

WEEK 3

SUBJECT: BIOLOGY

CLASS: SS1

TOPIC: RELATIONSHIP BETWEEN SOIL TYPES AND WATER-HOLDING EFFECT OF SOIL ON VEGETATION

Specific objectives: By the end of the lesson. Students should be able to:

1. Define soil
2. State the composition of soil
3. Mention the major types of soil found in Nigeria
4. Describe an experiment to compare porosity and water holding capacity of various soil types
5. State various instruments used to measure various ecological factors
6. Explain how these instruments are used
7. Draw the diagram of some common measuring instruments

Soil could be defined as the upper surface which is important for the growth of plants. It could also be defined as the most outer layer of the earth's crust in which plants are normally fixed by their roots. Soil is formed during weathering of rocks by extremes of temperature, wind, rainfall, snow and frost.

Composition of soil

The soil is made up of the following:

1. Rock particles
2. Humus (organic matter)
3. Air
4. Water
5. Mineral salt
6. Living organisms

Types of soil

Soils are of various types, and the common ones in Nigeria include:

- Loamy soil
- Sandy soil
- Clay/ clayey soil

LOAMY SOIL: Characteristic features of loamy soil include:

1. Loamy soil retains the adequate amount of water needed by plants. It has enough air spaces for the respiration of roots. It provides the richest quantity of plants nutrients
2. It is the best for agricultural purposes/crop production because of its combination of good physical properties of sand with chemical properties of clay
3. It has large particles of intermediate sizes, mixed with some sand and clay.

4. It consists of humus, coarse and fine soil particles.

SANDY SOIL: the characteristic features include:

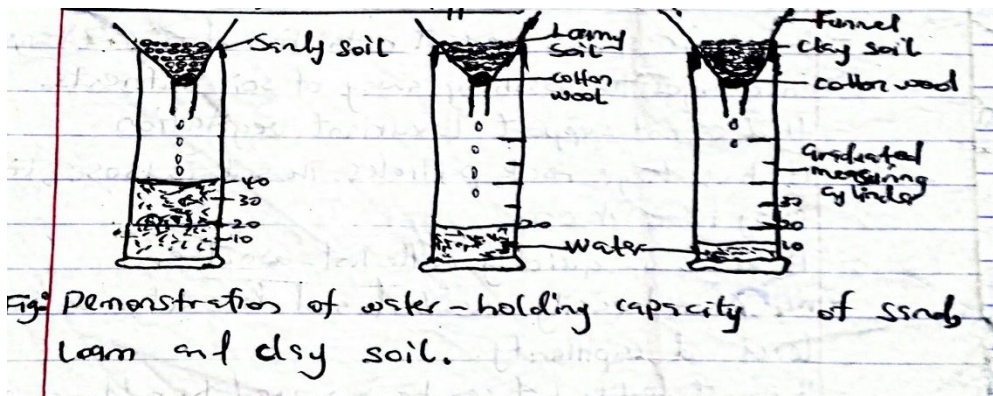
1. It has plenty of air spaces needed for the respiration of roots
2. Large air spaces prevent retention of rain water; it also encourages the washing away of soil nutrients
3. It does not support luxuriant vegetation
4. It has large rock particle. The soil is loose, light and easy to work on
5. It dries up quickly in hot weather
6. Sand particles are sharp to feel when rubbed between palms or fingers
7. Water is not easily absorbed and does not rise to a high level at capillarity
8. It is not fertile but can be improved by adding manure.

CLAYEY SOIL: characteristic features are:

1. It has very little air spaces, this makes it very difficult for plants to respire properly
2. It is very compacted because of fine particles
3. It is water-logged, wet and difficult to work on
4. There is poor growth of plant in this soil
5. It does not drain water well
6. Water can rise to high level by capillarity
7. It is hard when dry and can crack; when wet it is sticky and can be molded into various shapes

Experiment to show variations of water retention activities of the soil types

Aim: to compare porosity and water-holding capacity of various soil types



Method: Get three calibrated measuring cylinder. Plug the neck of the filter funnel with cotton wool and place over each of the measuring cylinder. Put equal weight of the soil samples into each of the funnel. Pour equal volume of water (say 80cm³) on the soil samples. Leave the set up until water stops dripping from the funnels. Determine the amount of water by taking the reading at the cylinder. Record your observations.

Results: The observations are tabulated below;

Type of soil	Volume of water added	Volume of water drained	Volume of water retained
Sandy	80cm ³	40 cm ³	80 cm ³ -40 cm ³ =40 cm ³
Loamy	80cm ³	20 cm ³	80 cm ³ -20 cm ³ =60 cm ³
Clay	80cm ³	10 cm ³	80 cm ³ -10 cm ³ =70 cm ³

From the results, clay retains most of its water while more volume of water is collected in the measuring cylinder carrying sandy soil. It shows that clay retains more water than the other two, while loamy soil retains more water than sandy soil.

Conclusion: Sandy soil is more porous than loamy soil, and loam is more porous than clay

Simple Measurement of Ecological Factors

Ecological factors affect living things in the habitat. These factors influence plant and animal distribution and their mode of life in the various habitats. These factors are specifically measured using some equipment otherwise called **MEASURING INSTRUMENTS (figure 2)**.

Some instruments used for measuring various factors in a habitat and the procedure for using them

Instrument	Ecological factor	Procedure for using it
Thermometer	Temperature	Hang it in the atmosphere/soil for some time and read the temperature
Waxed-bulb thermometer	Temperature of water	A waxed-bulb thermometer is tied to a string knotted at regular intervals. Take the reading of the temperature of water at different depths
Rain guage	Quantity of rainfall	Leave the rain guage in a suitable place in the ground, free from shade/trees. After rainfall, read the level of water in the cylinder daily, weekly or monthly and then calculate with the formula given below $D/d^2 \times h = \text{rainfall in cm for time/period}$ Where D= diameter of collecting cylinder, d= diameter of funnel mouth, h= height of rain water in cylinder
Anemometer	Wind speed	Set up in a convenient place/free of obstacle. Observe the speed/rate of rotation shown in metres per second(m/s)
Wind vane	Wind direction	The pole bearing the wind vane is erected in an exposed place free from trees and tall buildings. As the wind blows, the arrow rotates freely and indicates the direction of the wind

Light meter/photometer in terrestrial habitat, in aquatic habitat(hydro-photometer)	Light intensity	Expose to sunlight. Take reading
pH indicator/colorimeter	Acidity or alkalinity	Place some soil sample/water in a crucible containing some indicators and leave for 1-2 minutes. Compare its colour with the chart supplied with the indicator
Barometer	Atmospheric pressure	Expose to habitats. Take readings
Hygrometer	Relative humidity	Swirl several times. Take readings
Secchi disc	Turbidity/transparency of water	Lower a weighed white disc into water with graduated cord. Record the depth at which the disc disappear from sight and the depth at which it reappears again. Record the average of the two depths in centimetres (cm)
Hydrometer	Water density	Put inside water. Allow to stand and take reading
Metre rule/height metre	Depth of water, height/distance	Place it to cover the required distance. Take reading

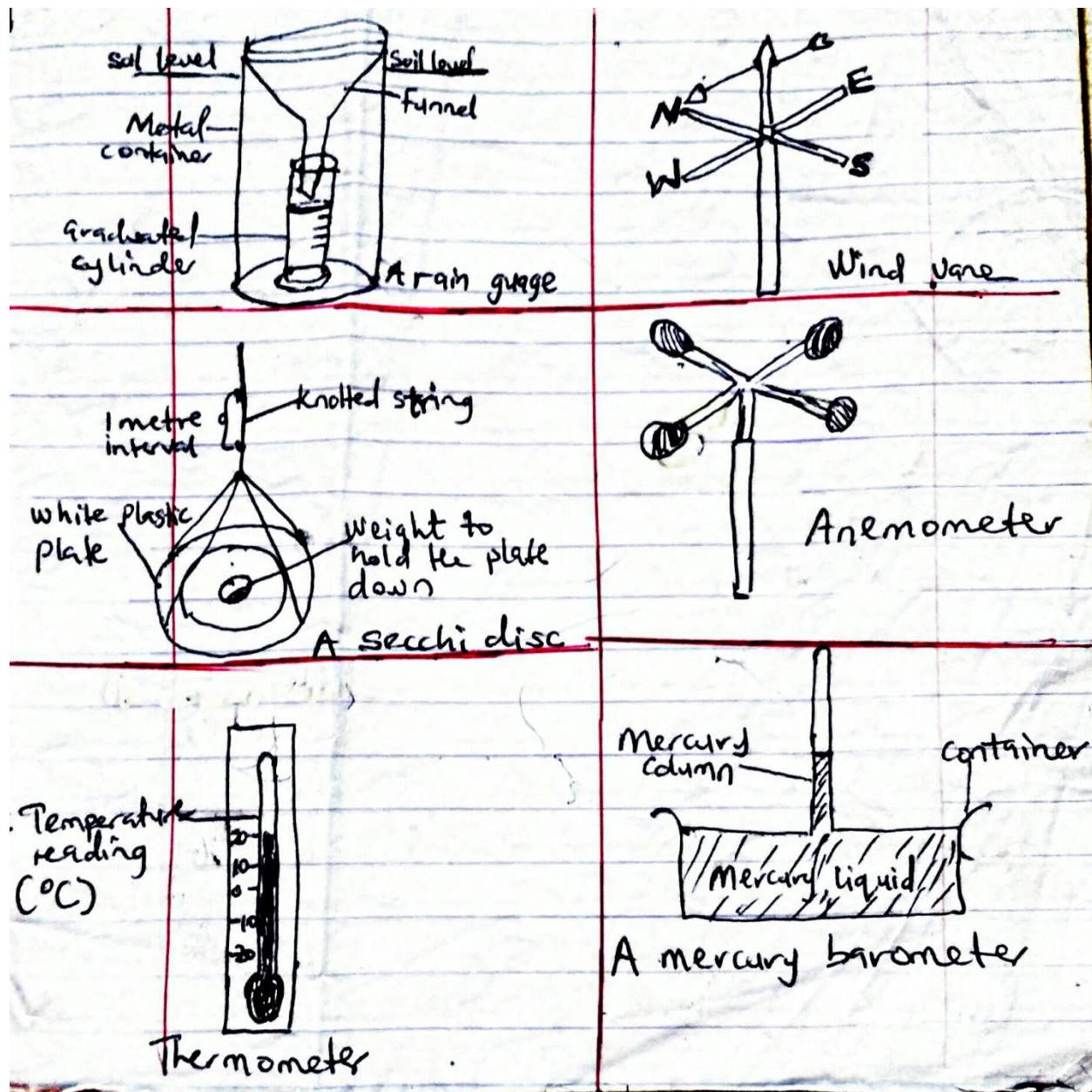


Figure 2: Diagrams of some common measuring instruments

Evaluation

1. What is soil?
2. State 4 compositions of soil
3. Mention 3 types of soil
4. Which soil is more porous from the experiment and give one reason for your answer
5. State the instruments that can be used to measure pressure and relative humidity in an ecosystem
6. How can you use wind vane to determine the direction of wind in your environment?

Assignment

- 1a. What type of soil is the best for Agricultural purposes?
- b. State one reason for your answer in (1a) above
2. Mention two advantages of sandy soil when compared with clayey soil
3. What is the difference between hydrometer and hygrometer?