods such as chemicals and sources of imported raw materials such as oil, heavy financing of modern port facilities

17. Historical factor. Lagos was used as a slave-trading center and later as a colonial town.

18. Its position as the capital city of Nigeria for a long time, which attracted many administrative offices and commercial activities.

Problems facing Lagos as a port

1. There is congestion of vessels due to ever increasing traffic leading to unnecessary delays.

2. Pollution of the environment especially oil/petroleum related industries such as oil refineries, petro-chemical industries,

3. Low-lying altitude which leads to flooding after heavy rains, destroying life and property.

4. Silting of the harbours which necessitates constant dredging which costly.

5. Narrowness and shallowness. There is still work to be done to expand the port and to deepen it in order to accommodate even larger ocean-going vessels.

6. Risks of fire hazards due to presence of oil tanks all over the port.

7. Strong winds which interfere with port activities
8. Urban – related problems such as high levels of unemployment problems, High crime rate due to overcrowding.
9. Limited land for expansion

Solutions to the above problems

1. Expanding port facilities to reduce congestion at the port.
2. Vertical expansion of the port to minimize the problems of limited space (building of storeyed buildings to create more room for accommodation).
3. Containerization to ensure fast handling and dispatch of cargo, hence reducing congestion.
4. Industrialists have advised to build elsewhere away from the concentrated area of the ports.
5. Treating industrial wastes before disposal into water to reduce pollution.
6. Industrial fumes have been exposed high up in the atmosphere by very long chimneys.
7. Regular dredging to reduce the effects of silting.
8. Greenbelts have been created in the city to reduce CO_2 from the atmosphere and in turn produce O_2 which is in short supply.
9. Strengthening the police to be more alert against crime among citizens, although it is still a challenge.
10. Developing new ports to reduce congestion and the problem of limited land for expansion.
11. Reclamation of the sea to extend port facilities.
12. Construction of drainage channels to reduce flooding.

PORTS IN SOUTH AFRICA

The great ports of South Africa are: Cape Town, Durban, and Port Elizabeth. Others are: east London, Saldanha , Mosselbaai, and port Shepstone

Factors responsible for the growth and development of ports in South Africa

1. Presence of a well sheltered natural harbor and with deep waters makes the ports to handle all types of ocean-going vessels (barges and ships) and has therefore developed a modern port due to handling large cargo.
2. The low tidal range which allows easy shipping/anchoring of vessels to the coastline. Therefore, ships easily come and go at any time.

3. Presence of ice-free conditions throughout the year. This allows continued use of the port throughout the year and hence its modernization.

4. Presence of relatively flat landscape/ topography and this allows easy construction of port facilities and accommodation facilities for the large population.

5. Presence of a hard basement rock which offered firm foundation for construction of the ports.

6. The Presence of a large and productive hinterland which increases the volume of cargo handled by the ports. The cargo from the interior include general merchandise, chemicals, machinery.

7. The strategic location of the port at coast hence easily access foreign markets and sources of raw materials.

8. The development of many industries which include oil refineries, shipbuilding, general engineering, brewing which provide employment to many people and increase the volume of cargo handled by the ports.

9. Modern technology which led to the setting up of modern port handling facilities and increased containerization at the port.

10. Availability of large sums of capital to develop the ports such as buying cranes, cargo carriers.

11. Political stability of the region, which has enabled the port to expand without any ravages of war—hence modern port handling facilities have been put up.

12. Efficient transport systems linking the port to the interior/ large hinterland. For example roads and railways linking to the interior centres like Pretoria and Johannesburg which also increases the volume of cargo handled by the ports.

13. Supportive government policy for example the need to open up the interior by easily accessing markets for the manufactured goods such as chemicals and sources of imported raw materials such as oil, heavy financing of modern port facilities

14. Availability of skilled and unskilled labour in the area—to carry out modern construction and development of the port.

Problems facing ports in South Africa

1. There is congestion of vessels leading to unnecessary delays.

2. Pollution of the environment especially oil/petroleum related industries such as oil refineries, petro-chemical industries, causing deadliy diseases.

3. Silting of the harbours which necessitates constant dredging which costly.

4. Narrowness and shallowness. There is still work to be done to expand the port and to deepen it in order to accommodate even larger ocean-going vessels.

5. Risks of fire hazards due to presence of oil tanks all over the port.
6. Strong winds which interfere with port activities
7. Urban – related problems such as Unemployment problems, High crime rate due to overcrowding.

Solution to the above problems

1. Vertical expansion of the port to minimize the problems of limited space (use of skyscrapers).
2. Containerization to ensure fast handling and dispatch of cargo.
3. Industrialists have advised to build elsewhere away from the concentrated area of the ports..
4. Treating industrial wastes before disposal into water to reduce pollution.
5. Industrial fumes have been exposed high up in the atmosphere by very long chimneys.
6. Regular dredging to reduce the effects of silting.
7. Greenbelts have been created in the city to reduce CO_2 from the atmosphere and in turn produce O_2 which is in short supply.
8. Police has been strengthened to be more alert against crime among citizens, although it is still a challenge.
9. Developing new ports to reduce congestion and the problem of limited land for expansion.
10. Reclamation of the sea to extend port facilities.

Benefits of the ports to the republic of south Africa

(research/ refer)

CONURBATIONS

A conurbation is a single urban complex formed by the merging of two or more neighboring urban centers.

The towns grow and merge such that there is no clear distinction between them, and conurbations are often formed due to urban sprawl.

THE RAND conurbation OF SOUTH AFRICA

The Rand (Witwatersrand) is the only true industrial conurbation in Africa, and it extends for approximately 100km from Randfontein to springs on the Veld.

The major towns in this conurbation include Johannesburg, Germiston, Krugersdorp, Pretoria, springs, Klerksdorp, Witbank. Others include Kimberley, Bultfontein, Vereeniging, Vanderbijl Park, Benoni, Middleburg, and Waterburg. The Rand has about 35% of all South African industrial establishments.

Factors for the location and growth of the Rand Conurbation

1. Presence of a wide range of valuable minerals for example gold in Johannesburg, springs, Krugersdorp; diamonds in Pretoria, Kimberley; coal in Middleburg, Vereeniging which have attracted many people to provide labour in the mining companies.

2. Availability of large quantities of power such as in form of coal and hydroelectric power to support various urban activities such as trade and commerce, banking, insurance, recreation, in urban areas like Witbank.

3. The development of many industries in the region by both local and foreign investors for example iron and steel industries, Vereeniging and Johannesburg which have attracted a large population to provide labour.

4. Internal competition among the industrial establishments of the Rand leading to increased production and expansion of industries and related activities like transport, trade.

5. Presence of large water supply for domestic and industrial use for example from the Vaal River supporting the iron and steel industries (for cooling machines) and as a raw material in some industries such as soft drinks industries

6. Well-developed transport and communication network by road, railway, and air linking various towns in the Rand – moving people and produce.

7. Abundant supply of skilled and semi-skilled labour who work in the industries, mining sector, and the service sector in the Rand. This has led to the expansion of urban facilities like banking, insurance and entertainment.

8. Presence of adequate capital to invest in various activities especially mining operations, industry, and trade, provided by and the government has invested in many urban facilities such as health centers, education, and power transmission.

9. Well-developed social and commercial facilities such as educational facilities, recreation, health facilities, banking, insurance, and ware housing. These have also attracted a large proportion of the population to concentrate in the urbanized Rand region.

10. Political stability of the region which has attracted many people and investments to the Rand hence the expansion of several towns like Germiston, Witbank, and Middleburg.

11. Positive government policy which promotes local production by restricting importation of similar goods, finances basic industries such generation of power.