

Teacher Packs in Experimental Science

Bio Pack 9

Soil Erosion

Pack contents:

- A. Teachers' Guide
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Curriculum areas covered:

Year 2 Semester 1 Unit 5.0 of Diploma in Basic Education Biology Curriculum for designated Science and Mathematics Colleges of Education in Ghana.

Title: Soil Erosion

Target group: DBE students

Also suitable for: Senior high school students

Learning outcomes:

These are the learning outcomes expected after students have gone through this Pack

1. Knowledge and understanding

KN1 Describe the nature of soil particles.

KN2 Demonstrate how environmental degradation can lead to soil erosion

2. Cognitive skills

CS1 Explain how soil erosion comes about.

CS2 Identify the type of erosion taking place in their environment.

3. Key skills

KS1 Put forward hypothesis for solving problems

KS2 Planning experiments for answering research questions

KS3 Carrying out experiments for checking soil erosion.

4. Practical skills

PS1 Determine the soil profile in areas where erosion is prevalent

PS2 Determine the steps to be taken to prevent erosion.

PS3 Observe and record experimental results accurately.

A. Teacher's Guide

This pack is to introduce students to the practical activities involved in preventing soil erosion

1. Let students work in groups.
2. Let students go round the school compound to identify sections where soil has been eroded.
3. Let students sketch or take photographs of different types of soil erosion.
4. Let students collect samples of soil from the eroded areas and analyze the soil particles
5. Guide students to follow the experimental procedure and record their results.
6. Let students relate the type of erosion to the soil particles in that area.

Sample Assessment Questions and Answers

- a. Describe how environmental degradation can lead to soil erosion.

(Answer: Environmental changes such as bushfires will expose the soil particles to wind which can blow off the loose soil particles thus bringing about sheet erosion. The run off of rain water washes away loose particles)

- b. Explain how soil erosion occurs

(Answer: When the soil particles are loosened they are carried away by such agents as water or wind, hence erosion will occur.)

- c. Describe how you will determine the structure of soil particles in the areas where soil has been taken from.

(Answer: Get a measuring cylinder of volume 1000ml, put a specimen of soil [about 50g] in it and shake about 500ml of water with it and let the mixture settle. The smallest particles will settle on the top followed by medium and the largest ones at the bottom).

- d. Why should soil erosion be prevented?

(Answer: To prevent gullies from forming and also to prevent leaching).

B. Students' Guide

This pack is to introduce students to the practical activities involved in preventing soil erosion

Background to experiment

Soil is a finely divided material that covers much of the earth's crust. It is derived from broken particles and decayed organic matter (humus). It also contains organisms, water, air and mineral salts. The study of soil is important because man and other animals depend on the plants, which grow in it for food and other uses. If soils are not well looked after, they may lose their fertility. This can happen in many ways. Some of these are: soil erosion, leaching, and surface compacting.

The increase in industrial activities such as mining, has greatly affected the landscape in many parts of the world. These activities expose the soil to erosion. In savanna, cattle herdsman may let the sizes of herds grow until the carrying capacity of the land is exceeded and the soil becomes increasingly exposed because of over grazing. The **consequence is erosion of the soil surface**, making the area even less able to support the large herds of cattle. Erosion can also follow crop growing if bare, sloping surfaces are left from which rains wash the soils, or from which, in the dry season, wind carries away the topsoil as dust.

Improvement of soil by the addition of nutrients and water presupposes the existence of soil to which these things can be added. If the system of agriculture is such that the soil is lost by erosion, the basis for any kind of cropping has gone.

Soil Erosion is the removal and carrying away of the fertile topsoil usually by action of water or wind

Kinds of Soil Erosion

- a. Erosion by water: Sheet, Rill, and Gully erosion
- b. Erosion by wind

Causes of Soil erosion

- a. Bush burning
- b. Deforestation
- c. Overgrazing by animals
- d. Construction

Conservation of the soil

Conservation is partly concerned with preventing or correcting environmental destruction caused by agricultural and industrial activity. Conservation can also be referred to as the protection, preservation and careful management of the soil in order to maintain its fertility. The following conservation methods are concerned with the control of soil erosion: Cover cropping, terracing

contour ploughing, strip cropping, avoiding over grazing, mulching, reforestation, bush fallow, crop rotation, manuring, composting, fertilizing, irrigation, etc.

Equipment/Materials

- Empty can
- 750 ml measuring cylinder
- tall transparent glass that can be graduated
- Hand lens
- Hand shovel/cutlass for collecting digging soil
- Stop clocks
- boxes

Other requirements

A sketch book, Notebook, Pens and pencils for drawing and for taking notes, Eraser

Experimental Procedure 1

Observing types of soil erosion

1. In groups of three or individually go round the school compound to identify sections where soil has been eroded.
2. Sketch or take photographs of different types of soil erosion around your compound.
3. Find examples of sheet, rill and gully erosion nearby and observe them carefully.
4. Discuss how they were formed.
5. How can their formation be prevented?
6. Why should their formation be prevented?

Experimental Procedure 2

Demonstrating the effect of slope and plant cover on soil

1. Obtain three open boxes, 30 cm x 20 cm x 5cm.
2. Cut a V- shaped slit at one end of the smaller ends (the 5cm end).
3. Nearly fill two of the boxes with equal amounts of soil.
4. From a well grassed area cut a turf of about the same volume as the soil in the first two boxes.
5. Fit the turf into the third box.

6. Set the first two boxes of soil inclined at 40 degrees and 20 degrees respectively to the surface of a bench. Incline the box of turf at 20 degrees. All the boxes should have the slit at the lower end or on the bench.
 7. Place a container directly below the slit of each box (to collect water)
 8. Obtain a large tin can such as an empty 'Milo' can.
 9. Punch several holes in the base of the can
 10. Set a stop clock for each set up
 11. Hold the cans containing equal amounts of water on each set up and sprinkle evenly on the soil.
 12. Collect the water and soil that drains from each set up into a labeled container
 13. Measure the amount of water that drained from each set up using the graduated glass or measuring cylinder
 14. Let the soil settle in each cylinder.
 15. Record the volume of water and soil collected from each set up and record the time water ceased dropping from each set up.
- Which box lost most soil?
Which box lost least soil?
In the collection process, which box did water last cease dropping from?
What factors in this activity gave rise to most soil erosion?
How can soil erosion be prevented?

Reflection on the experiment

Take some time to reflect on the activity carried out. Ensure that you have understood the procedure followed. If clarification is needed, discuss it with your tutor or colleagues.

Is there any other activity that can be carried out to demonstrate the prevention of soil erosion? Give reasons for your answer.

C. Assessment – Student's sheet

On completion of experiment, you should answer the following question:

1. What are the causes of soil erosion? (KN1 & CS1)

2. What is the effect of slope and plant cover on soil? (KN2, CS1 & CS2)

3. How can soil erosion be prevented? (KS2 & PS2)

4. Why should soil erosion be prevented? (CS1)

D. Extensions to experiment

Discuss the effects of deforestation, bush burning and sand winning on the soil

E. Useful links

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F. Health and Safety

- The required instrument should be used to carry out the activities
- Wear protective clothing (coat, gloves, etc)
- Remember to wash your hands after the activity

G. Evaluation

Answer the following questions:

- How would you check erosion on your school compound or at home?
- How does erosion degrade the soil?
- What factors promote soil erosion?