

Environmental Problems

You have already learnt about the environment and its components in the previous lesson, and must have realized the importance of maintaining a life-supporting environment. The environment has undergone many changes over the period of time. Population explosion in the recent times has resulted in a number of environmental problems.

In this lesson, you will learn about some natural and man-made environmental problems, their causes, effects and control.

OBJECTIVES

After completing this lesson, you will be able to:

- explain how ecological balance is maintained in nature;
- list some environmental problems (natural and man-made);
- explain the causes, effects and control of forest fire;
- explain the impact of increasing human population on the environment;
- define pollution and list its types;
- list the sources, consequences and means of control of air, water, soil and noise pollution;
- explain the cause and effect of global warming and ozone layer depletion;
- classify and define waste into biodegradable and non-biodegradable type.

22.1 MAINTENANCE OF ECOLOGICAL BALANCE IN NATURE

22.1.1 Ecological balance

The rich diversity of life that inhabits the earth helps in maintaining a balanced environment. The perfect balance between the physical environment and the living organisms in nature is called **ecological balance**. Herbivores eat plants, and are themselves eaten by carnivores. The number of plants, herbivores and carnivores is maintained in such a way that there are enough organisms of different species to survive. However, various human activities cause interference and imbalance in nature. Ecological imbalances may lead to:

- Destruction of natural habitat of wild life. For example, cutting of forests have resulted in the disappearance of Cheetah, and a falling number of tigers in India.
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- Addition of various chemicals from industries in the Kalu River near Bombay has resulted in extinction of the Bombay duck, a favorite fish of the people living in this area.
- Capturing or killing of lions has led to an increased number of herbivores that compete for grass. They may uproot grass, making the soil barren that may lead to soil erosion and desertification.
- Disturbance in the food chain, which has resulted in an enormous increase in the population of a particular types of organisms, while others may become endangered.

22.1.2 Impact of human population on the environment

The population of India has crossed the figure of 1 billion and the world population is estimated to have touched the 6 billion mark. To meet the demand of food, housing and energy, environmental resources are being exploited at a fast pace. Environment has the potential to replenish most of its resources in a certain period of time. However, over-exploitation of resources and human activities have altered it leading to many environmental problems, such as:

- deforestation,
- destruction of wild life,
- air, water and land pollution,
- diminishing fossil fuels (oil, coal and natural gas),
- concentration of pesticides in alarming proportions in organisms, and
- depletion of ozone layer and global warming.

22.1.3 Some environmental problems

While there are many things to appreciate about the nature's bounty, there also exist a number of environmental problems. Some of them are natural processes whereas others are man-made. Alterations made by man always affect life forms adversely including man himself, in the long run.

All the problems listed above in (section 22.1.2) are man-made. Growth in human population leads to putting in more land under cultivation for food production, which means more water for irrigation, more fertilizers and pesticides. Forests are cleared to create space for housing, roads, educational institutes, industries, etc.

22.1.3a Deforestation

Cutting of the natural forest cover is called **deforestation**. You are aware of the importance of forests as a major natural resource. They provide wood for multiple use, shelter to wild life, soil conservation and rainfall. Plants take up carbon dioxide for photosynthesis. Less forests mean more carbon dioxide in the atmosphere. Cutting down of forests may lead to the following:

- destruction of habitat or living place for wild plants and animals leading to disappearance and extinction of many species,
 - reduced rainfall in that area,
 - lowering of water table or depth of ground water,
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- soil erosion, loss of fertility of soil and lack of vegetation leading to desertification, and
- increased CO₂ levels in the atmosphere and global warming.

22.1.3b What can be done?

You would remember that replenishment of forests in nature takes a long time. This can be done by planting trees in place of cut down forests, known as **reforestation**. A reforestation programme may include the following:

- enforcement of strict environmental laws against felling of trees,
- growing of at least three new plants for every single tree that has been cut,
- celebrating **Van-mahotsava** enthusiastically, which involves mass plantation,
- practising **silviculture**, the cultivation of forest trees, as it provides wood for industries and also increases area under the forest cover,
- plants are given great respect and worshiped in Indian culture, this is, mainly, due to their use in providing food and fodder for animals, shelter, fire wood for cooking, medicinal properties, agricultural implements, and many more,
- women in the sub-himalayan region have started a movement to prevent cutting and felling of trees by surrounding the tree with arms around them,
- plants and their products play an important role in festivals and important occasions like marriages in our country, and
- the great Indian medicinal system-Ayurveda, relies on plants and their products for their excellent medicinal properties.

CHECK YOUR PROGRESS 22.1

Fill in the blanks.

1. The number of animals, such as _____ and _____ is falling due to cutting of forests.
2. Need for _____ leads to felling of trees.
3. Practice of _____ and _____ can help in reforestation.
4. Environmental problems, such as _____ and _____ are a result of increase in human population.
5. The practice of cultivating forests is called _____

22.2 POLLUTION

22.2.1 What is pollution?

Human life includes a number of daily activities. Bathing and washing of clothes with soaps and detergents add some chemical residue to water and change its quality. Cooking of food by using firewood may give out smoke in the air. Agricultural activities may dump fertilizers and pesticides in the environment.

Each activity, human or industrial, discharges some unwanted substances in the environment. The addition of unwanted substances in wrong concentration

that has an adverse effect on organisms and environment, is called pollution. Technological growth has given new devices for human comfort but has also added substances that may have an adverse effect on life and environment.

An undesirable change in the physical, chemical and biological characteristics of the environment especially air, water and land that may adversely affect human population and the wild life, industrial processes, cultural assets (buildings and monuments), is called **pollution**.

The agents that pollute the resources or cause pollution are called **pollutants**.

Look at the picture given below. Is this the state of environment we live in? What major sources of pollution can you identify?

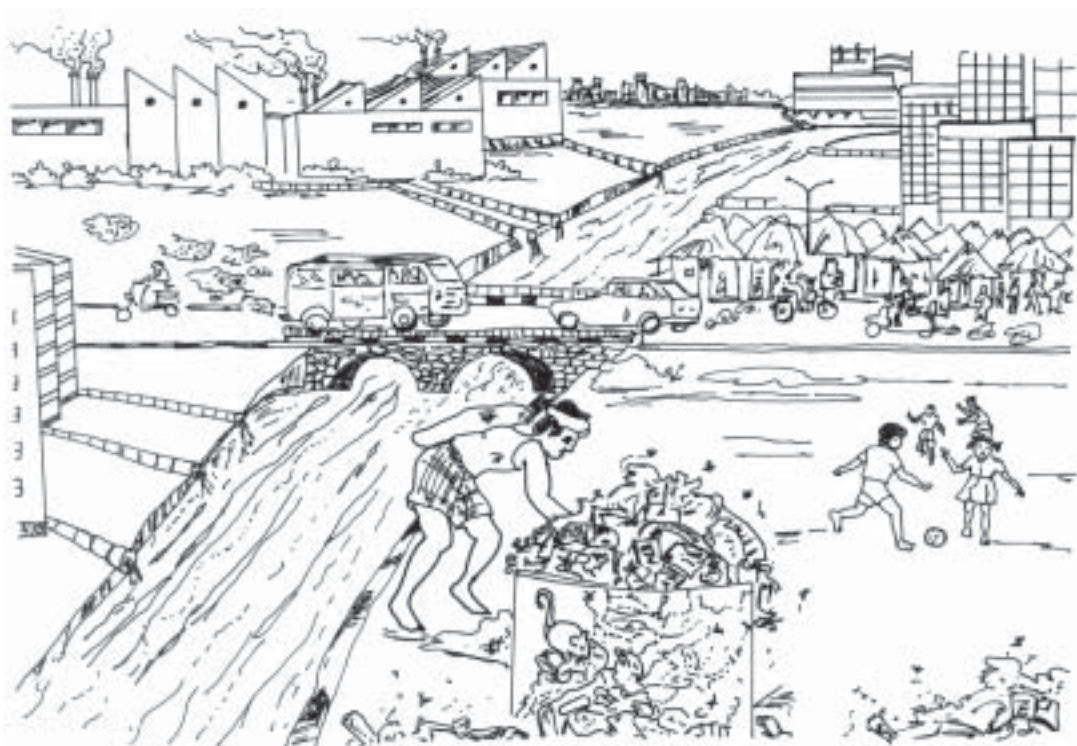


Fig 22.1 Activities leading to various types of pollution

22.3 TYPES OF POLLUTION

Depending upon the area or the part of environment affected, pollution may be of the following types:

- Air pollution
- Water pollution
- Land pollution
- Noise pollution

22.3.1 Air pollution

We all breathe in air, we can feel, and even smell the air and say whether it is fresh or stale. The pollution in air may not be noticed until we see smoke coming out

from some source. All human activities from cooking at home to the working of highly mechanized industries contribute to air pollution. Table 22.1 gives an idea of some major air pollutants, their sources and effects.

22.3.1a Prevention and control of air pollution

At domestic level, burning of wood and dung cakes can be replaced by cleaner fuel and use of biogas (formed by the decomposition of animal waste in a biogas plant).

Automobile pollution can be reduced by:

- pooling of transport or use of public transport,
- use of unleaded petrol and CNG,
- regular tuning and servicing of the engines, and
- switching off the engine at red lights or when not in use.

Table 22.1: Some major air pollutants, their sources and effects

Pollutant	Source	Harmful effect
Carbon compounds (CO and CO ₂)	Automobile exhausts, burning of wood and coal	<ul style="list-style-type: none"> • Respiratory problems • Green house effect
Sulphur compounds (SO ₂ and H ₂ S)	Power plants and refineries, Volcanic eruptions	<ul style="list-style-type: none"> • Respiratory problems in humans • Loss of chlorophyll in plants • Acid rain on dissolving with water
Nitrogen compounds (NO and N ₂ O)	Motor vehicle exhaust, atmospheric reaction	<ul style="list-style-type: none"> • Irritation in eyes and lungs • Low productivity in plants • Acid rain damages material (metals and stones)
Hydrocarbons (benzene, ethylene)	Automobiles and petroleum industries	<ul style="list-style-type: none"> • Respiratory problems • Cancer-causing properties
SPM (Suspended Particulate Matter), (Any solid or liquid particles suspended in the air, (fly ash, dust, lead)	Thermal power plants, construction activities, metallurgical processes, and automobiles	<ul style="list-style-type: none"> • Poor visibility, breathing problems • Lead interferes with the development of red blood cells, causes lung diseases and cancer • Smog (smoke+fog) formation leads to poor visibility and aggravates asthma in patients
Fibres (Cotton, wool)	Textile and carpet weaving industries	<ul style="list-style-type: none"> • Lung disorders

Following measures can reduce industrial pollution:

- installation of tall chimneys,
- installation of devices that do not allow pollutants to be released in the environment, such as filters, electrostatic precipitators, scrubbers etc.,

- closing down or shifting of industries polluting the atmosphere, and
- development and maintenance of green belt with adequate width.

22.3.1b Global environmental problems

i) The ozone hole: depletion of the ozone layer

The ozone layer present in the earth's atmosphere prevents the entry of sun's harmful ultraviolet (UV) radiations reaching the Earth's surface. Industrial use of chemicals called chlorofluorocarbons (CFCs) in refrigeration, air conditioning, cleaning solvents, fire extinguishers and aerosols (spray cans of perfumes, insecticides, medicines, etc.) damage the ozone layer.

Chlorine contained in the CFCs on reaching the ozone (O_3) layer splits the ozone molecule to form oxygen (O_2). Amount of ozone, thus, gets reduced and cannot prevent the entry of UV radiations. There has been a reduction by 30-40% in the thickness of the ozone umbrella or shield over the Arctic and Antarctic regions.

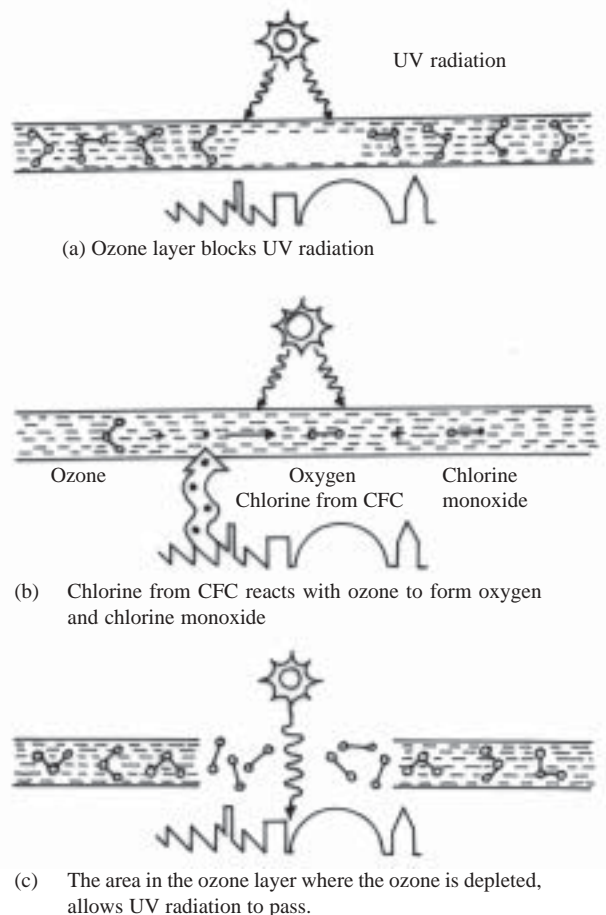


Fig 22.2 Depletion of the ozone layer

Depletion of ozone layer may lead to the following hazards:

- Sunburn, fast ageing of skin, cancer of skin, cataract (opaqueness of eye lens leading to loss of vision), cancer of the retina (sensitive layer of the eye on which image is formed)
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- Genetic disorders
- Reduced productivity at sea and forests

Damage to the ozone layer can be prevented by:

- Reduced consumption of CFCs by adopting alternative technologies (substituting air conditioning gases by non-CFCs)
- Discouraging the use of aerosol containing spray cans

ii) Global warming – The greenhouse effect

Greenhouse is referred to as a glass chamber where plants are grown in a closed warm environment as compared to the outside temperature. This is normally practiced in cold regions on the hills. The solar radiations bringing heat (in the form of infra-red rays from the sun) are trapped inside the chamber.

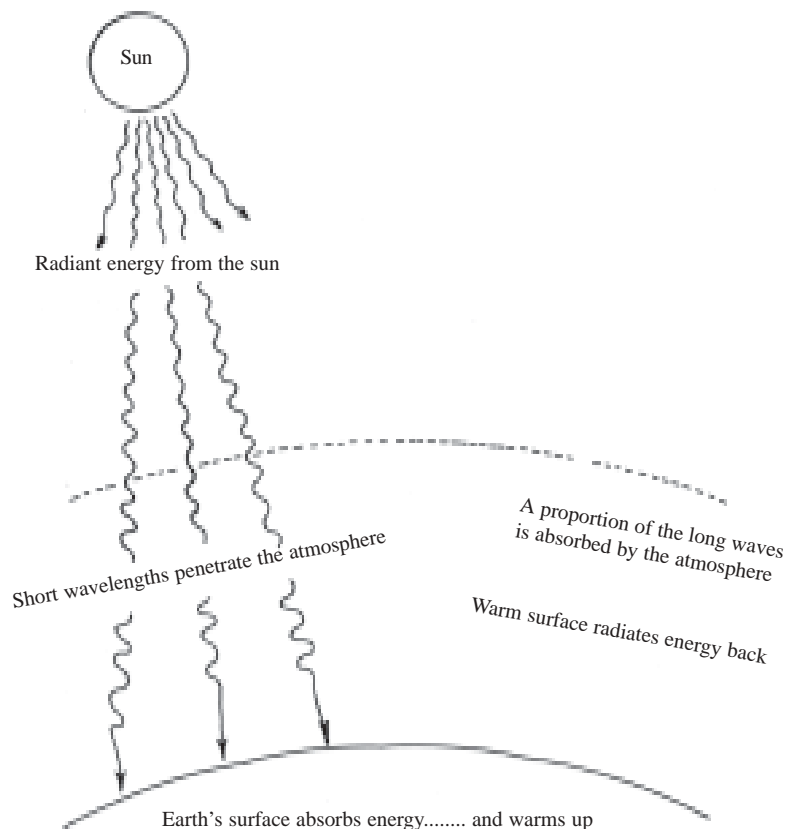


Fig. 22.3 Greenhouse effect

Industrialization and urbanization has lead to deforestation and release of gases, such as CO_2 , CH_4 and N_2O intoatmosphere These gases have converted the earth's atmosphere into a **greenhouse**. Heat contained in the solar radiations is allowed to come in, but the heat contained in it is not returned back due to increasing concentration of CO_2 . As a result, the earth's average temperature is increasing each year leading to **global warming**.

Effects of global warming

Although the increase in global temperature in the last hundred years has been estimated to rise by only 1 degree, it has resulted in serious consequences, such as:

- melting of snow caps/ glaciers and rising of sea level,
- unpredictable weather patterns,
- submerging of coastal areas of the Maldives islands in the Indian Ocean,
- early maturation of crops leading to reduced grain size and low yields, and
- interference with the hatching of eggs in certain fish.

Control measures against further global warming include reforestation, reduced burning of wood and reduced vehicular pollution.

CHECK YOUR PROGRESS 22.2

Fill in the blanks.

1. Addition of unwanted substances in the environment is called _____
2. Automobile exhaust gives out pollutants, such as _____ and _____
3. Increased carbon dioxide level in earth's atmosphere leads to the phenomenon of _____
4. _____ and _____ are examples of Suspended Particulate Matter.
5. Air pollution can be prevented by installing _____ and _____ in industries.

22.3.2 Water pollution

Addition of undesirable substances in water is called **water pollution**. Water pollution could be due to natural or man-made activities.

Natural sources are soil erosion, leaking of minerals from rocks, and decaying of organic matter, while **man-made sources** include domestic, agricultural and industrial activities. Many water sources have become a dumping ground of wastes. Water pollution is one of the main causes of human diseases in India.

Any physical, biological or chemical change in water quality that adversely affects living organisms or makes water unsuitable for desired use is called water pollution.

On the basis of origin, water pollution may be caused by point or non-point sources.

- **Point sources** discharge pollutants from specific source, for example, factories, power plants, drain pipes, and sewage treatment plants, etc.
 - **Non-point sources** of pollution have no specific location but arise from a larger area, such as surface runoff from fields, construction sites, etc.
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22.3.2a Types and effects of water pollutants

Let us study about the sources and effects of certain water pollutants in the following table 22.2.

Table 22.2: Some major water pollutants, their sources and effects

Type of pollutant	Examples	Sources	Effects
Infectious agents	Bacteria, viruses, and other parasites	Human and animal excreta	Water-borne diseases
Organic chemicals	Pesticides, detergents, oil	Agricultural, industrial and domestic waste	Biomagnification
Inorganic chemicals, fertilizers	Acids, alkalis, metals, salts	Industrial waste, household cleaning agents, surface runoff	Water unfit for drinking
Radioactive materials	Uranium, thorium, iodine	Mining and processing of ores, power plants, natural sources	Genetic disorders

Table 22.3: Some major disturbances in the ecosystem due to water pollution

Pollutant	Sources	Cause	Effect
Nitrates, phosphates, ammonium salts	Agricultural fertilizers, sewage, manure	Plant nutrients	Eutrophication
Animal manure and plant residues	Sewage, paper mills, food processing wastes	Oxygen deficiency	Death of aquatic animals
Heat	Power plants and industrial cooling	Thermal discharge	Death of fish
Oil slick	Leakage from oil ships	Petroleum	Death of marine life due to non-availability of dissolved oxygen

Fertilizers and pesticides are widely used in agriculture. You will learn more about them in lesson 32 on Agricultural practices. Their excessive use to increase agricultural yield has led to the phenomenon of **eutrophication** and **biomagnification**.

22.3.2b Eutrophication

With the use of high-yielding varieties of crops, the use of fertilizers and pesticides has increased a lot. Excess fertilizers may mix with surface water and may get drained into water bodies (surface runoff). The enrichment of water with nutrients such as nitrates and phosphates that triggers the growth of green algae is called

eutrophication. This fast growth of algae followed by decomposition depletes the water body of the dissolved oxygen. As a result, aquatic animals die of oxygen shortage.

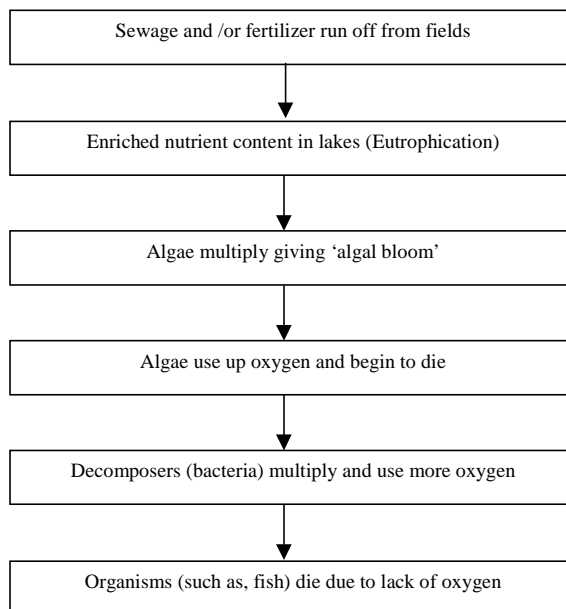


Fig. 22.4 Sequence of events that may occur as a result of eutrophication

22.3.2c Biomagnification

Non-biodegradable pesticides, such as DDT are widely used for crop protection. Once they enter the food chain, their concentration keeps on increasing with each trophic level (steps of a food chain). As a result, accumulation of these compounds takes place in the body of top consumers over a period of time.

Entry of harmful, non-biodegradable chemicals in small concentration and their accumulation in greater concentration in the various levels of a food chain is called biomagnification.

Consider the following food chain. Is there any difference in the concentration of DDT in water and that of the body of the Pelican bird?

Water	→	Algae	→	Fish	→	Pelican bird (top consumer)
0.2 ppm		77 ppm		500-600 ppm		1700 ppm

(ppm = parts per million)

DDT used in small quantities to kill mosquitoes can enter the food chain and may get concentrated in large concentration due to its non-biodegradable nature in the body of birds (top consumer). This causes adverse effects, such as weak egg shells, resulting in decreased population.

Death of vultures in large numbers has been reported due to eutrophication near Bharatpur area (Rajasthan).

High concentration of DDT has been reported in milk from cattle and mother's milk leading to various disorders in the newborn baby.

23.3.2d Control of water pollution

In order to control water pollution, following measures can be adopted:

- minimize the requirement of water by altering the techniques involved,
- maximum recycling of water after treatment (purification of waste water for reuse), and
- limiting the quantity of waste water discharge.

CHECK YOUR PROGRESS 22.3

Fill in the blanks.

1. _____ and _____ are examples of natural sources of water pollution.
2. Thermal discharge into rivers may lead to the death of _____
3. Presence of _____ and _____ in water may lead to infectious diseases.
4. Enrichment of water bodies with nutrients coming from fields is called _____
5. Non-biodegradable wastes, such as _____ may lead to biomagnification upon entering the food chain.

22.3.3 Soil pollution and land pollution

Addition of substances that change the quality of soil by making it less fertile and unable to support life is called **soil pollution**. Soil pollution is caused due to:

- **Domestic sources:** plastic bags, kitchen waste, glass bottles, and paper
- **Industrial sources:** chemical residue, fly ash, metallic waste, and
- **Agricultural residues:** fertilizers and pesticides.

Soil erosion leads to soil degradation due to uprooting of plants (over-grazing). It leads to the loss of the top fertile soil. Application of DDT, its entry in the food chain and accumulation in top consumers is also a part of soil pollution.

22.3.3a Recycling of waste materials for ecological balance

The waste generated from various sources can be categorized into two types:

- i) **Biodegradable waste** includes substances that can be degraded by microbes into harmless and non-toxic substances. Agricultural and animal wastes like leaves, twigs, hay, dung, etc. are biodegradable wastes.
- ii) **Non-biodegradable waste** cannot be easily degraded. Aluminium cans, plastics, glass, DDT, etc. are examples of non-biodegradable wastes. Radioactive wastes produced during nuclear reactions take a long time to decay and are harmful to human beings.

If a waste material is processed by some means and converted to a product, we call the process **recycling**. Recycling helps in efficient management of wastes and also reduces the load on natural resources. For example, recycling of plastics

and paper, converting municipal waste into manure, and rice husk into wood particle board.

Use of cow dung for the production of biogas is a good example of recycling of waste for the production of energy.

22.3.4 Noise pollution

You may enjoy listening to music. But if the volume is too high you may not enjoy it any longer. It may become irritating. Noise can be simply defined as “unwanted sound”. It is generally higher in urban and industrial areas than in rural areas. Workers using heavy machinery are exposed to high noise levels for long period of work hours every day. Intensity of sound is measured in a unit called **decibel** or **dB**. *The lowest intensity of sound that human ear can hear is 10 dB.*

22.3.4a Sources of noise pollution

The major sources of noise pollution are:

- Means of transport i.e. automobiles, railways, aircrafts, etc.
- Use of loud speakers, loud music system and television at public places
- Industrial activities
- Noisy fireworks



Jet plane taking off



Noisy group



At a party



Heavy traffic

Fig 22.5 Sources of noise pollution

22.3.4b Effects of noise pollution

- Temporary loss of hearing, earache, sometimes even leading to permanent deafness
- Inability to concentrate, headache
- Increased blood pressure, irregular heart beat
- Ringing of ears (a feeling of sound coming from within the ear in a very quiet environment)
- Inability to sleep, slow recovery from sickness.
- Irritability and interference in communication

22.3.4c Prevention and control of noise pollution

Following steps can be taken to control or minimize noise pollution:

- Control the noise emanating from your radio and television.
 - Use automobile horn only in case of emergency.
 - Do not burn fire crackers, they are noisy and also cause air pollution.
 - Getting all machinery and engines of automobiles properly tuned and serviced
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at regular intervals and by the use of silencers.

- Use of soundproof cabins and sound-absorbing materials in the walls.
- A green belt of vegetation is an efficient absorber of noise.
- Not playing loudspeakers during odd hours. It is legally banned and should be reported to the police immediately.

Radioactive pollution

Disintegration of atomic nuclei in some elements such as radium-224, thorium-232, and uranium-235 and uranium-238 is called radioactivity. The alpha, beta, and gamma particles produced during disintegration of radioactive substances in the environment cause ionization in the living cells. This may lead to genetic/birth defects, cancer of body parts including leukemia (blood cancer).

Overexposure to X-rays may lead to cancer. Pregnant females are advised not to get X-ray done for any diagnosis.

Radioactive waste produced by nuclear power plants, and nuclear weapons cause serious pollution and require careful disposal.

22.4 NATURAL ENVIRONMENTAL PROBLEMS

Some environmental problems are not man-made but are caused by natural forces. Floods, cyclones, earthquakes, volcanic eruptions, hurricanes, forest fires, etc. are a few examples. These are termed as **natural disasters**. The government of India has set up a High Powered Committee on Disaster Management to look into various disasters and suggest the ways to cope up with these disasters. Let us discuss about some such disasters and their impacts.

22.4.1 Flood

India is one of the most flood-prone countries in the world. We regularly learn about the damage caused due to floods. This is because 75% of the total annual rainfall occurs in about four months of monsoon from June to September. As a result, most of the rivers are full of water during this period. For example, as per the report of the High Powered Committee on Disaster Management in India about 1400 lives were lost, and about three lakh hectares area of land was affected due to floods in Gorakhpur and adjoining districts in Uttar Pradesh alone in 1998. On an average, about eight million hectares of land area is affected by floods annually in our country.

The following steps may be taken to prevent damage due to floods:

- Timely cleaning and desilting of water channels and reservoirs by civic agencies
 - Safe disposal of surplus run-off water from river to river and drain to drain to ensure easy flow of water
 - To locate buildings like public institutes, schools, offices, telephone exchange, power supply stations, railway tracks and stations, roads and residential areas etc. sufficiently above levels corresponding to floods of last few years frequency
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- Making buildings flood proof by raising their levels with the use of earth fill etc.
- Construction of rings around villages and residential areas
- Identify an evacuation center in the flood-prone area so that people can move there in emergency
- Stocking adequate stock of material / equipments to handle floods
- Ensure supply of drinking water by installing hand pumps above the highest flood level and storing adequate food and water
- Consuming boiled water and properly cooked food at the time of floods
- Preventing outbreak of epidemics during floods
- Keep away from high-held structures like walls and electricity poles in the event of flooding

Did you know?

Years 1955, 1971, 1978, 1988 and 1996 were the major flood years in India. In the year 1996 alone, about 7.42 million-hectare land was submerged, 39.4 million people were affected and over 2000 people died in the floods. The estimated economic loss amounted to Rs. 1.8 billion due to 1996 floods.

Source: Source book of District Disaster Management, Ministry of Agriculture, Dept. of Agriculture & Co-operation, Government of India.

22.4.2 Cyclone

India has a long coastline, which is vulnerable to the tropical cyclones in the Bay of Bengal and the Arabian Sea. Cyclones are intense low-pressure systems in the form of depressions, cyclone storms, severe cyclones associated with hurricane winds, etc. There are two cyclone seasons in India, the pre-monsoon season (April-May) and the post-monsoon season (October-December). The states of Orissa, Andhra Pradesh, Tamil Nadu and West Bengal are the most affected states due to cyclones. Balasore district in Orissa is the most vulnerable district for cyclone landfall. You would have heard about Orissa super cyclone that occurred in the state of Orissa on October 29, 1999 at a wind speed of 270-300 km per hour accompanied by heavy rains continuously for three days. The sea surged up to 7m high and seas waves travelled up to 15-20 km in land. This resulted in heavy losses. The agriculture, livestock, infrastructure, industries and environment were badly devastated during this cyclone.

Steps to be taken before, during and after a cyclone

- Build houses, buildings, etc. taking cyclone safety measures. Repair doors, windows, walls and roof tops, wherever necessary, before cyclone season. Remove decaying trees or any other loosely fixed objects. Demolish unsafe buildings.
 - Do not go into the areas where water level is high due to rains, coastal areas and where streams or rivers flow.
 - Have clean drinking water.
 - Store extra food, such as rice, pulses, *sattu*, etc.
 - Store enough drinking water.
 - Keep yourself alert and updated to the latest weather warnings.
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- Keep hurricane lantern filled with kerosene, and flashlights, matchbox, candles etc. ready.
- In case of a cyclone, head for the proper shelter or evacuation point, keep calm and remain there until informed that you may return back to your place.
- When you are moving to a shelter, move your valuable articles to upper floors so that they are not destroyed.
- Do not keep free objects like cans, tyres and other implements as they can cause injury during strong winds.
- Do not touch any loose electric wire to avoid electrocution.
- Do not spread rumours or listen to them.
- Board up glass windows and provide strong suitable support to outside doors.
- Make provisions for children and adults who require special diets.
- After the cyclone has passed get yourself inoculated against diseases and seek medical care for the injured and sick.
- Clear the house and dwellings of debris.
- Report any loss to the revenue authorities.

22.4.3 Earthquake

An earthquake is the shaking, rolling or sudden shock of the earth's surface. We are aware of the serious damages caused by earthquakes to life and property, at Bhuj and Anjar near Ahmedabad and some other places in Gujarat on 26th January 2002. Latur in Maharashtra also experienced a similar natural disaster on 30th September 1993.

Earthquakes are a common phenomenon. Most earthquakes pass unnoticed. Earthquakes of greater intensity shake buildings, and loosen the bricks. Falling of walls may injure people and property. Earthquakes also cause breakage of water pipes, cut electric lines, damage rail and road routes.

The intensity of earthquake is related to the amount of energy released when rocks give way to the forces within the earth. It is measured with the help of an instrument known as **seismograph**. The intensity of an earthquake is measured on the **Richter scale** (invented by the scientist *C.F. Richter*). Following values indicate the degree of damage.

Intensity on Richter scale	Extent of Damage
Up to 3	No damages
5	Cracks in old buildings
7	Cracks in roads
Above 8	Falling of buildings

22.4.3a Impact of a severe earthquake

Most problems from an earthquake result due to falling objects and debris because of collapse of the building, collapse of the ceiling plaster etc., and not due to the ground movement. The possible areas of impact of a severe earthquake are given below:

- Damage to property

- Damage to roads, bridges, dams, etc. that may leads to loss of human and animal lives and injuries
- Fires due to short-circuits or other means
- Damage to fields and settlements (landslides)
- Spreading of diseases sometimes may lead to epidemics

22.4.3b Preventive measures

- Construct earthquake-resistant buildings, roads, dams, bridges, etc.
- At home, locate beds away from the windows and heavy objects that could fall in event of an earthquake. Make sure that overhead plaster and lighting fixtures are well secured to the ceiling. Move heavy unstable objects away from the exit doors.
- In the event of an earthquake
 - Keep away from buildings, specially old and tall ones, electricity poles, wires and walls that are liable to collapse.
 - If travelling, stop the vehicle away from buildings, walls, slopes, trees, electricity poles and wires.
 - Move out in the open.
 - Do not rush to doors or exits, keep calm, never use lift and keep well away from windows, mirrors and furniture.
 - Stand under strong beams that may not fall or creep under the dining table or a strong bed.
 - If your home is badly damaged, come out of it immediately. Collect all emergency supplies like food, water, first aid kit, medicines, flashlight or torch, candles, matchbox, clothes, etc.
 - If you are under a building and unable to move, cover your head and body with your arms, pillows or blankets to protect yourself from falling objects.
 - If in a multi-storied building stay on the same floor. Do not use elevators or run towards the staircase. They may sustain damage.
 - Check for injuries. Apply first aid. Help others who require your help.
 - Check for fire and structural damage and clear blocked exits.

India has experienced four earthquakes of destructive magnitude (more than 8.0 on Richter scale). These are,

- 4th April, 1905; Kangra (8.25)
- January, 1934; Pusa, Bihar (8.25)
- 26th June 1941; Andaman (8.1)
- 15th August, 1950; Assam (8.6)

In addition, there have been many seismic contingencies of moderate magnitude

(6.0 to 7.0 on the Richter scale) during the last decade or so.

- 20th August, 1988; Bihar (6.5)
- 21st October, 1991; Uttarkashi (6.5)
- 30th September, 1993; Latur (6.2)
- 22nd May, 1997; Jabalpur (6.0)
- 29th May, 1999; Chamoli (6.8)
- 26th January, 2001; Gujrat (6.9)

22.4.4 Forest fires and their control

You are already aware of the benefits we derive from forests. Full benefits of forest resources can be obtained only if timber (wood) is protected from fire, diseases and insect pests.

Fire is a great threat to forests because it can cause tremendous damage in a short time. Forest fire may be caused due to:

- Human negligence, by carelessly dropping lighted matchsticks
- Lightening striking the dry trees
- Extreme heating of rocks, especially during the dry season

22.4.4a Fire fighting

Damage caused due to a forest fire can be controlled by the following means:

- Remove dry litter like dying twigs, leaves etc. during summer season.
- Try to put out the fire by digging a circle around it or by water, and call a fire brigade.
- Move farm animals and movable goods to a safe place.
- Do not throw smouldering *bidi*, cigarette or leave burning wood sticks around.
- Do not enter a forest if it is on fire.
- Inform all members of your family and others about the ways in which a fire can be caused and the methods to prevent fire.

CHECK YOUR PROGRESS 22.4

Fill in the blanks.

1. Domestic sources, such as _____ and _____ lead to land pollution.
2. Unwanted sound may lead to _____ pollution.
3. Noise pollution may be caused by _____ and _____
4. Intensity of earthquakes can be measured on _____
5. Vegetable peels and paper are examples of _____ waste.

LET US REVISE

- The perfect balance between the physical environment and the living organism in nature is called ecological balance.
 - Ecological imbalances may lead to destruction of natural habitat of wild life and loss of vegetation leading to desertification.
 - Increased population leads to over-exploitation of resources and many
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environmental problems, such as pollution, soil degradation, destruction of wild life, etc.

- Trees provide wood for multiple use, shelter to wild life, soil conservation and rainfall. Cutting down of trees may lead to environmental problems.
- Silviculture is the practice of reforestation; it includes planting of more trees to develop forest cover.
- Addition of unwanted substances in the environment is called pollution. Pollution could affect air, water, soil and noise quality.
- Loss of air quality is called air pollution, and is caused by the addition of gaseous and particulate pollutants from domestic, vehicular and industrial sources. Human, plant and animal life are adversely affected by air pollution.
- Water may be polluted from domestic, agricultural and industrial sources and makes it unfit for drinking and industrial use.
- Uranium-235, uranium-238, and radium-224 cause radioactive pollution that may lead to genetic or birth defects and cancer.
- Addition of nitrates and phosphates in water leads to eutrophication, followed by algal growth, depletion of oxygen and death of aquatic animals.
- Non-biodegradable chemicals, such as DDT, enter the food chain in small quantities but get accumulated in higher concentrations in top consumers. This phenomenon is called biomagnification.
- Soil pollution includes addition of substances that reduce the fertility of the soil.
- Waste can be classified into biodegradable (e.g. cow dung, vegetable peels, paper, wood etc.) and non-biodegradable (e.g. aluminium cans, glass bottles, plastics, DDT etc.).
- Recycling of wastes, such as cow dung, paper, sewage and rice husk, into useful products help in conservation of resources.
- Ozone provides a protective layer against harmful ultra-violet rays coming from the sun. Excessive use of chemicals, such as CFCs used in spray cans, gas used in refrigerators and air conditioners, lead to thinning of the ozone layer.
- Accumulation of high concentration of carbon dioxide has led to the phenomenon of global warming (greenhouse effect), and has resulted in increased earth's temperature.
- Earthquakes, floods, and volcanic eruptions are examples of some natural environmental problems.
- Forest fires may be caused due to human negligence; lightening and extreme rise in temperature in rocky areas, and can be controlled by removing inflammable material from fire line.

TERMINAL EXERCISES

A. Multiple choice type questions.

1. Which of the following may NOT lead to air pollution?
 - a) Carbon dioxide
 - b) Cooking oil
 - c) Lead particles
 - d) Carbon monoxide
2. Growing of forests is called
 - a) monoculture
 - b) horticulture
 - c) silviculture
 - d) agriculture
3. Which of the following chemicals lead to depletion of the ozone layer?
 - a) Carbon dioxide
 - b) Chloro-fluorocarbons
 - c) Nitrogen
 - d) Water vapour
4. Which of the following can be found in the body of top consumers in high concentration?
 - a) Nitrates
 - b) Phosphates
 - c) DDT
 - d) Vitamins
5. Soil erosion can be prevented by
 - a) use of pesticides
 - b) deforestation
 - c) afforestation
 - d) excessive use of fertilizers

B. Descriptive type questions.

1. Which of the following are biodegradable?
Aluminum foil, paper, ballpoint pen refill, grass
 2. Which gaseous pollutant has the ability to absorb infra-red radiations?
 3. A chemical factory in a village discharges its waste that is rich in nitrogen, in a pond. What phenomenon do you expect to take place?
 4. Leakage of gases used in refrigerators and air conditioners for cooling are not considered eco-friendly. Why?
 5. A ship carrying oil from the gulf region collides with huge rocks and gets damaged. Is this just news or has some serious consequences? Give your opinion in one sentence.
 6. Give the term given to replenishment of the forests from where wood can occasionally be taken for commercial use?
 7. List two ways to replenish forests.
 8. To set up a new industry, a large forest area had to be cut. List four ways in which the environment in that area may be affected.
 9. How does production of more paper in the world contribute to ecological imbalance? Use only four key phrases to support your answer.
 10. What could be a major disadvantage for man being placed at the top of the food chain? Name the phenomenon that may cause this harmful effect.
 11. List any three ways in which noise from various sources can affect the well-being of a person. Suggest few methods to control noise pollution.
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12. What does 'Global warming' mean? Name the gas responsible for this phenomenon and why should it be considered an environmental problem.
13. It was observed that a large number of vultures were dying around a crop field. Considering the fact that vultures are top consumers, explain the phenomenon that may have caused their death in large numbers.
14. How would you classify the waste generated at home? What is the difference between the different groups? How would you manage this waste so that it causes least pollution?
15. Name the instrument used to measure the magnitude of an earthquake. Suggest some ways to cope with them in earthquake prone areas.

ANSWERS TO CHECK YOUR PROGRESS

22.1

1. Cheetah, Tiger
2. Housing, construction of roads, industrialization
3. Silviculture, mass plantation
4. Air pollution, water pollution, global warming
5. Silviculture

22.2

1. Pollution
2. CO, NO, CO₂, NO₂ (any two)
3. Global warming/ greenhouse effect
4. Fly ash, lead particles, dust (any two)
5. Tall chimneys, electrostatic precipitators, scrubbers (any two)

22.3

1. Soil erosion, leaking of minerals from rocks, decay of organic matter (any two)
2. Fishes
3. Virus, bacteria, protozoa (any two)
4. Eutrophication
5. DDT

22.4

1. Kitchen waste/ glass /plastic bags/ bottles
2. Noise
3. Fireworks, loudspeakers, moving automobiles
4. Richter Scale
5. Biodegradable waste

GLOSSARY

Deforestation: Cutting of natural forest cover.

Reforestation: Plantation of trees to replenish forests.

Silviculture: The cultivation of forest trees to increase forest area. Silviculture provides wood for industries.

Pollution: Addition of unwanted substances in wrong concentration having an adverse effect on organisms and environment.

Greenhouse effect / Global warming: Increase in average global temperature due to high concentration of carbon dioxide, methane etc. that trap heat (from solar radiations).

Eutrophication: Enrichment of water bodies with nutrients such as nitrates and phosphates, leading to algal growth and death of aquatic life.

Algal bloom: Tremendous algal growth covering the pond surface.

Biomagnification: Entry of harmful, non-biodegradable chemical in small concentration and its accumulation in higher concentration at various levels of a food chain.

Decibel: Measurable unit of sound intensity.

Biodegradable: Organic compounds that can be decomposed / degraded by microbes, such as bacteria and fungus.

You Would Enjoy Doing the Following Activities

ACTIVITY 22.1

Aim: To compare the amount of particulate pollutants emitted from different vehicles.

Material required: pieces of white cotton cloth 8"x 8", rubber bands or thread to tie.

Method: Tie a piece of cloth on the exhaust of a diesel bus and another on the exhaust of a CNG bus. Remove the cloth after 2-3 days and compare the two pieces. Do you notice any difference in the colour of the cloth? Is the patch on one piece very dark? Was it tied to the diesel bus? Record your observations.

A comparison can be made between the amount of particulate pollutants emitted from different vehicles.

ACTIVITY 22.2

Aim: To compare the level of particulate pollutants in different areas in a city.

Material required: Some samples of leaves, hand lens, old white cloth/ tissue paper

Method: Pluck few leaves from a plant or tree growing near a road on which heavy vehicular traffic runs. Pluck few leaves from an area with little traffic. Compare the two samples. Observe them for particulate matter. Which of the two show more particulate pollutants on their surface? Which of the two has a shiny surface?

Gently wipe them with cloth or tissue paper. Which leaf makes it darker?

ACTIVITY 22.3

Aim : To study effects of noise pollution in different places.

Method : Conduct a survey among people living in very noisy areas, such as near railway crossings, place with heavy vehicular traffic, or a construction site. Do the people living in such places show signs of adverse effect of noise pollution, such as of stress, headache, and inability to concentrate, increased blood pressure, reduced or loss of hearing? Compare these with those living in an isolated place away from the city.