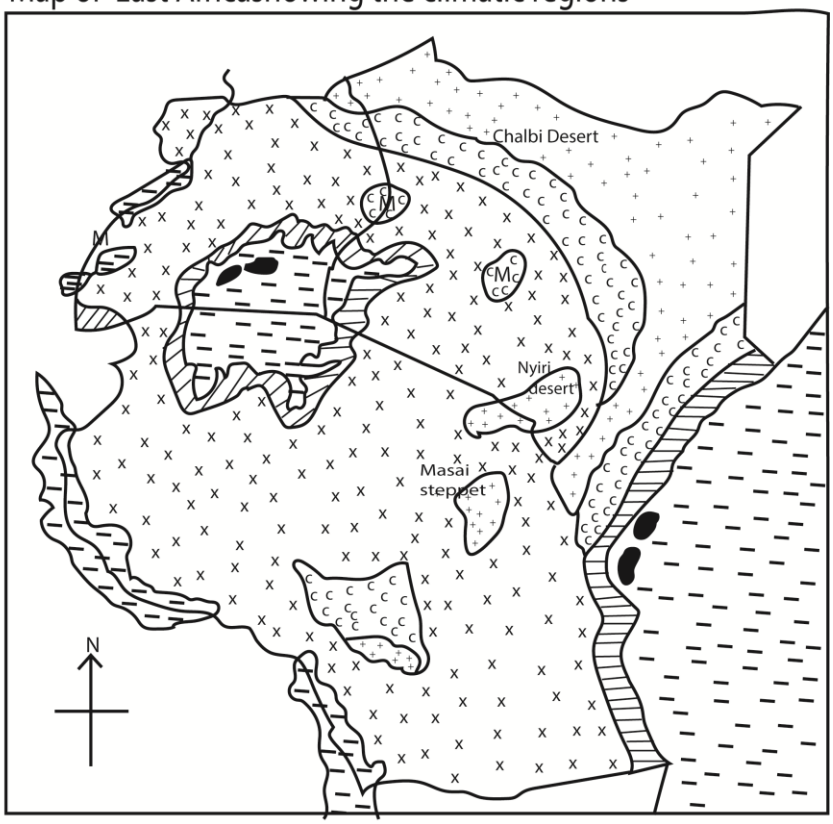
Physical geography Chapter 13: Climatology (Climate) in East Africa

Climate

Climate is the average weather conditions of the atmosphere of a given place studied and recorded over a long period of time over 40 years. It constitutes the study of weather elements such as temperature, wind speed and direction, rainfall, pressure, humidity, amount of sunshine and cloud cover over a long period. It covers a large area extending for hundreds of kilometers. Climatic conditions tend to remain stable over a long period of time though with minor variations.

In East Africa there are different types of climate ranging from equatorial around the Victoria basin, tropical, semi desert in the north-eastern region like Turkana and Kotido and montane climate around mountains like Rwenzori.

Map of East Africashowing the climatic regions



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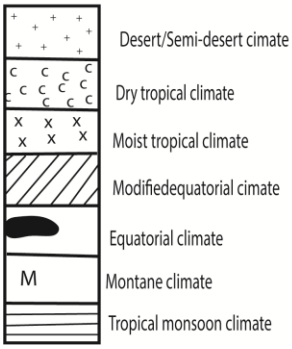

Equatorial climate

East Africa lies astride the Equator and thus experiences the following:

- Temperatures are **generally** hot and uniform **departing** little from 27^0C.
- There is great uniformity of temperature throughout the year ranging between 25^0C- 28°C.
- The diurnal range is much more marked than the seasonal one, it's small and sometimes attaining only 8^0C while the annual range barely exceeds 2°C.
- Convectional rainfall is usually received during the afternoon and evening and is often accompanied by thunderstorms and lightening for example around the L. Victoria basin at Jinja, Entebbe and Kampala in Uganda, Bukoba and Mwanza in Tanzania.
- Receives heavy and well distributed rainfall throughout the year of between 1000 - 2000mm per annum

- Characterized by two rainfall maxima with peaks in March and November (Bi-modal pattern) where the first is heavier than the other.
- There is no clear marked dry season since rainfall is received throughout the year.
- Constantly high humidity (80%) throughout the year due to high rate of evaporation.
- Characterized by a thick cloud cover throughout the year due to high rates of evaporation and condensation.
- Equatorial areas are affected by air masses that converge along the I.T.C.Z though there may be long periods of calms or light winds.
- Mainly experiences convectional type of rainfall

Factors that favor/ lead to occurrence of equatorial climate in East Africa

- **Latitude:** equatorial climate is experienced in area between 0^0 to 5^0N below 1000m above sea level due to sun's insolation that leads to high temperatures.
- **Altitude:** equatorial climate is experience in area below 1000m above sea level due to high temperatures
- **Water bodies:** equatorial climate is experience around water bodies because provide moisture leading regular rainfall
- **Cloud cover:** thick cloud cover promote equatorial climate because they prevent heat loss during night causing small diurnal temperature range.
- **Air masses or wind system:** like south east trade winds have promoted equatorial climate through heavy rainfall and high temperature.
- ITCZ and apparent movement of overhead sun has promoted equatorial climate because it contributes to the two rainfall maximas and high temperature in the region

Savanna climate

It's found between a transition zone between the equatorial belt and the hot desert.
It's experienced majorly in Central and Northern Uganda, South and Western Tanzania, coast.al areas of East Africa etc.

Characteristics of Savanna climate

- There is alternating dry and wet season as a result of the apparent movement of the sun.
- Maximum temperatures of up to 32°C are attained before the onset of the rains as a result of the dry air and cloudless skies.
- Receives moderate rainfall of over 750mm - 1000m. But the rains are unreliable from year to year.
- Temperatures range between 23°C and 27^0C.
- Because of limited cloud cover, there is a high marked diurnal temperature range (150C) The annual temperature range is relatively low at between 7°- 8°C.
- Receives convectional rainfall alternating with a dry winter which either the trades or stable air masses are dominant The rains are normally short-lived and torrential.
- Low humidity during the dry season and relatively high during the rainy season.

Factors that favor/ lead to occurrence of equatorial climate in East Africa

- **ITCZ and apparent movement of the sun:** Savanna climate has developed in area that receive one rainfall season a year due to apparent movement of the sun.
- **Influence of trade winds:** Savanna climate occurs in area that receive dry winds such as Turkana land due to the North-East trade winds from Arabian Desert.
- **Continentality:** savanna climate occurs in areas of East Africa that are far from big water bodies such as Gulu that experience low humidity.
- **Cloud cover:** savanna climate develops in areas of limited cloud cover that allow intense heat and large diurnal temperature range such as central Tanzania
- **Vegetation:** Savanna climate is promoted in area of limited vegetation and limited rainfall due to limited evaporation
- **Latitude:** savanna climate occurs in area relatively near the equator between 5^0-10^0 north or south of the equator due to high insolation and high temperature.
- **Attitude:** savanna climate occurs in areas 100m below sea level because of high temperatures.
- Biotic factor: savanna climate occurs in area where overgrazing, bush burning, charcoal burning has reduced the vegetation cover

Montane climate

This covers the Highland areas of East Africa: mountains - Kilimanjaro, Kenya, Mt. Abadares and Mau ranges, parts of Western Uganda (Rwenzori and Muhavura), Elgon in Eastern Uganda, Southern highlands of Tanzania, etc.

Characteristics montane climate

- High rain fall totals of over 1000mm- 1500mm per annum
- Receive orographic type of Rainfall
- Has cool temperatures of less than19°C

Semi- Arid and Arid climate

Majorly found in the North-East and Nothern Kenya., North East Uganda, Central and Western Tanzania etc.

Characteristicsofsemi-AridantiArid climate

- Low/ limited rainfall totals of less than 700mm
- Unreliable rainfall throughout the year
- High temperatures of about 30°C
- Large diurnal temperature range of above 50C
- High evaporation rates due to hot temperatures
- Low/limited cloud cover.
- Low humidity level of less than 30%

Factors that affect climate of East Africa

Relief

- For every 1000m ascend temperature drops by 6^0C
- Areas of high altitude e.g. the highland and mountains like Kenya. Kilimanjaro, southern highlands of Tanzania experience cool temperature because temperatures decrease with increasing altitude due to rarefied air; while low altitude areas like the coastal regions, Rift valley floor, mountain foothills experience hot temperatures due to a lot of dust particles, water molecules and carbon dioxide that absorb heat that's radiate in the lower altitude
- The highland areas e.g. mountain tops experience low pressure as pressure reduces with increasing altitude while in low altitude areas, pressure is high because of the big column of air pressing over the Earth s surface.
- The highland areas /mountainous areas like Rwenzori mountain, Kilimanjaro mountain receive heavy rainfall (1000mm -1500mm)
- Higher plateau areas (central plateau) receive moderate rainfall ranging between 700mm – 1000mm
- The lower plateau of East Africa e.g. Nyika plateau are dry i.e. receive rainfall totals of less than 700mm
- Low altitude areas experience high humidity due to high evaporation - transpiration levels and hot temperatures while high altitude areas experience low humidity levels due to cool temperatures.
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Prevailing winds

- North East trade winds from Arabia desert are dry and hot leading to arid conditions in Northern Kenya and North-Eastern Uganda.
- The south East trade winds that are warm and moist bring rainfall to the Northern shores of Lake Victoria and the coastal areas of East Africa.
- The warm moist Westerlies bring rainfall on the western slopes of mountain Rwenzori and aridity on the lee ward side of the mountain Rwenzori (Albert flats)

Latitude

East Africa lies a stride the Equator. Its location explains the generally hot temperatures experienced though out the year. It also explains the double rainfall pattern maxima in the low latitudinal zone while one single rainfall peak in the southern Tanzania is being experienced and one rainfall peak in areas of Northern Uganda because in they are relatively away from the Equator.

Presence of water bodies

Water bodies influence the climate of East Africa through rain formation. Water evaporates into the air; this ascends into the atmosphere; and condenses to form rainfall.

Presence of vegetation cover:

Forests maintain heavy rainfall, high humidity, and moderate temperatures throughout the year unlike areas with scanty vegetation.

Human activities

Human activities affects the climate of East Africa both positively and negatively

- Deforestation, over grazing, swamp reclamation reduce the rainfall amounts in affected area

- Afforestation, reforestations, forest conservation increases considerably on the amount of rainfall received in a place

Aridity in East Africa

Aridity is a climatic phenomenon characterised by high temperatures and insufficient rainfall or very low rainfall. In the USA areas of less than 250mm of rainfall are regarded as arid areas. However in some parts of the world, the aridity may be measured differently e.g. in East Africa areas of less than 500mm may be regarded as arid. Areas of aridity are generally referred to as deserts or semi deserts and are characterized by dryness.

In East Africa areas that experience aridity include Northern Kenya, parts of Eastern Kenya, North Eastern Uganda, the Ankole - Masaka corridor parts of North Eastern Tanzania, Central Tanzania, parts of southern Kenya and parts of the western and the Eastern rift valley e.g. along Lake Albert, Lake Edward and Lake George. Desert areas are those that may receive less than 250mm of rainfall and these may include areas in Northern Kenya e.g. around Ladwor in North Eastern Kenya and the Chalbi desert. In addition to this there is also the Nyiri desert in Southern Kenya and the Masai steppe in North Eastern Tanzania. On the other hand semi desert areas experience relatively higher rainfall though less than 500mm.

Characteristics of arid areas

- Low and seasonal rainfall is experienced. Drought is a common phenomenon in such areas.
- High temperatures are experienced i.e. temperatures of 30°C and above.
- High diurnal range of temperature normally more than 15°C i.e. during the day it is very hot and during the night is cold.
- There is generally low humidity. Relative humidity tends to be less than 20%.
- There is a limited cloud cover. Much of the year is characterised by clear skies. 6. There are high transpiration rates and evaporation rates.
- There is unreliable or unpredictable rainfall.
- There is occurrence of strong winds and occasionally dust storms are experienced.
- There is limited plant cover, this is because of the low rainfall such that the vegetation tends to be adapted to low rainfall conditions e.g. there are generally drought resistant species such as steppe savannah grasslands, thicket, thorn bush, cactus, scrub, as well as patches of bare land

Causes of aridity

Physical causes of aridity

1. Prevalence of dry/desiccated winds such north-east from Arabian Desert cause low rainfall in Turkana region.

2. Limited water masses: Several areas in East Africa that experience aridity such as Northern Kenya and Central Tanzania lack large water bodies that could otherwise contribute to atmospheric moisture and rain through evaporation.
3. Highland relief form rain shadow on their leeward side causing aridity. For example are the Masai steppet is on the leeward side of the Pare and Usambara mountains ranges in N. East Tanzania and the western rift valley zone area on the leeward side of the Rwenzori mountains.
4. Continentality: arid areas such as central Tanzania are located a big distance from big water bodies leading to low humidity. in these area that have contributed to the moisture of the place. This
5. Coastal configuration: this refers to the shape or alignment of the E. African coast. The coast is aligned in a N.E or S.W direction. Due to this alignment winds from the N.E such as the N.E trades tend to blow parallel to the coast especially along the Kenyan coast in a south westerly direction and hardly blow inland. Therefore these moisture-laden winds which may not blow inland deprive much of northern, central and southern parts of Kenya of rainfall
6. Corriolis force effect: this is a drag force as a result of the earth's rotation and has effect in that any object moving in the northern hemisphere from the southern hemisphere is deflected to the right. This force accounts for the prevalence of arid conditions in the Ankole - Masaka corridor and other parts to the N. West of Lake Victoria. This is because when the S.E trade winds blowing through Tanzania cross the Equator, they are deflected eastwards i.e. to the right leaving the North Western parts of Lake Victoria without moist winds.
7. Perturbation: This is a situation where low pressure conditions due to high temperatures are created on the Indian Ocean and as a result air from the land or air that would have blown on shore is instead redirected into this low pressure belt. Air will therefore blow from the land to the Indian Ocean thereby becoming offshore winds and as a result rain is formed in the Indian ocean while parts of the East African mainland and including Northern Kenya are left dry.

Human causes of aridity

1. Human such deforestation, overgrazing, bush burning, settlement, mining, road construction, war, poor farming methods and industrialization deprive and of vegetation cover leading low moisture in atmosphere and low rainfall
2. Reclamation of wetlands and borehole drilling low the water table such that plant roots are unable to access water

Effects/problems of desertification/aridity

1. Low crop yield leading to human and animal starvation
2. High temperatures that are not conducive for settlement
3. Lack of water for animal and human use
4. Irrigation cause salinity and soil degradation
5. Lack of vegetation lead to soil erosion
6. Desertification destroys natural habitats for wildlife

Steps to combat desertification

1. **Legislation against environmental degradation.** Laws have been passed against the destruction of the environment such as wetland reclamation. Most of such vulnerable areas have been gazetted as nature reserves or conservation sites.
2. **Afforestation:** this has involved the campaign to plant trees in order to arrest the effects of desertification. Tree planting campaigns have been conducted by the government, NGO's, environmental/wildlife clubs as well as individuals.
3. **Re-afforestation:** i.e. re-planting of trees where trees have been cut or where deforestation has taken place e.g. Mabira forest, Kibaale forest etc.
4. **Introduction and practice of improved methods of cultivation i.e. methods that do not harm the environment.** This has been mainly through protecting agricultural land by adopting practices that conserve soils e.g. mulching, crop rotation, gully prevention measures, application of manure and fertilizers etc.
5. **Rotational grazing:** This has been facilitated by paddocking. Efforts have also been made to ensure that the carrying capacity of land is maintained in order to avoid overstocking. Rotational grazing also helps to check overgrazing.
6. **Re-settlement of people adjacent to forest reserves as well as eviction of forests encroachers.** Re-settlement of the people is to prevent encroachment upon the forests especially when population is increasing and when land shortage problems are cropping up e.g. encroachers in Kibaale forest reserve were evicted and resettled.
7. **Sensitization of the public about the role of forests or natural vegetation.** This has been through the education of the masses on the dangers of deforestation and also how to utilize the environment sustainably. This has created awareness about environmental issues such as desertification-associated problems. This sensitization has been through a variety of mass media e.g. the press, electronic media, seminars/workshops, schools, Local council meetings, public rallies etc.
8. **Introduction and encouragement of the use of fuel saving stoves** or those that use saw dust such that less biomass is used as fuel. This reduces on the tendency of the destruction of forests for fuel.
9. **Rural electrification** and provision of other sources of energy such as solar energy, biogas etc as an alternative to wood fuel.
10. **Creation or establishment of environmental organizations** to champion or spearhead the fight against desertification through environmental protection and restoration of degraded lands. Some of these organizations are governmental or non-governmental. They may also be international, inter-state, national or local. Some are also voluntary organizations. Examples of these bodies include; NEMA in Uganda (a parastatal body charged with protecting the environment.) Uganda Wildlife Authority (UWA). In addition, there are wildlife clubs, tree planting clubs and anti-pollution clubs. International organizations include; the Kagera Basin Organization, Inter Governmental Authority on Drought and Development (IGADD), interstate ones like the East African Wildlife Society and others like Karamoja Development Agency (KDA) to combat desertification and aridity and ensure development of the area.

11. Encouragement and use of indigenous methods of protecting the environment and more so natural vegetation and drainage features i.e. through traditional customs and taboos.
12. Population control measures through population re-distribution and family planning as well as encouraging late marriages, discouraging polygamy etc. to avoid over population, which would lead to land shortage and deforestation.

Thank you
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