

CHAPTER 8 ENVIRONMENTAL HAZARDS

Objectives

After studying this chapter, students should be able to:

- define or state the meaning of environmental hazard.
- describe the types of environmental hazard.
- state the causes of the types of environmental hazards mentioned.
- outline the effects of environmental hazards.
- highlight the preventive and curative measures.

8.1 Meaning and Types of Environmental Hazards

Environmental hazard is the state of events which pose a threat to the surrounding natural environment and adversely affect people's health. There are several types of environmental hazards in the world today, ranging from soil erosion, drought, desert encroachment, deforestation, flood, thunder storm, and lightning, tornado, hurricane and typhoon, environmental pollution, volcanic eruption, earthquake and tsunami, etc.

Each environmental hazard will be discussed under the following headings:

1. Causes
2. Agents
3. Effects
4. Measures for their control (preventive and curative)

8.2 Soil Erosion

Meaning: Soil erosion can be defined as the removal of the top layer of the soil by agents of denudation, namely running water, ice and wind. The major types of soil erosion are: sheet erosion, rill erosion and gully erosion.

- Sheet erosion: This is the gradual and uniform wearing away of the topsoil on gentle or low-lying surfaces.
- Rill erosion: This takes place on hillslopes, where channels may later develop to gully when they merge.
- Gully erosion: When erosion concentrates on deficit channels, it becomes widened, deepened and steep-sided. This is referred to as gully, e.g. Agulu-Nanka in Anambra.
- Splash erosion: This is caused by raindrops and their impact on topsoil. By this, soil particles are displaced and intensity and effectiveness depends on the size of the raindrops. It affects mostly areas of scanty or unprotected vegetation.

Causes

Soil erosion is caused by both physical and human factors. The physical factors which cause soil erosion are:

- (i) The nature of the soil: A soil with poor structure and texture will not absorb water very well, so erosion can easily occur.
- (ii) Topography: Steeper slopes are susceptible to soil erosion than gentle or flat areas.
- (iii) Climate: Heavy rainfall initiates soil erosion, especially in areas with low soil permeability.
- (iv) Vegetation cover: Adequate vegetation cover protects the soil from being eroded by direct raindrop. Soil erosion is more intense in areas without vegetation cover.

Several uncontrolled human activities also lead to soil erosion. These activities include:

- (i) Bush burning: This removes the protective cover of vegetation and surface litters, thereby exposing the soil to erosion.
- (ii) Overgrazing: This occurs through excessive grazing or removal of grasses by animals, exposing the soil to erosion.
- (iii) Bad agricultural practices: Bad agricultural practices such as shifting cultivation, clean weeding and cultivation along the slope increase the rate of erosion.
- (iv) Deforestation: It involves the removal of the natural vegetation.
- (v) Excavation of soil for building and construction purposes also leads to soil erosion.

Effects

- (i) Soil erosion brings about loss of soil fertility.
- (ii) It leads to poor agricultural yields.
- (iii) It leads to the destruction of roads and other track ways.
- (iv) Soil erosion can lead to water and land pollution.
- (v) It brings about reduction or loss of farmlands.
- (vi) Soil erosion can lead to siltation of streams and rivers through the deposition of eroded materials or sediments.
- (vii) Severe gully erosion in an area leads to loss of lives and properties, such as the Amucha gully erosion in Imo State of Nigeria.

Control

- (i) Controlled grazing by fencing off the grazing areas.
- (ii) Afforestation; this is the planting of trees to prevent erosion.
- (iii) Planting of cover crops such as cowpea, melon on farmlands.
- (iv) Contour ploughing or making ridges across slopes.

- (v) Public enlightenment campaign to enlighten the people on the dangers of soil erosion and on the conservation measures.
- (vi) Improved farming methods such as mixed farming, crop rotation and strip cropping help to reduce soil erosion.
- (vii) Terracing; this is the method of cutting steeps on hill sides to reduce the speed of running water down the hill.

8.3 Drought

Drought can be defined as a period of prolonged and unusual dry weather and moisture deficiency within a geographical area.

Causes

Drought often occurs as a result of the following:

- (i) Absence of rainfall
- (ii) High rate of evapotranspiration
- (iii) Changes in weather and climate
- (iv) Low humidity and cloud cover
- (v) Presence of high daily temperature
- (vi) Man induced drought such as desertification due to deforestation.

Effects

- (i) Drought leads to high loss of crops and livestock.
- (ii) It affects the growth of plants.
- (iii) Surface streams or rivers may dry up.
- (iv) It may lead to migration of man and animals.
- (v) Drought causes reduction in agricultural productivity.
- (vi) It causes conflicts between farmers and pastoralists.

Control

- (i) Avoidance of overgrazing.
- (ii) Planting of drought resistant trees and plants.
- (iii) Creating environmental awareness through organization of seminars and workshops.
- (iv) Irrigation scheme to encourage the growth of plants.
- (v) Deforestation and bush burning should be controlled or restricted.
- (vi) Planting of cover crops helps to reduce evaporation.

Examples of area of occurrence: Northern fringes of Nigeria such as Sokoto, Bauchi, etc.

8.4 Desert Encroachment

Desert encroachment is the extension or spread of the desert to areas which were originally moist.

Causes

- (i) Overgazing: This leaves the soil bare and makes wind erosion very effective.
- (ii) Deforestation: The indiscriminate cutting down of trees also encourage desert encroachment.
- (iii) Over cultivation: Overcultivation, most especially in the Sahel region lead to desert encroachment.
- (iv) Excessive bush burning.
- (v) Prolonged drought.
- (vi) Changes in climate: Desert encroachment may occur when there are changes in the climate of a place from wet to dry climate.

Effects

- (i) Desert encroachment brings about hot and dusty environment.

- (ii) It exposes the soil to wind erosion.
- (iii) It can lead to the displacement of people and settlements.
- (iv) It leads to loss of agricultural lands.
- (v) It leads to crop failure or poor agricultural yield.
- (vi) Desert encroachment can bring about famine and hunger.
- (vii) It leads to water shortage for animal and human consumption.
- (viii) It can lower the water table.
- (ix) It can lead to loss of vegetation.
- (x) It can lead to loss of animals and humans.

Control

- (i) Planting of trees afforestation, re-afforestation.
- (ii) Creation of shelter belts (planting of drought resistant trees) reduces the wind speed, thereby discouraging desert encroachment.
- (iii) Planting of legumes to cover the soil.
- (iv) Government legislation against bush burning.
- (v) Controlling the rate of tree felling.
- (vi) Indiscriminate felling of trees should be discouraged.
- (vii) Public awareness on the danger of desert encroachment and how it can be prevented or controlled.

Examples: The northern eastern fringes

8.5 Deforestation

Deforestation is defined as the indiscriminate felling of trees for a variety of purposes such as fuel wood, lumbering, farming, grazing, mining and industrialization without an immediate replanting of trees.

Causes

Deforestation occurs when:

- (i) trees are cut for timber.
- (ii) trees are cut for agricultural purposes.
- (iii) the bush is subjected to excessive burning and grazing.
- (iv) trees are used for fuel wood.
- (v) trees are cut for construction works.

Effects

The major effects of deforestation are:

- (i) It exposes the land surface to erosion.
- (ii) It leads to environmental deterioration.
- (iii) It decreases transpiration.
- (iv) Deforestation increases evaporation and lowers the water table.
- (v) It destroys the habitats of wildlife and the animals migrate to other places.
- (vi) It leads to reduction of soil nutrients.
- (vii) Plants absorb carbondioxide from the atmosphere, hence cutting of trees reduces its action.
- (viii) It destroys the ecosystem.

Control

- (i) Planting of trees to check deforestation.
- (ii) Public awareness campaign on the effects of deforestation.
- (iii) Development of other sources of fuel e.g. kerosene, gas, etc.
- (iv) Legislation against indiscriminate felling of trees.
- (v) Issuance of licence to authorised persons and bodies to fell trees.

Examples of areas of occurrence: Forest areas and some savannah areas.

Examples in Nigeria include Ondo, Edo, Ogun and Calabar.

8.6 Flooding

Flooding is defined as the occurrence of excessive volume of water in areas not usually water logged. It is an abnormally large quantity of water in an area which has refused to percolate or flow away. It usually occurs mostly along river valleys. When there is heavy rainfall in an area and the soil is saturated, excess water runs off into streams and river channels. A flood occurs when the stream overflows its banks and spread out upon and beyond the flood plain.

Causes

- (i) Flooding occurs mainly when there is heavy rainfall in an area and the water cannot be accommodated within a river channel.
- (ii) Erection of buildings along the drainage channels e.g. culverts and on watershed.
- (iii) Presence of steep slopes in an area.
- (iv) Dumping of refuse along culverts usually blocks river channels.
- (v) Poor drainage system or lack of culverts.
- (vi) Improper urban planning.
- (vii) The cementing of extensive areas within cities impedes infiltration and leads to excess runoff.
- (viii) Poorly constructed of dams, collapse leading to disastrous floods.

Effects

- (i) Flooding often results in the loss of lives and properties as in Benue, Kogi, Bayelsa, Cross River among others.
- (ii) It interrupts socio-economic activities such as trading and children going to school.
- (iii) Flooding causes health hazards such as malaria, cholera, diarrhoea, etc.
- (iv) It makes human and vehicular movement difficult.

- (v) It washes away roads and railways.
- (vi) It leads to destruction of farmlands.
- (vii) It leads to migration.
- (viii) Some houses may be abandoned or rendered uninhabitable because of flood.

Control

- (i) Construction of wider culverts and gutters, and drainage channels.
- (ii) Proper channelization of rivers especially those flowing through towns.
- (iii) Proper urban planning to avoid flooding.
- (iv) Regular environmental sanitation to clear drainage channels.
- (v) Legislation against indiscriminate dumping of wastes and refuse and the erection of buildings in swampy areas and flood plains.
- (vi) For areas that are prone to flood, studies should be carried out to determine flooding regime, and adequate preparation should be made against predicted floods.
- (vii) Too many drainage channels should not be allowed to drain into any single stream so that such a stream is not over supplied leading to flooding.
- (viii) Construction of dams to act as flood reservoirs by well qualified engineers.
- (ix) Weather forecast.
- (x) Early warning system provide information on weather and environmental hazards.

8.7 Thunder Storms and Lightning

Thunder is the sound caused by lightning. Depending on the nature of the lightning and distance of the listener, thunder can range from a

sharp loud crack, to a long low rumble.

Causes

- (i) Collision of clouds.
- (ii) Vacuum produced by lightning.
- iii) Thunder is caused by shock wave in the air due to the sudden thermal expansion of the plasma in the lightning channel.

Effects

The shock wave in thunder is sufficient to cause injury, such as internal bruise to individuals nearby.

Control

One of the preventive measures is the installation of thunder protectors on buildings.

Lightning is a massive electrostatic discharge caused by unbalanced electric discharge in the atmosphere, either inside clouds, cloud to cloud or cloud to ground, accompanied by the loud sound of thunder.

Causes

- (i) Lightning is caused by the circulation of warm moisture filled air through electric fields.
- (ii) It occurs during volcanic eruption.

Effects

- (i) Most lightnings are harmless, but a number of them strike air planes, buildings, ships and people.
- (ii) A direct strike on a person can cause serious injuries or death.
- (iii) It can lead to death of livestock.

- (iv) It can result in blast injuries, including hearing damage or blunt trauma by being thrown to the ground.
- (v) It can set forests and buildings on fire.
- (vi) On the other hand, lightning helps in the fixation of atmospheric nitrogen for plants.

Control

Lightning rods are used to prevent lightning damage and safely redirect lightning strikes.

8.8 Tornadoe and Hurricane

A tornado is a small, intense, violent storm in which the air is spirals at a tremendous speed. It appears as a dark funnel cloud hanging from a dense cumulonimbus cloud. It is commonest in the spring and summer but could occur in any month of the year. Typical areas of occurrence include USA, etc.

Tornadoes are very devastating, as they could cause complete destruction of everything in their paths. However, there are certain preventive measures being undertaken in the areas vulnerable to tornadoes. For example, storm cellars built completely below ground level provide satisfactory protection if they can be reached in time. Another step is for the meteorological department to maintain a tornado forecasting and warning system.

Hurricane

Hurricane is a type of tropical cyclone or severe tropical storm that forms in the southern Atlantic Ocean, Caribbean Sea, Gulf of Mexico, and in the eastern Pacific Ocean. It has calm-rainless centres where the pressure is lowest, but wind strength is high. Hence, dark cloud gather and

violent stormy weather lasts for several hours, for example, the USA (hurricane Katrina in Louisiana in 2010), hurricane sandy in the Caribbean 2012 and South-East Asia.

Effects

- (i) Damage of properties and loss of lives.
- (ii) It can raise the sea level and provoke disastrous stream floods.
- (iii) Hurricanes hinder sea transport.

Control

Cloud seeding, thereby reducing the hurricane's intensity, particularly wind speeds.

8.9 Environmental Pollution

Pollution is the release or the introduction of substances into the environment that is water, land or air in quantities that are harmful to animals and plants. The substances that cause pollution are called pollutants.

Types of environmental pollution

There are three types of pollution. These are (i) air pollution, (ii) land pollution and (iii) water pollution.

- (i) **Air pollution:** it is caused by the introduction of harmful or discharge of chemical pollutants into the atmosphere.

Causes

- (i) Release of gases such as sulphur dioxide, carbon monoxide from exhaust pipes of motor vehicles and aeroplanes.

- (ii) Discharge of solid substances like dust, smoke and soot from industries, machines and mining centres.
- (iii) The spraying of liquid and gaseous insecticides, pesticides and herbicides.
- (iv) Radioactive rays from industrial processes such as electric plants that use radioactive substances.
- (v) Noise from loud speakers, aeroplanes, sirens, construction and mining sites
- (vi) Volcanic eruption can also cause serious air pollution.
- (vii) Fumes from explosion of bombs and other dangerous weapons.

Effects

- (i) Air pollution causes respiratory problems and irritation of the eyes.
- (ii) It causes climatic variation.
- (iii) Noise pollution affects hearing by causing temporary deafness and reduces concentration and relaxation.
- (iv) It can cause accident as a result of poor visibility.
- (v) It leads to the destruction of the ozone layer.
- (vi) Air pollution causes acid rain which increases the acidity of rivers and lakes.
- (vii) Acid rain can also increase the acidity of soils and retard growth of crops.
- (viii) Buildings and roofs are being corroded by chemical action as a result of acid rain.
- (ix) Formation of thin layer on leaves leading to reduction in transpiration.
- (x) It hinders road and air transportation.

Control

- (i) Industries should be sited away from residential houses.
- (ii) Proper enlightenment on the dangers of air pollution.
- (iii) Government legislation to check industrial emissions into the atmosphere.
- (iv) Factories and cars to use environment-friendly source of energy to reduce pollution. Environmental Impact Assessment (EIA) should be done by government before they establish industries.
- (v) Controlling the level of noise from loud speakers, car sirens and horns through legislation.
- (vi) Fitting of chimneys with filters to remove pollutants.
- vii) Extracting sulphur compounds from coal and low grade fuels before use.
- viii) Reduction in the use of coal, as its combustion produces much smoke.
- (ix) Use of biofuels and solar energy which are environment-friendly.

Land pollution

Land pollution is caused by dumping of refuse, sewage, metal scraps, etc. in an area or place.

Causes

- (i) The use of pesticides, fertilizers and dumping of metal scraps.
- (ii) The land can be polluted through oil spillage.
- (iii) Indiscriminate dumping of refuse and sewage wastes.
- (iv) Discharge of toxic wastes from industries.
- (v) Mining activities release toxic metals into the soil and on people especially where illegal mining takes place e.g. local gold mining in Zamfara State, Nigeria caused lead poison.

Effects

- (i) Land pollution can render the soil infertile.
- (ii) It may lead to the destruction of microorganisms in the soil.
- (iii) Most of the pollutants are dangerous to man and other living organisms.
- (iv) It leads to low agricultural yield.
- (v) It destroys the aesthetic value of the land.

Control

- (i) Proper disposal of sewage.
- (ii) Oil pipe lines should be maintained and checked regularly to prevent oil spillage.
- (iii) Government legislation against dumping of harmful/toxic wastes.
- (iv) Refuse should be burnt in an incinerator.
- (v) Urban wastes should be disposed properly.

Water pollution

Water pollution can be defined as the release of pollutants into various water bodies such as streams, rivers, seas, oceans, springs and lakes.

Causes

- (i) Discharge of domestic waste into water bodies.
- (ii) Oil spillage.
- (iii) Discharge of industrial effluents or wastes into water sources.
- (iv) Use of agro chemicals e.g. fertilizer.
- (v) Discharge of effluents from ships at the various harbour.
- (vi) The use of chemicals for fishing.
- (vii) Natural factors such as floods can lead to discharge of materials into rivers thereby causing pollution.

Effects

- (i) It leads to the destruction of aquatic plants and animals.
- (ii) It can cause water borne diseases.
- (iii) It renders water unfit for drinking and other domestic uses.
- (iv) It leads to inadequate water supply for industrial use.
- (v) It can lead to unemployment among the fishermen.
- (vi) It leads to migration of people from the area.
- (vii) Loss of man-hours in search of usable water.

Control

- (i) Public enlightenment on the dangers of water pollution.
- (ii) Sufficient provision of pipe-borne water for the public.
- (iii) Government legislation against the discharge of domestic and industrial wastes into water bodies.
- (iv) Discourage the use of chemicals for fishing.
- (v) Building of public toilets.
- (vi) Monitoring of pipelines to prevent oil spillage.
- (vii) Cleaning up of polluted rivers.

8.10 Volcanic Eruption

Volcanic eruption can be simply defined as a rupture or an opening in the earth's crust. This opening allows hot ash, molten magma and gases to blow off from the underground layers.

Causes

A volcano erupts when magma escapes from underneath the earth. As the magma is escaping from a confined space, a lot of energy is released with it. Magma sometimes rises under enormous pressure, so it not only finds

cracks in the earth's crust, it can also create them. When magma reaches the earth's surface it is called **lava**.

Effects

- (i) Explosive volcanic eruption pose both short-term and long-term hazards.
- (ii) Ash clouds can prevent aircraft travel.
- (iii) Eruptions can inject massive quantities of ash into the atmosphere, greatly reducing the solar heating of the earth and potentially interrupting the global food supply for several years.
- (iv) Volcanic eruption contributes to global warming.
- (v) It causes loss of lives and properties.
- (vi) Lava flows can bury homes and agricultural lands under tens of metres of hardened black rock.

Control

- (i) The use of volcanic activity warning systems.
- (ii) Detection of ash and plume products for warning airline industry.

8.11 Earthquake and Tsunami

It occurs as a result of disturbances or movement within and below the earth's crust.

Causes

Earthquakes are caused by faulting, a sudden lateral or vertical movement of rock along a rupture. An earthquake occurs when the rocks break and move as a result of stress caused by plate movement.

Effects

- (i) Earthquakes are natural disasters which can kill thousands of people in an instant.
- (ii) It can destroy cities and countries.
- (iii) It leads to the collapse of buildings.
- (iv) It leads to the collapse of roads, bridges and railways.
- (v) Earthquake leads to the disruption of power.
- (vi) Deformed ground surface.

Control

- (i) The proper design and construction of buildings to withstand the seismic effects while sustaining an acceptable level of damage.
- (ii) Long-term forecasting based mainly on the knowledge of when and where earthquakes have occurred in the past to determine the locations and recurrence intervals of earthquakes.

Major areas of occurrence includes: circum-pacific regions, Japan, Morocco, China, etc.

Tsunami

Tsunami is a series of water waves caused by the displacement of a large volume of a body of water, typically an ocean or a large lake. It does not resemble normal sea waves because their wave lengths is far longer.

Causes

- (i) Earthquakes
- (ii) Volcanic eruptions
- (iii) Landslides
- (iv) Nuclear devices
- (v) Sub-marine rockslide

Effects

- (i) Destruction of structures (buildings, boats, telephone lines).
- (ii) The force of tsunami wave can kill people instantly or they may be drowned as water rushes on the land.
- (iii) Tsunamis flood areas closest to the coast. This can cause diseases to spread in the stagnant water.

Summary

- The state of events which pose a threat to the natural environment and adversely affect people's health is known as environmental hazard.
- Environmental hazards can be categorized into: (i) physical or natural hazards and (ii) man-made or anthropogenic hazards.
- Examples of natural hazards include: thunderstorm, lightning, tsunami, hurricane, volcanic eruption, etc.
- Examples of man-made hazards include: deforestation, soil erosion, desert encroachment, air pollution, water pollution, land pollution, flooding, etc.
- Environmental hazards pose serious threat to humans and animals; it leads to the deterioration of the environment.
- Curative and preventive measures such as planting of trees, government legislation, public enlightenment, proper disposal of sewage, etc. are used to control, mitigate and avert environmental hazards.

Revision Questions

Objectives

1. Which of the following is not a measure of environmental control?

- A. Preservation
 - B. Stabilization
 - C. Regradation
 - D. Afforestation (WAEC, 1988)
2. Which of the following is not an environmental hazard?
- A. Sedimentation
 - B. Flooding
 - C. Earthquake
 - D. Deforestation (WAEC, 1989)
3. Loss of farmland can be attributed to the following except
- A. Sedimentation
 - B. Leaching
 - C. Desertification
 - D. Erosion (WAEC, 1990)
4. Which of the following does not encourage desertification?
- A. Large scale irrigation scheme
 - B. Reduction in mean annual rainfall
 - C. Overgrazing and over cultivation
 - D. Bush burning (WAEC, 1991)
5. Air pollution may cause
- A. a balanced energy system in the atmosphere
 - B. acid rain formation
 - C. increased photosynthesis
 - D. increased evaporation (WAEC, 1993)
6. Desert encroachment can best be controlled by
- A. erecting barriers
 - B. deforestation
 - C. overgrazing
 - D. afforestation (WAEC, 1994)

7. All the following are major pollutants of the environment except
- the flaring of gas in oil wells
 - oil spillage
 - industrial waste
 - domestic cooking (WAEC, 1995)
- 8) They are tropical and subtropical storms, occurring over land, they are funnel shaped and violent, with wind of high velocity reaching up to 330kmph. Which of the following is described above?
- Chinook
 - Hurricane
 - Typhoon
 - Tornado (WAEC, 1996)
- 9) Which of the following activities will lead to deterioration of the environment?
- planting of trees
 - contour ploughing
 - afforestation
 - overgrazing (WAEC, 1997)
- 10) A major hazard to both human and aquatic life in some coastal areas of Nigeria is
- air pollution
 - overfishing
 - desalination of sea water
 - oil spillage (WAEC, 2001)

Answers

1. C
2. A
3. A
4. A
5. B
6. D
7. D
8. D
9. D
10. D

Essay

- 1(a) Name any four (4) natural hazards.
 - (b) Highlight any three effects of air pollution on man.
 - (c) In what three ways can air pollution be controlled? (WAEC, 2012)
- 2(a) (i) Define the term drought. (ii) Name two areas affected by drought
 - (b) Explain any three effects of drought.
 - (c) Suggest three ways in which drought can be reduced. (WAEC, 2003)
- 3(a) Explain the term soil erosion.
 - (b) Write short notes on soil erosion under the following headings:
 - (i) Causes
 - (ii) Effects
 - (iii) Methods of prevention(WAEC, 2005)
- 4 Write short notes on flooding under the following heading:
 - (a) Definition
 - (b) Causes
 - (c) Effects
 - (d) solution(WAEC, 2006)
- 5(a) Name two main types of environmental pollution and describe three causes of any one of them.
 - (b) State three effects of pollution on man. (WAEC, 1991)