STANDARD HIGH SCHOOL ZZANA

S.6 GEOGRAPHY PAPER 1 NOTES

NATURAL VEGETATION IN EAST AFRICA

Major vegetation types in East Africa and factors influencing their growth and distribution.

With specific reference to East Africa, examine the factors that influence the growth and distribution of natural vegetation.

Approach

- Define natural vegetation
- Identify the various natural vegetation types in East Africa and areas where they occur
- Describe the characteristics of each vegetation type
- Explain the factors that have favored each vegetation type/zone identified.

Answer guide

Natural vegetation refers to that type of plant life that grows naturally in a particular physical environment without man's influence or interference. It can be a forest, grassland or scrub.

East Africa has different types of natural vegetation grouped into; natural forests, savanna wood land and grass land, scrub (semi desert) and swampy vegetation.

Natural forest vegetation Includes the tropical rain forests, mangroves and montane forests.

They are common in areas of mabira, kalangala, Budongo, East African coast, Kakamega, slopes of mountain Kilimanjaro, Rwenzori, Kenya and other major mountains.

Forest vegetation is characterized by;

▪ever green trees with broad leaves

▪tall trees of up to 50 meters high

▪trees have buttress roots to support the huge and straight trunks

▪trees appear in mixed stand for example mahogany, iron wood, ebony

▪trees form 2-3 canopy layers

▪there many climbing plants for example lianas

Savanna vegetation is subdivided into savanna wood land and grassland depending on the annual rainfall received and the duration of the dry season.

Savanna woodlands and grasslands cover areas of Northern Uganda, western and southern Tanzania e.t.c

Savanna vegetation is characterized by;

▪dominance of medium height trees in the woodland and tall grass in the grassland

▪trees have small waxy needle like leaves,

▪trees are drought and fire resistant,

▪trees are deciduous

▪trees are umbrella shaped at the top to reduce water loss,

▪dominant tree species are acacia and baobab,

▪grass dries during the dry season and become brown or yellow, and green during the wet season.

Scrub or semi desert vegetation in northern, north western and north eastern Kenya, north eastern Uganda (Karamoja), Ankole – Masaka corridor, northern Tanzania and some parts of Rift valley due to low annual rainfall between 250mm-500mm.

Scrub vegetation is characterized by;

▪bushy thorny trees of 5- 10 meters tall with shrub growing between them

▪trees are drought and fire resistant for example acacia,

▪very poor and short tuft grasses with bare ground between the scattered thorny bushes,

▪grass dries up and turns yellow / brown during the drought period and roots become dormant in soil

▪some plant species have twisting leaf system to prevent direct sunshine and high transpiration

▪Trees have small waxy needle like leaves to reduce transpiration

Swampy vegetation found in poorly drained areas and includes

●Mangrove swamps in the salty waters along the coastal plains for example Lamu and Rufijj delta.

●Papyrus swamps in water logged areas such as shores of Lake Kyoga and Victoria; valleys in central and western Uganda and river valleys such as katonga, kagera and Rwizi.

Characteristics of swampy vegetation

▪dominance of papyrus, palm trees and sedge grass in papyrus swamps,

▪Mangrove swamps have Medium height trees of about 12 meters,

▪trees have aerial roots for breathing because of mud,

▪trees have short and twisted trunks,

▪trees have ever green broad leaves

▪trees are of tropical hard wood.

Factors responsible for vegetation growth and distribution in East Africa

PHYSICAL FACTORS

These include climate, type of soil, drainage, altitude, relief and biotic factors.

Climate- Influences vegetation growth and distribution through its elements of rainfall, temperature and humidity

▪Heavy, reliable and well distributed rainfall over 1500 mm per annum and hot temperatures of about 22^0-27^0 C encourage the growth of natural forests.

▪Moderate to heavy rainfall of about 760 mm -1200 mm annually and distributed in one season and hot temperatures of about 24^0c - 30^0 c encourage growth of savannah woodland while moderate annual rain fall of about 500mm-760 and hot temperatures over 30^0 c encourage grass lands.

▪Low and seasonal rain fall of about 250mm- 500 mm per annum and very hot temperatures over 30^0 C encourages the growth of scrub vegetation.

▪High humidity over 80 % encourages equatorial vegetation; moderate humidity savanna and low humidity for scrub vegetation.

Altitude refers to the height above sea level. Different vegetation types thrive at different altitude because the conditions that influence vegetation growth like climate, soil and drainage change with altitude For example;

▪Low and high altitude about 1000m-2500m above sea level encourage forest vegetation while savanna, scrub and swampy vegetation thrive well at low altitude of less than 1000m above sea level.

Nature of the soil present. The Type of soil in terms of; fertility, depth and texture influence vegetation growth and distribution in the following ways;

▪deep and fertile soils such as volcanic on gentle slopes of volcanic highlands, loamy and alluvial soils in low lying areas such as lake shores and valleys have encouraged growth of forest and swampy vegetation.

▪fairly fertile soils with low water retention capacity have favored the growth of woodlands with soils of moderate fertility for example latosols and laterites have favored grass lands

▪Poor sandy soils for example in Karamoja and rift valley regions have encourage growth of scrub vegetation

Drainage of the area influences the moisture in the soil. That is;

▪Well drained areas for example gentle slopes of major highlands and basins with adequate supply of steams have favored the growth of forest vegetation

▪Water logged areas have favored swampy vegetation

▪Well drained areas without or very limited surface water and streams have encouraged the growth of savanna and scrub vegetation

Influence of relief- determines depth and moisture in the soil for example;

▪Gentle slopes and lowlands such as the coastal plains, lake shores and river valleys have encouraged the growth of both swampy and forest vegetation

▪Low lying plateau areas have favored savanna wood lands while flat lowlands have favored both savanna grass lands and scrubs

Biotic factors for example;

▪Termites, locusts, and elephants have led to destruction of the original vegetation types which are replaced with scrubs or other poor forms.

▪Animal grazing through nomadism, ranching and dairying leads to disappearance of forests, woodlands and grasslands and swamps

▪Man's activities such as deforestation, construction, cultivation and mining have led to the destruction of the original forests, woodlands, swamps and grasslands and replacing them with secondary vegetation types.

●On the other hand, human intervention through environmentally friendly activities such as afforestation, re-afforestation and agro forestry, creation of national parks and forest reserves has led to regeneration of formally degraded natural vegetation such as forests and protection of the existing ones.

To what extent has climate influenced vegetation distribution in East Africa?

Approach

- Define natural vegetation,
- Identify vegetation types in East Africa descriptively or drawing a sketch map,
- Give the 1St evaluation and explain the role of climate
- Give the 2r d evaluation and explain other factors that influence vegetation distribution in East Africa. That is; altitude, type of soil, relief, biotic factors and drainage

Answer guide

Natural vegetation refers to that type of plant life that grows naturally in a particular physical environment without man's influence or interference. It can be a forest, grassland or scrub.

East Africa has different types of natural vegetation grouped into; natural forests, savanna wood land and grass land, scrub (semi desert) and swampy vegetation.

Natural forest vegetation Includes the tropical rain forests, mangroves and montane forests.

They are common in areas of mabira, kalangala, Budongo, East African coast, Kakamega, slopes of mountain Kilimanjaro, Rwenzori, Kenya and other major mountains.

Savanna vegetation is subdivided into savanna wood land and grassland depending on the annual rainfall received and the duration of the dry season.

Savanna woodlands and grasslands cover areas of Northern Uganda, western and southern Tanzania e.t.c

Scrub or semi desert vegetation in northern, north western and north eastern Kenya, north eastern Uganda (Karamoja), Ankole – Masaka corridor, northern Tanzania and some parts of Rift valley due to low annual rainfall between 250mm-500mm.

Swampy vegetation found in poorly drained areas and includes

●Mangrove swamps in the salty waters along the coastal plains for example Lamu and Rufijj delta.

●Papyrus swamps in water logged areas such as shores of Lake Kyoga and Victoria; valleys in central and western Uganda and river valleys such as katonga, kagera and Rwizi.

Climate has to a largest extent Influenced vegetation growth and distribution through its elements of rainfall, temperature and humidity as explained below;

Heavy, reliable and well distributed rainfall over 1500 mm per annum and hot temperatures of about 22^0 C-27^0 C encourage the growth of natural forests characterized by;

.▪ever green trees with broad leaves

▪tall trees of up to 50 meters high

▪trees have buttress roots to support the huge and straight trunks

▪trees appear in mixed stand for example mahogany, iron wood, ebony

▪trees form 2-3 canopy layers

▪there many climbing plants for example lianas

Moderate to heavy rainfall of about 760 mm -1200 mm annually and distributed in one season and hot temperatures of about 24^0c - 30^0 c has encouraged growth of savanna woodland while moderate annual rain fall of about 500mm-760mm and hot temperatures over 30^0 c encourage grass lands. Savanna vegetation is generally characterized by;

▪dominance of medium height trees in the woodland and tall grass in the grassland

▪trees have small waxy needle like leaves,

▪trees are drought and fire resistant,

▪trees are deciduous

▪trees are umbrella shaped at the top to reduce water loss,

▪dominant tree species are acacia and baobab,

▪grass dries during the dry season and become brown or yellow, and green during the wet season.

Low and seasonal rain fall of about 250mm- 500 mm per annum and very hot temperatures over 30^0 C have encouraged the growth of scrub vegetation characterized by;

▪bushy thorny trees of 5- 10 meters tall with shrub growing between them

▪trees are drought and fire resistant for example acacia,

▪very poor and short tuft grasses with bare ground between the scattered thorny bushes,

▪grass dries up and turns yellow / brown during the drought period and roots become dormant in soil

▪some plant species have twisting leaf system to prevent direct sunshine and high transpiration

▪Trees have small waxy needle like leaves to reduce transpiration

High humidity over 80 % has encouraged growth of natural forest and swampy vegetation; moderate humidity savanna and low humidity for scrub vegetation.

Other factors that have influenced the growth and distribution to a large extent apart from climate include type of soil, drainage, altitude, relief and biotic factors.

Explain these factors.

To what extent has altitude influenced the distribution of natural vegetation in the highland areas of East Africa?

Approach

- Define natural vegetation
- Identify the highland areas of East Africa where altitude controls or influences vegetation distribution.
- Explain the vegetation zonation with a clear diagram
- Explain the characteristics of each vegetation zone
- Give the 1St evaluation (to a large extent) and explain how attitude influences natural vegetation.
- Give the 2r d evaluation (other factors) that is; Climate, type of soil, nature of relief, biotic factors, drainage and human activities.

Answer guide

Altitude refers to the height above sea level and influences vegetation distribution in Highland areas like mountain Kilimanjaro, Kenya, Rwenzori, Elgon, Meru, Muhavura and other highlands above 3500m above sea level.

In highland regions, Altitude controls climate, soil and drainage which influence Vegetation zonation from the foot of the mountain to the top (summit) as explained below.

Areas lying below **1800 meters** above sea level have savannah vegetation, sub-divided into three depending on the annual rainfall and the duration of the dry season.

At its lowest level is **dry savanna** (dry bush and thicket) characterized by;

▪short bushy thorny trees with shrub growing between them

▪thorny trees have small waxy needle like leaves to reduce loss of water through transpiration

▪Poor and short tuft grasses with bare ground between them

▪trees are drought and fire resistant

▪growth of thickets

▪some plants have twisting lea system

The dry savanna merges into grassland characterized by;

▪dominance of tall grasses of about 3-5 m such as spear and elephant

▪few scattered short trees growing within the grasses for example acacia

▪trees have tiny leaves and are deciduous

▪trees are fire and drought resistant

▪grasses dry during the dry season and turns brown or yellow and green during the wet season

As altitude increases to **about 1800m** above sea level, savanna grasslands change into woodland characterized by;

▪dominance of trees forming a continuous cover towards the margin of the rain forest and less grass

▪trees are of tropical hard wood and appear in mixed stands

▪trees are umbrella shaped to reduce loss of water through transpiration

▪trees are of medium height of about 16- 18 meters

▪trees are deciduous in nature

▪they are also drought and fire resistant with tap roots to reach the water table deep in the ground and thick barks

▪trees also have small leaves to reduce loss of water through transpiration

▪dominant tree species include acacia and baobab

▪thick under growth of tall grasses, shrubs and bushes growing under scattered trees because adequate sun light reaches the ground easily than in the tropical rain forests

▪grasses dry during the dry season and turns brown or yellow and green during the wet season

▪some trees such as baobab have swollen trunks to resist drought and fire

At an altitude of **about 1800 – 2500** meters above sea-level, savanna woodland gradually merges into tropical rain forests characterized by;

.▪ever green trees with broad leaves

▪tall trees of up to 50 meters high

▪trees have big and straight trunks

▪trees have buttress roots to support the huge and straight trunks

▪trees appear in mixed stand for example mahogany, iron wood, ebony

▪trees form 2-3 canopy layers

▪there many climbing plants for example lianas

▪limited under growth because the canopies block sunlight from reaching the ground

▪trees are of tropical hard wood species

At an altitude **of about 2500- 3000 meters** above sea-level, equatorial forests gradually merge into temperate forests characterized by;

▪dominance of coniferous soft wood trees species like cedar, podocarp and camphor.

▪trees are ever green,

▪trees have straight trunks,

▪trees have thick barks,

▪trees have needle shaped leaves and no under growth.

▪Trees are shorter towards the bamboo forest.

At an altitude of about 3000 - 3500 meters above sea-level, temperate forests gradually merge into bamboo forest characterized by;

▪trees which appear in single layer,

▪trees grow in pure stands

▪have segmented or reed like stems with hollows inside to minimize water consumption which is relatively scarce at this altitude,

▪have small, tough pointed leaves,

▪trees are ever green,

▪they have prop roots to anchor firms in the thin soil layer

At an altitude of about **3500 - 4500metres** above sea-level, bamboo forest gradually merges into heath and moorland characterized by;

▪short grasses, shrubs and Alpine flowers

▪Plants include lobelia and giant groundsel.

DIAGRAM SHOWING NATURAL VEGETATION ZONATION IN MOUNTANEOUS AREAS IN EAST IN RELATION TO ALTITUDE

On the other hand, vegetation distribution is influenced by climate, type of soil, drainage, relief and biotic factors

Account for the differences in the natural vegetation zonation in one mountainous area in East Africa.

Approach

- identify any one mountainous area in East Africa with different natural vegetation
- identify the different natural vegetation zones existing on it
- describe the characteristics of each vegetation type
- explain the factors that have favored each vegetation type/zone identified.
- Draw the diagram showing the arrangement of vegetation types from the top to the base

Answer guide

Vegetation zonation refers to the arrangement of vegetation along the slope from the summit to the base. It is dictated by altitude hence limited to mountainous regions such as Kilimanjaro, Kenya, Rwenzori, Elgon, Meru and Muhavura.

Altitude influences vegetation zonation because rain fall, temperature, soil and drainage change with altitude as explained below.

The vegetation zones vary from mountain to mountain depending on the height of the mountain. In addition the zones don't have clear margins instead overlap.

Diagram showing natural vegetation zonation in mountainous areas in East Africa

Generally the following zones can be identified

Areas lying below **1800 meters** above sea level have savanna vegetation, sub-divided into three depending on the annual rainfall and the duration of the dry season.

At its lowest level on the drier margins is **dry savanna** (dry bush and thicket) characterized by;

▪scrub, bush and thicket with stunted trees **due to;**

▪moderate to low annual rainfall of about 500 mm-250mm supports dry bush.

▪Low humidity in the atmosphere supports growth of drought resistant plants

▪very hot temperatures of over 30 ^{0}C support growth of drought resistant plants

▪poor sandy soils with low water retention capacity support growth of drought resistant plants

▪fair drainage hence limited moisture in the soil

▪flat low lying relief/ lower slopes

▪low altitude less than 1000m above sea level- the lower slopes of the mountain

The dry savanna merges into **grassland characterized by**;

▪dominance of tall grasses of about 3-5 m such as spear and elephant

▪few scattered short trees growing within the grasses for example acacia

▪trees have tiny leaves and are deciduous

▪trees are fire and drought resistant

▪grasses dry during the dry season and turns brown or yellow and green during the wet season

Savannah grass exists at this level because of;

▪Moderate annual rain all of about 500mm-760mm encourages growth of tall grasses and short trees

▪Alternate short wet and long dry seasons encourage growth of deciduous trees and drying of grasses

▪Low humidity in the dry season and high in the wet season

▪Hot temperatures above over 27 ^{0}C support growth of drought resistant plants

▪Fairly fertile soils encourage growth of tall grasses and short scattered trees

▪Fairly good drainage especially in the wet season increases moisture in the soil and growth of tall grasses

▪Relatively flat lowland relief favors growth of grasses and short trees

▪Low altitude of less than 1000m above sea level minimizes moisture in the soil for growth of grasses

As altitude increases to **about 1800m** above sea level, savanna grasslands change into woodland towards the rain forest with the following characteristics;

▪dominance of trees which are umbrella shaped with less grass

▪trees are of tropical hard wood and appear in mixed stands

▪trees are of medium height of about 8- 16 meters

▪trees are deciduous in nature to reduce water loss through transpiration

▪they are also drought and fire resistant with tap roots to reach the water table deep in the ground.

▪Trees have thick barks to resist water loss and destruction from animals and wild fire,

▪trees also have small leaves to reduce loss of water through transpiration

▪dominant tree species include acacia and baobab

▪thick under growth of tall grasses, shrubs and bushes growing under scattered trees because adequate sun light reaches the ground easily than in the tropical rain forests

▪some trees such as baobab have swollen trunks to resist drought and fire

Savanna woodland exists at this level because of;

▪Moderate to heavy rain fall of about 760mm – 1200 mm annually supports the growth of medium height trees and thick under growth.

▪Rainfall is seasonal and concentrated in one peak hence growth of deciduous and drought resistant plants such as acacia and baobab

▪Fairly high humidity in the wet season encourages growth of deciduous trees, tall grass and shrub.

▪hot temperatures above 24^0c encourage high transpiration hence growth of deciduous and drought resistant plants.

▪Fairly fertile soils with low water retention capacity favor growth of and drought resistant plants

▪low lying plateau relief favors the growth of short trees intermixed with shrubs

▪Fairly good drainage with limited surface water favors growth of deciduous and drought resistant plants

Rain forests exist at **an altitude of about 1800- 2500 meters** above sea-level. They are characterized by;

▪tall trees of up to 50 meters,

▪trees are ever green with broad leaves,

▪trees form 2-3 canopy layers. That is, upper layer of very tall trees, middle and lower layer.

▪Trees have huge and straight trunks

▪trees have buttress roots to support the huge and straight trunks,

▪trees appear in mixed stand, for example mahogany, iron wood, ebony e.t.c

▪Little or no under growth because of the canopies which block sunlight,

▪there many climbing plants for example, lianas and epiphytes like Ferns, mosses and orchids,

▪trees have thick barks and provide hard wood for example, mahogany, iron wood, rose wood, green heart and ebony.

Tropical rain forests exist at this level because of;

▪Heavy and well distributed rain fall over1500mm annually provides adequate water for growth of tall trees with buttress roots

▪High humidity over 80 % contributes to formation of heavy rain fall

▪hot temperatures of about 22^0c- 28^0c increases humidity and rain fall formation through evapotranspiration

▪Deep fertile soils such as volcanic provide adequate nutrients for growth of tall trees

▪Low and high altitude of about 1000m- 2500m above sea level encourages growth of tall trees

▪Good drainage with adequate supply of streams increases moisture in the soil.

▪In terms of relief, rain forests thrive on gentle slopes of major highlands

Temperate forests exist at an altitude of about 2500 - 3000 meters above sea-level. They are characterized by;

▪dominance of coniferous soft wood trees species like cedar, podocarp and camphor.

▪trees are tall near the tropical rain forests due to heavy rain fall

▪trees are ever green,

▪trees have straight trunks,

▪trees have thick barks,

▪trees have needle shaped leaves and no under growth.

▪Trees are shorter towards the bamboo forest.

Temperate forests exist at this level because of;

▪Low rain fall

▪Low humidity

▪Low temperatures below 20^0C

▪Shallow soils

Bamboo forests exist at an altitude of about 3000m – 3500m above sea. Bamboo plants have the following characteristics;

▪they appear in single layer,

▪grow in pure stands

▪have segmented or reed like stems with hollows inside to minimize water consumption which is relatively scarce at this altitude,

▪have small, tough pointed leaves,

▪they are ever green,

▪have prop roots to anchor in the swallow soil.

Bamboo forests exist at this level because of;

▪low rain fall

▪cool temperatures

▪thin and skeletal soils.

Heath and moorland exists at an altitude of about **3500m – 4500** meters above sea- level and have the following characteristics;

▪They consist of short grasses, shrubs and Alpine flowers

▪Plants include lobelia and giant groundsel.

Heath and moorland exist at this level because of;

▪low rain fall

▪cold or Low temperatures

▪thin soils such as scree soils due to high rate of erosion on steep slopes and limited chemical weathering

Other factors that influence vegetation zonation include;

▪**Aspect of relief**. That is, forest vegetation exists on the wind ward side while savanna and scrub vegetation exists on the leeward due to arid conditions

▪Occurrence of Natural disasters such as landslides have led to the destruction of the original vegetation in highlands; replacing them with secondary vegetation types.

▪Wild fires have led to the destruction of the original vegetation in highlands; replacing them with secondary vegetation types.

Influence of biotic factors for example;

▪Termites, locusts, and animals in game parks such as elephants have led to destruction of the original vegetation types which are replaced with scrubs or other poor forms.

▪Animal grazing through nomadism, ranching and dairying led to destruction of the original vegetation types which are replaced with scrubs or other poor forms.

▪Man's activities such as deforestation, construction, cultivation and mining have led to the destruction of the original forests, woodlands, swamps and grasslands and replacing them with secondary vegetation types.

●On the other hand, human intervention through environmentally friendly activities such as afforestation, re-afforestation and agro forestry, creation of national parks and forest reserves has led to regeneration of formally degraded natural vegetation such as forests and protection of the existing ones.

●Favorable Government policy of gazetting highlands as national parks and game reserves has protected and preserved natural vegetation

To what extent has the natural vegetation of East Africa been modified by human activities?

Approach

- ❖ define natural vegetation
- ❖ Identify and describe the characteristics of natural vegetation types modified by human activities
- ❖ State areas where human activities have modified natural vegetation
- ❖ Give the 1St evaluation (to a large extent) and explain the activities that have modified natural vegetation
- ❖ Give the 2r d evaluation (physical factors)

Answer guide

Natural vegetation is that type of plant life that grows naturally in a particular physical environment. The natural vegetation types modified greatly by human activities include:

Natural forests, savanna wood land and grass lands and scrub.

Natural forests include tropical rain forests, mangroves and montane Forest. They are common in areas of mabira, kalangala, Budongo, East African coast, mountain Kilimanjaro, Rwenzori, Kenya and other highlands above 3500 m above sea level.

Forest vegetation is generally characterized by;

▪ever green trees

▪trees are tall

▪trees have broad leaves,

▪ trees have buttress roots to support the huge trunks,

▪trees appear in mixed stand for example mahogany, iron wood, ebony e.t.c

▪trees form 2-3 canopy layers. That is, upper layer of very tall trees, middle and lower layer.

▪trees have thick bark and provide hard wood for example, mahogany, iron wood, rose wood, green heart and ebony.

Savanna woodlands and grasslands cover areas of Northern Uganda, western and southern Tanzania e.t.c

They are characterized by;

▪dominance of medium height trees in the woodland and tall grass in the grassland

▪trees have small waxy needle like leaves,

▪trees are drought and fire resistant,

▪trees are deciduous

▪trees are umbrella shaped at the top to reduce water loss,

▪dominant tree species are acacia and baobab,

▪grass dries during the dry season and become brown or yellow, and green during the wet season.

Scrub or semi desert vegetation in northern Kenya, north eastern Uganda (Karamoja), Ankole – Masaka corridor, northern Tanzania and some parts of Rift valley due to low annual rainfall below 500mm.

Scrub vegetation is characterized by;

▪bushy thorny trees of 5- 10 meters tall with shrub growing between them

▪trees are drought and fire resistant for example acacia,

▪very poor and short tuft grass with bare ground between the scattered thorny bushes,

▪grass dries up and turns yellow / brown during the drought period and roots become dormant in soil

▪some plant species have twisting leaf system to prevent direct sunshine and high transpiration.

The natural vegetation types identified above have been modified by man's activities mainly in areas of Kenya highlands, Kigezi highlands, Lake Victoria basin, north eastern Uganda, northern and western Kenya, slopes of mountain Kilimanjaro, parts of central Tanzania and central Uganda e.t.c

The areas stated above have witnessed the following human activities that have to a largest extent modified natural vegetation as explained below;

●steady destruction and clearing of forests and swamps to expand cultivable land either for commercial or subsistence for example sugar cane in lugazi , coffee, Banana plantations, tea on the fringes of Mabira forest, palm oil in Kalangala, islands, yams ,rice; millet and sorghum in savanna and semi desert areas.

The original vegetation cover has been replaced by planted crops.

●He burns vegetation to provide new pastures for nomadic pastoralism, dairying and ranching for example in Nakasongola, Teso, Kikuyu, Karamoja and Miombo in Tanzania.

●clearing of forests and grasslands and swamps for settlement/ urbanization in areas of Kampala, Lugazi, Mukono, Nairobi, Kisumu, Jinja, Dodoma and other towns in central, Eastern and south western Uganda, Kenya and Tanzania

●lumbering in tropical rain forests have been replaced by woodland and scrubs for example Imaragambo, Budongo, Kibaale, Kalangala islands, Miombo woodlands e.t.c

●cutting down of trees for fuel (fire wood and charcoal) for industrial and domestic use for example Budongo, Kibaale, Kalangala islands, Miombo woodlands , Karamoja, central Uganda, south western Tanzania e.t.c .Trees have been replaced by secondary forms of vegetation.

●Swamp reclamation for agriculture, dairying, settlement, industrial development e.t.c has led to disappearance of swampy vegetation in most areas such as Nakawa-Banda, Nalukolongo-Natete and other swamps in western and central Uganda

●mining and quarrying in Mwandui (Diamond),Tororo (limestone and vermiculite),Kilembe(Cobalt), Bamburi (cement), Gold, Tin, Wolfram in south western Uganda, murrum, sand, e.t.c destroys the original forests, grasslands and swamps ;replacing them with secondary vegetation types.

●animal grazing through nomadism, ranching, and dairying leads to disappearance of original forests, grasslands and swamps; replacing them with secondary vegetation types for example in Karamoja, Ankole – Masaka corridor, Kigezi and Kenya highlands a Miombo in Tanzania e.t.c.

●repeated bush burning in Karamoja, Mbarara, Turkanaland, Masai, Nakasongola, Miombo in Tanzania and other pastoral communities to prepare for good pastures, kill pests and diseases e.t.c has led to the destruction of the original vegetation types which are replaced with scrubs or other poor forms.

●Man also clears natural vegetation for setting up and expanding industries for example Namanve industrial park destroys the original forests, grasslands and swamps ;replacing them with secondary vegetation types.

●Cutting down of trees for timber and building materials have modified forest, grasslands and swamps; replacing them with secondary vegetation types.

●Human interference through afforestation, re-afforestation and agro forestry has led to the introduction of exotic tree species such as p pine, eucalyptus, Robusta, Grevilleea e.t.c replacing the former grasses and natural vegetation types

To a least extent, natural vegetation has been modified by physical factors such as;

Harsh climatic conditions/ unreliable rain fall/ desertification e.t.c has changed the natural vegetation characteristics fore example Karamoja, northern Kenya, Miombo e.t.c

Occurrence of landslides has removed the original vegetation cover; exposing rock layers for example on Mount Elgon slopes Kigezi highlands, Rwenzori slopes, Rwampara hills e.t.c

Overgrazing by wild game, browsing, debarking and over trampling have changed the original natural vegetation in National parks such as Queen Elizabeth, Masai-Mara e.t.c

Living organisms such as termites, ants, locusts e.t.c in Nakasongola e.t.c have destroyed savanna grasslands; changing it to scrub. Aphids and Tsetse flies in Masindi, Bunya, and Mayuge e.t.c prompted man to clear forests changing to savanna woodland and grassland

Continued deposition of sediments on flood plains leads to gradual successions of vegetation types and growth of new types.

To what extent has man influence the distribution of natural vegetation of East Africa?

Approach

- ❖ define natural vegetation
- ❖ Identify and describe the characteristics of natural vegetation types in East Africa.
- ❖ State areas where human activities have influenced/ modified natural vegetation in East Africa
- ❖ Give the 1St evaluation (to a large extent) and explain the activities that have influenced natural vegetation
- ❖ Give the 2r d evaluation (physical factors)

Answer guide

Refer to the question above for answers

Human activities that have influenced vegetation distribution in East Africa include;

●steady destruction and clearing of forests and swamps to expand cultivable land either for commercial or subsistence

●He burns vegetation to provide new pastures for nomadic pastoralism, dairying and ranching

●clearing of forests and grasslands and swamps for settlement/ urbanization in areas of Kampala, Lugazi

●lumbering in tropical rain forests have been replaced by woodland and scrubs

●cutting down of trees for fuel (fire wood and charcoal) for industrial and domestic use

●Swamp reclamation for agriculture, dairying, settlement, industrial development

●mining and quarrying in Mwandui (Diamond), Tororo (limestone and vermiculite), Kilembe (Cobalt), Bamburi

●Human interference through afforestation, re-afforestation and agro forestry has led to the introduction of exotic tree

●repeated bush burning in Karamoja, Mbarara, Turkanaland, Masai, Nakasongola, Miombo in Tanzania

●Man also clears natural vegetation for setting up and expanding industries for example Namanve industrial park

●Cutting down of trees for timber and building materials have modified forest, grasslands and swamps;

●animal grazing through nomadism, ranching, and dairying leads to disappearance of original forests, grasslands

To a least extent, man has influenced vegetation distribution through;

●afforestation, re- afforestation and agro forestry for example planting pine, eucalyptus, Robusta, Grevilleea

●Favorable Government policy of conserving natural vegetation in form of forest reserves and national parks has led to the existence of natural forests, savanna and swamps for example Mabira, Budongo, Bugoma, IMaramagambo, Bwindi impenetrable forests, Elgon forests, Tsavo National parks e.t.c

On the other hand, vegetation distribution is influenced by physical factors like;

Climate, altitude, type of soil, nature of relief, biotic factors and Drainage

Remember to explain these factors.

NATURAL FOREST VEGETATION IN EAST AFRICA

Account for the distribution of natural forest vegetation in East Africa.

Approach

- Define natural forest vegetation.
- Identify the types of natural forests in East Africa

- ❖ State the characteristics of each type of forest and where it is found descriptively or by drawing a sketch map.
- ❖ Explain the factors influencing the growth of each type of forest

Answer guide

Natural forest vegetation refers to the community of a dense cover of trees growing naturally in a particular physical environment

Natural forests in East Africa are grouped into three types. Namely; equatorial forests/ tropical rain forests, montane forests, mangrove and riverine forests

Equatorial tropical rain forests are common in areas of mabira, kalangala, Budongo, Kibaale, Imaramagambo and on the foot hills of Mount Elgon, Rwenzori, Kenya, Kilimanjaro and Meru.

Tropical rainforests are characterized by;

▪ever green trees

▪trees are tall

▪trees have broad leaves,

▪trees have huge and straight trunks

▪ trees have buttress roots to support the huge trunks,

▪trees appear in mixed stand for example mahogany, iron wood, ebony e.t.c

▪trees form 2-3 canopy layers. That is, upper layer of very tall trees, middle and lower layer.

▪trees have thick bark and provide hard wood for example, mahogany, iron wood, rose wood, green heart and ebony.

▪Limited or no under growth because of the canopies which block sunlight from reaching the ground

Montane forests- sub divided into temperate and Bamboo.

Temperate forests exist at an altitude of about 2500m- 3000meters above sea –level and characterized by;

▪dominance of coniferous soft wood trees species like cedar, podocarp and camphor.

▪trees are tall near the tropical rain forests due to heavy rain fall

▪trees are ever green,

▪trees have straight trunks,

▪trees have thick barks,

▪trees have needle shaped leaves and no under growth.

▪Trees are shorter towards the bamboo forest.

Bamboo forests exist at an altitude of about 3000m – 3500m above sea. Bamboo plants have the following characteristics;

▪they appear in single layer,

▪grow in pure stand

▪have segmented or reed like stems with hollows inside to minimize water consumption which is relatively scarce at this altitude,

▪have small, tough pointed leaves,

▪they are ever green,

▪have prop roots to anchor in the swallow soil.

Mangrove forests in the salty waters along the coast of East Africa between 5^0 north and 5^0south of the equator for example Rufiji delta, areas near Mombasa, Lamu e.t.c

▪Mangrove contain Medium height trees of about 12 meters,

▪trees have aerial roots for breathing in mud,

▪Have tap roots for filtering salts from the blackish water

▪Have buttress roots to anchor firmly in the unstable mud flats

▪trees have short and twisted trunks,

▪trees have ever green broad leaves

▪trees are of tropical hard wood.

▪trees form a dense cover due to water logging conditions,

Factors favoring the growth and distribution of natural forests

The growth and distribution of natural forests in East Africa is influenced by; climate, type of soil, drainage, altitude, relief and biotic factors as explained below.

Climate- has influenced the growth and distribution of forests through its elements of rainfall, temperature and humidity. That is;

▪hot and wet/ humid conditions have encouraged the growth of tropical rain forests.

▪cool and wet conditions in highland areas have encouraged the growth of montane forests.

▪hot and moist conditions in the coastal areas of East Africa have encouraged the growth of mangrove forests.

Altitude: refers to the height above sea level and affects temperate and rainfall.

▪Low and high altitude about 1000m-2500m above sea level encourages tropical rain forest

▪High altitude of about 2500m-3500m above sea level has encourage growth of montane forest vegetation

▪Coastal areas of about 0-200m above sea level have encouraged the growth of mangrove forests

Nature of the soil. The Type of soil in terms of; fertility, depth and texture has influenced the growth of forests in the following ways;

▪deep and fertile soils such as volcanic on gentle slopes of volcanic highlands, loamy and alluvial soils in low lying areas such as lake shores and valleys have encouraged growth of rain forests.

▪shallow and fairly fertile soils on mountain slope have encouraged the growth of montane forests

▪deep, muddy and saline soils have encouraged the growth of mangrove forests.

Drainage of the area influences the moisture in the soil. That is;

▪Well drained areas such as gentle slopes and steep slopes have encouraged the growth of both rain and montane forests.

▪poorly drained or water logged areas such as salty marshes in the coastal areas and deltas have encouraged the growth of mangrove forests.

Influence of relief. That is;

▪lowlands and gentle slopes have encouraged growth of rain forests

▪fairly steep slopes or hilly areas have encouraged the growth of montane forests

▪low lying coastal plains have encouraged the growth of Mangrove forests.

Influence of relief biotic factors for example;

▪Bird have helped in dispersing seeds form which trees thrive

▪Human intervention through afforestation, re-afforestation and agro forestry has facilitated the existence of natural forests,

▪Favorable Government policy of conserving natural forests in form of forest reserves and national parks has facilitated the existence of natural forests for example Mabira, Budongo, Bugoma, IMaramagambo, Bwindi impenetrable forests, Elgon forests, Tsavo National parks e.t.c

▪Absence of serious diseases and pests such as elephants and giraffes which would have other wise destroyed and change the quality and quantity of forest vegetation. For example Mabira and Bwindi forests.

EQUATORIAL FORESTS / TROPICAL RAIN FORESTS

(a) describe the characteristics of tropical rain forests in East Africa
(b) Explain the conditions which have favored the growth of tropical rain forests in East Africa.

Approach

- ❖ Identify areas covered by tropical rain forests in East Africa
- ❖ Give and describe the characteristics of tropical rain forests

- ❖ Identify and explain the factors favoring the growth of tropical rain forests

Answer guide

Tropical rain forests exist in equatorial climatic region in areas such as mabira, kalangala, Budongo, Kibaale, Imaramagambo, Kakamega western Kenya, parts of central Uganda; and on the foot hills of Mount Elgon, Rwenzori, Kenya, Kilimanjaro and Meru.

Tropical rain forests are characterized by;

▪tall trees that grow to height of 60 meters due to competition for sun light

▪Hard wood tree species such as mahogany, musizi, mvule, ironwood, Ebony e.t.c due to availability of adequate water and nutrients

▪Trees form dense canopies usually in 3 layers. That is; upper layer of very tall trees, middle and bottom layer due to growth of trees at different intervals or age and sprawl to form canopies

▪Ever green trees, shedding leaves at different intervals throughout the year due to constant rain fall hence continuous growth of trees

▪They have little or no undergrowth due to thick canopy preventing sunlight from reaching the ground

▪Trees have broad leaves that allow evaporation to get rid of excess water

▪Trees have many climbing plants for example lianas and epiphytes such as ferns, mosses that get support from the tall and huge trees

▪Trees grow in mixed stands/ have a variety of plants growing profusely such as mahogany, palms, iron wood, ebony e.t.c

▪Trees have straight trucks and buttress roots due to ample water supply

▪Most trees have buttress roots that give support to the huge and tall trees

▪ Trees have a long gestation period to mature of about 30 years

Impression marking……10 marks

Tropical rain forests are largely favored by physical factors for example;

Climate. Equatorial forests grow well in areas;

▪Receiving heavy and reliable rainfall above 1500mm annually.

▪Rain fall is distributed through out the year with a bi-modal pattern

▪Have hot to warm temperatures of about 22^0c- 28^0c throughout the year; increase humidity in air and formation of heavy rainfall that encourages the growth of tall trees

▪Have high humidity levels of about 80% that promotes luxuriant tree growth

▪Presence of adequate sun light for plants to manufacture food promotes plant growth

Altitude-affects temperature and rainfall. Consequently tropical rain forests thrive at an altitude of about 1000m-2000m above sea level where rainfall is abundant and temperatures range from hot to warm in lowland and highlands respectively

Soil-tropical rain forests grow in areas with deep fertile soils along mountain slopes, gently sloping areas, alluvial soils along river valleys and loamy soil near shores of lakes.

Drainage. Tropical rain forests grow in well drained areas especially along gentle slopes of major highlands and lowlands

▪Water logged areas especially those containing numerous streams and rivers favor riverine forests

Aspect of relief. Equatorial rain forests thrive on the gentle slopes on the windward side of major mountains due to moist winds that facilitate the formation of relief rain fall

Influence of biotic factors for example;

▪**Favorable government policy** of conserving/ gazetting forest reserves for ecological functions has ensured the growth and continuous existence of rain forests in various parts of East Africa for example mabira, Bwindi forest reserve, Elgon forest, Rwenzori, Kibaale e.t.c

▪Human intervention through afforestation, re-afforestation and agro forestry programs has led to regeneration of formally degraded tropical rain forests.

Maximum……15 marks

Explain the factors influencing the distribution of tropical rain forests in East Africa.

Account for the distribution of tropical rain forests in East Africa.

Account for the growth of equatorial forests in East Africa.

Approach

- Identify areas covered by tropical rain forests in East Africa
- Give and describe the characteristics of tropical rain forests
- Identify and explain the factors favoring the growth of tropical rain forests

Refer to the question above for the answers

SAVANNA VEGETATION

(a) Describe the characteristics of savanna vegetation.

(b) Explain the conditions which have favored the growth of savannah vegetation in East Africa.

Approach

- define savanna vegetation
- identify the types of savanna
- give and describe the characteristics of each type and where it occurs
- Identify and explain the explain the conditions favoring the growth of savanna

.

Answer guide

Savanna refers to a belt of tropical grassland with scattered trees. It occurs in the interior landmasses experiencing tropical climate.

Savanna vegetation is subdivided into three types depending on the annual rainfall received and the duration of the dry season. That is; dry savanna, grassland and woodland.

Dry savanna (dry bush and thicket) covers areas in northern, north western and north eastern Kenya, north eastern Uganda (Karamoja), Ankole – Masaka corridor, northern Tanzania and some parts of Rift valley.

Dry savanna is characterized by stunted poor vegetation of;

▪bushy thorny trees of 5- 10 meters tall,

▪trees are short with small waxy needlelike leaves,

▪plants are drought and fire resistant,

▪ presence of Shrubs and thicket,

▪very poor and short grasses and grow in bunches or tufts and widely spaced,

▪the bushes and the shrubs have thorns instead of leaves to reduce transpiration

▪some plant species have twisting leaf system to prevent direct sunshine and high transpiration

Savanna Grassland -covers Nyika plateau and Athi plains, parts of Northern Uganda, Rift valley areas of western Uganda, areas of Bukoba e.t.c.

Savanna Grassland is **characterized by**;

▪dominance of tall grasses of about 3-5 m such as spear and elephant

▪few scattered short trees and bushes grow within the grasses for example acacia

▪trees have tiny leaves and are deciduous

▪trees are fire and drought resistant

▪grasses dry during the dry season and turns brown or yellow and green during the wet season

Savanna Woodlands cover mainly parts of western and south western Tanzania, parts of Northern Uganda, parts of western rift valley region for example lake George and Albert flats, parts of southern and Eastern Kenya.

Savanna Woodland vegetation is characterized by;

▪dominance of trees which are umbrella shaped with less grass

▪trees are of tropical hard wood and appear in mixed stands

▪trees are of medium height of about 8- 16 meters

▪trees are deciduous in nature to reduce water loss through transpiration

▪they are also drought and fire resistant with tap roots to reach the water table deep in the ground.

▪Trees have thick barks to resist water loss and destruction from animals and wild fire,

▪trees also have small leaves to reduce loss of water through transpiration

▪dominant tree species include acacia and baobab

▪thick under growth of tall grasses, shrubs and bushes growing under scattered trees because adequate sun light reaches the ground easily than in the tropical rain forests

▪some trees such as baobab have swollen trunks to resist drought and fire

Factors or conditions favoring the growth of savanna vegetation

These include climate, type of soil, drainage, altitude, relief and biotic factors.

Climate- Influences the growth and distribution of savanna vegetation through its elements of rainfall, temperature and humidity. That is;

▪Moderate to heavy rainfall of about 760 mm -1200 mm annually and distributed in one season and hot temperatures of about 24^0c - 30^0 c encourage growth of savanna woodland while

▪moderate annual rain fall of about 500mm-760mm and hot temperatures over 30^0 c encourage grass lands.

▪Low and seasonal rain fall of about 250mm- 500 mm per annum and very hot temperatures over 30^0 C encourages the growth of dry savanna vegetation.

▪high to moderate humidity has favored savanna wood lands and grassland while low humidity for dry savanna vegetation.

Altitude -Low altitude of less than 1500 meters above sea level encourages savanna vegetation. That is;

▪ Low plains encourage dry savanna and grassland while high plains encourage savanna woodland.

Nature of the soil present. The Type of soil in terms of; fertility, depth and texture influence savanna vegetation in the following ways;

▪fairly fertile soils with low water retention capacity have favored the growth of woodlands

▪soils of moderate fertility for example latosols and laterites have favored grass lands

▪Poor sandy soils for example in Karamoja and rift valley regions have encouraged growth of dry savanna vegetation

Drainage of the area influences the moisture in the soil. That is;

▪Well drained areas without or very limited surface water have encouraged the growth of dry savanna vegetation

▪Fairly good drainage especially in the wet season increases moisture in the soil hence growth of tall grasses

▪Fairly good drainage with limited surface water and streams favors growth of savanna woodland characterized by deciduous and drought resistant plants

Influence of relief- determines depth and moisture in the soil for example;

▪Low lying plateau areas have favored savanna woodlands while

▪flat lowlands have favored both savanna grasslands and dry savanna for example rift valley areas and the plains

Biotic factors for example;

▪Occurrence of pests such as tsetse flies, termites, bees, caterpillars and locusts, and diseases such as Nagana and sleeping sickness deter human interference through deforestation hence continuous existence of savannas.

▪Wild fire and animals especially in national parks have destroyed and altered the characteristics of the tropical forests; degradation and changing them into savannas for example Elephants, giraffes, buffaloes and cattle.

Man's activities such as logging, charcoal burning, mining and agricultural expansion in the tropical forests has led to degradation and changing of these forests into savannas

▪**Favorable government policy** of conserving/ gazetting savannas as reserves and national parks for ecological functions has ensured their growth and continuous existence in various parts of East Africa for example Murchison falls national park, Queen Elizabeth national park, Tsavo, Masai Mara and Serengeti national parks.

▪Human intervention through afforestation, re-afforestation and agro forestry programs has led to regeneration of formally degraded savannas.

N.B conditions must be attached to the vegetation type as shown above.

SAVANNA WOOD LAND/ MIOMBO WOODLAND

Account for the occurrence of the Miombo wood land type of vegetation in East Africa.

Approach

- Define Miombo wood land type of vegetation
- Identify areas where the Miombo woodland occur descriptively or by use of a sketch map
- Describe the characteristics of Miombo woodland.
- Identify and explain the various factors that have led to the occurrence of Miombo wood land type of vegetation.

Answer guide

Miombo wood land is a form of savanna vegetation with more or less continuous cover of trees and shrubs intertwined. It is also referred to as tropical wood land/ savanna wood land.

Miombo wood lands occur in Western and South Western Tanzania, parts of the western Rift valley region such as lake George and Albert flats, parts of southern and Eastern Kenya , Northern Uganda e.t.c

A candidate may draw a sketch map of East Africa showing the distribution of savanna woodland vegetation.

Characteristics of Miombo wood land vegetation;

▪dominance of trees forming a continuous cover towards the margin of rain forests trees because of moderate water supply.

▪trees have medium height between 8 -16 meters,

▪trees are umbrella shaped at the top to reduce water loss,

▪trees are tropical hardwoods and of mixed stands,

▪trees are deciduous in nature. That is, they shed off their leaves in the dry season,

▪a dense cover of grass, bushes and shrubs grows among the trees because sun light reaches the surface,

▪trees have tiny leaves, twisted trunks with thick, rough barks to reduce water loss,

▪trees are drought and fire resistant, with long tap root system which enables the plants draw water deep underground,

▪some tree species such as baobab have swollen trunks to store water for use during the hot dry season.

▪dominant tree species are acacia and baobab.

▪Most trees develop branches close to the ground.

Factors or conditions favoring the growth of savanna woodland vegetation

Climate, altitude, soils, drainage, relief, biotic factors, influence of human activities.

Climate- Influences the growth and distribution savanna woodland vegetation through its elements of rainfall, temperature and humidity;

▪Seasonal and moderate rain fall of 760-1000mm per annum has encouraged the growth and dominance of trees to form a continuous cover towards the margin of rain forests.

▪Rain fall is concentrated in one peak.

▪The dry season encourages shedding of leaves and growth of grasses

▪High temperatures over 27^0 C - 30^0 C encourage growth of drought resistant tree species such as acacia

▪Moderate humidity allows fairly high transpiration.

Occurrence of fairly fertile and porous soils enables water to drain easily and trees to develop long tap roots.

Relief. The occurrence of low lying plateau areas has favored the growth of Miombo woodland vegetation.

Low altitude of less than 1500 meters above sea level has encouraged the growth of savanna woodland.

Drainage. Limited or lack of surface water leads to quite good drainage which encourages the growth of Miombo woodland.

Biotic factors for example;

▪Occurrence of pests such as tsetse flies, termites, bees, caterpillars and locusts, and diseases such as Nagana and sleeping sickness deter human interference through deforestation hence continuous existence of savanna woodland.

Man's activities such as logging, charcoal burning, mining and agricultural expansion in the tropical forests has led to degradation and changing of these forests into savanna woodland.

Government policy creating of national parks and forest reserves for ecological functions has led to protection and regeneration of formally degraded savanna wood lands for example Murchison falls national park, Queen Elizabeth national park, Tsavo, Masai Mara and Serengeti national parks.

MEDITERRANEAN VEGETATION

(a)Describe the characteristics of the Mediterranean type of vegetation

(b) Account for the growth of Mediterranean type of vegetation in Africa.

Approach

- ❖ State where Mediterranean vegetation is found

- ❖ Give and describe the characteristics of Mediterranean vegetation
- ❖ Explain the factors which have favored the growth of this type of vegetation

Answer guide

Mediterranean type of vegetation occurs on the west coast of continents in the mid-latitudes for example central California and central Chile; and low lands for example around the Mediterranean Sea basin and the Western Cape Province of South Africa.

Characteristics of Mediterranean vegetation;

▪Mediterranean forests have broad leaves and evergreen trees such as oak, eucalyptus, cork oak, red wood due to wetter winters and withstand the hot and dry summer conditions.

▪Much of the woody vegetation in Mediterranean has small shiny waxy leaves to reduce water loss by transpiration during the hot dry summer months.

▪Trees and other Plants such as grape vine have long tap root system which enables the plants draw water deep underground during the hot dry summer season.

▪Some plants have large fleshy bulbous roots to store water for use in hot and dry summer.

▪Some trees such as cork oak have thick rough barks to store water during summer

▪There are sweet-smelling herbs and shrubs such as lavender, rose Mary, thymes, thyme and oleander.

▪Some trees are cone shaped especially pine.

▪Some trees are short and flat topped for example cork oak.

▪In some places there is mixed type of vegetation with deciduous trees, coniferous, tough grass and dwarf trees.

▪Some trees have compact weedy stems, bushy scrubs with dense thickets

▪Short grass is common especially in the Mediterranean basin, grass land of California, central valley e.t.c

Factors or conditions favoring the growth of Mediterranean vegetation

Climate-that is;

▪They have hot and dry summers of about 25^0 C.

▪Cool and moist rainy winters of about 12^0 C

▪Moderate annual rain fall of about 500mm -750mm and the onshore westerly winds blow in the winter bring cyclonic rain.

Soil-that is;

▪The ashy Mediterranean residual soils support Mediterranean vegetation

▪Limestone soils are porous and drain water easily hence deep root system of plants.

▪In the drier parts, soils are poor hence support Mediterranean scrub-like vegetation composed of sweet smelling herbs and shrubs such as lavender and rose Mary.

Altitude

▪The Mediterranean vegetation is mainly found along the coastal areas with low altitude; except for the Atlas Mountains. Scrubs exist near the sea coasts are often adapted to winds and salt air off the ocean like strandveld in South Africa

Latitude.

▪Mediterranean vegetation is found between 30^0 N and 45^0 N and 30^0 S and 40^0 S of the equator.

▪Areas with Mediterranean vegetation are located mainly on the western sides of continents because of maritime conditions

Influence of human activities. For example logging, livestock farming, expansion of agricultural plantations, urbanization and introduction of exotic species has led to extensive loss of forests, degradation and extinction of many native plants.

▪Many of the pyrolytic plants or plants adapted to fire or even depending on fire for reproduction, recycling nutrients and the removal of dead vegetation for example herbaceous vegetation and some grasses.

CORAL LANDFORMS IN EAST AFRICA

Account for the formation of coral landforms in East Africa

Approach

- ❖ Define clearly coral landforms
- ❖ Describe the process of formation
- ❖ Identify the types
- ❖ Explain conditions which favor their formation in East Africa
- ❖ Explain the theories put forward to explain the formation of coral landforms

Answer guide

Coral landforms/ reefs are offshore limestone rock platforms formed by continuous deposition and accumulation of shells or skeletons of small marine organisms known as coral polyps.

Polyps are minute living organisms rich in calcium carbonate and when they die; their skeletons get deposited and accumulate on the continental shelf where they are compacted and cemented together to form coral reefs.

The processes of coral formation therefore involve;

▪The death of coral polyps and deposition of skeletons rich in calcium carbonate on the continental shelf

▪Over time, the coral deposits increase in weight, become compressed and compacted and cemented together

▪In this way, large banks of consolidated rocks are gradually built up, called coral reefs

▪The process of cementation and consolidation of coral reefs is facilitated by other organisms such as algae (calcareous algae) and echinoderms.

▪The nature of the coral landforms formed depends on the position and shape of the landmass on which they have accumulated. Thus there are three types of coral reefs namely; fringing, barrier and atoll

Types of coral reefs

Fringing reef - a narrow coral platform of about one kilometer wide joined to the coast or separated from it by a shallow lagoon which may disappear at low water level.

▪A fringing reef is formed very close to the coast with its leeward edge sloping steeply into the sea floor.

▪Fringing reefs can be seen at the East African coast near Kilifi, Tiwi and Mombassa in Kenya and Oyster Bay at Dar es Salaam in Tanzania.

Diagram

Barrier reef - a wide coral plat form formed much farther or several kilometers from the coast and separated from it by a much deeper and relatively wider lagoon.

▪Barrier reefs can be cited at Mayotte Island between Mozambique and Madagascar.

Diagram

An atoll is a circular shaped coral reef surrounding a wide and fairly deep flat-floored lagoon and generally broken in places by narrow channels.

Atolls are formed very far from the coast for example Aldabra atoll reef lies 700 km off the coast of East Africa, Chumbe Island found on Zanzibar

Diagram

Conditions that favor development of coral reefs

The growth and development of coral landforms along the East African coast is facilitated by;

▪Warm temperatures of tropical climate between 20^0c-30^0c ideal for growth of coral polyps. This applies to areas 30^0 N and south of the equator for example Indian Ocean coast

▪ Availability of salty, well oxygenated seawater with a salinity level of 27-40 parts per 1000 parts of ocean water provides adequate calcium carbonate taken up from sea water by coral polyps used to build and harden their shells /skeletons.

▪Existence of clear, silt free and calm water away from river mouth allows coral growth.

▪Existence of shallow continental shelf with depth less than 60 meters allows penetration of sun light to the sea bottom. This enables planktons on which polyps feed to carry out photosynthesis.

▪Presence of plentiful supplies of planktons on which polyps feed and survive

▪Presence of solid rock bed along the coast upon which coral reefs grow. A continuous continental shelf along the coast is ideal for the growth of coral reefs.

▪Occurrence of sea-level changes/ isostatic adjustments. That is, increase in the sea level encourages coral deposition while a fall in the sea level exposes the coral reefs.

▪Presence of calm/ stable water hence no strong waves such as typhoons to destabilize normal growth and accumulation of coral reefs.

▪Presence of coral polyps in abundance which when die; deposit skeletons of calcium carbonate which accumulate to form coral landforms.

▪The warm Mozambique Ocean current that washes the East African coast helps to maintain the temperatures of the Indian Ocean and thus enables the polyps to survive.

Theories of coral reef formation

The formation of barrier reefs and atolls has created a lot of controversy as they have been found at far greater depths, in some areas exceeding 1000 meters; a level where polyps cannot survive. As a result, relevant theories have been put forward to explain this anomaly. That is subsidence theory, deglaciation theory and antecedent theory.

Subsidence theory by Charles Darwin 1842

Charles Darwin explained that the process of coral formation was gradual and occurred due to subsidence of a volcanic island.

Darwin's theory explains that volcanic eruption formed a volcanic island on the ocean floor.

Coral polyps established and colonized the edge of the volcano hence formed a fringing reef.

The volcanic island slowly subsided due to isostatic re-adjustments that followed eruption. Such subsidence increased the depth of water beyond the level at which coral polyps could survive.

Consequently, some polyps died while others survived on the flanks/ sides and started to grow to keep pace with the changes in the water depth.

The polyps that survived grew vigorously upwards and outwards and in the process transformed into barrier reefs and eventually into atolls when the volcano completely submerged.

N.B. the diagrams should show the upward ad outward growth.

Deglaciation theory by Daly

Daly based his theory on the sea level changes during and after the ice age, not subsidence of the volcanic island.

According to Daly, before the ice age or glaciation, fringing corals colonized the edge of a Marine Island due to warm water and other conditions that favor coral growth and development.

During the ice age/glaciation, a lot of water was locked up in ice-sheets and caused a fall in the sea level. The cold conditions killed some coral polyps while maximum erosion removed the top of the island and the reef to form a wave cut platform.

After the ice age, the return of warm conditions resulted into deglaciation, a rise in the sea level and growth of corals.

As sea level increased, the polyps that survived on the flanks of the wave cut platform grew vigorously upwards and outwards to keep pace with the changes in the water depth and be maintained at the surface water.

Through this process, coral reefs that colonized the flanks gradually transformed into barrier reefs and finally into atolls when the island/ wave cut platform submerged completely.

Diagram

Antecedent theory by sir john Murray

According to Murray, there existed stable submarine plat forms on which pelagic deposits including corals accumulated at a depth below 60 meters. Barrier reefs and atolls began to form on these platforms as fringing reefs.

As reefs grew upwards and outwards, they were pounded by waves such that masses of coral fragments accumulated on the seaward side; cemented and consolidated into hard reefs .The polyps inside the reef however died due to lack of food and their skeletons dissolved in water to form a lagoon inside the reef.

This changed the barrier reef in to atoll.

Diagram

Examine the relevance of Darwin's theory to the understanding of the formation of coral landforms in East Africa.

Approach

- Define clearly coral landforms
- Describe the process of formation
- Identify the types
- Explain conditions which favor their formation in East Africa
- Explain the formation of coral reefs with reference to Darwin's theory.

Theories put forward to explain the formation of coral reefs.

The formation of barrier reefs and atolls has created a lot of controversy as they have been found at far greater depths, in some areas exceeding 1000 meters, a level where polyps cannot survive. As a result, relevant theories have been put forward to explain this anomaly including Darwin's theory of subsidence

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The polyps that survived grew vigorously upwards and outwards and in the process transformed into barrier reefs and eventually into atolls when the volcano completely submerged.

N.B. the diagrams should show the upward ad outward growth.

Relevance of the theory

▪The theory is relevant because there was actual submergence of the East African coastline evidenced by presence of rias such as Mombassa and mud flats in submerged coastal areas.

▪Volcanic islands are also present off the coast of East Africa in Indian Ocean.

Examine the relevance of Daly's theory to the understanding of the formation of coral landforms in East Africa.

Approach

- Define clearly coral landforms
- Describe the process of formation
- Identify the types
- Explain conditions which favor their formation in East Africa
- Explain the formation of coral reefs with reference to Daly's theory

Theories put forward to explain the formation of coral reefs.

The formation of barrier reefs and atolls has created a lot of controversy as they have been found at far greater depth, in some areas exceeding 1000 meters, a level where polyps cannot survive. As a result, relevant theories have been put forward to explain this anomaly including Daly's theory of deglaciation

Deglaciation theory by Daly

Daly based his theory on the sea level changes during and after the ice age, not subsidence of the volcanic island.

According to Daly, before the ice age or glaciation, fringing corals colonized the edge of a Marine Island due to warm water and other conditions that favor coral growth and development.

During the ice age/glaciation, a lot of water was locked up in ice-sheets and caused a fall in the sea level. The cold conditions killed some coral polyps while maximum erosion removed the top of the island and the reef to form a wave cut platform.

After the ice age, the return of warm conditions resulted into deglaciation, a rise in the sea level and growth of corals.

As sea level increased, the polyps that survived on the flanks of the wave cut platform grew vigorously upwards and outwards to keep pace with the changes in the water depth and be maintained at the surface water.

Through this process, coral reefs that colonized the flanks gradually transformed into barrier reefs and finally into atolls when the island/ wave cut platform submerged completely.

Diagram

Relevance of the theory

▪Daly's theory explains why lagoons at the coast of East Africa have fairly flat floors.

▪The coast of East Africa has experienced sea level changes as evidenced by submergence landforms like rias, estuaries, creeks and emergent landforms like raised beaches, cliffs e.t.c

Examine the relevance of Murray's theory to the understanding of the formation of coral landforms in East Africa.

Approach

- Define clearly coral landforms
- Describe the process of formation
- Identify the types
- Explain conditions which favor their formation in East Africa
- Explain the formation of coral reefs with reference to Murray's theory.

Answer guide

Theories put forward to explain the formation of coral reefs.

The formation of barrier reefs and atolls has created a lot of controversy as they have been found at far greater depths, in some areas exceeding 1000 meters, a level

where polyps cannot survive. As a result, relevant theories have been put forward to explain this anomaly including Murray's theory

Antecedent theory by sir john Murray

According to Murray, there existed stable submarine plat forms on which pelagic deposits including corals accumulated at a depth below 60 meters. Barrier reefs and atolls began to form on these platforms as fringing reefs.

As reefs grew upwards and outwards, they were pounded by waves such that masses of coral fragments accumulated on the seaward side; cemented and consolidated into hard reefs .The polyps inside the reef however died due to lack of food and their skeletons dissolved in water to form a lagoon inside the reef.

This changed the barrier reef in to atoll.

Relevance of the theory

▪John Murray's theory is relevant because it helps to explain why barrier reefs and atolls are found in deep water over 60 meters deep.

Economic importance of coral reefs

Positive

▪Coral reefs are tourist attractions because of their beautiful shapes and color which make them unique hence a source of foreign exchange for Kenya and Tanzania. For example fringing reefs at Bamburi, Shungyu in Dar es Salaam.

▪Coral reefs contain limestone which is extracted for production of cement used in construction works for example Bamburi cement.

▪Coral reefs are source of education material and research. For example in the field of oceanography, geomorphology and search for oil prospects.

▪Coral reefs weather down into fertile soils which support crop cultivation for example coconuts, mangoes, citrus fruits and cashew nuts and cloves in Pemba, Mombasa and Zanzibar.

▪Coral reefs contain limestone used in manufacturing fertilizers rich in calcium carbonates hence boosts crop cultivation.

▪Fringing reefs have favored the development of ports by protecting the harbor from destructive waves which would otherwise have destroyed the coast through flooding. For example port Mombasa and Dar es Salaam.

▪Fringing reefs also protect beach swimmers from dangerous marine organisms such as crocodiles and hippos because they find it difficult to cross the reefs to the beach. This promotes tourism.

▪Coral reefs are potential areas for mining oil because they contain a lot of fats which sip down and accumulate into rock strata to form oil wells.

▪Fishing is carried out in the coral lagoons. For example fish, crabs and lobsters

▪Lagoons are also used for recreation purposes such as swimming and sun bathing especially tourists.

Negative effects

▪Coral reefs weather down into poor sandy soils which discourage growing of other crops apart from coconut and cloves.

▪Fringing and barrier reefs are obstacles to marine transport and fishing because they form hard projecting rocks which wreck ships, fishing boats and nets.

▪Coral lagoons are colonized by mangrove vegetation during the low tides leading to spread of disease vectors such as mosquitoes which cause malaria.

▪Fringing reefs limit the size of docking area at Mombasa and Dar es Salaam Ports which results into congestion of ships and limited space for ocean wagons.

SEA LEVEL CHANGES OR EUSTATISM

(a) Explain the causes of sea-level change in the coastal areas.

(b)Examine the landforms resulting from sea level changes.

Approach

- Define sea level change and state the types of sea level changes
- In part (b) Identify and describe the formation of both submerged and emerged coastal landforms in highland and low land areas

- ❖ Draw diagrams and give examples where applicable from East Africa and outside East Africa.

Answer guide

Sea level changes refer to the rise and fall of the sea level in relation to the land along the coastal areas. **Alternatively, sea level changes can be defined as** the vertical movement of land relative to the sea along the coastal regions.

When sea level changes occur worldwide is called **eustatic or major change** and when it occurs on minor or local scale is called **isostatic change**.

TYPES OF SEA LEVEL CHANGES

Sea level changes are either positive or negative. Positive eustatism/ change occurs when the sea level rises in relation to the land and produces submerged coasts and their related landforms.

Negative eustatism/ change occurs when the sea level falls in relation to the land and produces emerged coasts and their related landforms.

CAUSES OF SEA LEVEL CHANGES

Sea level changes are caused by climate, glaciation and deglaciation, Change in ocean temperatures, Occurrence of earth movements, deposition of sediments and global warming.

Climatic changes. Pluviation period characterized by heavy rain fall such as El-Nino and monsoon lead to the rise in sea level while desiccation/ prolonged drought period leads to a fall in sea level.

Glaciation and deglaciation. Glaciation during the last ice age caused a fall in sea level because huge quantities of water froze into ice on high mountains and ice-sheets in Polar Regions. Deglaciation during the inter-glacial period characterized by warmer conditions, melted thick ice sheets from continental landmasses, forming rivers; which drained huge volumes of water into the sea; leading to a rise in the sea level.

Change in ocean temperatures. When world temperatures increase for example due to volcanicity on the ocean floor, water in oceans expands and the volume of water increases causing a rise in sea level. On the other hand when temperature falls for

example during winter, water in oceans contracts and the volume falls; leading to a fall in sea level relative to the land.

Influence of global warming**.** The steady rise in the average temperature over the surface of the earth is affecting climate by melting ice on continental landmasses, bringing erratic rains and flooding hence the rise in sea level.

On the other hand, global warming is accelerating evaporation and aridity leading to the fall in sea level.

Occurrence of earth movements/ tectonic movements at the coast. Earth movements are forces that originate from the interior of the earth due to plate tectonism for example faulting, warping and volcanism.

Earth movements are responsible for sea level changes in the following ways;

▪Warping movements-up- warping / up lifting of coastal areas and down warping of ocean basins leads to a fall in sea-level while up-warping of ocean basins and down-warping of coastal areas leads to a rise in sea level.

▪Occurrence of Volcanicity on ocean floor. Volcanoes formed where tectonic plates meet at convergent boundary/ subduction zones, displace water in oceans up-wards causing a rise in sea level.

▪Plate tectonism. The divergence of oceanic plates at mid-ocean ridges leads to expansion/ widening of ocean floor and a fall in sea level.

Other hand, convergence of tectonic plates leads to contraction/ narrowing of ocean floor and a rise in sea level.

▪Faulting in coastal areas leads to down thrust of some parts causing a fall in the sea level.

Isostatic readjustments. When huge quantities of materials are added on to continental landmasses for example ice sheets during the quaternary era, increase the weight of continents forcing them to sink down slowly, displacing water upwards hence a rise in sea level.

▪Deglaciation of huge ice sheets and erosion on the continental landmasses reduces the weight of continents and cause isostatic uplift of landmass which ultimately leads to a fall in sea level.

▪Deposition of sediments on the ocean floor such as alluvium by rivers**,** construction works in water, cultivation along the coast e.t.c reduces the size of the ocean basin, displaces water upwards leading to the rise in sea level.

LAND FORMS PRODUCED BY SEA LEVEL CHANGES

(b)When the sea level rise in a highland coast, the coast is submerged and the following landforms are created;

Rias. A ria is a funnel shaped drowned river valley at the sea. Before submergence, the river flows into the ocean through a valley. When the sea level rise, the river valley is flooded or submerged at the sea to form a ria.

Rias are wider and deeper seawards and narrower and shallower landwards which gives them a funnel shape.

Rias are formed on coastlands where hills and river valleys meet the sea approximately at right angles for example Kilindini harbor on which Mombasa port is established, Mtwara, Tanga, Dar es Salaam, Lamu e.t.c along the East African coast. Rias also found on southern shores of Lake Victoria.

Dalmatian coast/ longitudinal coastline. This is a coast with a chain of off islands running parallel to it. A Dalmatian coast is Formed in areas where elongated hills / ridges and valleys lie parallel to the coast before submergence.

When the sea level rises, valleys are flooded or submerged to form sounds while the un submerged hilltops form a chain of islands running parallel to the coast line. The submerged valleys/ sounds separate islands from the main land to form a dalmatian coast. For example, Smith sound on the southern shores of Lake Victoria at Mwanza, Bamburi hills south of Bukoba on Lake Victoria, Dalmatian coast of Pemba and Zanzibar islands of Tanzania e.t.c.

Fiords are drowned u-shaped glacial troughs with steep walls seawards in highland coasts. Fiords are Formed when sea level rises and floods glacial troughs/ valleys formed initially by glaciers over deepening the valleys below sea level. Fiords have steep sides and deeper seawards. For example the coast of Norway, British Columbia, southern Chile e.t.c

Peninsulas. A peninsular is an elongated piece of land projecting seawards. They are formed in areas where highlands lie at right angles to the coast. When the sea

level rises, valleys are flooded / submerged leaving elongated pieces of land projecting seawards. For example Entebbe peninsular and Mweya peninsular.

Submerged lowland coasts. When a lowland coast is submerged the following landforms are produced:

Estuaries- are submerged river valleys in lowland coasts with a v-shaped cross profile pointing landwards. They are Formed when sea level rise along a lowland coast causing the sea to penetrate inland to a considerable distance along river valleys. They are wider and deeper landwards. For example river Rufiji in Tanzania, river kibanga at Mombasa, estuaries of Thames e.t.c

Creeks -are narrow inlets at the coast formed by submergence/ drowning of small streams in lowland coast due to rise in sea level. For example Chake- chake, Mtwapa, Makupa e.t.c along Mombasa on Kenyan coast.

Mud flats, **lagoons and marshes**. Mud flats are plat forms made of deposits of fine silt and alluvium deposited by rivers or waves. Continuous deposition of these sediments builds sand spits and bars. When the sea level rise, seawater is enclosed behind spits and bars to form a lagoon usually colonized by marshes and mangrove swamps. These features are Found at Mombasa, Dar es Salaam e.t.c.

Landforms created by the fall in the sea-level/ Emerged landforms

When the sea level falls the formally submerged landforms are exposed to form emerged landforms in **highland and lowland coasts:**

Emerged landforms in **highland coasts**

Raised cliffs. A raised cliff is a steep rock face along the sea coast that is no longer in contact with the sea. Before submergence, waves attacked coastal rock and through processes of abrasion, hydraulic action and solution, a notch formed, enlarged and deepened. With time, land above the notch lost support and collapsed to form a cliff.

When sea level falls, new cliffs are created and the old cliffs that are no longer in contact with the sea are left behind high above the present water level hence the name-raised. Raised cliffs are Found at Mombasa.

Raised terraces are former wave cut plat forms which are no longer in contact with the sea created by materials eroded from the cliff. When sea level falls, new wave

cut plat forms are created and the old terraces which are no longer in contact with the sea and left high above the current sea level hence the name raised terraces.

Raised beaches. These are beaches which are no longer in contact with the sea left high above the current sea level.

Before submergence, sand and shingle materials are deposited by constructive waves to form a gently sloping platform called beach at the coast.

When sea level falls, the beach loses contact with the sea and left behind high above the current sea level as a dry land hence the term-raised beach. For example Dar es salaam, Mombasa, Tanga e.t.c

Raised caves, geos and blowholes. Continuous wave erosion against jointed coastal rock through abrasion, hydraulic action and solution create large holes in the cliff face called caves. When the roof of the cave collapses, it forms a narrow inlet called a geo and a blowhole when waves erode the roof of a cave to the surface.

When sea level falls, all these features reappear behind high above the current water level.

The fall in the sea level in lowland coast creates coastal plains and Fiards.

coastal plains formed when the continental shelf is exposed after a fall in the sea level. The coast line of Coastal plains have no bays and head lands.

Fiards-are are drowned u-shaped glacial troughs/ valleys formed along lowland coasts. They have a broader u-shaped profile than the fiord. For example the coast of south East Sweden, coast of Nova Scotia and Maine