

UNIT

3

HUMAN INTERVENTION IN THE ECO-SYSTEM

Unit Outcomes

After studying this unit, you will be able to:

- Describe the causes and consequences of damage to resources.
- Identify major pollutants and preventive action.
- Realize the causes and effects of global warming.

Competencies: After studying this lesson, you will be able to:

- Analyze the effects of damage to natural resources on the ecosystem.
- Take part in activities to conserve resources in your local area.
- Name the major pollutant of water and air.

Key terms

- ↔ Deforestation
- ↔ Degradation
- ↔ Desertification
- ↔ Ecosystem
- ↔ Renewable resource
- ↔ Non-renewable resource

A. The destruction of natural resources and the effects on the ecosystem

- How do you define an Ecosystem?
- What is the difference between the terms ecosystem and environment?
- What are the damages of an ecosystem as the result of destruction of natural resources?
- Is there interdependence between the different elements of an ecosystem? Can you give some examples.

An ecosystem is a natural unit in which the life cycle of plants, animals and other organisms are linked to each other and to the non – living constituents of the environment to form a natural system. Thus, ecosystem means a community of plants, and animals together with their immediate environments, including the inanimate part of the environment.

◆ Elements of the Ecosystem and their Interdependence

- What are the elements of the natural environment?
- How do we explain that there is interdependence between the different elements of the natural environment?

Elements of the natural environment are interdependent. The living things depend on the non-living things. For example, plants grow on the soil. In turn plants contribute to the fertility of the soil when they die or their parts come off and fall to the ground and decay and decompose due to microorganisms available in the soil. Animals living on the plant and their remains contribute to the sustenance of soil. In

the final analysis, the existence of soil determines the presence of other elements in a given ecosystem. The carnivores live on the herbivores, the herbivores live on plants and plants depend on soil. The omnivores live on both animals and plants. By doing so, the omnivores may keep the well being of the environment or they may disturb it. Thus, in the ecosystem, there is interdependence, interconnectedness and interrelationship among the elements.

◆ What are the Natural Resources Found in an Ecosystem?

- What are the natural resources?
- How many groups of natural resources do we have? Can you mention their names?

Natural resources refer to the whole elements of the environment. Some resources are directly available for use, for example, air water, soil and plants. But resources, such as minerals and underground water are not directly available. They become useful when only we use our knowledge and skill to make use of them. Natural resources can be grouped into two: namely renewable and non – renewable resources.

Renewable resources: they are resources, which can last indefinitely without reducing the available supply. These resources can be replaced more rapidly through natural processes. Plants, wild animals, water, air and soil are good examples of renewable resources.

Non-renewable resources: are resources, which exist in a fixed amount. They can be finished and not easily replaced. These resources are also called exhaustible or finite resources. Coal, petroleum, gold, copper, etc. are some good examples of the non renewable resource.

◆ Destruction (degradation) of Natural resources

Throughout the world, more and more forest is cut, minerals are mined, soils are ploughed, waters put into use. This happens because of a continuous improvement in the life style of people. However, sometimes, resources are also misused and as a result they become smaller and smaller. This process is called degradation or destruction of resources. To overcome this problem, renewable and non renewable resources should be wisely or sustainably used.

Sustainable use of a resource: is an activity, which does not deplete or damage natural resources irreparably and which leaves the environment in good order for future generation.

- What are then the effects of the destruction of natural resources (unsustainable use of natural resources) on the ecosystem?

The destruction of one type of natural resource means the destruction of the others. Because, as we have seen at the introduction part of this section, elements of the natural environment are interdependent. For example, when forest cover is decreasing at the fastest rate because of deforestation the land will be exposed to all sorts of agents of erosion. This would result in several impacts, such as soil degradation, shortage of food crops, lack of potable water, lowering of the underground water level, disappearance of wild animals.

Case study

Amazonia

The clearance of the rain forest of the Amazon means a loss of habitat to many Indian tribes, birds, insects, reptiles and animals. Over half of our drugs, come from this region. Perhaps we are clearing away the cure for AIDS and other yet incurable diseases. Without tree cover, the fragile soils are rapidly leached of their minerals making them useless for crops and vulnerable to erosion. Half of the world's oxygen is supplied from trees in the Amazon. The process of burning these trees reduces the amount of oxygen and increases the amount of carbon dioxide which traps heat (the green house effect) and changes the world's climate.

◆ Pollution of Water and air and Possible Solutions

- What were the main cause of water and air pollution?

Pollution of water and air

In their attempt to industrialize, many countries of the world initially paid little attention to the negative effects that air and water pollution would have upon their environments. Water resources and the atmosphere, in particular, became severely polluted. This led to serious human health problems and adversely affected the habitats of plants and wildlife.

◆ Farming

Fertilizer and pesticides on farm lands are washed through the soil by heavy rainfall, and make their way into farm fields, rivers, lakes and eventually, the sea. Phosphates and nitrates encourage the growth of algae and other water plants which use up oxygen and may leave insufficient oxygen for fish to survive.

Case study

Instructions on fertilizer bags

Plants rely on a safe, healthy supply of food and nutrients like nitrogen, phosphorus and potassium for proper growth and development.

The following are some of the important instructions written on fertilizer bags:

- Each fertilizer bag has three or more numbers written on it to indicate the amount of each nutrient it contains.
 - The first number indicates the Nitrogen content measured as %N.
 - The second number indicates the Phosphorus content measured as % P₂ O₅
 - The third number indicates the Potassium content measured as % K₂O

- Use about 4 pounds of nitrogen per 1000 square feet each growing season on most bluegrass lawns.
 - It is best to add not more than 0.4536kg per 0.3048 meter square at a time.
- Do not add above the specified amount of fertilizer into the soil.
 - Farmers need to wash chemicals off their skin and wash vegetables before use if they can see chemical residues.

The information presented above gives us an insight as to the dangers of agro chemicals as pollutants. Over use does not benefit the plants and they are toxic to human and animals and gets into the water table.

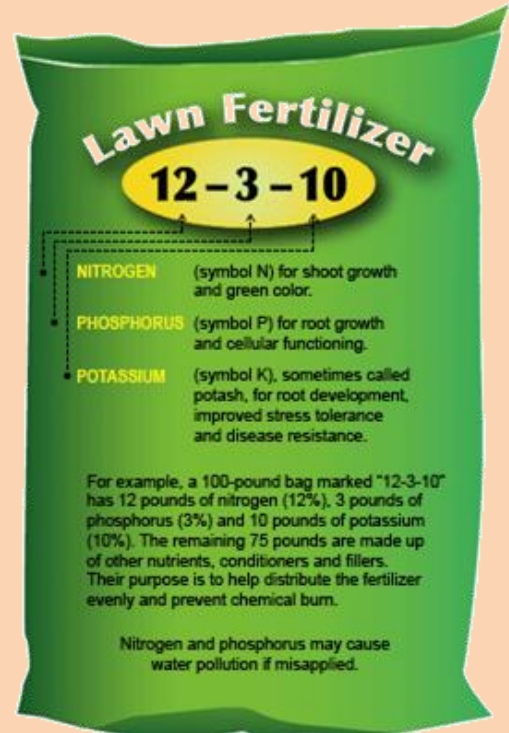


Fig 3.1. Fertilizer bag

◆ Domestic Sewage and Rubbish

- How do you define the term sewage?
- Do you think untreated sewage and disposal of domestic rubbish are equally a problem both in the rural and urban centers?

Many rural areas do not have main sewage, which urban areas are growing rapidly for authorities of countries to keep pace with demand for extra drains. Untreated sewage in rural areas escapes into water intended for either drinking purposes or for the farm fields. Untreated sewage from urban areas, is often allowed to escape into the sea. The worst affected areas are inland sea and big urban centers. For example increases in ammonia and nitrates in water reduce oxygen and animal life. The disposal of domestic rubbish is a major problem. Some urban centers burn rubbish but this only adds to air pollution and causes smoke.

◆ Industry

Industry also dumps its waste into water bodies or releases it into the air. Water bodies in this case become dull, lifeless and unsuitable for domestic consumption and plant and animal life. Large

industries which produce steel, cars, leather and chemicals (in many countries) are located on the coast where they could discharge their liquid waste directly into the sea. One of the consequences is the rapid decline in the number of fish caught.



Fig 3.2 Pollution in Japan from industries

◆ Power stations

Thermal power station ejects hot water into rivers and seas, raises the temperature beyond that usually tolerated by plants and fish, and reduces the oxygen content.

◆ Transport

As road traffic increases, eventually increases the emissions of exhaust fumes and the volume of noise.

◆ Possible solutions

- Governments should produce standards for the quality of their environment. These standards are to control the levels of water, air and soil pollution.
- Governments have to take steps to reduce chemical emissions to bodies of water and to surrounding air.
- Government should adopt a policy to recycle waste materials.

Lesson

3.1

Review

Activity 3.1**A. Questions based on facts:**

- How many groups of natural resources do we have? Name them.
- Explain the interdependence existing between the elements of the ecosystem.
- What do we mean by the natural resource degradation?
- What are the effects of the destruction of natural resources?
- What are the main causes of air and water pollution?

B. Things to do:

- Discuss in groups the statement. “Elements of the natural environment are interdependent.”
- Discuss in pairs the difference between renewable and non renewable resources.

C. Individual work:

- Visit your locality and identify the major air and water pollutants. Finally present your findings to your classmates and invite them for further discussion on the issue.

D. Things to do:

- List the components of physical (non-living or air) and living elements of an environment.

Competencies: After studying this lesson, you will be able to:

- Realize the causes of global warming.
- Evaluate the effects of global warming on people, natural vegetation and wild life.

Key terms

↔ Global warming

↔ Acid rain

↔ Chlorofluoro carbon

↔ Ozone

Causes and effects of global warming

- What is global warming?
- What are its causes and effects?
- Do you think that Ethiopian people are aware of the problem? How did you know?
- What do you think the solutions to this problem are?
- What do you know about the green house effect?

◆ The Green House Effect

The earth is warmed during the day by incoming radiation from the sun. The earth loses its heat at night through outgoing infra-red radiation. Over a long period of time, because there is a balance between incoming and outgoing radiation, the earth's temperatures remain constant.

On cloudy nights, temperatures do not drop as on clear nights. This is because the clouds act as a blanket and trap some of the heat emitted from the earth.

The gases in the atmosphere also act as a blanket for the earth as they prevent the escape of infra – red radiation. Certain gases in the atmosphere are called green house gases. Without these green house gases, which include: carbon dioxide, the earth's average temperature would be 33°C colder than it is today. During the ice age temperatures were only 4°C colder than the present. Recent human activity has led to a significant increase in the amount, and type of green house gases in the atmosphere. The green house gases are preventing heat from escaping into space, and is believed to be responsible for a rise in

world temperatures (see Fig 3.3). World temperature has risen by 0.5°C this century. This effect is called Green house effect. Fig 3.3 illustrates the green house effect. Can you explain it from the figure?

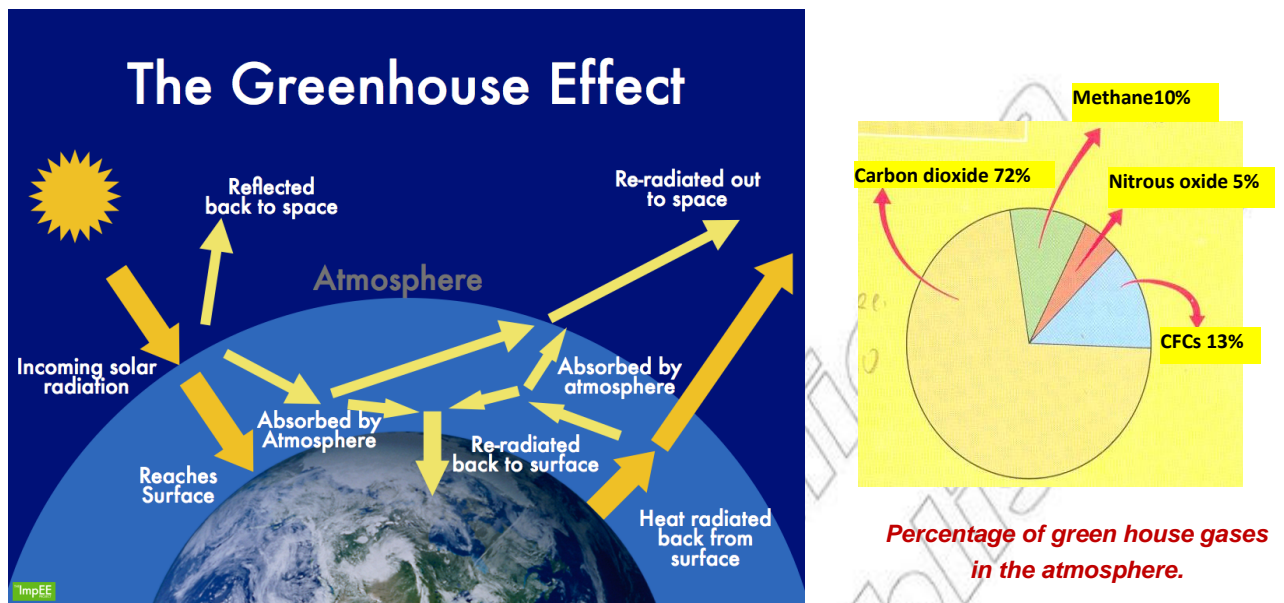


Fig 3.3 The green house effect

A. Causes of global warming

- What are the major causes of global warming?
- What is the relationship between greenhouse effect and global warming?
- Do you accept that there is the problem of global warming in our world today?
How do you explain it?

The major contributors to global warming are the surplus availability of certain gases in the atmosphere. These gases are:

Carbondioxide: is the most important single factor in global warming. It is produced by road vehicles by burning fossil fuels in power stations, in factories and homes. Since the economically more developed countries consume three quarters of the world's energy, they are responsible for producing this gas. A secondary source of carbondioxide is deforestation and the burning of the tropical rain forest.

CFCs (chlorofluorocarbon): is used in the manufacturing of refrigerators. It is released from refrigerators and is the most damaging of the greenhouse gases.

Methane: is released from decaying organic matter such as waste dumps, animal dung and farms. For example rice fields in south east Asia are the major source of methane.

B. Effects of global warming

- How serious is the problem of global warming?
- What are the predictions and warnings of scientists concerning the effects of global warming?
- Do you think leaders of the world are aware of the problem and are ready to find solutions?

The major consequences of global warming are the predicted world changes in climate and sea-levels. Scientists are suggesting that as air temperatures increase sea temperatures will also rise. As the sea gets warmer it will expand causing its level to rise between 0.25 and 1.5 meters. Ice caps and glaciers especially in polar areas will melt. The release of water at present held in storage as ice and snow in the hydrological cycle could raise the world's sea-level by another 5 meters. Even a rise of one meter could flood 25 percent of Bangladesh, 30 percent of Egypt's arable land and totally submerges several low-lying Islands in the Indian and Pacific Oceans (Example: Maldives).

The distribution of precipitation

- Do you think there will be climate change in the world due to increased global warming in the future?
- What would be the results of the climate change?
- Which regions of the world would be highly affected?

Many areas of the world at present, which have adequate water supplies may find themselves short of water and the rate of **desertification** is predicted to increase. Scientists' predictions suggest that areas around 40°N will become drier (Fig 3.4) and as these latitudes contain many important cereal growing regions there could be a world **food shortage**. There could also be a northward migration of climate belts in the northern hemisphere while **the Sahel countries** (Africa) would receive more rainfall. The Mediterranean and the Russian virgin lands might turn into deserts.

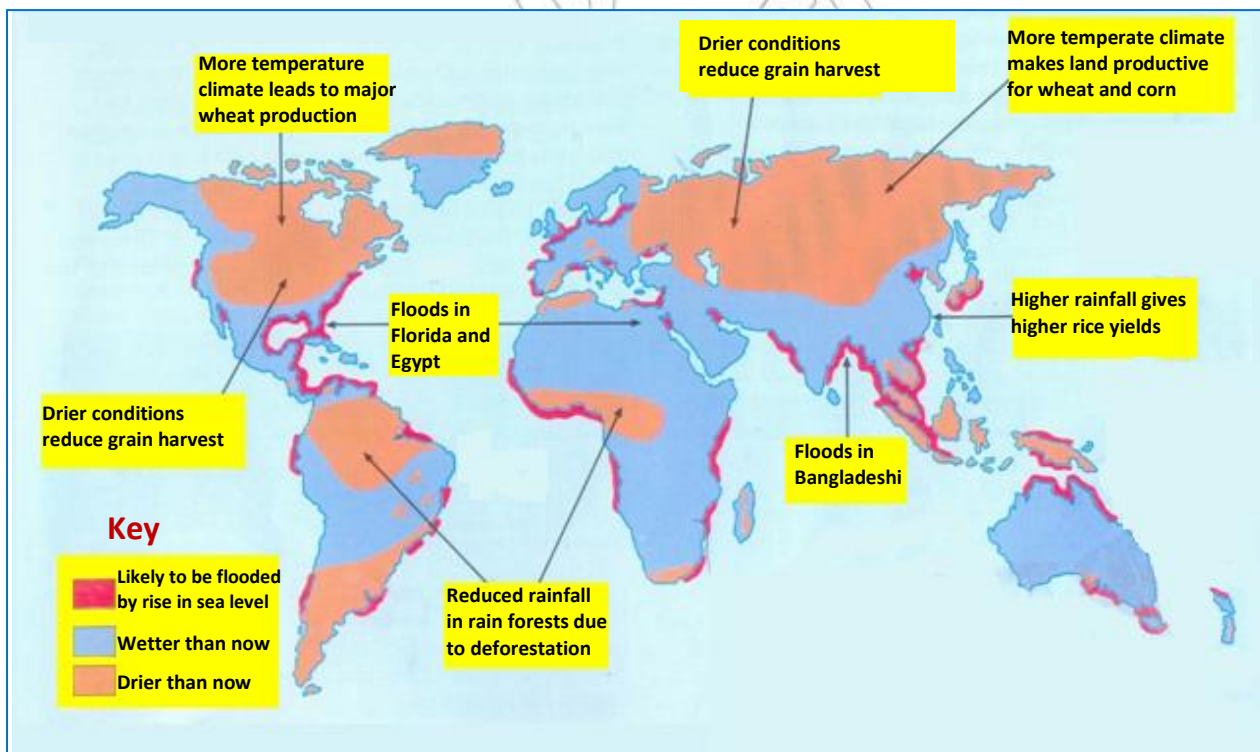


Fig 3.4 Predicted effects of global warming on the world

◆ Unpredictability of Climate and Increasing Bad Weather

Case study

The great storm in South East England, 16 October 1987

This storm, the worst to affect South Eastern England, developed so rapidly that its severity was not predicted in advance weather forecasts.

The storm began as a small wave on a cold front in the Bay of Biscay, where the few weather ships give only limited information, caused by contact between very warm air from Africa and cold air from the North Atlantic.

Although the storm passed within a few hours, and luckily during the night when most people were asleep, it left a trail of death and destruction. There were 16 deaths, several houses collapsed and many others lost walls, windows and roofs, thousands of trees were blown over, blocking railway lines and roads, one-third of the trees in few gardens were destroyed, power lines were cut and in some remote areas, not restored for several days.

◆ Depletion of Ozone Layer

- What do you mean by an Ozone layer?
- What is its main advantage?

Ozone is one form of oxygen gas. The major concentration of Ozone is in the stratosphere 25-30km above sea level. It acts as a shield, protecting the earth from the damaging effects of ultra-violet radiation from the sun. However, there is a serious concern because this shield seems to be breaking down. Each spring a hole the size of USA appears in the Ozone layer over Antarctica. In 1989 a similar hole was found to have appeared over the Arctic. It is feared that if more ultra-violet radiation reaches the earth it will increase the incidence of skin cancer and inhibit the growing of crops. The damage is believed to be caused by humans releasing into the atmosphere a family of chemical containing chlorine, which are known as Chlorofluro Carbons (CFCs). Chlorine reacts with Ozone and breaks down the Ozone layer. Scientists claim that a 1 percent depletion in Ozone causes 5 percent increase in skin cancer cases and this depletion has been 3 percent since 1970.

◆ Acid Rain

- What is an acid rain?
- What are the causes for the development of acid rain?
- Can you mention some of the effects of acid rain?

Acid rain was first noticed in Scandinavia in the 1950s when large numbers of freshwater fish died. Research showed that the water in which these fish had lived contained more than average amounts of acid. Later, it was discovered that this extra acid had been carried by rain, hence the term acid rain was introduced. The acid is formed in the air from **sulphur dioxide** and **nitrogen oxide** which are emitted by thermal power stations, industry and motor vehicles (Fig 3.5). These gases are either carried by prevailing winds across seas and national frontiers to be deposited directly on to the earth's surface (dry deposition). Or are converted into acids (sulphuric and nitric acid) which then fall to the ground in the rain form of (wet deposition).

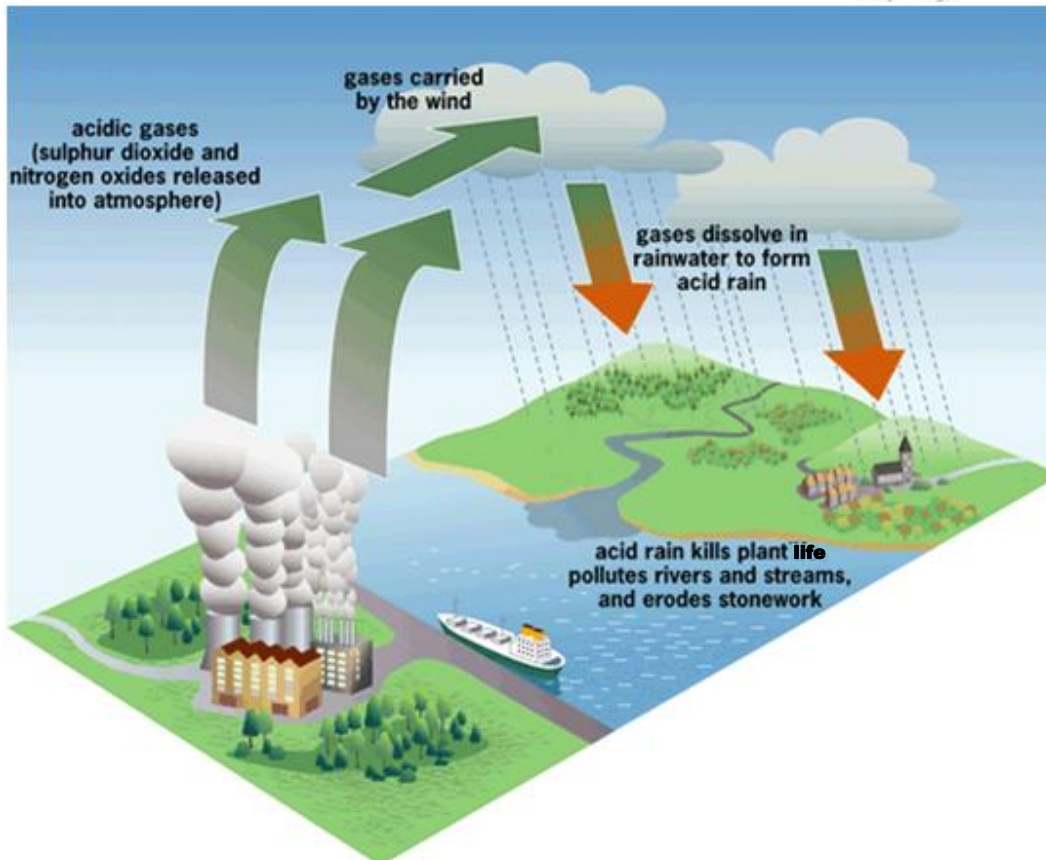


Fig 3.5 Cause and effect of acid rain

The effects of acid rain

- The acidity of lakes increases. Large concentrations kill fish and plant life.
- An increase in the acidity of soils reduces the number of crops that can be grown.
- Forests are being destroyed as important nutrients (Calcium and Potassium) are washed away.
- Water supplies are more acidic and this could become a future health hazard.
- Buildings are being eroded by chemical action caused by acid rain. The Acropolis in Athens and Taj Mahal in India have both deteriorated rapidly in recent years (Fig 3.6 (b)).



a) The effect of acid rain on forest



b) The effect of acid rain on architecture

Fig 3.6 The effect of acid rain

◆ Melting of Ice

- How do you define the term glacier?
- What are the causes and dangers of the melting polar ice caps.
- Which countries of the world are likely to be highly affected due to the melting ice.

Glaciers give solid evidence of global warming during the last century. Many experts expect that warming will be greatest at the poles, melting the ice caps and raising sea levels. A ten-foot rise in mean sea level would flood most of the world's coastal cities, as well as low-lying, densely populated areas like the Netherlands in Europe. A three feet rise in mean sea level would also affect many large nations like 72 million people in China, 11 million in Bangladesh, and 8 million in Egypt.

◆ Melting of Ice Cap

Case study

Rising sea level and Plight of polar bears

Although Bangladesh's contribution to global warming is minimal, the effects of this process upon the country are expected to be considerable. As global temperatures increase and Ice caps melt, the predicted rise in the world's sea – level will result in many parts of Bangladesh, including the whole delta region, being totally submerged. For every few centimeters that sea level rises, the more frequent and serious will flooding be along the coast of Bangladesh.

The polar bear is one of the animals to be found in the Tundra region of the northern hemisphere. This animal is adapted to the severity of the climate by having either thick furs or productive layers of fat. It is a carnivorous animal that lives on seal and foxes. At present, its existence is highly at risk, because of the melting of ice in polar region.

◆ Flooding

• Why are coastal areas prone to flooding?

Flood is a body of water which rises to over flow land. The major causes of flood include:

- The rise of the sea level which results from ice melting.
- Excessive amount of rainwater flooding the river banks
- Coastal flooding caused by waves and tropical storms

Case study

Bangladesh is trapped between two sets of floods: one caused by tidal surges and rising sea level, and the other by rivers.

• By rivers

Silt deposited at the mouth of the Ganges and the other rivers, has formed a large delta. The silt created many flat Islands which divided the several rivers into numerous distributaries. As the marshy islands are ideal for rice growing, they have attracted large numbers of farmers. Further, deposition of silt blocks the main channels and increases the flood risk by raising the beds of the rivers. Flooding is most likely to occur in late summer following the heavy, seasonal monsoon rains and snow melt in the Himalayas. Deforestation in the Himalayas may be a contributory factor for flooding.

• By tidal (storm) surge

As tropical cyclones moves up the Bay of Bengal, the force of the wind increases and water is pushed northwards, towards Bangladesh, causing coastal flooding.

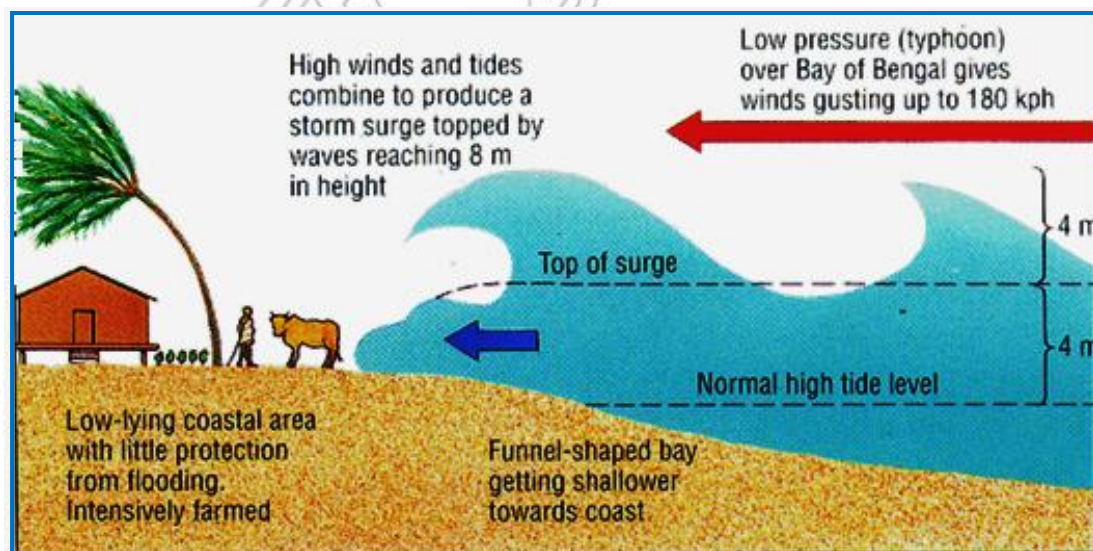


Fig 3.7 Development of storm surges in the Bay of Bengal.



Fig 3.8 Flood distress in Bangladesh

What can be done to reduce the flood risk?

- Levees (flood banks) building
- Construction of large dykes
- Introduction of Early warning systems

Lesson

3.2

Review



Activity 3.2

A. Questions based on facts:

- Explain the concept of greenhouse effect.
- What is an acid rain? How does it develop?

B. Group discussion:

- What factors are causing damage to the earth environment? What do you believe should be done about it? Are any clubs or groups at your school working to reduce environmental damage? Discuss the Issue mentioned above in groups.
- Just as a class discuss the following question. Do you believe that recent conferences on the environment will have positive effects on changing attitudes and practices that damage the environment? Why or why not?

C. Individual work:

- Visit your locality and try to record factors that you think will contribute to the development of global warming. Report your findings to your classmates so that there can be further discussion.

D. Things to do:

- List the greenhouse gases and the gases responsible for the formation of acid rain.

Summary

- Ecosystem means a community of plants and animals together with their immediate environments, including the inanimate part of the environment.
- Elements of the natural environment are interdependent.
- Natural resources refer to the whole elements of the environment. They are grouped into two i.e. Renewable and Non renewable.
- Renewable resources are resources which can last indefinitely without reducing the available supply.
- Non renewable resources are resources which exist in a fixed amount. They are exhaustible or finite resources.
- Resources may be misused and as a result they become smaller and smaller. This process is called degradation or destruction of resources.
- The destruction of one type of resource means the destruction of another.
- The causes for air and water pollution are all the results of human activities.
- Possible solutions are: government issuing policies, fitting cars with catalytic converters and using unlead petrol, reduction of sulphur emissions, reduction of the amount of domestic waste and recycling them, etc.
- The green house gases in the atmosphere prevent heat from escaping into the space, and increase world's temperature.
- The process by which world temperature rises is known as global warming.
- The major contributors to global warming are carbondioxide and other pollutants released into the atmosphere. The green house gases are: (CO₂, CFCs, Methane, and Nitrous oxide)
- The effects of global warming are:
 - The rise of sea temperature
 - Melting ice caps and glaciers
 - The rise of sea level and the flooding of low lying areas.
 - Depletion of ozone layer.
- Ozone layer acts as a shield protecting the earth from the damaging effects of ultra – violet radiation from the sun.
- The damage is believed to be caused by humans releasing into the atmosphere, a family of chemical containing chlorine which are known as chlorofuloro carbons (CFCs)
 - The acid rain is formed in the air from sulphur dioxide and nitrogen oxide which are emitted by thermal power stations, Industry and Motor vehicles.
 - These acids are either carried by prevailing winds across seas and national frontiers to be deposited directly on the earth's surface or converted into acids (sulphuric and nitric) which then fall to the ground with rain.
- The effects of acid rain are:
 - Acidity of water bodies increases death of fish in lakes
 - An increase in the acidity of soils reduces the number of crops that can be grown
 - Forests are being destroyed
 - Water supplies are becoming more acidic, and this could become future health hazard.
- Floods are the results of rise in the sea level, rivers and tidal surge.

Glossary

- **Acid rain:** rain containing a high level of acid that can damage the environment. It is caused by pollution in the air.
- **Chlorofluro Carbon:** A family of chemical containing chlorine.
- **Deforestation:** the process of removing the trees from an area of land.
- **Desertification:** the process by which land becomes too dry to be used for farming.
- **Degradation:** the process of changing into a worse condition.
- **Ecosystem:** the plants and animals in a particular area, considered as a system with elements that depend on one another.
- **Renewable resources:** are resources which, although the supply may be limited in quantity, tend to replenish themselves when they are used.
- **Non-renewable resources:** these type of natural resources require long period of time for accumulation, and when used they are gone forever.
- **Global warming:** the slow increase in the temperature of the earth caused partly by the greenhouse effect, increasing the amount of carbondioxide in the atmosphere
- **Ozone:** is a kind of oxygen that exists high in the earth's atmosphere.

UNIT 3

Review Questions

I. True/ False Item

Instruction: Write True if the statement is correct and False if the statement is wrong

- _____ 1. Acid rains are formed by manganese oxides and aluminum oxides.
- _____ 2. The depletion of the ozone layer is a result of the releasing of chemical containing chlorine (Chlorofluro carbons –(CFCs)) into the atmosphere.
- _____ 3. The deforestation of the tropical rain forests of the Amazon region of Brazil and South East Asia intensified global warming.
- _____ 4. One major result of acid rain is the reduction of the rate of forest growth and the elimination of some species of trees.
- _____ 5. Petroleum, Natural gas, coal and gold are some examples of non-renewable resources.

II. Matching Item

Match the correct items in column “B” with their explanations in Column “A”

Part “A”

- _____ 1. The removal of trees from an area of land
- _____ 2. A result of greenhouse gases
- _____ 3. Degradation of productive rangeland into desert.
- _____ 4. Released into atmosphere by burning
- _____ 5. protecting the earth from the dangers of the ultra-violet rays

Part “B”

- a) Carbondioxide
- b) Ozone
- c) Desertification
- d) Global warming
- e) Deforestation
- f) Skin cancer
- f) Acid rain
- h) Infra-red radiation
- i) pollution

III. Multiple choice Item

Instruction: Choose the right answer and write the letter of your choice on the space provided.

- _____ 1. A community of plants and animals together with their immediate environments including the inanimate part of the environment is known as;
 - a) Ecology
 - b) Ecosystem
 - c) Habitat
 - d) Community

- _____ 2. The resources which can last indefinitely without reducing the available supply are called _____.
- a) non replaceable resources
b) renewable resources
c) exhaustible resources
d) finite resources
- _____ 3. Wise use of resources means;
- a) conservation of resources
b) preservation of resources
c) Sustainable use of resources
d) "a" and "c"
- _____ 4. Water and air can be polluted by:
- a) domestic sewage and rubbish
b) industrial waste
c) power stations
d) all of above
- _____ 5. The effect of acid rain was for the first time recognized in the 1950s in:
- a) U.S.A
b) Scandinavia countries
c) Latin America
d) Asia.

IV. Fill in the blank Item

Fill in each of the blank spaces with suitable word/words.

1. Currently, depletion of the ozone layers is spreading over _____.
2. The major consequences of global warming are the predicted changes in _____.

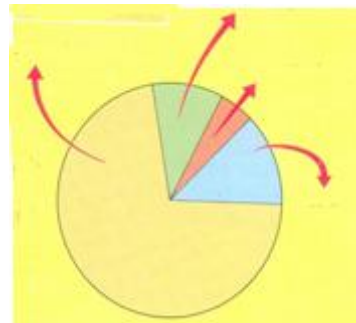
V. Short answer Item

A. Give short answer to each of the following question.

1. Why is global temperature rising?
2. By how many degrees has the global temperature risen this century?
3. By how many degrees is it expected to rise at the end of the next century?
4. How is global warming likely to affect people living in Bangladesh, the Amazon basin, the central parts of the U.S.A and Northern Canada?
5. What is desertification?
6. Name four countries in the Sahel which are at great risk from desertification.
7. Explain how overgrazing, over cultivation and deforestation can all lead to desertification.

B. Things to do

1. Copy and complete the pie graph by:
 - a. Inserting the names of the four missing greenhouse gases
 - b. Name one source for each of the four missing gases.



The Green house gases

2. Draw annotated diagrams to show the humus (nutrient) cycle before and after deforestation.
3. Draw a political map of Africa and indicate the Sahelian countries by shading them.
4. Visit your locality recording the causes for water and air pollution. Then, report the findings to your classmates, inviting them for further discussion on the Issue.
5. List the gases responsible for the formation of acid rain.

Check List

Put a tick (✓) mark in each of the boxes for activities you can perform

I can

1. Analyze the effects of damage to natural resources on the ecosystem.
2. Take part in activities to conserve resources in my local area.
3. Name the major pollutants of water and air.
4. Realize the causes of global warming.
5. Evaluate the effects of global warming on people, natural vegetation and wildlife.