PARTLY CONTAINS GRADE 8 GEOGRAPHY NOTES - SUPPLIMENTARY

-ADVANCED GEOGRAPHY-

ADVANCED SOCIAL STUDIES NOTES

COMPILED BY TONNY MULATI- tonnymulati79@gmail.com

Mungakha ACK

1
MAP WORK

Map - representation of the whole or part of the earth's surface drawn to scale.

- Shows outline of objects on the ground
- Drawn as if the drawer was above the ground
- It shows details
- Most of the features are indicated by symbols.

Picture: image of a real object.

- Gives details in their visible shapes and sizes
- Can be inform of free hand, drawing, painting or a photograph
- Not drawn to scale

Plan: outline of something drawn to scale.

- Also drawn as if a person was directly above the ground
- It represents a very small place
- The scale is large to show details e.g. house plan
- Gives specific information

Types of Maps

Classified according to the purpose for which each map is drawn.
Topographical Maps: This shows selected natural physical features on a small portion of a country.
Atlas maps: this is a collection of maps in one volume.
Sketch maps: maps which are roughly drawn. A good sketch map should have the following characteristics:

1. neat and clear
2. title
3. frame
4. key
5. compass direction

Uses of Maps

1. Sketch maps are used to summarise information for easy reference.
2. Used for locating other countries.
3. Used for comparing sizes of countries.
4. For locating climatic regions of different parts of the world.
5. Give information on distribution of geographical phenomena e.g. vegetation on the earth's surface.
6. Help travellers to find their way.
7. Used to calculate distance of a certain place.
8. Used to locate physical features like landforms.

Marginal Information

Information contained in the area surrounding the map.

1. Map name e.g. Yimbo.
2. Sheet title e.g. East Africa 1:50000 (Kenya).
3. grid system numbers
4. latitudes and longitudes
5. Compass direction with grid, true and magnetic north.
6. scales
7. key
8. publisher and copyright
9. Map identification
    - Map series
    - Sheet number or sheet index

Map Scales

A scale is a ratio of a distance on a map to a corresponding distance on the ground.

Types of Scales

Statement scale –expressed in words e.g. 1cm represents 1km, 1cm to 1km.

Representative Fraction (RF)-expressed as a fraction or ratio e.g. 1/200,000 or 1:200,000.

Linear scale-shown by a line which is subdivided into smaller units.

Conversion of Scales

Statement scale into RF

1cm rep 1km to RF

Multiply the number of kilometres by 100,000 (1km=100,000cm) i.e.

1×100000=100,000.

Statement scale is 1/100,000 or 1:100,000.

2cm rep 1km

Divide both sides by two to get 1cm rep ½ kilometres.

Multiply ½ by 100,000 to get 50,000.

RF is 1/50,000 or 1:50,000.

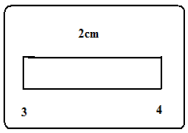
RF to Statement Scale

Divide the denominator by 100,000.

Write the scale in statement form.

Linear Scale to Statement Scale

- Measure a unit distance off a linear scale e.g.



- The distance is 4-3=1km which is represented by 2cm.
- Use the methods in (1) and (2) above.

Q. Given that the ground distance is 200km while the distance on map is 20cm calculate the scale.

Sizes of Scales

1. Small scales- show a large area of land on a small size of paper. They show limited details e.g. 1:250,000, 1:500,000, 1:1,000,000.
2. Medium scales- used to represent a relatively smaller area on a given size of paper e.g. 1:50,000, 1:100,000, 1:125,000.
3. Large scales-used to represent a small area of land on a given piece of paper. They show a lot of details e.g. 1:2,500, 1:10,000, 1:25000

Arranging Scales in Order

Ascending Order-smallest to largest

Descending Order-largest to smallest

(1)1/500,000

(3)1:25,000

(4)1/10,000

(2)1cm rep 500m

Uses of Scales

1. Estimating distances on maps
2. Measuring distances accurately-use dividers and ruler, piece of string or thread for curved distances or straight edge of paper.

E.g. calculate actual distance of a line 8.5cm long on a map using the following scales.

(i) 2cm rep 1km

(ii) 1:100,000

3. Calculation of areas-no. of full grid squares+ number of ½grid squares/2 or use of rectangles (l×b) or triangles (½ b×h).

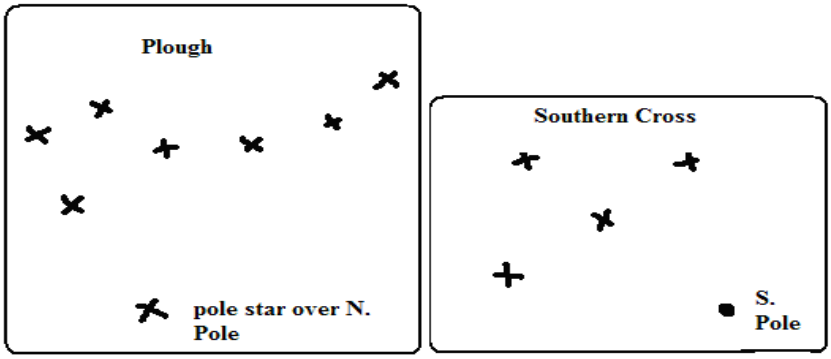
Direction

-Course upon which something is pointing to.

Methods of Showing Direction

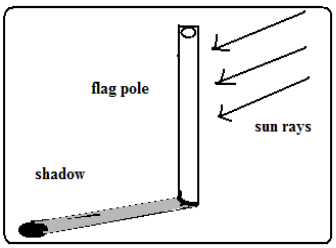
Traditional Methods

1. Use of Stars



-E.g. use of groups of stars called plough to find northern direction by locating the pole star and use of Southern Cross by using the brightest star which is over South Pole to find northern direction.

2. Use of Shadows



-E.g. morning, shadow of flag pole cast to your left you are facing north, etc.

3. Land Marks

-Using conspicuous features such as hills, buildings even roads to get direction.

Modern Methods

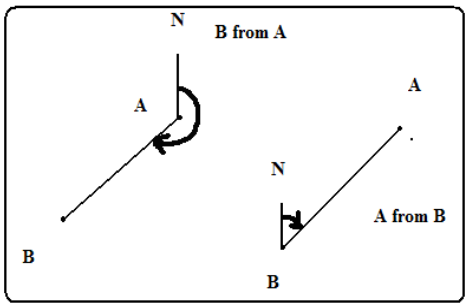
1. **Land Marks**
2. **Compass Direction.**

-Use of magnetic compass which has a needle which always points north.
It has 16 cardinal points and 4 are basic.

Bearing

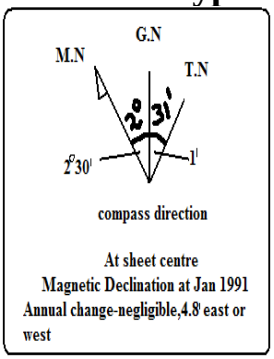
-Expression of direction in degrees of an angle.
It's measured from north in a clockwise direction.

Calculation of Bearing



Draw N-S line through observation point.
Join the two points. If it's a feature the line should end at the centre of that feature.
Using a protractor measure the angle between the N-S line and the line joining the 2 points in a clockwise direction.
Bearing is expressed in degrees, minutes and seconds. 1◦=60'(min), 1 min=60" (sec)
The degrees are always expressed in 3 figures e.g. 030◦

Types of Norths



1. True North

-Position on the globe where all longitudes meet or the direction of N. Pole.

2. Grid North

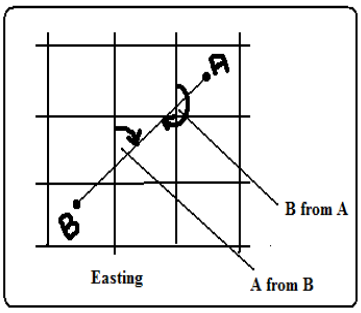
-Point where Eastings meet at the N. Pole.

3. Magnetic North

-Point which the magnetic needle rests when left to swing freely.

Types of Bearing

1. Grid Bearing



-Bearing calculated from Grid North.

- Join the two points on the topographical map using a line.
- Measure the angle where the Eastings intersect the line joining the two points e.g. **030◦.**

2. True Bearing

-Bearing calculated from True North. Its calculated when the type of bearing isn't specified.

-E.g. from our compass diagram true bearing will be 30◦-1'=**29◦59'**

3. Magnetic Bearing

-Bearing calculated from Magnetic North.

Position of Magnetic North changes slightly every year.

Steps

- Years which have elapsed ×Annual change. (No need if annual change is negligible). E.g. from our compass diagram annual change =(2009-1991)×4.8'=18×4.8''=86.4''=1◦26.4'
- Add to the angle between the grid and magnetic bearing 1.e. 1◦26.4'+2◦30'=3◦56.4'
-
- Add to the Grid bearing (if change is towards E) or Subtract (if change is towards W). 30◦ +3◦ 56.4'=**33◦56.4'**

Location of Places

-Showing of position of a place or feature on a topographical map.

Methods

Use of Place Names

-Locating a feature by using the name of the place it's at e.g. a river in Kisumu, Nakuru, etc or if it isn't at a named place locate by the nearest name place e.g. a meander near Garissa town.

Use of Direction, Bearing and Distance

This is from a stated position e.g. Locate Nakuru from Nairobi.

Nakuru is 157km N.W of Nairobi.

Latitudes and Longitudes

The main longitudes are I.D.L and Greenwich /Prime Meridian.
The main lines of latitudes:

- The equator/Great Circle (0◦) which is the longest.
- Tropic of Cancer (23½◦N) of equator.
- Tropic of Capricorn (23½◦) south of equator.
- The Arctic Circle (66½◦N).
- Antarctic Circle (66 ½ ◦ S).

They are marked at the margins. Latitude is stated first (N or S) and longitude later (E or W) e.g. **X◦N Y◦E**

- Identify a place.
- Identify the nearest numbered latitude and longitude.
- Estimate to the nearest 1◦.

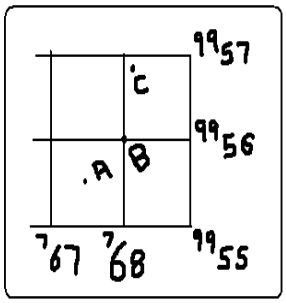
Grid Reference

Grid lines: network of lines on topographical maps.
-Numbered in small and large numbers and the large ones are used.
Eastings: N-S grid lines called so because they are numbered eastwards.
Northings: W-E grid lines called so because they are numbered northwards.
Grid reference is given in 4 figures or six figures. In 4 figure the nearest grid line is stated while the 6 figure is estimated in fractions by dividing the space between grid line into 10 equal parts.
Easting is stated first followed by northing.
In the example below the 4 figure grid references are:

- A-6856
- B-6856
- C-6857

6 figure grid references are:

- A-675555
- B-680560
- C-682568



Methods of Representing Relief on Topographical maps

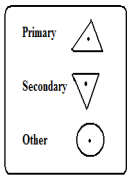
Relief is the nature of landscape e.g. plain, plateau, valleys, hills, etc.

Spot Heights

-Points on map whose positions and heights have been determined by surveyors. They are shown by a dot and a figure e.g. (.1827).

- Advantage-show actual heights
- Disadvantage-can't be used to identify landforms.

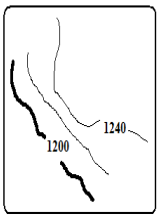
Trigonometrical Stations/Points



-Carefully chosen points carefully chosen and their altitude determined which ---Are used as a basis for surveying an area.
They are marked on the ground by concrete pillar or slab.
They are indicated on topographical maps by:

Isohypes/Contours and Form Lines

A contour is a line on a map joining all points of the same height above sea level. They are browner in colour and have heights written on them.
Form lines are lines drawn on a map joining places of approximately the same height above sea level. They are less brown than contours and not all have values written on them.
Both contours and form lines are referred to as contours.



Contour/Vertical interval is the difference in height between any two successive contours.
Advantages of contours:

- They show actual heights.
- Can be used to identify land forms.

Pictorials

-Showing relief by drawing landforms at approximate positions where they are found e.g. mountains, hills, valleys, etc.
Disadvantages:

- They obscure details behind them.
- Don't give height above sea level.
- Limited variety of landforms can be accommodated.

Hachures

-Short lines drawn to represent direction of slope.

- On steep land they are thick and close together.
- On gentle slopes they are thin and wide apart.

Their disadvantage is that they can't be drawn on flat land.

Hill Shading

-Showing relief by shading to show shadows where by steepest slopes which are list lit have darker shade while hill tops, surfaces of plateaus and plains and valley bottoms are well lit have lighter shade.

Layer Tinting

-Colouring or shading land within a certain range of altitude or using a single colour with varying tones where the colour gets darker with increasing altitude.

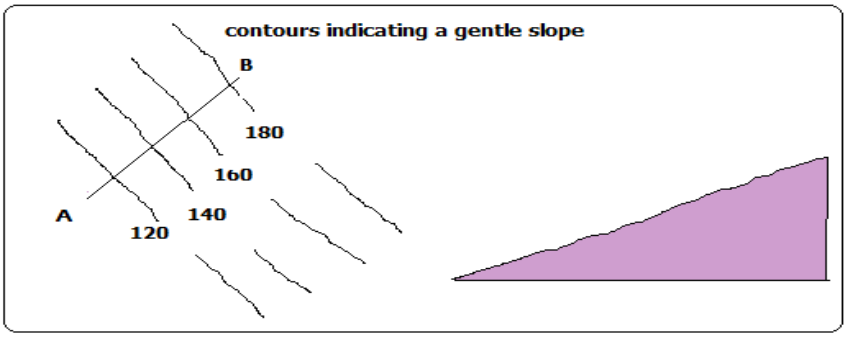
2. MAP WORK

Description of Relief

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

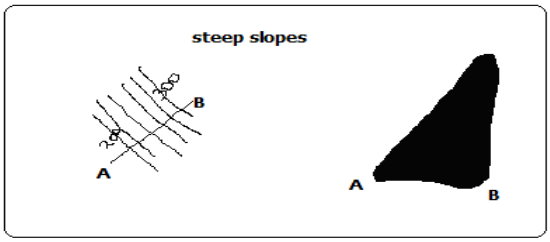
Gentle Slope

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



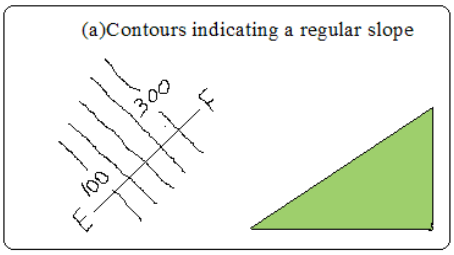
Steep Slopes

- Where land rises or falls sharply
- Contours are close to each other



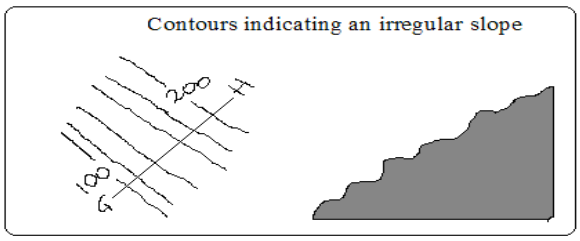
Even Slopes

- Shown by contours which are evenly spaced.



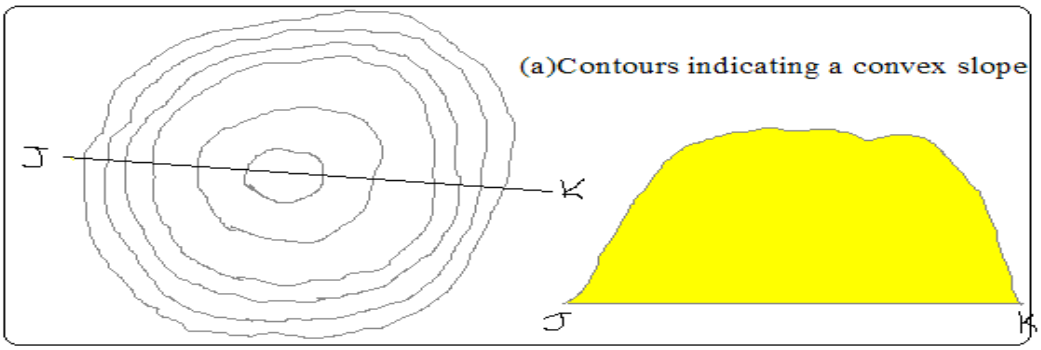
Uneven Slopes

- Indicated by unevenly spaced contours.



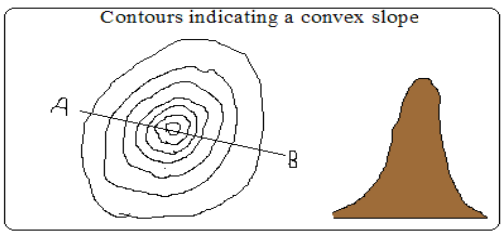
Convex Slopes

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



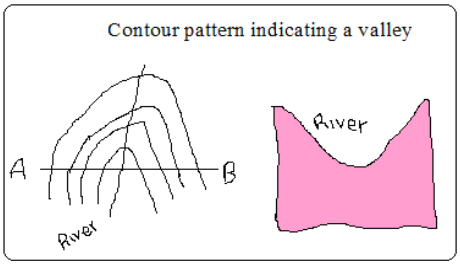
Concave Slopes

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



A Valley

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

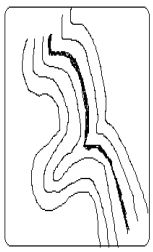


A Spur

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

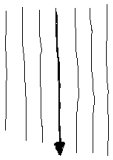
Interlocking Spurs

- Spurs which appear as if to fit together.



Truncated Spurs

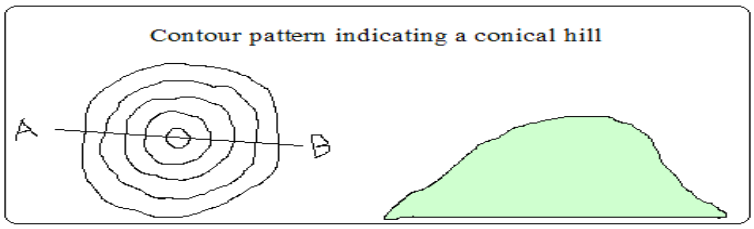
- Spurs in glaciated highlands whose tips have been eroded and straightened.



Contours forming truncated spurs

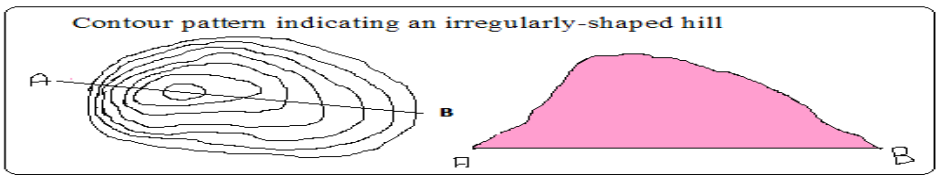
Conical Hills

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



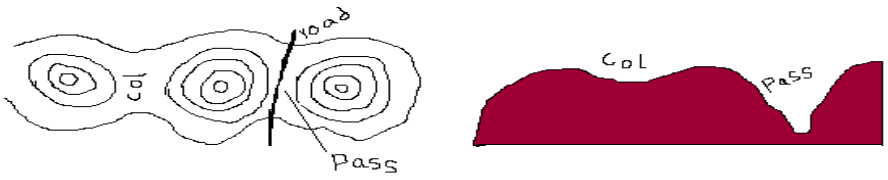
Irregular Shaped Hills

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



Ridges

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



Hills, saddle and a pass on a ridge

A Col

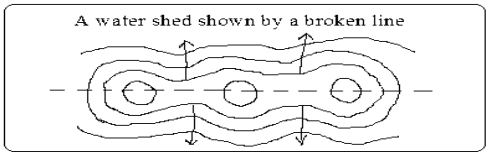
- A low area which occurs between two hills.

A Pass

- A narrow steep sided gap in a highland.

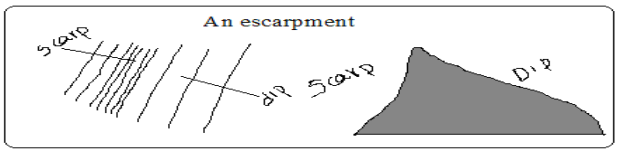
A Water Shed

- The boundary separating drainage systems which drains into different directions
- Escarpment and ridges often form water sheds.



Escarpment

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



A Plateau

- A high flat land bound by steep slopes.

Description of Vegetation

Natural vegetation is classified as woodlands, thickets, scrubs or grasslands.
Symbols are given as pictures of vegetation.

- Types present
- Distribution
- Reasons for distribution e.g. seasonal streams, scrub or grassland due to low rainfall.

a) Forests

Likely indications of the following in the area:

- Heavy rainfall
- Fertile rainfall
- Cool temperature depending on altitude

b) Thickets and shrubs

- Seasonal rainfall
- Poor soil
- High temperature

c) Riverine trees

- High moisture content in the river valley

Describing Drainage

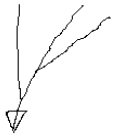
- Identify drainage features present

Natural drainage features include lakes, rivers, swamps, sea, rapids, water falls, cataracts, springs, deltas, fjords, sand or mud, and bays
Artificial features include ponds, wells, boreholes, water holes, cattle dips, cattle troughs, canals, reservoirs, irrigation channels, aqueducts, water treatment plants and man made lakes.

- Identify main rivers by name
- Size of rivers-big or small-shown by thickness of blue lines.
- Give the general direction of flow.
- Location of water shed if any
- Characteristic of each feature

a) Permanent Rivers

- Which flow throughout the year
- Shown by continuous blue lines



Likely indication of:

- Heavy rainfall
- Impermeable rocks

b) Seasonal Rivers

- Which flow seasonally or during the rain season
- Shown by broken blue lines

Likely indication of:

- Low rainfall
- River doesn't have a rich catchment area

c) Disappearing Rivers

Blue lines ending abruptly

Likely indication of:

- Permeable rocks

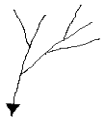
- Very low rainfall
- Underground drainage

- Identify drainage patterns and description

-Drainage pattern is the layout of a river and its tributaries on the landscape.

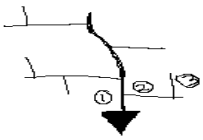
a) Dendritic

-Resembles a tree trunk and branches or veins of a leaf.
-Tributaries join the main river at acute angles.



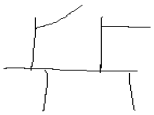
a) Trellis

Tributaries join the main river and other tributaries at right angles
of hard and soft rocks)
Common in folded areas where rivers flow downwards separated by vertical uplands.



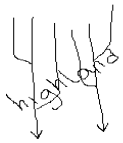
b) Rectangular Pattern

-Looks like a large block of rectangles.
-Tributaries tend to take sharp angular bends along their course.



c) Parallel Pattern

-Rivers and tributaries flow virtually parallel to each other
Influenced by slope
-Common on slopes of high mountain ranges



d) Centripetal Pattern

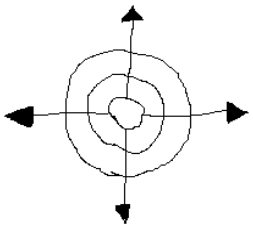
-Rivers flow from many directions into a central depression such as a lake, sea or swamp.
-Examples are rivers flowing into some of the Rift Valley lakes such as Nakuru and Bogoria.

e) Annular Pattern

Streams (rivers which are small in size) are arranged in series of curves about a basin or crater
It's controlled by the slope.

f) Radial

-Resembles the spikes of a bicycle
-Formed by rivers which flow downwards from a central point in all directions such as on a volcanic cone e.g. on Mt. Kenya, Elgon and Kilimanjaro.



g) Fault –Guided Pattern

- Flow of river is guided by direction of fault lines

Human/Economic Activities

Description of Human Activities

- Identify types
- Evidence –man made features
- Reasons e.g. tea-cool temps and heavy rainfall

Agriculture

a) Plantation farming

Evidenced by presence of:

-"C"-coffee
-Named estates e.g. Kaimosi tea estate

b) Small scale crop farming

(a) Cotton ginnery or sheds
(b) Coffee hullerlies
(c) Posho mills for maize, millet, sorghum
(d) Tea factory/store

Livestock Farming

(a) Dairy farms
(b) Veterinary stations
(c) Cattle dips
(d) Creameries
(e) Water holes
(f) Dams
(g) Butcheries
(h) Slaughter houses

Mining

(a) Symbol for a mine/mineral works
(b) Name of the mine
(c) Particular mineral e.g. soda ash
(d) Quarry symbol
(e) Processing plant of a mineral e.g. cement indicates cement is mined in that area

Forestry/Lumbering

- Saw mills
- Forest reserves
- Forest station

- Forest guard post
- Roads ending abruptly into a forest estate used to transport logs to saw mills

Fishing

- Fish traps
- Fishing co-operative society
- Fish ponds
- Fish hatcheries
- Fisheries department
- Fish landing grounds(*banda)*

Manufacturing/Processing Industry

- Saw mills for lumber products
- Ginnery for cotton processing
- Mill for maize, millet, wheat processing
- Creameries for milk processing
- Factory for manufacturing or processing a known commodity.

Services

a) Trade

- Shops
- Markets
- Stores
- Trading centres

b) Transport

i) Land

- Roads
  - All weather roads- which are used all year round i.e. tarmac and murrum roads.
  - Dry weather roads- which are used reliably during dry seasons.
  - Motorable trucks- rough roads which are used by people on foot and by vehicles on dry season.
- Other trucks and foot paths
- Railways, station, sliding, level crossing lines and railways light

ii) Air

- Air fields
- Airports
- Air strips

iii) Water

- Ferries
- Bridges

c) Communication

- Post offices(P.O.)
- Telegraph(T.G.)

- Telephone lines(T)

d) Tourism

- Camping sites
- Tourist class hotels and restaurants
- National parks
- Game reserves
- Curio shops
- Museums
- Historical monuments

e) Administration

- DO, DC, PC, police post, chiefs camp.

Social Services

a) Religious Services

- Church
- Mosque
- Temples

b) Education

- Schools
- Colleges
- Universities

c) Health Services

- Hospitals
- Dispensaries

d) Recreational Services

- Golf clubs/courses
- Stadiums

Description of Settlement

A settlement is a place with housing units where people live together

- Densely distributed settlements- high concentration of settlements(black dots)
- Moderately distributed settlements- settlements moderate in quantity
- Sparsely distributed settlements-few settlements spread over a large area.
- Very sparse if very few
- Identify type of settlement patterns present
- Type of Settlements

a) Rural settlements

Consist of villages and homesteads and homesteads in which people are involved in subsistence agriculture and traditional activities such as pottery weaving, curving, etc.

b) Urban settlement

Consist of dense permanent and sometimes high buildings and population engaged in non agricultural activities such as industrial activities.

Factors Influencing Settlement

1. Physical Factors

a) Climate

Areas with moderate temps and adequate rainfall are densely settled while those with extremely low or high temps have fewer settlements.

b) Relief

Terrain: Steep slopes are less settled due to thin soils and difficulty to erect buildings.

Aspect: Slopes facing away from the sun in high latitudes are less settled than those facing the sun.

Wind ward slopes of mountains on the path of rain bearing winds are more settled due to heavy rainfall making them ideal for agriculture.

c) Drainage

Rivers and springs attract settlements because they provide clean water.

Areas with drainage swamps are less settled because it's difficult to erect buildings and they also harbour mosquitoes and snails which cause diseases.

d) Vegetation

Dense forests discourage settlements because of wild animals and also harbour disease vectors such as tsetse flies e.g. Miombo woodland of Tanzania and Lambwe valley in Kenya.

e) Pests and diseases

Areas prone to pests and diseases are less settled because people like to live in healthy environment.

f) Natural resources

Settlements start where there is mineral extraction. e.g. Magadi

Lakes with abundant fish may also attract settlement.

g) Human Factors

i) Political factors

- 1967 TZ settled peoples in villages and the rest of land was left for farming (Ujamaa villages)
- After independence Kenya settled its landless in settlement schemes e.g. Mwea, Laikipia, Nyandarua.
- Settlement of refugees in refugee camps due to political upheavals

ii) Historical factors

- Weaker communities were forced to move elsewhere by wars.
- Settlement of communities in strategic sites such as hilltops or plateaus to see approaching enemies e.g. Fulani of Nigeria in Jos plateau.

iii) Cultural factors

- Farming communities settled in agriculturally productive areas.
- Pastoralists settle in areas with enough land to provide pasture for their animals at ease.

iii) Economic factors

- Rural to urban migration for employment and trading.
- Mining activities may lead to development of settlements e.g. Magadi due to trona mining.

Types of Settlements Patterns

a) **Nucleated/Clustered Settlement Pattern**

- Buildings are close to each other

Factors

- Availability of social amenities such as schools and health care
- Shortage of building land
- Favourable climate leading to high agricultural potential e.g. Kenya highlands.
- Fertile soils.
- Presence of natural resources e.g. minerals in Magadi, Mwadui, Kimberly.
- Security concern especially in banditry prone areas

b) Linear Settlement

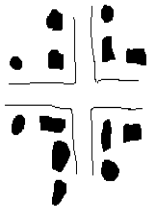
- Buildings are arranged in a line
  - Presence of a transport line e.g. road or railway.
  - Presence of a river or a spring to provide water for domestic or commercial use
  - Presence of a coast line which has a favourable fishing ground e.g. shore of E. African coast.
  - Suitable terrain for cultivation of crops such as at the foot of a scarp

c) Dispersed/Scattered Settlement

- Buildings are scattered

- Plenty of land to build whenever they want
- Avoidance of harsh climate e.g. arid and semi-arid areas.
- Poor infertile soils.
- Pests and diseases.
- Physical features such as ridges, valleys which separate houses.

d) Radial Pattern



Buildings are arranged like a star

-Common at cross roads where housing units point in all directions.

Enlargement and Reduction of Maps

Steps

1. Identify the area requiring to be enlarged
2. Measure its length and width
3. Multiply (E) or divide (R) the by the number of times given. The scale also changes e.g.1:50000/2(enlarged)×2(reduced)
4. Draw the new frame with new dimensions
5. Insert the grid squares e.g. 2×2cm, 2/2, etc.
6. Draw diagonals on the frame
7. Transfer features exactly where they were

Drawing a Cross Section/Profile

-Line drawn on a piece of paper showing the nature of relief of a particular area.

Steps

1. Identify the given points and name them A and B
2. Joint point A and B using a pencil
3. Take a piece of paper and fold it into two parts
4. Place the papers edge along the line joining A and B
5. Mark all contours and their heights
6. Mark features along A-B e.g. R- river, H- hill, M- mountain
7. Determine the highest and lowest contour height to determine the appropriate vertical scale
8. Draw horizontal axis and mark it A-B
9. Draw vertical axis from A to B
10. Place the edge of folded paper along horizontal axis
11. Use values along vertical axis to plot contour heights. Remember to show features marked along A-B

12. Join plotted points using smooth curve (cross Section)
13. Include title on top vertical and horizontal map scale.

Calculation and Interpretation of Vertical Exaggeration and Gradient

Vertical Exaggeration

Number of times that the vertical scale is larger than horizontal scale
V.E. =Denominator of H.S. /D. of V.S. (cross section scale.
e.g. V.S. =1:20M
H.S=1:50000

V.E.=50000/20×100 (To convert into cm) =25

Interpretation

The vertical height has been exaggerated 25 times compared to the horizontal distance

Intervisibility

Ability of one place to be seen from another

Steps

- Draw cross section
- Join points A-B using visibility line
- If the visibility line is above the cross section, the two points are ***intervisible***. If below they are ***not intervisible***.

Gradient

Degree of steepness of a slope between two given points
STEPS

1. Identify the two points
2. Calculate difference in height between the two points(**V**ertical **I**nterval) e.g. 500m
3. Joint them with a light line

4. Measure ground distance between the two points(**H**orizontal **E**quivalent)e.g.12 cm

G=V.I./H.E.

=500×100/12×50000=50000/600000=1/12=1:12

Interpretation

For every 12 m travelled on the Ground, there is a vertical rise of 1m

3. WEATHER

-Daily atmospheric conditions of a place at a particular time.

Elements of Weather

1. Temperature
2. Humidity precipitation
3. Precipitation
4. Atmospheric pressure
5. Wind
6. Sunshine
7. Cloud cover

A Weather Station

-A place where observation, measuring and recording of weather elements is done

Factors to Be Taken Into Account When Sitting a Weather Station

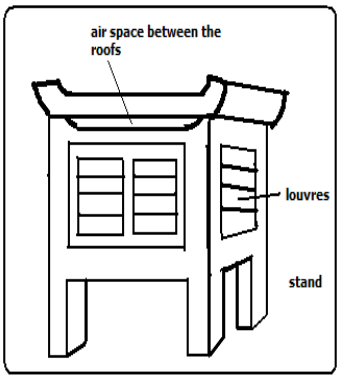
1. An open place where there is little obstruction of weather elements.
2. Accessible place so that recording can be done easily.
3. A fairly level or gently sloping ground (5◦) so that it's easy to position weather instruments.
4. The place should provide a wide view of the surrounding landscape and the sky.
5. The site should be free from flooding.
6. The place should have security.

Instruments for Measuring Elements of Weather

1. Thermometer-temperature
2. Hygrometer-humidity
3. Rain gauge-rainfall
4. Barometer-air pressure
5. Sunshine recorder-sunshine duration and intensity
6. Wind vane –wind direction
7. Anemometer-wind speed

8. Evaporimeter-rate and amount of evaporation.

The Stevenson Screen



-A white wooden box mounted on 4 legs used to house thermometers and hygrometers.

The instruments which are found in it are:

1. Maximum thermometer
2. minimum thermometer
3. Six's thermometer
4. hygrometer-wet bulb and dry bulb thermometer

Importance

1. Provide shade conditions for accurate temperature recording.
2. Ensure safety of thermometers because they are delicate.

Qualifications Which Make Stevenson Screen Suitable For Its Work

1. Painted white for little absorption of solar heat energy.
2. Made of wood which is a bad conductor of heat.
3. Well ventilated to allow easier flow of air inside it.
4. Raised to prevent contact with terrestrial radiation.
5. Has double roof which acts as an insulator to prevent direct heating from the sun.

Recording and Calculating Weather Conditions

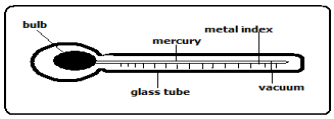
Temperature

-Degree of hotness of an object or a place.

It's measured using 3 types of thermometers namely:

- Maximum thermometer
- Minimum thermometer
- Six's thermometer

Maximum Thermometer

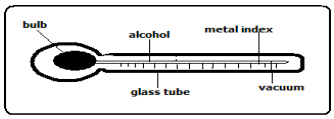


It's used to measure the highest temperature reached in a day.
It uses mercury.

How It's Used/Works

- Temperature rises causing mercury to expand.
- Mercury pushes the index up.
- When temperature falls mercury contracts.
- The maximum temperature is read from the scale at the lower end of the index.
- Thermometer is reset by shaking it to force mercury back into the bulb.

Minimum Thermometer



It's used to record the lowest temperature reached in a day.
It uses alcohol.

How it's Used/Works

6. Temperature falls causing alcohol to contract.
7. Alcohol pulls the index down.
8. When temperature rises alcohol expands and rises in the tube.
9. The index remains where it was pulled.
10. Minimum temperature reading is obtained from the scale at the lower end of the index.

Calculating Temperature

a. **Diurnal/daily Temperature range**

-Difference between the maximum and minimum temperature for any one day.

b. **Mean Daily Temperature**

-Average of the maximum and the minimum daily temperatures.

c. **Mean Monthly temperature**

-Sum of mean daily temperatures in a month divided by the number of days in that month.

d. **Mean Monthly minimum Temperature**

-Sum of daily minimum temperatures divided by the number of days in that month.

e. **Mean Monthly Maximum Temperature**

-Sum of daily maximum temperatures divided by the number of days in that month.

f. **Mean Annual Temperature**

-Sum of mean monthly temperatures divided by 12.

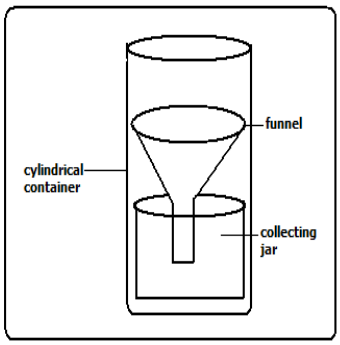
g. **Mean Annual Temperature Range**

-Difference between the highest and the lowest mean monthly temperatures in a year.

h. ◦k=◦c+273

i. ◦F=(◦c×1.8)+32 derive the rest from the formulas.

Rainfall



Rain gauge is the instrument used to measure the amount of rainfall in a day.
It should be made of impermeable material which can't absorb water.

How It's Used/Works

11. It's taken to an open space to prevent water from dropping into the funnel.
12. Its sunk into the ground to prevent evaporation
13. The funnel top is left 30cm above the ground to prevent splashes of water and run off.
14. After 24 hours water is emptied into the measuring cylinder.
15. The reading of the amount of rainfall is got from the measuring cylinder in millimetres.
16. The figure represents the millimetres of water falling on each square millimetre of the ground.
17. It could be used to measure snow fall by melting it before the readings are gotten.

Calculating Rainfall

a. **Monthly Rainfall Total**

-Sum of rainfall recorded in a month.

b. **Annual Rainfall Total**

-Sum of monthly rainfall totals for 12 months.

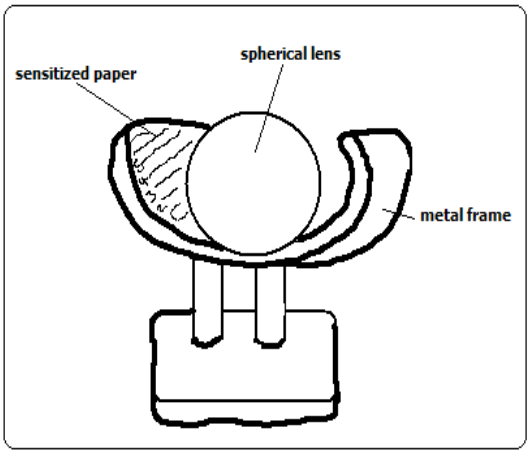
c. **Mean Monthly Rainfall**

-Sum of rainfall totals for a particular month over several years divided by the number of the years of observation.

d. **Mean Annual Rainfall**

-Sum of mean monthly rainfall for 12 months of the year.

Sunshine



Duration of sunshine is measured using Campbell stokes sunshine recorder.

How It Works

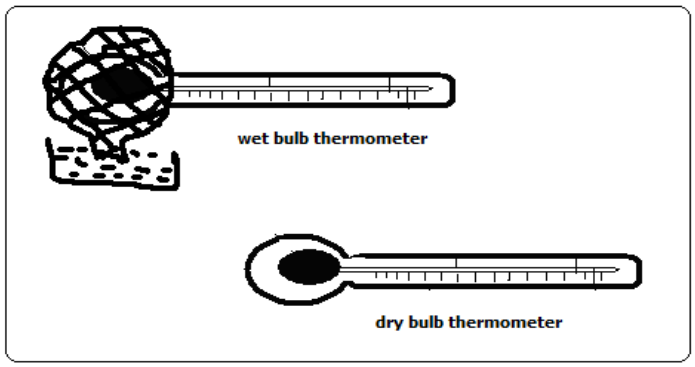
9. Spherical lens focuses light on sensitized paper.
10. The paper burns when the sun is shining.
11. The total hours of sunshine is got by adding all the burnt sections from calibrations on the side of sensitized paper.
12. The sensitized paper is changed every day.

Humidity

Humidity is the condition of atmosphere with reference to its water content.
It's measured with hygrometer or psychrometer which consists of wet and dry bulb thermometers kept in Stevenson screen.
Dry bulb thermometer is a thermometer covered with muslin bag immersed in water while dry bulb thermometer has no muslin.

How It Works

10. When air is dry there is a lot of evaporation from the muslin.
11. Evaporation cools the bulb of thermometer resulting in a low temperature reading.
12. When humidity is high there is little evaporation from the muslin.
13. The wet bulb thermometer is cooled at a slower rate and both thermometers show almost the same temperature reading.
14. The difference in readings between the two thermometers is used to determine relative humidity.



Interpretation of Hygrometer Readings

- When the 2 readings are the same, relative humidity is 100% i.e. the air is saturated.
- If the difference is small, humidity is high.
- If the difference is big, humidity is very low.

Calculating Humidity

Absolute Humidity

-Actual amount of water vapour a given volume of air can hold. It's expressed in g/m3.

Specific Humidity

-Mass of water vapour in a given mass of air. It's expressed in g/km.

Relative Humidity

-Ratio between the absolute humidity and the maximum amount of water the air can hold expressed in a percentage.

R.H.=A.H/Maximum amount of water the air can hold at the same temperature.

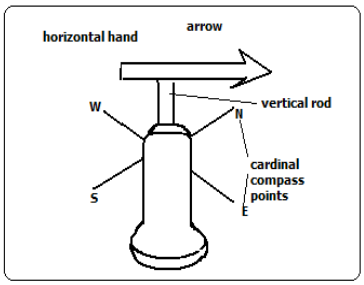
Example

4. If the air at 20◦c contains 10g/m3 and given air can hold a maximum of 20g/m3.calculate the relative humidity.

10×100/20=50%

Wind

Direction

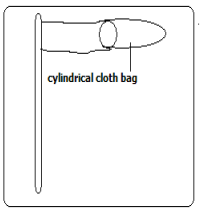


Wind direction is determined using wind vane.

How It Works

5. As the wind blows the arrow swings.
6. The arrow points in the opposite direction of the wind flow.
7. The direction is read from the cardinal compass points.
8. The arrow will point in the direction from which the wind is blowing.
9. For instance if it points S the wind is blowing from S towards N.

Wind Sock

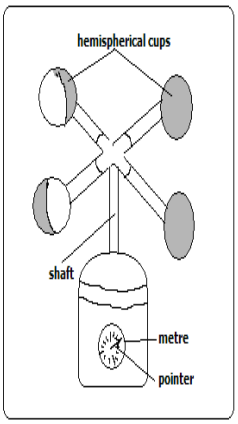


-Used to indicate the general direction of wind flow.
-Not kept in a weather station because it doesn't give the accurate direction of wind flow.
-Seen near airstrips for the benefit of pilots.

How it Works

4. When wind blows the bas stretches out in the direction that the wind is blowing.

Wind speed/Velocity



-Measured using anemometer.

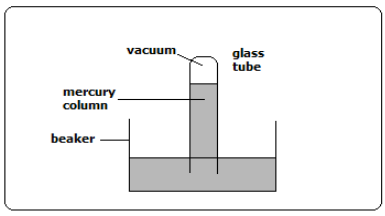
How It Works

5. When wind bows hemispherical cups rotate.
6. The number of rotations is obtained from the metre on the lower part of the anemometer.
7. The units for measuring wind are called knots.

Atmospheric Pressure

-The force exerted by gases in the atmosphere on some area or body on the earths surface.
-Measured using barometers of three types namely mercury, aneroid and Fortin Barometers.

Mercury Barometer



How It Works

- Air exerts pressure on the mercury in the beaker.
- The height of mercury in the tube is proportional to the atmospheric pressure.
- The readings are taken in mmHg.
- Its 760mmHg at sea level

Advantage

Quite accurate

Disadvantage

- Cumbersome to carry around.
- Can be damaged quite easily while being carried around.

Aneroid Barometer

-Measures changes in atmospheric pressure.

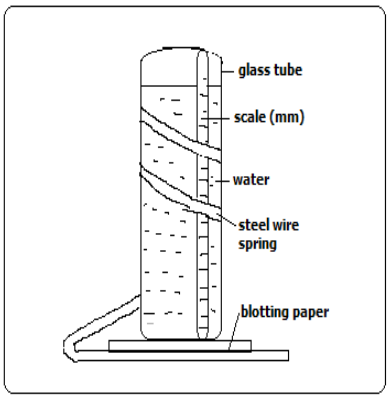
How It Works

- Has air tight compartment (vacuum).
- Compartment expands when pressure decreases.
- It collapses when pressure increases.
- The movement is transmitted by lever to a pointer on a dial.
- The readings are in kg/cm3.

Evaporation

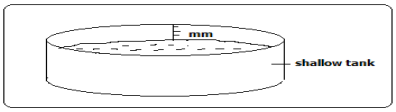
The rate and amount of evaporation is measured using piche and tank evaporimeters.

Piche Evaporimeter



- When there is a lot of sunshine water evaporates from the blotting paper.
- The level of water in the glass tube reduces.
- The rate and amount of evaporation is got by looking at the scale on the outside of the glass tube.
- The units are in mm.

Tank Evaporimeter



How It Works

- The tank with water is put in the open.
- Water evaporates when there is a lot of sunshine.
- Water in the tank reduces.
- The rate and amount of evaporation is got from calibrations in the inner side of the tank in mm.

Cloud Cover

The amount of cloud cover is observed using eyes.
It's given in oktas**.**
Okta=approximately 1/8 of sky is covered with clouds.

Weather Forecasting

-Prediction of the conditions of the atmosphere for a given place for a certain period.

Methods of Weather Forecasting

Traditional Methods

-Prediction of weather based on traditional beliefs and facts.

- Plants shedding leaves indicates period of drought.
- Safari ants indicate it will rain.
- Migration of butterflies also indicates it will rain.
- Croaking of frogs during dry season indicate its going to rain.
- Flowering of certain plants indicates the onset of rainfall.
- Changes in the intensity of sunshine indicate its going to rain.

Modern Methods

-Prediction of weather using modern instruments and new technology of collecting, transmitting, processing and analysing weather data.

Instruments Used

- **Satellites-**electronic devices which orbit the earth which collect and transmit weather data which is interpreted by computers.
- **Radar**-an instrument used to see cloud formation.
- **Sensors/radiosodes-**instrument fixed on a balloon used to measure atmospheric pressure, temperature and humidity.
- **Computers-**electronic device used to store, analyse and display weather information.

Significance/Importance of Weather Forecasting

- Helps us to be aware of natural calamities related to weather before they occur so as to take precautionary measures.

- Guiding tourists on when to visit national parks.
- Helps farmers to plan their activities such as planting, harvesting, etc.
- Ensures air and water transport is carried out safely.
- Helps sporting people to plan their training and competition schedules.
- Helps people to plan many other activities such as mining, electricity generation, holiday events, etc.
- Helps fishing communities to plan their activities.

Factors Hindering Weather Forecasting

- Lack of skilled man power due to limited training facilities.
- Lack of modern equipment leading to wrong forecasts.
- Natural calamities such as storms and earthquakes.
- Extreme weather conditions which may damage or displace instruments.
- Use of faulty instruments.
- Human error.
- Poor sitting of instruments.

Factors Influencing Weather

Temperature

Factors influencing temperature

- **Altitude**

-Height above sea level.

- Temperature decreases with increase in height due to air at higher altitude being thinner and hence there is less particles e.g. gases, dust, smoke and water vapour to store heat so its rapidly lost to the outer space.

- **Latitude**

-Distance from the equator.

Temperature decreases with increase in latitude.

- Places neat equator experience high temperature due to the rays of the sun travelling a shorter distance facing less interference from atmospheric conditions hence more solar energy reaches the earths surface. Also the rays of the sun strike the earth at right angles hence solar energy is concentrated over a small area.
- At higher latitudes the rays of the sun travel a longer distance facing more interference from atmospheric conditions hence less solar energy reaches the earth's surface. Also the rays of the sun strike the earth at an acute angle hence solar energy is spread over a large area.

- **Aspect**

-Direction of slope.

- At higher latitudes slopes facing the equator have higher temperature because they face the sun while those facing the poles have lower temperature have lower temperature because they face away from the sun.

- **Winds**

-Transfer heat from one place to another.

- When they blow from cool areas they take the cooling effect to the areas they blow over and when they blow from warm areas they take warming influence to the places they blow over.

- **Distance from a Large Water Body**

- Areas near a large water body experience lower temperature during the hot season and higher temperature during the cool season due to sea breezes, warm and cold ocean currents and wind blowing over water which could be either warmer or cooler than the adjacent land.

- **Cloud Cover**

- Clouds reduce the amount of solar energy reaching the surface by absorbing, scattering and reflecting solar radiation.
- When there are clear skies during the day the temperature is higher due to the earth receiving maximum solar insolation.
- During clear nights there are very low temperatures due to a lot of terrestrial radiation being lost to the outer space.
- Cloudy nights on the other hand are warmer due to clouds radiating to the earth heat absorbed during the day.

1. **Length of Day**

- The longer the period of solar insolation the greater the quantity of radiation a place receives and hence the more the heat that will be generated by the earth and vice versa.

- **Solar Altitude**

- At equinox when the earth is farthest from the sun the temperature on the earth is lower due to less solar radiation reaching the earth's surface due to travelling a longer distance and hence facing great interference from atmospheric conditions.
- At solstices the earth receives more solar energy due to travelling a shorter distance and hence facing less interference from atmospheric conditions.

- **Solar Input**

- Sometimes the sun gives out more heat due to reactions being violent causing temperature on the earth to be higher.
- When it gives out less heat the temperature on the earth is lower.

- **Surface Conditions**

- Light surfaces e.g. smooth surfaces reflect sunlight and hence less solar energy reaches the earth's surface.
- Dark and irregular surfaces such as with vegetation absorb more heat leading to higher surface temperatures.

Humidity

Factors Influencing Humidity

1. **Temperature**

- Places with high temperature experience high humidity due to high evaporation and air having high capacity to hold moisture.

- Places with low temperature have low humidity due to low evaporation and air having low capacity to hold moisture.

2. **Source of Moisture**

- Areas near water bodies e.g. Kisumu and Mombasa experience high humidity due to evaporation of water from the water body.
- Places near thick vegetation also have high humidity due to evapotranspiration.
- Areas far away from water bodies such as the middle of deserts have low humidity.
- Areas receiving heavy rainfall also have high humidity.

3. **Air Pressure**

- There is high humidity at low altitudes because high pressure compresses air warming it increasing its capacity to hold moisture and also causes high evaporation.
- There is low pressure at high altitudes because air expands and cools thus reducing its capacity to hold moisture.

4. **Latitude**

- Low latitudes experience high humidity due to high temperatures resulting into high rates of evaporation and air having high capacity to hold moisture.
- High latitudes experience low humidity due to low temperatures resulting into low rates of evaporation and air having low capacity to hold moisture.

Significance of Humidity/Moisture

1. Affects rain formation in such as way that places with high humidity are likely to experience higher rainfall than those with low humidity.
2. Regulates the heat loss from the earth's surface by absorbing terrestrial radiation (process in which the earth gives off heat into the atmosphere).
3. It affects sensible temperature in that the higher the humidity the more we experience sensible temperature.

Precipitation

-The forms in which the earth's surface receives moisture.

1. **Snow**

Solid precipitation formed when tiny water droplets freeze and form ice crystals. The crystals may fuse to form flakes.

2. **Sleet**

-Precipitation which is a mixture of rain and snow.

3. **Hail**

Roughly spherical lumps of ice formed when super cooled cloud droplets mould themselves around ice crystals before cooling. It destroys crops life and house roofs.

4. **Dew**

-Precipitation consisting of water droplets formed on cold surfaces at night e.g. iron roofs and glass blades.

How It's Formed

- In a clear night there is a high ground radiation.

- Temperature of the earth's surface fall below dew point (temperature at which air being cooled becomes saturated).
- Excess water condenses on cold surfaces.

5. **rain**

-Precipitation consisting of water drops/droplets formed when tiny water droplets merge around particles of matter and become heavy and fall down to the earth.

Condensation

Turning of water vapour into tiny water droplets as cooling continues below dew point.

The droplets join to form clouds.

Causes of Condensation

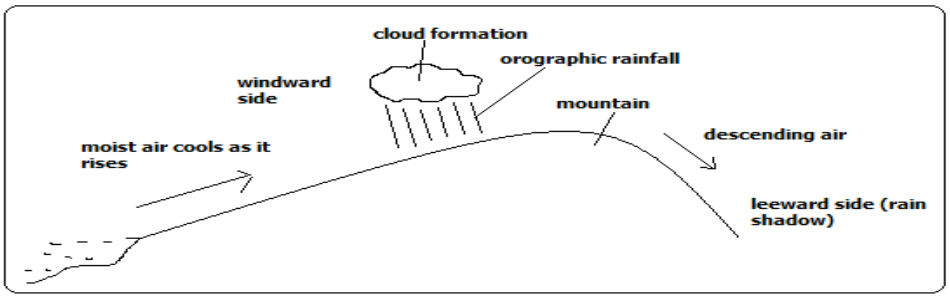
1. **Adiabatic cooling-**cooling of moist air as it rises vertically.
2. **Orographic cooling**-cooling of moist air as it climbs a hill or mountain.
3. **Frontal cooling**-cooling of warm air mass when it blows towards a cold air mass.
4. **Advection cooling**-cooling as a result of moist air moving over a cool land or sea.

How Condensation Takes Place/Cloud Formation

- Moist air rises to the condensation level (altitude where temperature is below dew point.
- It's cooled below dew point.
- Tiny water droplets condense around tiny particles such as dust, smoke particles and pollen grains and salt particles (condensation nuclei).
- The droplets merge and eventually become bigger and fall as rain.
- If moisture rises to an altitude where temperature is below 0◦c the condensed water droplets freeze forming ice particles or super cooled water (water which has remained in a liquid state at temperatures below freezing point due to lack of sufficient condensation nuclei.
- Super cooled cloud droplets may mould themselves around ice crystals before freezing to form hail.

Types of rainfall

1. **Relief/Orographic/Mountain rainfall**

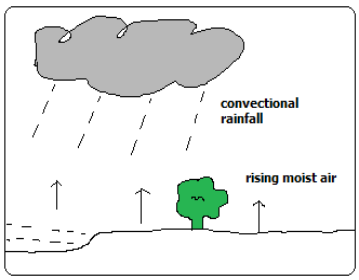


Rain experienced on the windward slopes of mountains or hills formed when moist air is forced to rise over a mountain or a hill.

How it Forms

- Moist air is forced to rise over a hill or mountain.
- The temperature and air pressure decreases making it to expand.
- Air cools due to decreased temperature and decreased pressure causing it to expand.
- Moisture condenses forming tiny water droplets (clouds).
- The tiny water droplets in clouds merge and become too heavy to be suspended in air and fall as rain.
- Air proceeds to the leeward side with low moisture content.
- Since its heavier due to being cool it descends over that side and gets warmed making it to hold onto the little moisture it had causing that side to receive low rainfall (rain shadow).

1. **Convectional Rainfall**

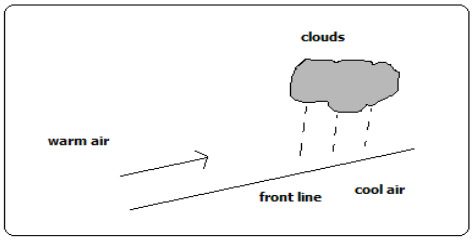


Type of rainfall common near large water bodies formed as a result of convective rising and cooling of moist air.
It's accompanied by thunderstorms.

How it forms

- Ground or water body is heated causing evaporation.
- There is convective rising and cooling of moist air.
- Condensation takes place forming tiny water droplets (clouds).
- The droplets merge and fall as rain.
- The cooled dry air descends to the surface where its heated and its capacity to hold moisture is increased.
- The process is repeated.

2. Frontal/Cyclonic Rainfall



Type of rainfall common in mid-latitudes formed when warm air blows towards a cold area or when warm air mass meets with a cold air mass.
It's accompanied by cyclones (violent winds).

How it Forms

- Warm moist air mass meets with a cold air mass.
- The warm air is forced to rise as it's less dense.
- It cools as it rises at the line of contact with cold air.
- The moisture condenses forming clouds resulting in frontal rain.

Factors Influencing Rainfall Types and Amounts

1. Relief/Topography

Relief features such as mountains and hills results in the rising and cooling of moist winds to form relief rainfall.

2. Aspect

Windward slopes which are on the path of rain bearing winds receive heavier rainfall than leeward slopes which face away.

3. Forests and Water Bodies

Areas near forests and large water bodies experience higher rainfall and more often due to high rate of evaporation.

4. air pressure

High pressure areas receive low rainfall than low pressure areas due to pushing of air masses from high pressure to low pressure. The high pressure areas have descending dry air.

5. air masses

When warm and cold air masses meet frontal rainfall is formed.

6. **Ocean Currents**

- It influences rainfall whereby coasts washed by warm ocean currents experience heavy rainfall when moist onshore winds are warmed by the current and made to hold on to moisture which they release on reaching the land.
- The coasts washed by cold ocean currents on the other hand experience low rainfall as a result of moist winds being cooled and moisture in them condensed resulting in rain falling over the ocean thereby bringing little or no rain to the coastal areas. This is the cause of western margin deserts e.g. Kalahari and Namib deserts.

Atmospheric pressure

Factors Influencing Atmospheric Pressure

1. **Altitude**

- Pressure decreases with increase in altitude because the column of air becomes shorter hence it exerts less weight.

1. **Temperature**

- When air is heated it expands and exerts pressure over a large area resulting in reduced pressure.
- When it's cooled it contracts and exerts pressure over a small area resulting in increased pressure.

2. **Rotation of the earth**

- Rotation pushes air masses from poles towards the equator causing air to spread out and occupy more space causing it to expand making pressure to decrease.
- When air from the equator moves towards the poles it occupies less space causing it to contract resulting into high pressure.

Mist and Fog

Mist and fog are a mass of tiny water droplets suspended in the lower layers of the atmosphere.
Fog is denser than mist i.e. has more moisture.
Both hinder visibility although fog reduces visibility to less than a kilometre.
When fog mixes with smoke its called smog.

How They Form

- Moist air cools below dew point.
- Condensation takes place.
- The resultant water droplets remain suspended in the air.

Types of Fog

1. **Radiation Fog**

- Type formed when moist air is cooled below dew point as a result of intense radiation on the ground at night.

1. **Advection Fog**

- Type formed when moist air from the sea moves horizontally over a cold surface e.g. snow covered ground.

2. **Orographic/Hill/Upslope Fog**

- Type formed when moist air is cooled after climbing a hill or mountain.

3. **Evaporation Fog**

- Type formed when water vapour is added to cold air that is already near saturation causing excess water vapour to condense and form fog.

4. **Frontal Fog**

- Type formed when warm moist air is cooled from below as it rises over a cold air mass.

5. **Steam Fog**

- **Type formed when moist air passes over the surface of a much warmer fresh water body.**
- The warm water is cooled from above and condensing water vapour forms fog. It appears to be steaming.

6. **Ice Fog**

- Type formed when water vapour is converted directly into ice crystals when temperatures are below freezing point.

Clouds

-Are a mass of tiny droplets or ice particles formed when water vapour condenses.

Three Cloud Forms

1. **Cirroform**

-Thin and wispy clouds composed of ice crystals.

2. **stratiform**

-Appear as greyish sheets covering most of the sky and are rarely broken into units.

3. **Cumuliform**

-Are massive rounded with a flat base and limited horizontal extent and billow upwards to great heights.

Basic Cloud Types

1. **Stratus Clouds**

-Are found in layers, are flat in shape and resemble fog.

2. **Nimbus Clouds**

-are dark at the base and sometimes white at the sides and cause rain and thunderstorms.

3. **Cirro-cumulus**

-Are white clouds consisting of white ice crystals.

4. **Nimbostratus**

-A rain cloud which is dark grey and spreads over the sky in low uniform layers.

5. **Cumulus Clouds**

-Clouds with a flat horizontal base, massive, rounded and less horizontal extent.

6. **Alto cumulus**

-High clouds composed of ice crystals which indicate fair weather.

World distribution of Pressure Zones and the Planetary wind System/World Prevailing Winds

The Equatorial Low pressure Zone (ITCZ-low)

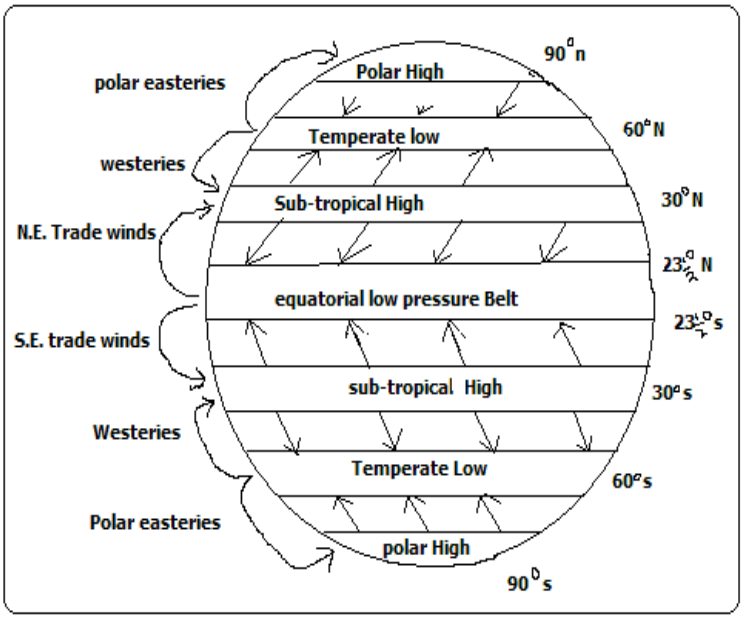
- Found between 23 ½ ◦N and 23 ◦N
- Experiences high temperatures.
- A zone of low pressure and doldrums (light and intermediate winds).
- Zone where S.E and N.E Trade Winds converge.
- Associated with convectional rain and thunderstorms.
- Migrates to the N and with the apparent movement of the overhead sun.

The Sub-tropical High Pressure Zone

- Found within 30◦N and 30◦S.
- A zone of high pressure.
- A region of calm descending air.
- Source of Trade Winds and Westeries.
- Zone of divergence of T. Winds and Westeries.

The Temperate Low Pressure Zone

- Found within 60◦N and 60◦S.
- A low pressure zone.
- Zone of convergence of westeries and polar easteries.



The Polar High Pressure Zone

- Found over the poles 90◦N and 90◦S.
- A high pressure Zone.
- Zone of descending calm air of low temperature.
- Source of polar easteries.

The Worlds Prevailing Winds

These are the major winds blowing over the earth frequently and consistently and which influence the world weather.

1. **Trade Winds**

- Blow from sub-tropical high pressure zone and blow to the equatorial low pressure belt.

2. **Westeries**

- Originate from sub-tropical high pressure zone and blow to the temperate low pressure belt.

3. **The Polar Easteries**

- Originate from polar high pressure zone and blow to temperate low pressure zone.

Monsoon Winds

- Seasonal winds which reverse in the direction of flow.
- They blow towards the land during summer (onshore) and from the land during winter (off shore).
- Bring heavy rains when onshore which can cause severe flooding.
- Well developed in the Indian Sun-continent, china, Japan and S.E Asia.

Air Masses

-Distinct large parcels of air moving in one direction
-Originate from areas of uniform weather and topography from where they derive their characteristics e.g. flat areas, forests, deserts, and snow covered areas.

Characteristics of Air Masses

- A large volume of air.
- Covers an extensive area.
- Has uniform temperature and humidity.
- Distinct from the surrounding air.
- Retains its characteristics when it moves away.

Types of air Masses

1. **Equatorial Air Mass**

- Originate from equatorial oceans.
- It's hot and unstable.

1. **Sub-tropical Air Mass**

- Forms near sub-tropical high pressure belt.

2. **Polar Air Mass**

- Forms near the poles or temperate low pressure zone.
- It's cool.

3. **Arctic and Antarctic air Masses**

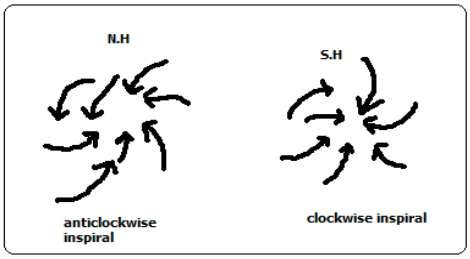
- Forms over the ice sheets of Greenland and Antarctica respectively.

4. **Effect of air masses on Weather**

- When warm moist air mass and cool air mass meet cyclonic rainfall is formed e.g. tropical maritime and polar maritime.
- Cool air masses take cooling effect to the areas they move to e.g. polar continental.
- If they are warm they take warming influence to the area they move to e.g. tropical continental.

Pressure Systems in the World

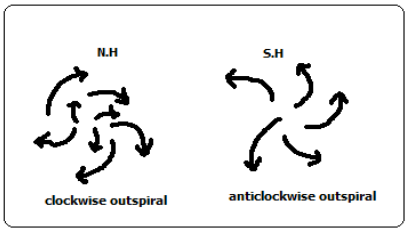
1. Cyclone



- It's a low pressure system characterised by low pressure at the centre and increases outwards.
- Starts in areas where air ascends from the ground to the atmosphere and descends at high altitude.
- It's of two types. Tropical cyclones e.g. hurricane, typhoon and willy willies and depressions which are characterised by temperate latitudes.
- The movement of wind is anticlockwise in the N. hemisphere and clockwise in the S. hemisphere.

2. Anticyclone

- A high pressure system characterised by high pressure at the centre and decreases outwards.
-

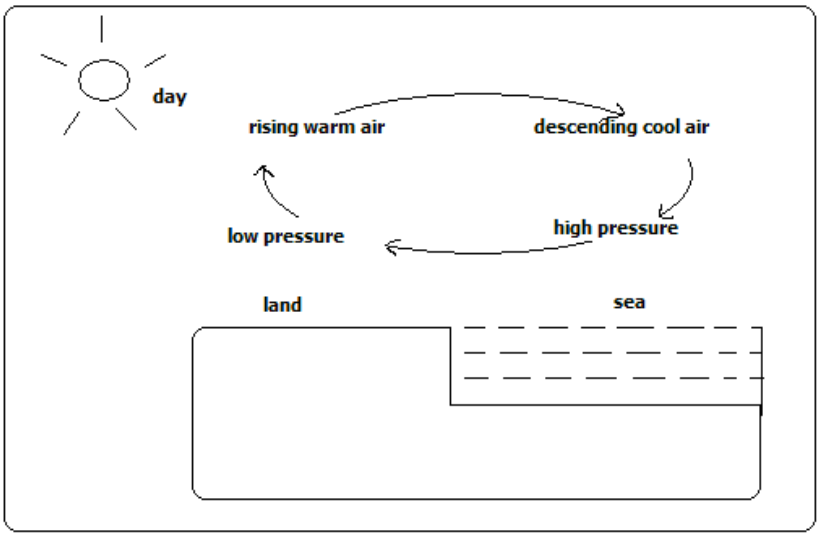


- It starts in areas where air is descending from the atmosphere onto the ground and then blows outwards on the ground.
- The movement of wind is clockwise in the N. hemisphere and anticlockwise in the S. hemisphere.

Local Winds

-Which occur regularly for a short period of time affecting a limited area.
-Modify the weather of the area they blow to.

1. Sea Breeze



-A light and gentle wind which blows from the sea to the adjacent land.

How it Forms

- During the day land is heated faster than the sea.
- Air over the land is warmed and rises.
- Air from the sea moves to the land to replace the rising air.
- The rising air from the land cools and descends over the sea at high altitude.
- Circulation continues until the pressure difference is reversed at night.

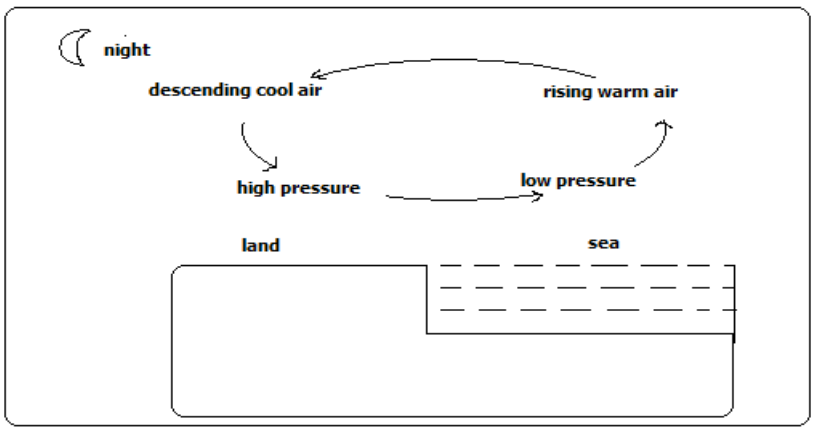
Effects on weather

It takes cooling effect on land on a hot afternoon.

2. Land Breeze

-A light and gentle wind which blows from land to the sea during the night.

How it Forms

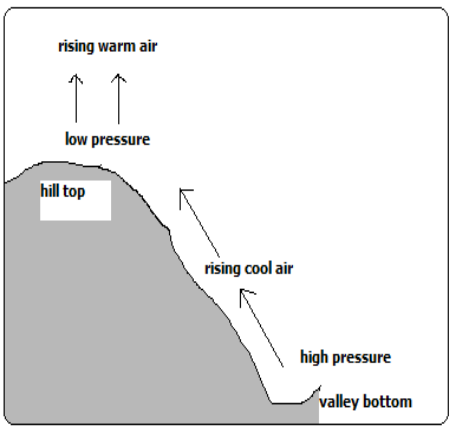


- At night land loses heat faster than the sea.
- Air over the sea is warmed and rises.
- Air from the land moves to the sea to replace the rising air.
- Rising air from the sea descends over land at high altitude.
- Circulation continues until pressure difference is reversed during the day.

Effects on weather

It causes early morning showers through moisture brought towards land at high altitude.

3. **Anabatic winds (Valley Breeze)**



-Cool local winds which blow from the valley to the hill tops during summer afternoons.

How it Forms

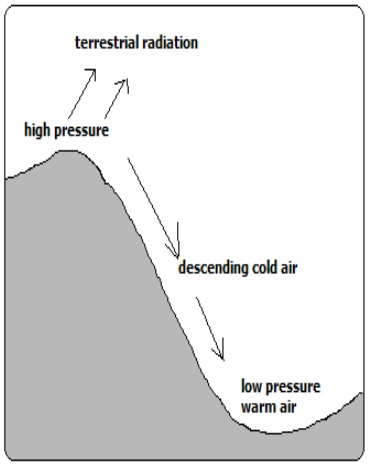
- During the day hill tops are heated more than valley bottoms.

- Air over the hill tops is warmed and rises.
- Cool air over the valley move up to the hill to replace the rising air.

Effect on weather

-Cause afternoon showers on hilly grounds.

4. **Katabatic/Descending Winds**



-Cold local winds which blow from hill tops to the valley during the night.

- During the night hill tops lose heat faster than the valley.
- Air over the valley is warmed and rises.
- Cool air over the hill tops move to the valley by gravity to replace the rising air.

Effect on Weather

-Takes chilly conditions on valley bottoms.

5. **Harmattan Winds**

-N.E winds which originate from Sahara and blow across W. Africa between November and March taking dry conditions there.

6. **Fohn Winds (Alps)**

-Local cold winds which slide down the leeward side of the mountain at high speed and are warmed producing a temperature rise.
Due to the high speed and temperature they are associated with wild fires.
They are known as Chinook in Rocky Mountains, Santa Anas in California and Mistral in France.

Factors influencing Wind Flow (Speed and direction)

1. **Pressure Gradient**

If the pressure difference between high and low pressure areas is high the winds blow at high speed (strong) but if it's low they blow at high speed (are gentle).

2. **distance between Places of High and Low Pressure**

if the high and low pressure areas are near each other winds blow at high speed but if distant from each other winds blow at low speed.

3. **Rotation of the earth**

Rotation of the earth deflects winds to the right in the N. hemisphere and to the left in the S. hemisphere.

4. **Frictional Force**

If the surface of the earth is rugged or has obstacles such as hills, mountains, valleys or vegetation the wind is blocked causing speed reduction and its direction of flow is also changed.

4. CLIMATE

-Average weather conditions of a given place over a long period of time usually 30-35 years.

Factors Influencing Climate

Latitude

- It influences temperature whereby low latitudes have high temperature and high latitudes have low temperature due to the angle at which the sun rays strike the earth and the distance travelled by the suns rays.
- It also influences rainfall whereby places in the equator receive rainfall in two seasons when the sun is overhead there while northern and southern tropical areas receive rainfall when the position of the sun is overhead in those areas.

Inter-Tropical Convergence Zone

It's a low pressure belt around equator where trade winds converge.
It influences rainfall in the following ways:

- Places further from equator experience one rainy season when the sun is overhead and a long dry season when the sun is in the S. hemisphere.
- Regions near equator have 2 seasons of heavy rainfall because they experience passage of ITCZ twice.

Altitude

- It influences temperature whereby at low altitude temperature is high while at high altitude its lower due to the thickness of atmosphere determining the number of particles to store heat and distance from space where terrestrial radiation is lost.

- It also influences rainfall whereby mountains on the path of rain winds receive Orographic rainfall and the windward slopes receive heavier rainfall than leeward slopes.

Distance from the Sea

- It influences temperature whereby places in temperate regions near the sea experience low temperature during summer onshore winds blowing over cold ocean water and taking the cooling influence on adjacent land because the water is heated at a slower rate than land.
- Places near the sea also experience higher temperatures during the winter or cool season due to sea breezes carrying warmer air to the land because water loses heat at a slower rate than land.
- Temperatures in the interior of continents tend to be high in summer and very low in winter due to lack of marine influence.
- It also influences rainfall whereby coastal regions receive a lot of rain when the winds are onshore and the continental interiors receive less rain mainly in summer because onshore winds will have dropped most of moisture along the way.

Ocean Currents

- It influences temperature whereby coasts which are washed by warm ocean currents are warmer while those washed by cold ocean currents are cooler due to the onshore winds being either warmed or cooled and then taking the warmth or coolness to the land.
- It influences rainfall whereby coasts washed by warm ocean currents experience heavy rainfall when moist onshore winds are warmed by the current and made to hold on to moisture which they release on reaching the land.
- The coasts washed by cold ocean currents on the other hand experience low rainfall as a result of moist winds being cooled and moisture in them condensed resulting in rain falling over the ocean thereby bringing little or no rain to the coastal areas. This is the cause of western margin deserts e.g. Kalahari and Namib deserts.

Aspect

-Direction of slope in relation to sunlight and the rain bearing winds. Its effect on temperature is more pronounced in the northern and southern hemisphere.

- In the N and S hemispheres the slopes facing sun are warmer while those facing away are cooler.
- The slopes in the direction of rain winds i.e. the windward slopes receive heavier relief rainfall than the leeward side.

Winds and Air Masses

Wind blowing from a warm region warms the region its passing over and if blowing from a cool region cools the region it's passing over since wind is a medium of transfer of heat.

- Sea breezes take cooling influence on land during hot afternoons.

- Katabatic winds cause low night temperatures on valleys and foot of mountains.
- Fohn and Chinook which are descending dry winds take dryness to the leeward sides of Alps and Rockies.

Winds influence rainfall in the following ways:

- Anabatic winds cause afternoon showers on mountainous regions.
- Moisture laden winds cause heavy rainfall.
- Persistent dry winds cause desert like conditions in the area they pass over e.g. Harmattan winds from Sahara which blow over W. Africa.
- Regions around large water bodies experience high rainfall because of the effect of land breezes.

Configuration of Coastline

Coastal regions across the path of moisture laden winds receive higher rainfall because winds deposit moisture on land e.g. Mombasa while those lying parallel to the path of those winds receive less rainfall because moisture is deposited on the sea e.g. Lamu.

Forests

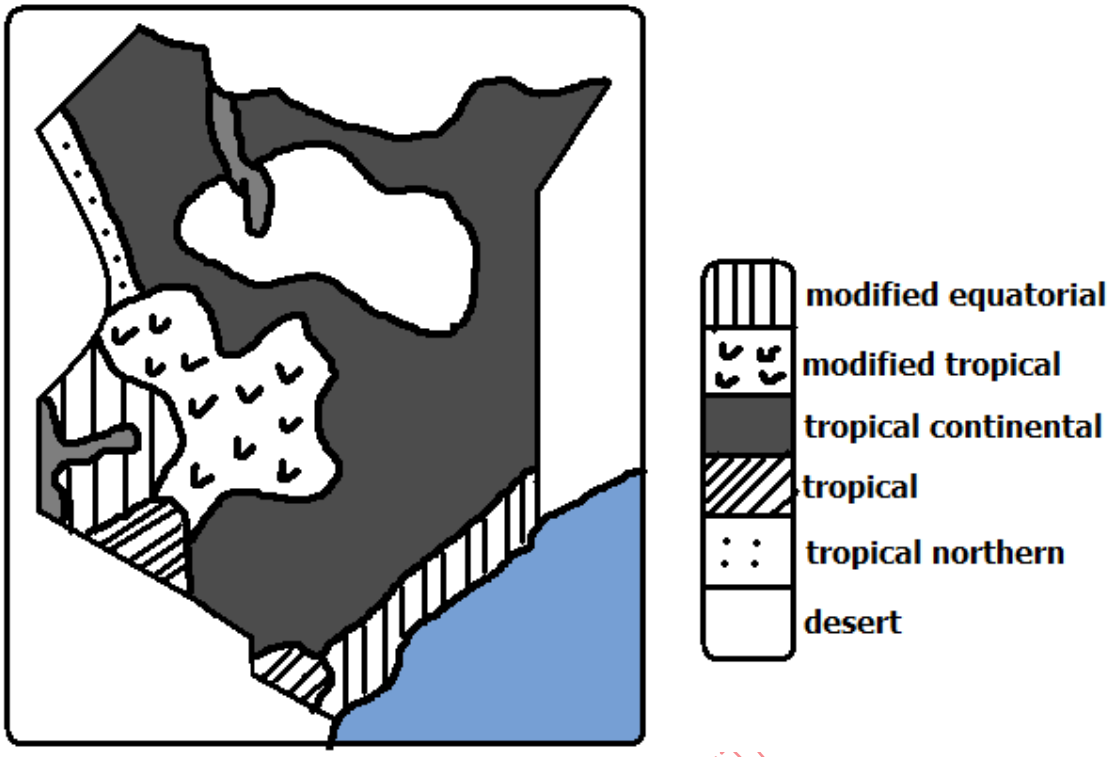
Forested areas experience a micro climate whereby:

- Temperature is lower due to shades of trees reducing solar insolation reaching the ground.
- Rainfall is heavier due to high rate of evapo-transpiration and friction between trees and rain bearing winds.

Human Activities

- Man has caused deforestation in the process of creating room for settlement and agriculture which has caused drop in rainfall amounts leading to semi-arid conditions.
- Man has constructed dams across rivers and done afforestation which has caused semi-arid regions to become wetland.
- Gases especially co2 emitted from burning fossil fuels and chlorofluorocarbons layer cause global warming through the green house effect and destruction of ozone layer respectively.

The Climatic Regions of Kenya



Modified Equatorial Climate

-Experienced along the coast and along the coast from Somali-Tanzanian border and L. Victoria basin regions around the lake.

Along the Coast

Characteristics

- High temperatures throughout the year mean annual about 27◦c.
- Small mean annual range of temperature about 4◦c.
- Hottest months are December and January.
- Experiences rainfall throughout the year/ no real dry season.
- Double maxima rainfall regime (2 rain seasons) in May and October.
- High humidity due to high temperature causing high rates of evaporation and nearness to the sea.

L. Victoria Basin

Characteristics

- Temperature is lower than the truly equatorial climate due to modifying influence of the lake (mean annual range between 22-26◦c).
- There are no real dry months.
- Heavy rainfall ranging from 1000-600mm.
- Double maxima rainfall regime.
- Receives convectional type of rainfall which falls mainly in the afternoons.
- High relative humidity due to high temperature and nearness to the lake which is a source of moisture.

Modified Tropical Climate

-Experienced in central highlands E and W of R. Valley.

Characteristics

- Mean annual temperatures averages between 17-24◦c.
- Lower warmer slopes and cooler higher slopes due to modification by altitude.
- Receives rainfall throughout the year (1000-2000mm).
- Receives Orographic rainfall caused by S.E Trade Winds.
- Double maxima rainfall regime in eastern highlands and single maximum in the W. highlands.
- Humidity is moderate.

Tropical Continental/desert Climate

-Experienced in about ½ of Kenya in most of N, N.E, most of E and S Kenya.

Characteristics

- High temperatures throughout the year with mean between22 and 27◦c.
- Generally dry with less than 500mm of unreliable rainfall.
- Large diurnal range of temperature.
- The skies are generally clear.
- Low humidity.
- Temperature has been modified by relief in some areas e.g. Voi-25◦c and Garissa -28.5◦c.

Tropical Climate

-Experienced in Narok, S. Taita and Kwale region.

Characteristics

- High temperatures (mean annual temp-16.5◦c).
- Temperature is modified by relief in some areas e.g. Loita, Taita and Narok which has made the place suitable for human habitation.
- Generally low rainfall amounts.
- Rain falls in one season.
- A long dry season lasting up to 6 months.

Tropical Northern Climate

-experienced in a small area in the N. W part of Kenya bordering Uganda.

Characteristics

- High average temperatures.
- Temperatures are modified in some places by altitude.
- Low mean annual rainfall of about 850mm.
- Rain falls mainly in June and September.
- Experiences a long dry season of up to 6 months.

Desert Climate

-Experienced in central northern Kenya where there are pure deserts such as Chalbi, Karoli and Kaisut deserts.

Characteristics

- Temperatures are very high throughout the year averaging 30◦c due to cloudless skies.
- Very low rainfall of less than 250mm per year.

- Characterised by diverging or descending winds which don't bring any rain.
- Night temperatures are extremely low.
- Humidity is low.
- Sandstorms are common occurrences.

World Climatic Regions
Classifications

1. Hot climates
2. Warm climates
3. Cool climates
4. very cold climates
5. Mountain climates
6. micro/local climates

Hot/Tropical Climates

-Experienced within the tropical latitudes.
-Subdivided into:

(a) Equatorial climate
(b) Tropical monsoon climate
(c) Savannah climate/Sudan type
(d) Tropical desert climate
(e) Tropical marine climate

Equatorial climate

-Experienced in the following areas:

(a) Amazon basin in S. America.
(b) Along west coast of Africa from guinea to Cote d' Ivoire.
(c) Southern part of Nigeria through Cameroon, Gabon, Central African Republic, Congo to Zaire.
(d) S.E Asia in Malaysia, Indonesia and a stretch between Burma and Vietnam.

Characteristics

- High temperatures throughout the year (between 24-27◦c).
- Temperature neither rises nor drops too low due to thick cloud cover all year round.
- Heavy rainfall throughout the year (mean annual of about 2000mm).
- Double maxima rainfall regime.
- Experiences convectional rainfall in low lands and relief rainfall in areas of high relief.
- High relative humidity of over 80% due to convergence of moist air masses and high evapotranspiration rates.
- Low pressure all year round.
- There are no seasons.

Tropical Monsoon Climate

It's found in the following areas:

(a) S.E Asia in parts of Pakistan, India, Bangladesh, S. china and Philippines.

(b) Along the northern coastal region of Australia.

Characteristics

- High mean annual temperatures of about 28◦c.
- Seasonal reversal of winds.
- Heavy rainfall when monsoon winds are onshore (600-1300mm) climate.
- Rain falls in a few months and the rest of the year is dry due to influence of latitude.
- Low pressure in summer when winds blow onshore.
- High pressure in summer when winds blow offshore.
- Cloudy skies in summer and clear skies in winter.

Tropical Marine Climate

It's found on windward slopes of islands and coastal areas on the east of continents under the influence of S.E Trade Winds in the following areas:

(a) C. America in S. Mexico through Guatemala, Nikaragua and Panama.
(b) N. coast of S. America.
(c) Caribbean islands of Cuba, Haiti and Jamaica.
(d) Coastlands of E. Africa from Kenya, Tanzania through Mozambique and E. Malagasy.

Characteristics

- Summer temperatures are very high approximately 30◦c.
- High rainfall totals in summer when winds are onshore (1000-2000mm).
- Orographic and convectional rainfall in summer.
- Dry winters due to winds being offshore.
- High humidity due to coastal location.
- Experiences tropical cyclones towards end of hot season.
- Winters are cool (about 21◦c).

Tropical Continental/Savanna/ Sudan type

-The largest natural climatic region in Africa.

It's found in the following areas:

(a) In Africa it extends from Senegal through E. Africa to the northern part of s. Africa.
(b) Western Madagascar.
(c) A broad belt in N. Australia.
(d) N.W and S.E of Amazon Basin called Llanos and Campos.

Characteristics

- Higher temperatures of up to 32◦in hot season.
- Large diurnal range of temperature in dry season.
- Convectional rainfall in summer averaging 765mm annually.
- High humidity during the hot wet season.
- Low humidity in cooler drier months.
- Prevailing winds are mainly trade winds.

Types of deserts

- **Erg -** Sandy deserts with large amounts of deposited sand.
- **Hamada - Rocky** deserts made of bare surfaces.
- **Reg** - Rocky deserts covered with angular pebbles, gravels and boulders.
- Hot continental interior deserts found on the interior of continents on the leeward sides of high mountains e.g. Sahara and Arabian Desert.
- Coastal deserts of western margins characterised by offshore trade winds and cold ocean currents e.g. Atacama of S. America, Namib in Namibia and Arizona in U.S.A.
- Mid latitude deserts of continental interiors with high summer and low winter like Gobi in C. Asia.

Ice and snow deserts of polar lands like Greenland and Antarctica desert. **Tropical Desert Climate**

-Found on the western coasts of continents washed by cold ocean currents.
They are the following:

(a) Arabian Desert of the middle East
(b) Sahara, Kalahari and Namib deserts in Africa.
(c) Atacama Desert in S. America.

Mohave and Colorado deserts of U.S.A. and Mexican deserts in N and C America.

(d) Jordan, Syria, Iran, Iraq, Saudi Arabia, Israel and Afghanistan.
(e) The great Australian desert in the greater western part of the continent.

Characteristics

Characteristics

- High temperatures during the day and very low temperatures during the night due to high terrestrial radiation.
- Large diurnal range of temperature.
- Clear/ cloudless skies.
- Receives less than 250mm of rainfall annually.
- Rainfall is localised, short and torrential and accompanied by storms which cause flash floods.
- Rain falls for a short period and the rest of the year or even several years are dry.
- High wind velocity due to little frictional force.
- Some areas experience temperatures below zero in winter with ice forming on the oasis.
- Humidity is low and evaporation rate is high.
- Sand storms are very common i.e. sand being blown through the air by the wind.

Warm Climates

They border tropical climates and they experience moderate temperatures lower than of tropical climates.

They are situated in the zone of divergence of trade winds and westeries (subtropical high pressure belt).
Subdivided into:

1. Warm temperate Western margin/Mediterranean Climate.
2. Warm Temperate Interior/continental Climate.
3. Warm temperate Eastern marginal Climate.
4. Warm temperate Deserts.

Warm Temperate Western Margin

-Also known as *Mediterranean Climate*.
-Found on the western margin or sides of continents in the following areas.

(a) Southern Europe and N. Africa in the lands bordering Mediterranean Sea.
(b) S.W tip of Africa around Cape Town.
(c) Central Chile in S America.
(d) S.W and S Australia.

Characteristics

- Hot summers with temperatures of about 21◦c.
- Mild winters with temperatures of about 10◦c.
- Characterised by hot and cold local winds called Mistral and Sirocco.
- There is high sunshine duration and intensity in summer.
- Experiences cyclonic rainfall in winter when westeries are onshore.
- Rainfall decreases inland.
- Summers are dry due to trade winds blowing offshore.
- There are distinct seasons i.e. summer, autumn, winter and spring.

Warm temperate Interior Climate

-Also called ***Steppe Type***.
It's found in the interior of continents in the following areas (grasslands):

(a) Steppe Land of U.S.S.R.
(b) Veldt of S Africa.
(c) Prairie lands of Canada and U.S.A.
(d) Pampas lands of Argentina.
(e) Downs of Australia.

Characteristics

- Warm short temperatures between 18-21◦c.
- Long winters with extremely low temperatures due to continentality which can fall up to -20◦c.
- Precipitation is received all the year round.
- Most rainfall is received in summer and snow precipitation in winter.
- Rainfall is moderate with annual mean of 500mm.
- Summer rainfall is caused by convection and depressions.
- There is high humidity in summer.

Warm temperate Eastern Margin climate

-Also known as *China Type.*

It's experienced on the eastern margins of continents in the following areas.

(a) S.E China and S. Japan.
(b) S.E Australia.
(c) S and S.E states of U.S.A.
(d) S. America in S. Brazil, Uruguay, E. Paraguay and coast of Argentina.

Characteristics

- Hot summers with a mean annual of about 26◦c.
- Mild to cool winters due to marine influence and local winds (4-13◦c).
- Receives rainfall throughout the year (about 1000mm).experiences hurricanes and typhoons.
- Convectional rainfall is common in summer.
- Rainfall is moderate between 760 and1500mm.

Warm Temperate Deserts

-Also known as Mid-Latitude Desert climate.
It's experienced in the following areas:

1. Nevada and Utah states of U.S.A.
2. Pentagonia in S. America.
3. Gobi Desert extensive desert area of southern Mongolia and northern China and the largest desert in Asia.
4. Turkey, Turkmenistan, Uzbekistan and Kazakhstan.

Characteristics

- High summer temperatures (27-37◦c).
- Cold winters as low as -7◦c.
- Very large diurnal and annual ranges of temperature.
- Low and unreliable rainfall due to great distance from the sea about 250 mm annually.
- Most rainfall falls in late winter or early spring.

Cool Climates

They differ from warm climates by having definite seasonal variations in temperature.
Subdivided into:

1. Cool Temperate Western Margin
2. Cool Temperate Continental Interior
3. Cool Temperate Eastern Margin

Cool Temperate Western Margin Climate

-Also known as ***British Type.***
It's under coastal influence.
-Found in the following areas:

(a) British Isles (Island)
(b) Central and N.W Europe
(c) N.W U.S.A. and British Columbia in Canada.
(d) S. Chile

(e) Tasmania in Australia

Characteristics

- Warm summers (13-15◦c).
- Cool winters (2-7◦c).
- Small temperature range.
- Well distributed rainfall throughout the year (760-2000mm).
- Cyclonic rainfall in the coastal lands and relief rainfall in mountainous areas.
- High humidity in winters.
- Long summer days with irregular thunderstorms.
- Convergence of sub-tropical and polar air masses.
- Onshore westerly winds are dominant.

Cool Temperate Continental Interior Climate

-Also called ***Siberian type.***

-Found in the following areas:

(a) Alaska and most of Canada

(b) Eurasia covering Sweden, Finland, Poland, Germany, across former U.S.S.R. up to Kamchatka Peninsular in the east.

Characteristics

- Warm summers with temperatures of about 18◦c.
- Generally short summers.
- Extremely cold winter temperatures which go below 20◦c.
- Long winters with long nights.
- Precipitation is mainly in form of snow during winter (annual precipitation 400-500mm).
- Convectional rainfall in summer is accompanied by thunderstorms.

Cool Temperate Western Margin Climate

It's also known as ***Laurentian Type***.

Areas:

(a) N. U.S.A. and S Canada.

(b) S. Argentina.

(c) N & S Korea, N. China, C and N Japan and E. Siberia.

Characteristics

Long warm summers with temperatures of about 18◦c.

Cold winters (-40-0◦c).

Precipitation all year round (600-1000mm).

Snow precipitation in winter.

High humidity in summer.

Cold Climates

-Also known as ***Polar Desert Climates*** or ***Arctic*** and ***Antarctic Climates***.

-Found beyond Arctic Circle i.e. 66 ½◦N and S of equator.

-Classified into **Tundra** and **Polar** Climates.

Tundra Climate

Areas:

(a) Coast of N. America bordering Arctic Ocean.
(b) N part of America from Alaska through Canada to Greenland.
(c) From N coast of Scandinavia to the N.E of Russia.
(d) Baffin Island.

Characteristics

- Short cool summers with average temperatures of about 10◦c.
- Long cold winters (-29 - -40◦c).
- Continuous days in winter and summer for several days.
- Low annual precipitation of about 250mm.
- Precipitation in form of rain and snow in winter.

Polar Climate

-experienced at the poles in the interior of Iceland, Green land and Antarctica.

Characteristics

Temperature is permanently below freezing point.
There is permanent snow cover and ice on the ground (permafrost).
Snow storms (blizzards) are common.

- Continuous winter nights and summer days with exception of equinox when sun rises above horizon.

Mountain Climates

-Experienced on high mountain ranges of the world.

Areas:

1. Mt. Kenya (5199)
2. Mt. Ruwenzori (5109)
3. Mt. Kilimanjaro (5895)
4. Mt. Everest (8848)
5. Atlas mountains in Africa
6. Rockies of N. America
7. Alps of Europe
8. Himalayas in Asia

Characteristics

- Temperature decreases with increasing altitude.
- Temperature ranges from cool to cold.
- Experiences Orographic rainfall.
- Rainfall increases with altitude up to 3000mm and starts to decrease because air is cold and hence has poor capacity to hold moisture.
- Windward slopes are wetter than leeward slopes.
- Atmospheric pressure decreases with increasing altitude.
- Local winds are common and blow up the slope during the day and down slope at night.

- In temperate regions slopes facing the equator are warmer than those facing the poles.
- Atlas mountains in Africa
- Rockies of N. America
- Alps of Europe
- Himalayas in Asia

Local/Micro Climates

Climate experienced within a small area which is slightly different compared to the general climate of the area.
It occurs on the immediate surroundings and within some phenomenon on the earth's surface.
Micro-climates can be found in the following areas:

(a) Within and around a forest

- Experience low temperatures due to trees preventing solar insolation from reaching the ground.
- Experiences high rainfall due to high rates of evapotranspiration.

(a) Urban areas

- Higher temperatures due to green house effect (situation where atmospheric gases absorb heat that is given off by the earth (terrestrial radiation) before its sent back to space causing the temperature of the lower atmosphere to increase.

(b) Around man made lakes

- Experience high convectional rainfall due to high moisture content.
- Around natural lakes experiences land breezes which cause early morning showers and sea breezes which lower temperatures during the hot season.

Aridity and Desertification

Aridity-state of land being deficient of moisture leading to little or no vegetation.
Desertification-process in which desert like conditions slowly and steadily encroach on formerly productive agricultural land.

Causes of Aridity and Desertification

1. Low and unreliable rainfall below 250mm per annum causing little or no vegetation and absence of animal and biological life causing soil forming processes to be incomplete.
2. High temperatures which cause high rates of evaporation which exceed evaporation or low temperatures which reduces air capacity to hold moisture causing a place to receive little or no rain..
3. Where a place is washed by ocean currents causing moist onshore winds to cool and then drop moisture over the sea and reach the land as dry winds e.g. Kalahari when onshore westeries cross the cold Benguela Current.
4. Where relief barriers such as hills or mountains cause some areas to lie on the rain shadow hence rain winds drop most of their moisture on the windward side and they drop on the leeward side, are warmed and hold

onto moisture causing dry conditions e.g. Kalahari and Namib on the rain shadow of Drakensberg mountains.

5. Location of some places very far from the sea causing them to be far removed from wet onshore winds e.g. Gobi Desert.
6. Where hot dry winds blow over a region causing drying effect on land e.g. Harmattan over West Africa.
7. Where cool air descends causing no rain because cool air has to rise before condensation takes place.

Human Activities

8. When people clear forests which causes runoff to exceed infiltration which interferes with the water cycle.
9. Keeping large number of animals which exceed the carrying capacity of land they eat vegetation leaving the land bear exposing the land to soil erosion.
10. Poor agricultural practices such as overcultivation, monoculture and slashing and burning which lead to soil erosion.
11. Industrialisation which releases green house gases such as co2 to the atmosphere which absorb more heat making the earths temperature to rise.
12. Reclamation of water logged areas which lowers the water table causing arid conditions to set in plants when plants can't access ground water.
13. Poor irrigation methods when evaporation takes place and salt from below are brought to the surface and are deposited on the top soil making the soil salty and hence unable to support plants.

Effects of Aridity and Desertification

1. Infertile soils which support little or no vegetation.
2. Low agricultural production due to insufficient rainfall leading to famine.
3. Shortage of water for domestic and industrial use which may also lead to shutting down of my sons.
4. Migration of people from areas affected by aridity and desertification leading to population pressure and eventually conflicts.
5. Destruction of vegetation which exposes land to soil erosion.
6. Can lead to extinction of some plants and animal species causing loss of biodiversity.

Solutions to Aridity and Desertification

1. Afforestation and reafforestation because trees protect soil from erosion, increase run off and release moisture to the atmosphere leading to increased rainfall.
2. Adopting soil conservation measures such as terracing, contour ploughing, planting cover crops etc.

3. Rearing a number of animals which is proportional to the carrying capacity of land.
4. Irrigating dry lands.
5. Introduction of energy saving stoves to reduce demand for wood fuel which will reduce deforestation.
6. Use of alternative sources of energy which don't pollute the environment e.g. solar and water.
7. Introducing drought resistant crops in the arid areas.
8. Controlling industrialisation by setting laws governing pollution.

Climate Change

-Establishment of a new climatic state.
-Continuous changes in climatic states such as temperature and precipitation over time.

Causes of Climate Change

Natural Causes

1. **Variations in the Earths Orbital Characteristics**

-Changing or earths orbital characteristics within 1000 years from elliptical (aphelion) to nearly circular (perihelion) when the earth is nearest to the sun and receives maximum solar energy and back to elliptical when the earth is farthest from the sun and receives least solar energy.

2. **Variation in the Atmospheric Carbon Dioxide**

-When natural rise in temperature cause carbon dioxide held up in cold ocean waters to be released to the atmosphere after oceans warmed.

3. **Volcanic Eruptions**

- When large quantities of volcanic ash and dust thrown out of the ground block some of the solar insolation from reaching the earths surface causing temperatures on the earths surface to drop for a short period.
- When sulphur dioxide given off during volcanic eruptions reacts with water vapour forming a bright layer within stratosphere reducing the amount of solar radiation reaching the surface by reflecting some of it back which also lowers temperatures on the surface.

4. **Variation in Solar Output**

-changes in the amount of solar energy given off by the sun whereby at times its less causing drop of temperature on the earths surface and at others its gives off more causing rise in temperature on the surface.

Human Causes

1. Burning of fossil fuels in industries, transportation, electricity generation etc. which contributes 65% of additional co2 in the atmosphere which is the main green house gas.
2. Burning of vegetation e.g. in shifting cultivation and forest fires which also adds co2 in the atmosphere.

3. Clearing large tracts of forests foe agriculture, settlement etc. which reduces the main deposal system for co2 from the atmosphere by photosynthesis.
4. industrial developments which add gases like methane, nitrous oxide and those containing chlorine and chlorofluorocarbons which damages ozone layer which filters a greater percentage of ultra violet radiation given off by the sun which causes the average temperatures on the earth to rise.

Consequences of Climate Change

1. Global warming due to green house effect by gases added in to the atmosphere and destruction of ozone layer.
2. Increased rainfall as a result of high temperatures causing high rates of evaporation causing wet areas to become wetter and dry areas to become drier.
3. Effect on agriculture by causing crop growing areas to shift to cooler altitudes and latitudes e.g. wheat growing areas of Canada shifting to the poles and causing dropping or failure of crop yields in area where temperatures have increased.
4. Water shortage when climate becomes drier causing less water to infiltrate underground and hence less water to feed rivers.
5. Submergence of coastal areas causing flooding when Antarctic and Arctic glaciers melt and water is added to the oceans.
6. Heat waves due to increased temperature which leads to death of people.
7. Receding and disappearance of ice caps on mountains e.g. Mt. Ruwenzori.
8. Abnormal growth of plants due to increased amounts of co2 causing increased rate of photosynthesis which may lead to increased yields of major crops, poor soils due to soils having to sustain high rates of plant growth.
9. increased levels of ultra violet radiation which causes human diseases such as skin cancer, lowering crop production by slowing photosynthesis and germination, lowering fish population by damaging plankton which fish eats and degradation of paint and plastics.

Solution to Climate Change

- Afforestation and reafforestation.
- Use of energy saving stoves to reduce the rate of deforestation.
- Use of alternative sources of energy which are environmentally friendly e.g. solar and water instead of fossil fuels.
- Proper maintenance of vehicle to reduce emissions from their exhausts.
- Use of public transport to reduce the amount of fossil fuel used and hence the amount of co2 added into the atmosphere.

5. VEGETATION

-Plant cover on the earths surface.

Types of Vegetation

1. **Natural Vegetation**

-Which grows by natural means of seed dispersal without interference and modification by man.

2. **Semi- Natural/Derived Vegetation**

-Natural vegetation which is in the process of recovering from interference by man.

3. **Planted/Cultivated Vegetation**

-Vegetation planted by people e.g. forests of exotic trees, trees in Agroforestry and plants used as hedges e.g. cypress.

Factors Influencing Types and Distribution of Vegetation

Topographical Factors

1. Altitude

- Coniferous trees are found at high altitudes because they are adapted to cool conditions.
- There is no vegetation on mountain tops because there are very low temperatures which inhibit plant growth.

2. Terrain

- Gentle slopes which have deep and well drained soils are best suited for plant growth than steep slopes which have thin soils due to severe erosion and less soil water to sustain plant growth due to high runoff.
- Flat areas have poor drainage hence are swampy and can only support swamp plants.

3. Aspect

There are a wide range of plants on the slope facing the sun and in the direction of rain bearing winds as they are warm and wetter. Grass lands are dominant on the leeward side because they are drier.

4. Drainage

There is a large variety of plants on well drained soils while water logged soils have swamp plants such as reeds and papyrus.

Climatic Factors

1. Temperature

- Plants in warm areas are large in number and grow faster e.g. in the tropical lands. Also there are deciduous trees which shed leaves to reduce the rate of transpiration.
- In areas with low temperatures there is slow growth of plants and coniferous forests are found there.

2. Precipitation

- There are a large number of plants in areas with high precipitation and these areas are dominated by forests which are broad leaved to increase the rate of transpiration.
- Areas with moderate rainfall are dominated by grasslands and those with little rainfall have scanty vegetation of scrub and desert types.

3. Sunlight

- There is large number of plants in areas experiencing long sunshine duration.
- There is little undergrowth in tropical rain forests because the canopy prevents sunlight from reaching the ground.

4. Wind

- There is heavy rainfall in areas where warm moist blow to and hence a large number of plants which may be broad leaved to increase the surface area for transpiration.

Edaphic/Soil Factors

- Fertile soils have a larger number of plants while infertile soils have scanty vegetation.
- Soil pollution e.g. oil spillage cause drying up of plants.
- Deep soils have deep rooted plants such as trees while shallow rooted soils have shallow rooted plants such as grasses and shrubs.

Biotic/Biological Factors

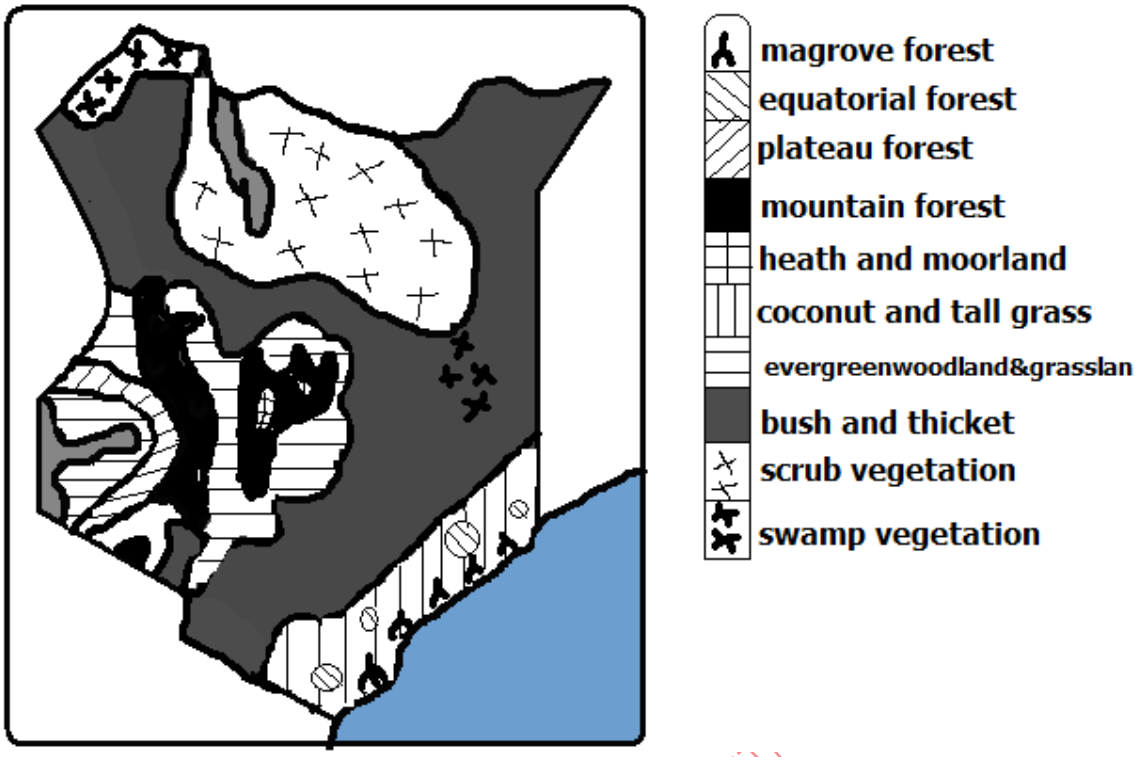
1. Living Organisms

- Bacteria, earth warms and burrowing animals improve soil fertility resulting into more vegetation growth.
- Insect and birds pollinate plants enhancing their propagation.
- Bacteria and insects cause plant diseases of plants resulting in death of some e.g. aphids which affected cypress in late 80s.
- Large herds of wild animals can destroy vegetation through overgrazing and can turn grasslands into deserts.

1. Human Activities

- Clearing of natural vegetation for settlement, agriculture etc. can lead to desertification.
- Bush fires such as burning grasslands for the grass to sprout can cause extinction of some plant species.
- Overstocking can lead to overgrazing turning grasslands into deserts.
- Rehabilitation of deforested areas can stop the spread of deserts.

Vegetation in Kenya



1. Forests

The area under forest is less than 7%.
The bulk is found in Central Highlands

(a) Plateau Forests

It used to cover extensive areas around L. Victoria but today there are few patches around the lake in Maragoli, Kakamega, Kaimosi, Malava, Turbo and Tinderet forests.
They are tropical rain forests with tall trees standing among shorter trees intertwined with creepers.

(b) Lowland Forests

-Found along the Kenyan coast.
The main types are:

- Mangrove forests which grow in shallow waters and
- Tropical rain forests in Shimba hills in Kwale District and Arabuko Sokoke in Kilifi.

(c) Highland/Mountain Forests

-Found on the slopes of Mt. Kenya, Aberdare forests, Iveti, Mbooni, Kilala and Marsabit forests.
Indigenous hardwoods are olive, Meru oak, mvule, Elgon teak and camphor while indigenous softwoods are podocarpus and African pencil cedar and bamboo.
They have been planted with exotic hard wood trees e.g. eucalyptus and silver oak and exotic softwoods such as pines, cypress, fir and wattle.

2. Savanna

-Most widespread vegetation covering about 65% of the total area.

(a) Wooded/Tree Grassland

-Found along the coastal strip and on the plateau bordering highlands east of rift Valley.
-Consists of grass of 1m mixed with thorny acacias.
Where rain decreases trees become fewer and shorter and the grassland becomes more open.
There are many large trees along water courses due to abundant moisture (riverine or gallerie forests).
The trees shed leaves during the dry season to reduce the loss of water by transpiration.

(b) Bushland and Thicket

-Covers about 48% of savannah.
-Found between coastal land and Machakos and extends into Kitui, Mwingi, Garissa, Wajir and Mandera districts.
-Consists of a mixture of thorny acacias and shorter thorny shrubs between forming thorn bush with gaps between bushes which are bare or covered by scattered varieties of grasses.
Plants are adapted by:

- Having thin leaves and hard cuticle to reduce transpiration rate.
- Baobab has large trunk to store water for use during long dry period.
- Shedding of leaves to conserve water.

(c) Highland Grassland

-Found on the undulating slopes of grasslands.
-Grasses are such as red oat, wire, Manyatta and Kikuyu grass where forests have been cleared.
-Clover grows along kikuyu grass where rainfall is over 1000mm.

3. Semi-Desert and Desert Vegetation

-Covers about 21% of Kenya.
It's found on the parts of N.E and N Kenya including Marsabit and Turkana districts.
It receives insufficient rainfall of less than 380mm annually.
It has mainly scrub type of vegetation (covered with underdeveloped trees or shrubs).
A shrub is a plant lower than a tree with a small woody stem branching near the ground.
The shrubs are up to 1m and grasses are up to 3m and in between there is bare ground.
Tree species are acacia and comiphora.
Real deserts hardly have any vegetation.

Adaptations plants (Xerophytes)

- Some have thick leaves to store water.
- Long tap roots to access water from rocks below.
- Needle like leaves to conserve water.

- Shedding of leaves to conserve water (deciduous).

4. Heath and Moorland

-Vegetation found towards the mountain tops.

- At lower altitudes there is groundsel, lobelia and heather.
- Where there is poor drainage there is mountain swamp vegetation referred to as bogs.
- At high altitudes there is tussock grasses, flowering plants and alchemilla shrubs. This vegetation is adapted to cold windy conditions towards the summit.

5. Swamp Vegetation

-Vegetation found in areas with flat relief in wet areas along river courses and areas experiencing periodic flooding e.g. along the course of R. Tana, Lorian swamp in Isiolo, Wajir and Garissa and the mangrove belt along he coast.
Vegetation found there are marshes, grasses with smooth surfaces and long blades and papyrus which is dominant.

Vegetation Zones of the World

A. Forests

A forest is a continuous growth of trees and undergrowths covering large tracts of land.

1. Tropical Rain Forests

-Known as Selvas in S. America.
It's found in the following areas:

1. Congo Basin
2. Amazon Basin
3. Western sides of India, Burma and Vietnam.
4. Coastal land of Queensland Australia.

Characteristics

- Closely set trees with three distinct canopies.
- There is less undergrowth on the forest floor due to light being obstructed by canopies.
- Trees take long time to grow.
- Trees have large trunks with buttress roots (radiating wall like roots).
- Trees have broad leaves to increase the surface area for efficient transpiration due to high precipitation.
- There is varied number of plants species over a small portion.
- Trees are tall, have smooth stems and straight trunks.
- Some trees are evergreen shedding a few leaves at a time while others shed leaves and are left bare.
- Some trees are very heavy and don't float on water.
- Trees take very long time to mature between 70-100years.

Types of trees present are mahogany, ebony, ironwood, rose wood, camphor and Sapele.

Tree creepets and parasites are found around tall main trees.

Uses of tropical rain Forests

(a) Trees are valuable sources of timber for furniture, building and construction.
(b) Oil palms are for production of palm oil.
(c) Cacao crops for production of cocoa beans used to make cocoa used to make chocolates and beverages.
(d) Chicle from the bark of Zabote tree is used to make chewing gum.
(e) Ivory nuts are used for making buttons.
(f) Fibres from torquilla palm are used for making hats, mats, baskets and thatching materials.
(g) Cinchona tree's bark contains quinine used in malarial treatment.

2. Mangrove Forests

-Found in low lying muddy coasts of tropical seas with shallow salty waters.

Areas

1. Along the east coast of Africa.
2. Near the estuary of Amazon River in S. America.

Characteristics

- Dominated by mangrove trees and 30 other species of trees.
- Mangrove trees have special roots which are partly aerial to aid breathing. Some grow horizontally and then vertically downwards into mud while some grow horizontally in mud and bend upwards to aid breathing and others have net work of roots resembling stilts.

Uses of mangrove Forests

1. Mangrove trees provide tannin used for tanning leather.
2. Mangrove poles are used for building and construction because they are very strong.
3. Mangrove trees are also used for firewood.
4. Mangrove forests are habitats for marine life used for tourist attraction.

3. Tropical Monsoon Forests

Location

1. S.W and S coast of Mexico
2. parts of India, Bangladesh, Burma, Vietnam and Indonesia
3. Monsoon lands of Australia

Characteristics

- Most trees shed leaves during dry season and grow during hot wet season.
- Smaller number of tree species than tropical rain forests.
- Tall species of trees rising up to 30m.
- Trees don't grow together.
- Trees have more branches because of light penetrating at lower levels.
- Denser undergrowth than tropical rain forests.

- Particular species of trees dominate an area (pure/definite stands) e.g.
  -Leak in Burma
  -Sal in India
  -Eucalyptus in Queensland Australia
  -Bamboo in S.E Asia
- Dominant tree species are leak, bamboo, acacia, camphor, ebony, Sapele and Pyinkaido.

Uses of tropical Monsoon Forests

(a) Teak in Burma and Thailand is used for building houses and boats because it's hard and resistant to termites.
(b) Bamboo and rattan creeper are used for making furniture, baskets and weaving.
(c) Young tender shoots of bamboo are consumed as vegetables.

4. Mediterranean Forests

Areas

1. S. Europe and N. Africa areas bordering Mediterranean Sea.
2. Around Cape Town on S.W end of Africa.
3. Central coast of California.
4. Around Perth in S.W Australia.

Characteristics

- Forests are open woodlands.
- Many trees are deciduous.
- Some trees are evergreen e.g. oak
- There is woody scrub vegetation in areas which are dry and with poor soils which is called marquis in France, Chaparral in California and Machia in Italy.
- Many plants are sweet smelling (aromatic) e.g. rosemary, lavender, oleander, broom and myrtle.
- Many trees are xerophytes e.g.
  - Trees have long tap roots to reach the water deep below during long dry spells.
  - Waxy leaves to reduce transpiration
  - Storing water in their thick leaves or stems
  - Small spiny leaves
- Types of trees are olive, sweet chestnut, beech, cedar, cypress, sequoia, eucalyptus

Uses

(a) Cork oak is used to make corks for bottling wine.
(b) Olive tree fruits are used for cooking and extraction of olive oil.
(c) Timber from sweet chest nut, beech, cedar, cypress and pine is used for building houses and making furniture.
(d) Shrubs and grasses are used as pasture for goats.

5. Temperate Evergreen Forests

-Found in areas experiencing warm temperate eastern margin or China Climate.

Areas

1. Along Natal coast in S. Africa
2. S. china and S. Japan
3. S.E Australia
4. S.E and S. states of U.S.A.

Characteristics

- Evergreen because of abundant rainfall throughout the year.
- Most trees have broad leaves to increase the surface are for efficient transpiration.
- Many evergreen trees are hardwoods.

Uses

(a) Hard woods such as oak and iron wood are used for furniture and building materials.
(b) Soft woods such as cypress and pines are used for furniture.
(c) Wattle trunks are used in the coal mines of natal.
(d) Bamboo is used for making furniture and building in China and Japan.
(e) Walnuts provide nuts used for making chocolate.
(f) Ivory nuts are used for making buttons.
(g) Young shoots of bamboo are eaten as vegetables in china and Japan.

6. Temperate Deciduous Forests

-Found in areas experiencing cool temperate western marginal climate.

Location

1. C. and W. Europe.
2. Most of E. states of U.S.A.
3. Chile in S. America.

Characteristics

- Trees are deciduous and shed leaves in autumn and become green in summer.
- Individual species of trees are scattered and their density per unit area is small.
- Trees are smaller in size.
- Trees are broad leaved.
- Most of the trees are hardwoods
- There is rich undergrowth because of being fairly open.
- Trees grow in pure stands in some regions and at others they are mixed.
- Trees are easier to exploit than tropical hardwoods.

Uses

(a) Hardwoods such as oak and birch are used for timber, wood fuel and charcoal.
(b) Chestnut and walnut nuts are edible.
(c) Oak tree fruits are used for feeding pigs.
(d) Tung tree yields oil for making paint and furnish.

(e) Maple sap is used for making maple syrup.
Trees include eucalyptus (blue gum), olive, birch, walnut, elm and ash.

Coniferous Forests

It's dominant in cool climates. It's known as Taiga and Boreal in Russia.

Location

1. W. coast of Canada.
2. Scandinavia across Russia to the Pacific coast.

Characteristics/of soft woods in Canada

- Their seeds are cone shaped.
- Most trees are softwoods and are light in weight.
- Trees mature faster than hardwoods of tropical regions.
- Trees have big proportion of stem compared to leaves.
- Most tree species are evergreen with few shedding leaves e.g. larch and fir.
- Tree species occur in big pure stands.
- Very little undergrowth due to acidic humus from leaf fall.
- Trees have straight trunks.
- Trees mature after a long period of time (50-70 years) due to the cold conditions especially in winter.

Species of trees found here are pines, Fir, spruce, larch and Hemlock.

Adaptations

- Needle-like leaves to reduce transpiration.
- Leaves with tough waxy skin to protect them from winter cold.
- Tree crowns are cone shaped and flexible crowns to allow snow to slide off to prevent it from accumulating on the branches.
- Trees are evergreen to have maximum utilisation of sunlight during the short summers.
- Flexible tree trunks to allow swaying so as to allow swaying so as not to break during strong winter winds.
- Widely spread root system for maximum utilisation of moisture from top soil because sub soil is permanently frozen.

Used

Soft woods such as spruce, fir, pine and larch are used for construction, wood pulp used in paper manufacture.

7. Mixed Forests

-Found at the zone of transition between temperate deciduous and coniferous forests.

Location

1. Saskatchewan and Alberta provinces of Canada
2. Scottish regions in Europe
3. low lying Mediterranean regions

Characteristics

A mixture of broadleaved deciduous and coniferous trees.

Uses

Cedar and hazel are used for fencing posts.
Grazing activities are carried out where forests are open.
Softwoods such as spruce, fir and pine are used to make wood pulp used for paper manufacture.
Hardwoods such as oak and birch are valuable sources of timber, wood fuel and charcoal.
Maple tree syrup is used for making maple syrup.

B. Grasslands

-Found in climatic regions where a seasonal pattern occurs with a prolonged drought of about 5-7 months.

Tropical Grasslands/ Savanna

-Found in areas experiencing tropical continental climate.

Areas

1. N and S of Congo Basin.
2. Between Sahel and equatorial forests in E. Africa plateau.
3. N.E of Australian Desert.
4. Brazilian highlands

It's divided into:
(a) Open grasslands where grass is dominant and
(b) Woodlands in areas which receive more rainfall.

Characteristics

- Grasslands with widely spaced trees such as acacias.
- Grasses die in dry season and sprout quickly when it rains.
- Grasses are tall (up to 3m with stiff blades and elephant grass is tallest reaching up to 4m.
- Trees are of medium size up to 13m
- Tree crowns are umbrella shaped to provide shade around roots to reduce evaporation.
- Most trees are deciduous and shed leaves during dry season.
- Trees have small leaves and thick barks to reduce transpiration.
- Trees have long tap roots to reach the water deep below during long dry spells.

Uses

(a) Grass is for grazing and commercial ranching though it's of low nutritional value due to lack of phosphorous.
(b) Cereals e.g. wheat farming because the soil is rich in humus resulting from the grass cover.
(c) Vegetation acts as soil cover to reduce soil erosion.
(d) Homes of wild animals which attract tourists e.g. E. and C. African savannas.
(e) Trees are habitats for bees which provide honey.
(f) Some shrubs and herbs are used for medicine.
(g) Trees such as acacia provide fuel wood and charcoal.

Temperate Grasslands

-Found in continental interiors of temperate grasslands where rainfall isn't sufficient to sustain forests.

Location

The Prairies

Areas

-Canadian provinces of Alberta, Saskatchewan, Manitoba and neighbouring states of U.S.A.

Characteristics

Continuous tuft grass
Grasses are nutritious.
Grass is short
Grass is interspersed with bulbons and leguminous plants.
Grass is mixed in some areas with species such as stipa, buffalo and gamma grasses.
Tall grasses in areas with rainfall of over 500mm.

The Steppes

-Found in Eurasia- temperate interiors of Europe and Asia.

Characteristics

True Steppes-rich carpet of grass and some flowering plants.
Desert steppes-Coarse grass growing in tufts
-Grass doesn't form a continuous cove on the ground.
-Short grass which grows very close to the ground.

The Pampas

-Found in Argentina.

Characteristics

Feather-like grass
Grass forms individual tussocks with patches of bare soil.
Forests are present in some areas due to increased moisture.
Xerophytic or drought resistant plants are present in some areas.

The Veldt

-Found in S. Africa.

Characteristics

- Grasses are extensively spread.
- There is little or no mixture of trees or shrubs.
- There is a uniform cover of grass on high plateaus.

The Downs

-Found in Australia and New Zealand.

Characteristics

- Tall grass mixed with trees.
- Semi desert areas have patches of dominant grass.
- Mixture of temperate and tropical grass species.
- Grass is nutritious and nutritious for livestock.

- Natural grasses of Argentina have been replaced by Alfalfa and in New Zealand British meadow grasses now dominate.

Uses of Temperate Grasslands

(a) For grain cultivation e.g. wheat which requires as low as 325mm of rainfall.
(b) For cultivation of other crops e.g. oil seeds, Soya beans, vegetables and millet and sorghum widely grown in the Veldt.
(c) For livestock farming e.g. cattle, sheep, goats and horses. There are scientifically managed ranches called Estancias in Argentina.

Desert Vegetation

Tropical Desert Vegetation

-Found in tropical deserts.

Characteristics

- Vegetation is present except in bare rock and sand covered areas.
- There are more plants on oasis e.g. date palms and a variety of shrubs.
- Some plants are succulent to have high water storage capacity.
- Some have spines to protect them from animals.
- Some have thorn-like leaves to reduce rate of transpiration.
- Some have long roots to enable them to tap water from deeper parts of rocks.
- Some shed leaves during dry season and grow new leaves during wet periods to reduce water loss.
- Some are salt tolerant (halophytic) by having many water storing cells to counter soil salinity or alkalinity.

Temperate and Arctic Desert Vegetation

-Found in warm temperate deserts and arctic climates.

Characteristics

- Grasses and woody plants.
- Woody plants which are Xerophytic and halophytic.
- Shrubs have shallow roots due to permafrost.
- Plants flower and produce fruits within short wet season.
- There is scarce vegetation in Tundra.
- Plants present in arctic deserts are such as lichens, mosses and flowering plants such as anemones and marsh marigold.

Uses of Desert Vegetation

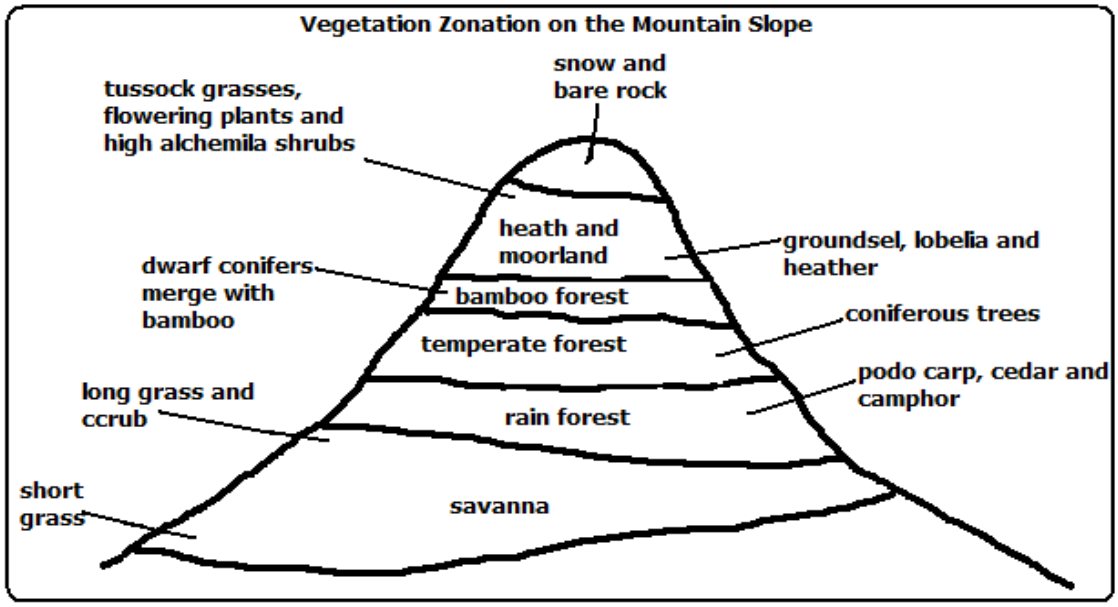
(i) Bilberries in temperate deserts bear edible fruits.
(j) Small trees are source of fuel foe Eskimos who live in arctic region.
(k) Vegetation in tropical deserts is important in arresting sand dunes to prevent them from burying oasis and settlements.
(l) In tropical deserts fringes vegetation is valuable food for animals.
(m) Date palm is cultivated for its fruit.

Mountain Vegetation

-Vegetation found towards the top of the mountain.

Uses of Mountain Vegetation

(e) Grasslands are used for grazing.
(f) Alpine meadows in temperate regions provide summer grazing pastures.
(g) Mountain forests provide timber, building materials, fuel wood and charcoal.
(h) Mountain forests are habitats for wild animals e.g. elephants.
(i) Mountain vegetation makes mountains to be water catchment areas.
(j) Mountain forests help to purify air by absorbing carbon dioxide and providing oxygen.
(k) Mountain vegetation is used for research.



Significance of Vegetation

(f) Forests add beauty to country's landscape.
(g) Vegetation protects soil from erosion by wind and rainwater.
(h) Vegetation partly decays forming humus making the soil fertile.
(i) Some plants roots, barks and leaves are used for medicine.
(j) Forests modify the climate of the surrounding area by increasing rainfall and reducing temperatures.
(k) Some plants such as bamboo shoots and wild fruits are consumed as food.
(l) Some fibrous plants such as sisal and jute are used for making ropes, sacks, mats, etc.
(m) Latex from rubber tree is used for manufacture of rubber used in tire manufacture.