

In addition, you will also learn the meaning and definition of water pollution, soil pollution, air pollution and noise pollution as well as their causes and consequences.

**NOTES**

Finally, you will know the role and responsibilities of the Pollution Control Boards and the various measures offered by these boards to keep check on the existing pollution and depletion.

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**3.1 UNIT OBJECTIVES**

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After going through this unit, you will be able to:

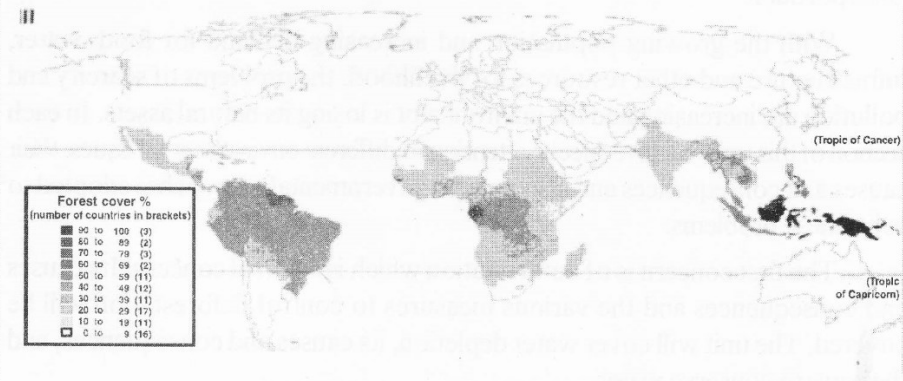
- Explain the term deforestation
- Identify the ways in which water resources are being depleted
- Define the meaning, causes and consequences of water, soil, air and noise pollution
- Explain the role of the Pollution Control Boards
- Analyse the measures being taken to control pollution

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**3.2 DEFORESTATION**

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According to several estimates made by the Food and Agriculture Organisation, forests cover about 10 per cent of the Earth's surface and 20 per cent of the continental surface area, excluding Antarctica and Greenland (see Figure 3.1). About 55 per cent of these forests are located in tropical and developing nations, with the remaining 45 per cent in the developed world. With time, the destruction of forest, also known as deforestation has become a very common phenomenon. The destroying of forests and the possibility of their disappearing from the very face of the earth is an issue of concern for all peoples of the world and it is also getting appropriate attention from all across the world. This attention is due to the forests' singular role in terms of ecology and evolution and their diverse roles and functions.



*Fig. 3.1 Natural Forest Area as a Percentage of Total Land Area in 90 Tropical Countries in 1990*

Forests constitute a prime part of global ecosystem and economy. They provide the largest natural habitat for wildlife. From the air, they take in CO<sub>2</sub> and release oxygen, thus regulate the supply and flow of fresh air. Forests also provide medicinal plants; help in flood control and prevent soil erosion. They furnish timber and wood for energy and fuel to about 1 billion people around the globe. Their contribution to local, national, and international economies is also quite significant.

## NOTES



**Fig. 3.2** Annual Average Deforestation Rate in 90 Tropical Countries during 1981–90

However, these precious resources are facing extinction or near extinction in several areas of the world due to deforestation. Deforestation is the process of permanent destruction of forests and woodlands. It refers to the clearance of naturally occurring forests by several methods such as burning, logging, cutting, etc. It has been found that the process of deforestation has led to the reduction of indigenous forests to the extent of four-fifths of their pre-agricultural area.

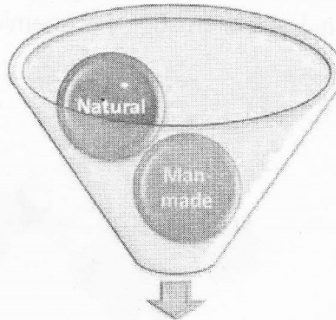
### 3.2.1 Causes of Deforestation

There are multiple reasons that cause deforestation. Sometimes it may be natural and sometime it may be manmade. The causes usually vary from place to place. According to several scientific communities, policy makers, and international agencies, felling of trees for commercial purpose, rising use of wood across the world for industries, cutting down of forest trees for agriculture and housing, increased economic development, globalization of wood product trade, overpopulation, road construction, poor harvesting practices, overgrazing, insects, pests and diseases, pressure combined with poverty, landlessness, demand for fuel wood, poor enforcement of existing laws by corrupt politicians and bureaucrats, air pollution, and extreme climatic events such as wildfires, ice-storms, and floods are some causes of deforestation. Figure 3.2 shows the annual average deforestation rate in 90 tropical countries during 1981–90.

On the whole, we find that there are basically two types of cause for deforestation:

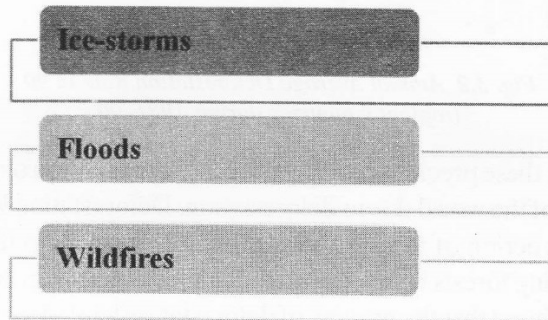
- Natural
- Man-made

**NOTES**



**Causes of Deforestation**

**1. Natural causes**



**• Ice-storms**

In many regions of the world, ice-storms have led to tremendous degradation of forests and the environment. In the years 1977 and 1998, ice storms were the major cause of deforestation in Canada and the United States. Here, large areas of forests of New England and Northeast Canada were badly affected. The estimated loss to forest covers was about \$10 million. Usually, through ice-storm the plants and trees are capped with ice which ultimately damages their root resulting in the trees and plants dying. The cause of deforestation due to ice storms is limited to cold climate regions of the world.

**• Floods**

Floods continue to devastate forests to a large extent. In many regions of the world, with rain flooding, not only the animal and human settlement get disturbed but the plants and trees of the ecosystem also get devastated. The intensity of flood disaster has increased tremendously in many Asian nations over the past few decades. Rampant destruction of Asia's forests is causing death and damage from floods, landslides and fire that may cost for more than the revenue earned from cutting of the trees.

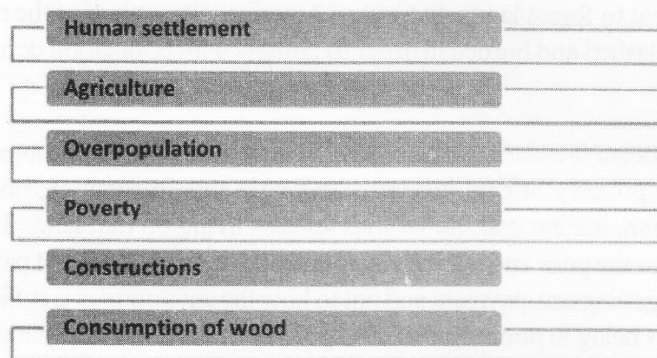
Few years back, an estimated 7,000 people died in floods in the Philippines which officials there blame on deforestation. Deforestation causes silting when loose soil is washed away as it was into the mighty Yangtze River in China. The river threatened to burst its banks in summer during rains that flooded large areas of eastern China and killed more than 1,000 people.

**NOTES**

• **Wildfires**

Due to rise in temperature, volcanic eruption and dry nature of climate, large tracts of forests are burned. This is termed as wildfire. Wildfires are becoming a very common reason for deforestation. Wildfires can burn huge portions of forests. In 1987, approximately 1.33 million hectares of forest land went up in flames in the North of China. In the year 1988, 400,000 hectares of forest were destroyed by fire in the United States.

**2. Manmade causes**



• **Human settlements**

The increasing human population, man's several activities on earth and his greed for more have led to the problem of scarcity of land for human settlement. To overcome this need, people are continually degrading the forests land for human settlement. In doing so, they are constantly cutting down the trees and plants for constructing new settlements for expanding new activities. When we lose our forest cover, we obviously also lose the rich biodiversity. This is clearly seen in both South Africa and Asia.

	Cropland	Pasture	Forest	Other
Africa	+8	-4	-25	+22
N&C America	+3	+11	+7	-20
S America	+14	+20	-41	+11
Asia	+4	-2	-29	+29
Europe	-2	-3	+2	+4

*Note:* Other land includes roads, uncultivated land, wetlands, built-on land.

*Source:* Estimated from World Resources Institute 1992, Table 17.1.

The figure suggests that sheer pressure of human population and its settlement has forced the conversion of a lot of forest land into commercial land.

- **Agriculture**

## NOTES

The need for more agricultural land has led to deforestation. In most developing nations, agriculture ranks high as a cause for deforestation. According to Food and Agriculture Organization (FAO) unsustainable agricultural practices lead to approximately 90 per cent of the deforestation. Various poor harvesting practices, logging and plantation forestry lead to deforestation. Besides this, in many countries, the governments formulate several policies to expand agricultural land and promote agricultural practices. This too can result in deforestation and degradation of forest land.

- **Overpopulation**

Another root cause of deforestation is overpopulation. A rising population poses serious threat to forest lands. In Central America, almost half of the rainforests have been slashed and burned in order to comply with population demands.

- **Poverty**

Persons associated with or concerned with betterment of the environment should know how poverty affects land use and how this impacts erosion, carbon concentration, habitat and the various species living on that land. If the main concern is for the poor and not the environment, such persons might pay attention to the poor getting eco-payment and not to how the environment is suffering. With most forests being in poor regions, irrespective of motivation, policies aimed at betterment of the rural poor will invariably affect many people and a large forest region.

Academic debates about how income changes impact deforestation, clearing of forests and macroeconomic growth are not definitive. According to Wunder, there is only an ambiguous link between degradation of land and income levels. Some nations show higher deforestation by persons with higher income and some others show lower income being associated with higher deforestation. Thus, deforestation provides low or high gains to both the poor and the rich.

In Madagascar, deforestation is mainly done for small and short-term gains, like for only about \$39 per year for a hectare of land and that too for just some years. In the forests of the Brazilian Amazon, it is not for home use that deforestation happens — approximately 80 per cent of it is for commercial purposes. Forests prove to be both a means out of poverty and a geographic poverty trap.

In order to understand the relation between poverty and deforestation, let us consider an example of Haiti. Haiti is considered to be the poorest country of the Western Hemisphere. One of the main reasons of this poorness mainly lies in Haiti's natural environment which is continually degrading. In fact, environmental degradation is unquestioningly one of the most immediate threats for Haiti. The

most important cause of Haiti's environmental degradation is the shortage of electricity. In search for more energy, the Haitians are looking for alternative sources of energy. And for them wood is the principal source of energy, accounting for 70 per cent of energy consumption in the year 2006. The demand for wood for energy production has resulted in steady increase in deforestation and loss of trees from the island.

## NOTES

### • **Constructions**

Construction of roads, industries, buildings, dams, houses, etc., is another major cause of deforestation in many parts of the world. Forests covering over thousands of hectares were removed in India and South America for building hydro-electric dams. The process of constructions not only gets rid of forests but at times tears away thousands of natives, in the process snatching away the very land they lived on and the traditions and culture they held dear.

In India, in the Himalayan valleys, contractors who came to clear the forest which is going to be submerged, greedily cut trees even in unaffected areas. People who were being displaced from Tehri town in Garhwal to make way for the dam were rehabilitated on forest land that had been acquired and cleared near Hardwar and Rishikesh. The forest is also being cleared for approach roads, residential quarters and for storage of construction materials. With the reduction in forest cover and the entry of people into that area, the pressure on the remaining forest increases. The need of these new settlers for fire wood leads to further denudation. The construction of the dam, therefore, has a multiplier effect. It is estimated that during the period 1951–1976, 0.49 million hectare of forest have been lost due to major river valley projects.

### • **Consumption of wood**

With the increasing population, the consumption of wood has also increased. People use wood for trade, cooking, heating and for several industrial purposes. This excessive use of wood has led to deforestation. It has been found that in the year 2008 the world's forests lost wood worth almost 3.4 billion cubic metres. Almost half of this wood was directly used for cooking and for obtaining heat and the remainder went into paper production and lumber purpose.

### **3.2.2 Consequences of Deforestation**

Forests are the major source of survival for animals, plants and trees and for humans as well. But with the increasing demand of mankind and several climatic changes, the forests are losing their assets through deforestation. On environment, the process of deforestation has led to several positive and negative effects. In few cases, deforestation can be advantageous. It could act as a balanced change from one kind of land use to a more productive use. On the contrary, in some places it may lead to serious environmental degradation. Some of the leading consequences of deforestation are:

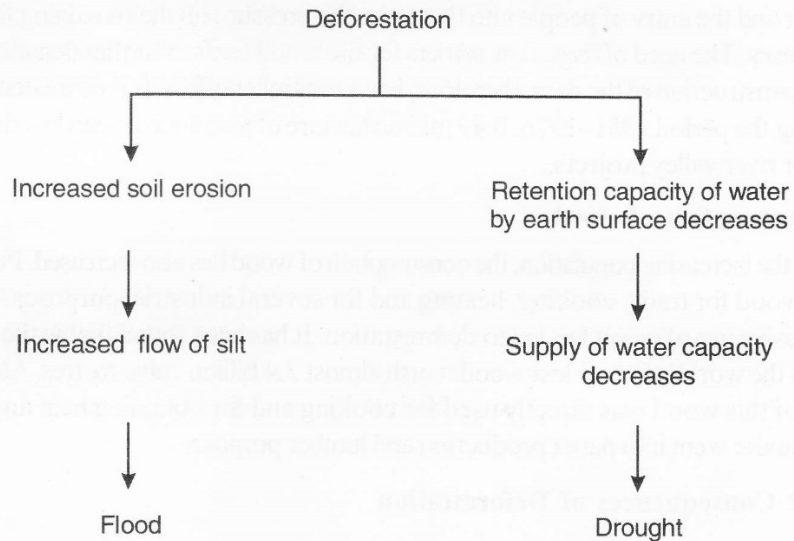
**Atmospheric consequences****NOTES**

The deforestation process contributes to global warming and also leads to the ineffectiveness of the enhanced greenhouse effect. It changes the climate and geography of an area. Deforestation is very much responsible for greenhouse gas emission and anthropogenic carbon dioxide emissions. It has been found that approximately 20 per cent of world greenhouse gas emissions occur due to deforestation and 12 per cent of total anthropogenic carbon dioxide emissions occur due to the same.

In addition, with the process of deforestation large amounts of  $\text{CO}_2$  is emitted in the environment resulting in global warming which is yet another cause of several other problems in the environment.

**Hydrological consequences**

Another important effect of deforestation is on water. The water cycle is greatly affected by deforestation. Due to deforestation, the content of water in the soil and groundwater as well as atmospheric moisture gets reduced resulting in a much drier climate. Trees extract groundwater through their roots and release it into the atmosphere. However, due to deforestation, the trees no longer evaporate away this water. As a result of this the climate become very dry and parched.



Deforestation also reduces the capacity to intercept, preserve and transpire precipitation by landscape. Instead of catching precipitation, which then penetrates to groundwater systems, deforested areas become the basis of surface water runoff, which moves more rapidly than subsurface currents. Another consequence of deforestation is decreased evapo-transpiration, which also reduces atmospheric moisture.

**Soil-related consequence**

Besides losing forest cover, deforestation leads to soil loss. Generally, deforestation exposes vulnerable soils to erosion and fosters their degradation through the loss of soil nutrients and reduced soil vitality. When farming the fields, the farmer usually creates a fertilized layer of ash by burning the vegetation and trees. It turns the entire land into the deforested area.

**Ecological consequences**

Another outcome of deforestation is decline in biodiversity. Deforestation has resulted in a degraded environment with reduced biodiversity. A forest is the habitat for many animals and natural resources. But due to deforestation, all these assets get destroyed. Deforestation can also irretrievably destroy genetic variations such as crop resistance. According to an estimate, the impact of rainforest deforestation has led to the loss of 137 insect, plant and animal species on a daily basis. It is estimated that on an annual basis 50,000 species are lost.

**Social and economic consequences**

The arrival of 'civilization' for most of the indigenous communities generally implies the devastation of their traditions and the crumbling of social institutions. Generally, the local communities and the indigenous people have been kept out of decision-making regarding issues that impact them directly and even their collective and individual claims to the forest resource are overlooked. With the intrusion of outsiders to destroy the forest, they have also destroyed the religious beliefs, customs and traditional life styles of the indigenous peoples.

In terms of economy, the process of deforestation has led to decline of forest capital. Cutting down and destruction of forests has hampered the employment and revenue that forests could have made available in the future if sustainable management had been practiced.

**3.2.3 Control of Deforestation**

In order to curb deforestation, many national and international organizations are taking major steps for formulating programmes. These organizations include the World Bank and the United Nations. The term Reducing Emissions from Deforestation and Forest Degradation (REDD) is used to address these sorts of programmes, which limit deforestation by using various monetary measures and other direct incentives in the developing countries. In addition, the UN Framework Convention on Climate Change (UNFCCC) and other organizations are providing funds to control deforestation.

**Deforestation control in India**

In order to control deforestation in India many programs are undertaken by the Central and State Governments. Some such programs are Social Forestry Programme (1976) introduced by National Commission on Agriculture, Agro-forestry Programme and Urban-forestry Programme. All these programmes were enforced to check indiscriminate deforestation.

**NOTES**



**Chipko movement in India****NOTES**

To save important parts of mother earth some people became conscious and started opposing those who not only destroyed the environment of the earth but also caused harm to themselves as well as other organisms. Chipko Andolan is a movement in which people opposed the cruelties of man on forests and trees in particular. The Chipko Andolan started in the year 1972 in the upper reaches of Uttar Pradesh Himalayan region, Tehri Garhwal. Many people opposed this large-scale deforestation but they never got success. The real movement started in March 1973 in Gopeshwar in Chamoli district when a sports goods factory of Allahabad was to cut ten Ash trees near the village Mandal. The local people prevented the same by hugging the marked tree. The same was repeated later in Rampur Phata in 1974, women led by Gaura Devi successfully prevented felling of forest trees near village Reni. The movement was slowly spread to all nearby areas and outside by Chandi Prasad Bhatt of Gopeshwar and Sunder Lal Bhuguna of Silyara in the Tehri region.

The Chipko Movement succeeded and the results of the movement are as follows:

- Contractor system was abolished by the government.
- Uttar Pradesh Forest Development Corporation department was formed which works for the welfare of the hilly areas and the population residing there.
- It slows down the process of deforestation.
- It enlightened people about the necessity of ecological balance in nature.
- It created awareness amongst the people of not only Uttar Pradesh but of other states.

**Others ways to counter deforestation**

Deforestation can also be controlled by individuals through several methods by reducing usage of wood-based products, such as by recycling books or pad paper, toilet paper, even shopping bags. In the field of agriculture farmers should stop using various agricultural practices, should avoid using excessive use of pesticides, herbicides, etc. Also, they should opt for rotational farming. With the process of crop rotation, the farmers not only increase the harvest every year, but there is also the chance of preserving that piece of land for a longer period of time. For domestic purposes, people should stop using firewood, instead they should use coal. And last but not the least, all people in the country should follow the programmes laid by the governments regarding deforestation control.

**CHECK YOUR PROGRESS**

1. Forests cover on the earth's surface about
  - (a) 20 per cent of the land area
  - (b) 12 per cent of the land area
  - (c) 15 per cent of the land area
  - (d) 10 per cent of the land area
2. According to Food and Agriculture Organization (FAO), about 90 per cent of deforestation is caused by
  - (a) Urbanization
  - (b) Irrigation
  - (c) Unsustainable agricultural practices
  - (d) Construction
3. In the year 2008, the amount of trees removed from the world's forests was
  - (a) 3.5 billion cubic metres
  - (b) 3.4 billion cubic metres
  - (c) 3.3 billion cubic metres
  - (d) 3.7 billion cubic metres
4. Due to deforestation, the emission of greenhouse gases is about
  - (a) 20 per cent
  - (b) 30 per cent
  - (c) 10 per cent
  - (d) 9.8 per cent

**NOTES****3.3 DEPLETION OF WATER RESOURCES**

Water is an element of great importance and is responsible for the existence of life on earth. Almost two-thirds of the earth's surface is covered by water. Some is used by humans; while some is used by plants and animals and some used to maintain the ecological balance of the environment. Besides, water has greatly contributed to the rise and fall of many a civilization. It has led to rivalry between nations that could get worse if no stop is put to the trend of rapidly depleting water resources. With time, due to several factors, various water resources are getting depleted from the planet. There is about 1360 million cubic kilometres of water on earth. The various resources of water on the planet are oceans, lakes, the atmosphere, underground aquifers, glaciers, snow, etc. Among all the resources, 97 per cent of the water is present in the oceans. The rest, about 37 million cubic kilometre, is fresh water but most of that is of little use since it is locked in icecaps and glaciers. Thus, we find that the percentage of water resource for general use is very low on earth. Wastage of water may create a condition of heavy water depletion and water shortage.

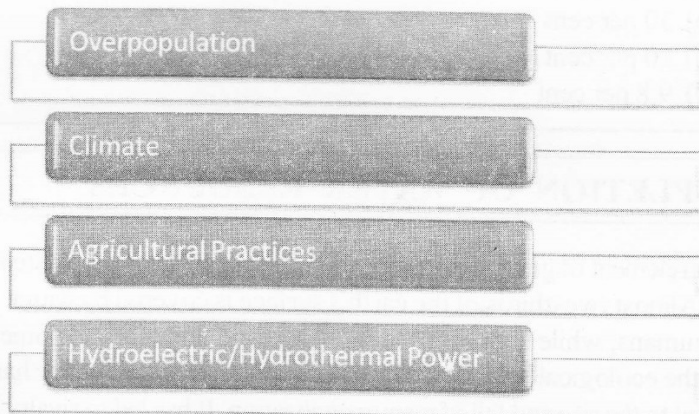
## NOTES

Water depletion is a phenomenon where the percentage of water gets reduced from earth. Today, depletion of water resources has become a global concern. The depletion of water resources can prevent many activities on the earth. Consider the following statistics: you need at least three litres of water to produce a tin of vegetables, 100 litres to produce one kilogram of paper, 4500 litres to produce one tonne of cement, 4.3 tonnes to manufacture one tonne of steel, 50 tonnes to manufacture a tonne of leather and no less than 2700 tonnes to make a tonne of worsted suiting.

Even more importantly, the average human needs to drink a litre or so of water a day to stay alive. Water requirement of those who are on starvation diets are dramatically higher, because food itself consists mainly of water. But this is not the most important statistic of all. There are few places in the world where survival is threatened directly by lack of drinking water. According to the United Nations Food and Agriculture Organization (FAO) approximately 20 per cent of the population on Earth (close to 1.2 billion) faces scarcity of water. An additional 500 million are not far from that mark. Water has today become higher in value than diamonds.

### Causes of depletion of water resources

There are various causes of depletion of water resources. Water depletion is an outcome of an imbalance between water use and water resources. Let us discuss some of the major causes of water resource depletion.



### Overpopulation

Overpopulation is one of the major causes of depletion of water resources. Overpopulation has created a perfect storm water shortage on the globe. It has been expected that by 2030 the population of world is going to hit 8.3 billion. This may cause a 30 per cent increase in the global requirement of fresh water for drinking which is already in shortage. With the increasing population, the demand for fresh drinking water and the demand to provide more to agriculture sector will ultimately deplete the various resources from earth.

### **Climate**

Change in climate also has a hand in depleting the various resources of water. Change in climate has led to global warming, drought and routine weather patterns changes that have led to depletion of water in many regions of the world. According to Natural Resources Defense Council, due to climate change about one-third of all counties of the world will face a higher risk of water shortages in 2050.

### **Agricultural practices**

Various agricultural practices due to increasing demand of food supply have led to the decrease in water resources. For instance, water resources depleted due to wasteful irrigation practices. Approximately 70 per cent of the water used on earth is channeled for irrigation while 50 per cent of the water that is meant for irrigation does not reach its correct destination.

Besides the above/mentioned causes, water use, water quality, food production, and poverty, etc., are responsible for depletion of water resources.

### **Effects of depletion of water resources**

Due to the depletion of water resources, one day people will not have any naturally clean, healthy water. People will not find fresh and clean water for drinking and other domestic purposes. This may lead to a situation of war.

The depletion of water resources will also hamper the generation of electricity in most of the developing countries, as most of them use hydroelectric power plants to produce electricity which requires huge amounts of water.

Another effect of depletion of water resources may be on people's health. For instance, when farmers in poorer parts of the world do not get fresh water to grow crops, they will use polluted water, meaning that more than 10 per cent of the global population will consume food that contains chemicals and potentially hazardous organisms. And the outcome of this will be poor health due to various diseases.

Therefore, it is very important for all people of the world to keep control on the use of water resources. It is essential for every government of the country to implement water conservation or water efficiency measures and work on water management practices. This way, the world can enhance the beneficial use of water and can conserve it for future while judiciously using it in the present.

## **NOTES**

**NOTES**

**CHECK YOUR PROGRESS**

5. On the planet earth the cubic kilometre of water is
  - (a) 1360 million
  - (b) 1380 million
  - (c) 1260 million
  - (d) 1560 million
6. The various causes of depletion of water resources are
  - (a) Agriculture
  - (b) Climate
  - (c) Economy
  - (d) Education
7. Due to water depletion people will not have access of
  - (a) Saline water
  - (b) Polluted water
  - (c) Clean drinking water
  - (d) Contaminated water
8. The world's water consumption for irrigation is
  - (a) 80 per cent
  - (b) 20 per cent
  - (c) 40 per cent
  - (d) 70 per cent

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**3.4 WATER, SOIL, AIR AND NOISE POLLUTION:  
THEIR CAUSES AND CONSEQUENCES**

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**3.4.1 Water Pollution**

Water is an important resource and commodity of nature and man. Since the origin of mankind, man is constantly exploiting water and its uses. Most of the demands for water by human are fulfilled through the rain water that seeps into the ground and is stored in both ground and surface water sources. On earth, the amount of such usable water is not limitless. The water cycle is all the time purifying the water yet water pollution remains a significant environmental hazard. Both the amount and quality of water is decreasing steadily and at a rapid pace. Besides others, the main cause of such water degradation is high pollution of water caused by agriculture, urbanization, industrialization and population growth over a century and a half.

**Meaning of pure water**

It can be said that we cannot consider any water pure since all waters have some amounts of minerals, life and gases in them. However, in pure water we will find considerably low quantities of its biological life, obnoxious gases and suspended and dissolved solids. Pure water is mainly used for the purpose of drinking. The water used for industries and agriculture can be of a lower quality with a certain accepted level of pollution.

**NOTES****Meaning of polluted water**

Water is considered polluted when its composition and quality are altered due to natural causes or due to human activities and it becomes unusable for the purposes of wildlife, recreation, industry, agriculture, domestic use, and drinking and any other purpose.

**Definition of water pollution**

Water pollution is defined as the impairment of water quality due to mixing of sewage or industrial wastes. The resultant is their adverse and unreasonable effects on a variety of beneficial water uses. Usually, pesticides and chemicals are the key man-made pollutants of water. Sometimes biological and physical elements are also pollutants. Physical factors like radiation and heat are major causes for water modification. Among biological factors, there are certain microorganisms that are present in the water which cause pollution in the water.

**Causes of water pollution**

Water pollution causes serious environmental and health problems. As discussed above, usually chemical and pesticides used in the industries and agriculture are the main causes of water pollution. Besides this, the other causes of water pollution are:

Sewage and Wastewater
Dumping
Industrial Waste
Oil pollution
Radioactive waste
Global warming
Atmospheric Deposition
Underground storage Leakages
Eutrophication

*Sewage and wastewater*

Water pollution and sewage go hand in hand. In most developing nations, sewage is one of the leading causes of water pollution. Sewage is often termed as wastewater

and is mostly generated through industrial, agricultural and several domestic practices. These wastewaters often contain chemicals, urine and laundry waste, etc., which play a dominant role in polluting water on a large scale.

## NOTES

It has been found that sewage is drained off in large quantities into rivers. According to an estimate in most of the developing countries about 90 per cent of the sewage water is discharged directly into streams and rivers without treating.

### *Dumping*

Disposal of waste material in water also pollutes water greatly. The disposal of waste material into water is a universal practice. In the beginning, lakes, streams and estuaries were the main waste repositories. With the passage of time, people started depositing their agricultural, industrial, medical and household wastes into oceans and seas. Today, dumping waste into various bodies of water is a cheap and convenient way to clean society from food wastes, trash, mining waste, human waste, etc.



*Industrial Waste*

### *Industrial waste*

Industries are a major cause of water pollution. The effluent from industries contains huge amount of chemicals that cause water pollution. Some of the major pollutants from the industries' waste include lead, mercury, nitrates, phosphate, sulphur, oil and petrochemical.

### *Oil leakage and spills*

Leakage of oil into ocean or spills of oil tankers in ocean water are very much responsible for water pollution. The biggest oil spill in recent years was in Alaska in 1989 due to the tanker Exxon Valdez breaking up in Prince William Sound. Around 44 million litres (12 million gallons) of oil spilled into the ocean, destroying several millions of marine animals, almon, herring eggs and birds.

### *Radioactive wastes*

Deposition of radioactive wastes in water is yet another source of water pollution in most of the developed and developing countries. Most of the radioactive wastes

are an outcome of scientific, medical and industrial processes. It may be sludge, gas, liquid or solid in state. Each form of radioactive waste can contain radio-nuclides like uranium that are heavy elements or like tritium that are very light elements. Based on the radio-nuclides it contains, waste can be radioactive from minutes, seconds or millions of years, seriously damaging the environment in the process.

In man-made environment, radioactive substances are found in watches, television sets, luminous clocks, medical equipments, nuclear power plants, etc. In natural environment, radioactive substances are found in cosmic radiations from space and the naturally occurring radioisotopes from organisms within the environment. If the wastes produced from all these substances are not properly disposed, they may result in serious water pollution.

For the deposition of radioactive waste in UK, an authorization permit is issued by a regulator — the Environment Agency. The permit is the applicable regulator in England and Wales. The agency sets very severe conditions in its authorization permits, as improper disposal of radioactive waste can cause water pollution that harms both the environment and human health.

#### *Global warming*

Today, global warming is a worldwide phenomenon. Many of the awful changes in environment are the outcomes of this phenomenon. One of the most adverse effects of global warming is water pollution. Due to global warming, the temperature of water increases in seas, oceans and other water bodies resulting in the death of many marine animals. For instance, coral bleaching of reefs occurs with the rise in temperature of water. This can affect coral reefs by damaging them and subsequently, all the marine life that depends on them. The death of aquatic life in large scale further pollutes the water to a great extent.

#### *Atmospheric deposition*

Atmosphere is also very much responsible for the pollution of water on earth. The water is mainly polluted due to air which contain various gases like carbon dioxide, sulphur dioxide, nitrogen dioxide, etc., which together constitute acid rain. When acid rain falls, these gases pollute the water and harm aquatic life.

#### *Underground storage leakages*

Underground Storage Tank (UST) is another source of water pollution. These tanks usually contain substances such as petroleum that are harmful to the surrounding environment. Any small leakages in them can create huge water pollution over time.

#### *Eutrophication*

Water enhanced with nutrients is termed as eutrophication. This can also be a cause for water pollution, especially in lakes. Eutrophications are mainly caused due to excessive use of fertilizers in agricultural sector. Sometimes these fertilizers

## NOTES



**NOTES**

run off into the nearby water and cause an increase in nutrient levels in the water which leads to algal blooms. The bloom of algae in the water disrupts normal ecosystem functioning and causes pollution in the water. This may result in the death of many aquatic organisms; it may obstruct sunlight, necessary for photosynthesis, from reaching the marine plants under the water surface.

**Consequences of water pollution**

Water pollution leads to serious consequences. These include changes in water quality, which makes it unfit for domestic, agricultural, industrial and recreational use. All forms of aquatic life suffer from some sort of water pollution. Some of the major consequences of water pollution are:

- Damaged marine food chain
- Spread of Diseases
- Acid rain
- Contamination of aquatic food
- Change in water nutrients
- Heating

*Damaged marine food chain*

Pollution in water is also responsible for damaging the aquatic food chain. Due to water pollution, many aquatic species are on the verge of extinction. And the day is not very far when many life forms will not be found in the aquatic environment. The adverse effect of this will be on those species that rely on them for food. They will also die and thus, the entire food chain will be damaged.

*Spread of diseases*

Water pollution is the principal cause of death for mankind across the world. It is a major cause of several infectious diseases such as typhoid and cholera. It can also cause several other health problems such as poor blood circulation, vomiting, skin lesions and damage to the nervous system.

*Contamination of aquatic food*

Through water pollution various marine food sources are contaminated. Due to water pollution several harmful toxins enter water through industries and other sources, they directly enter into the aquatic animal body and when animals or humans eat those aquatic beings it causes harm to the consumer causing many diseases and sometimes leading to death.

Water pollution also leads to the change in water nutrients which can ultimately lead to the destruction of plants and animals in water. For instance, excessive nutrients can lead to rapid growth of algae and plants in oceans. The algae releases huge amount of toxins in the marine environment and thus kills fishes. In addition, with the ample growth of plants due to excessive nutrients, the ratio of oxygen in the water also decreases. In the worst case, all of the oxygen will be removed from the water which will affect the entire marine life forms.

*Increase in water temperature*

Due to excessive intervention and action of man in the environment, the temperature of water also rises. Somewhere, pollution due to human action is also responsible for this phenomenon. The direct effect of this is seen on ecological environment, it mainly affects the marine life killing huge amount of life forms inside water. Besides, it may also lead to rise in the level of water bodies causing floods and other natural disasters.

### **3.4.2 Soil Pollution**

Soil is essentially a natural body of mineral and organic constituent produced by solid material recycling during a myriad of complex processes of solid crust modifications. Soil offers shelter and habitat for a countless number of organisms, provides an incubation and living medium for plants, while playing its role perfectly in the universal cycle of material flow between the four main geospheres, i.e., atmosphere, lithosphere, hydrosphere and biosphere.

#### **Definition of soil pollution**

Soil is mainly composed of two forms of thin layers, i.e., organic layer and inorganic layer that cover the surface of earth. The organic soil is the resultant of the concentration of decayed animals and plants in the topmost layer of soil. On the other hand, the inorganic layer of soil is made up of rock fragments which are mainly formed due to physical and chemical weathering of the bedrock. With time, there is a huge problem of soil pollution taking place in the environment. Pollution in soil refers to the persistent increase in the soil of disease causing agents, materials that are radioactive, salts, chemicals or toxic compounds.

Basically, there are two types of soil pollution that takes place in the environment:

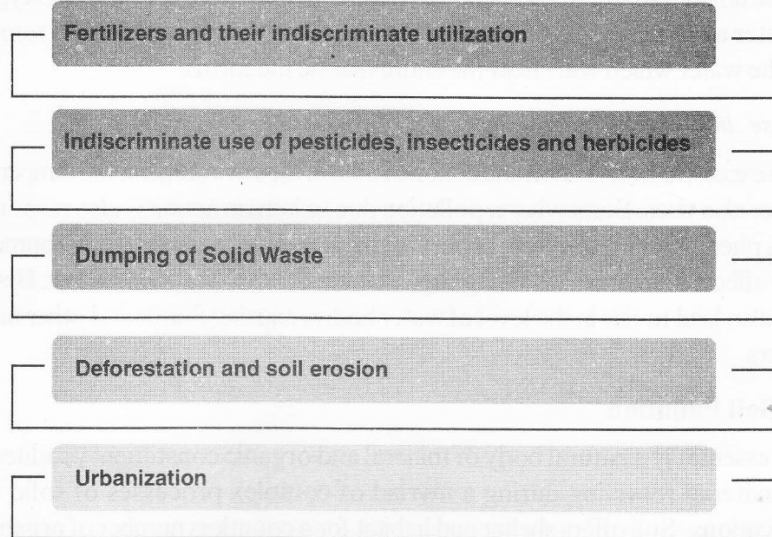
- Agricultural soil pollution
- Non-agricultural soil pollution

The agricultural soil pollution comprises those forms of pollution that are mainly found in agricultural land surface or in agricultural below topsoil level of land. These are mainly caused due to excessive use of pesticides, fertilizers, herbicides, fungicides, nematocides, etc. They are also polluted by the use of several forms of animal wastes. On the other hand, the non-agricultural soil pollution is the direct result of urbanization and industrialization.

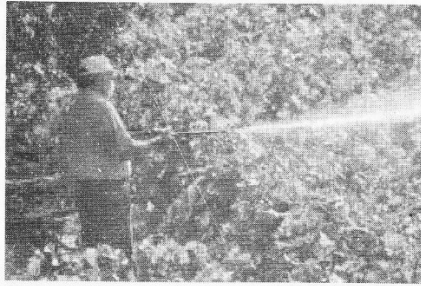
## **NOTES**

**Causes of soil pollution****NOTES**

Interference of human beings and several alterations made by them in the environment lead to soil pollution. It is through soil pollution that the soil's mineral content, texture and quality get degraded. Various causes of soil pollution are listed below.

*Fertilizers and their indiscriminate utilization*

In order to get better yield, mostly farmers use synthetic fertilizers. The excessive use of fertilizers pollutes the soil to a great extent as it contains chemicals like ammonium nitrate ( $\text{NH}_4\text{NO}_3$ ), potassium as  $\text{K}_2\text{O}$  and phosphorus as  $\text{P}_2\text{O}_5$ . The excess use of all these chemical rich fertilizers pollutes the soil and also reduces the quantity of vegetables and crops grown in the soil that is subject to such fertilizers.



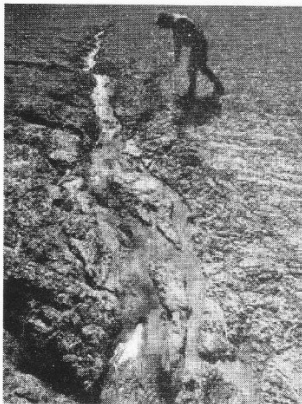
In order to kill the bacteria, viruses, insects, fungi, rodents and other animals that can harm a crop, farmers generally use various kinds of pesticides, insecticides and herbicides. The pesticides, insecticides and herbicides have a poisonous effect on humans and animals and pollute the soil and decrease its fertility.

*Dumping of solid waste*



Solid materials that have been discarded from agricultural, commercial or industrial processes, household waste and garbage, all fall in the category of solid waste. Some examples would be toxic waste like batteries and cells, organic solvents, oil, and other materials like glass, paper, construction material, plastic and cardboard. Dumping of all these substances on the earth's surface not only pollutes the topmost layer of the soil but it also pollutes inner layers of the soil.

*Deforestation and soil erosion*

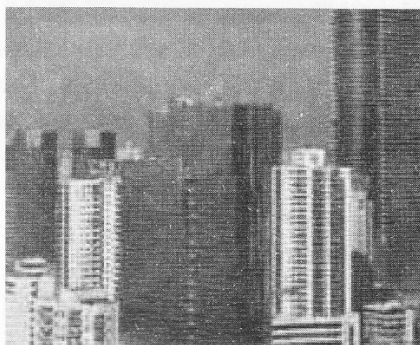


**NOTES**

## NOTES

Deforestation and soil erosion are other big causes of soil pollution on earth's surface. The process of soil erosion usually happens when broken down particles of soil get dislodged and flow away with water or are blown away by wind. Besides this, deforestation, temperature extremes, agricultural development, construction, mining, over-cropping and overgrazing by humans and precipitation, including acid rain also contribute to soil erosion. Due to the aforesaid activities, soil gradually loses its nutrients.

### Urbanization



Urbanization has led to the development of such urban activities that are gradually degrading the environment. One of its adverse effects is on soil. Most of the urban activities are related to industrial activities which generate large quantities of biodegradable materials such as animal and vegetable wastes, cement pieces, stone, glass in form of bottles fragments, etc., plastic in form of bags, bottles, cups, etc. cloth, leaves, plant branches and twigs, paper, carcasses and even pieces of wood, and sanitary wastes. Disposal of all these solid wastes in the soil not only pollute the air but also has a hazardous impact on soil.

### Consequences of soil pollution

The consequences of soil pollution are alarming and very hazardous. Some of them are listed below.

- Appearance of dangerous chemicals in the underground water
- Ecological imbalance
- Lessening of soil fertility
- Reduction in nitrogen fixation
- Reduction in crop yield
- Deposition of silt in tanks and reservoirs
- Larger loss of soil and nutrients
- Increase in erodibility
- Increase in soil salinity
- Less vegetation
- Damaged in soil structure
- Formation of toxic dusts
- Harm soil stability

### 3.4.3 Air Pollution

Air is a mixture of gaseous, liquid, or solid substances. It mainly constitutes 78 per cent nitrogen and 21 per cent oxygen and traces of the gases helium, neon, hydrogen, carbon dioxide and argon, to name some.

#### Definition of air pollution

As we know, air is composed of various forms of gases and when the composition of these gases gets disturbed by means of man-made intervention, it affects both the animal and plant life. This modification of composition of gases in the air which has a negative effect on the environment is termed air pollution. Air pollution is basically the evidence of unwanted substances in air. According to World Health Organisation, 'Air pollution is defined as the discharge into the atmosphere of foreign gases, vapours, droplets and particulates, or of excessive amounts of normal constituents either from natural sources such as volcanoes, or from man's activities'.

According to India Standards Institution IS-4167-1966, 'Air pollution is defined as the presence in ambient atmosphere of substances, generally resulting from the activity of man, in sufficient concentration, present for sufficient time and under circumstances to interfere significantly with comfort, health or welfare of persons or with full use or enjoyment of property'.

Air pollution means many different things to different people. To some, it is the reduction of visibility which interferes with automobile and airplane traffic. To the householder, it may be the source of eye irritation and throat irritation. To the farmer, it may be damaged vegetation. To the industrialists it may be the problem of process control, a source of poor public relation and of complaints that are often justified. Thus, in its broadest context, air pollution may exist in three distinct categories.

- Personal air pollution
- Occupational air pollution
- Community air pollution

#### *Personal air pollution*

Personal air pollution refers to exposure to dust, fumes and gases to which an individual exposes himself when he indulges in smoking, cooking from fossil fuels and cow-dung fires, etc., while the potential hazards from this form of pollution are regarded to be serious.

#### *Occupational air pollution*

The occupational air pollution represents the type of exposure of individuals to potentially harmful concentrations of aerosols, vapours and gases in their working environment.

## NOTES

**NOTES**

The community air pollution represents a varied assortment of pollution sources and contaminants, meteorological factors, and a wide diversity of adverse social, economic and health effect.

**Types of air pollutants**

Five types of substances, known as primary pollutants, account for more than 90 per cent of the nation wide air pollution. The five are:

1. Nitrogen oxides
2. Carbon Monoxide
3. Hydrocarbons
4. Sulphur dioxide
5. Particulates

The major source and amount of each primary pollutant are listed in the following table.

<i>Pollutant source</i>	<i>Weight of pollutant produced</i>					<i>Total weight of pollutant produced by each source</i>
	<i>CO</i>	<i>NO<sub>x</sub></i>	<i>HC</i>	<i>SO<sub>x</sub></i>	<i>Particle</i>	
Transportation fuel combustion (Stationary source)	63.8	8.1	16.6	0.8	1.2	90.5
Industrial processes	1.9	10.0	0.7	24.4	8.9	45.9
Solid waste disposal	9.7	0.2	4.6	7.3	7.5	29.3
Weight of each pollutant produced	7.8	0.6	1.6	0.1	1.1	11.2
<b>Miscellaneous total</b>	<b>16.9</b>	<b>1.7</b>	<b>8.5</b>	<b>0.6</b>	<b>9.6</b>	<b>37.3</b>
	<b>100.1</b>	<b>20.6</b>	<b>32.0</b>	<b>33.2</b>	<b>28.3</b>	<b>214.2</b>

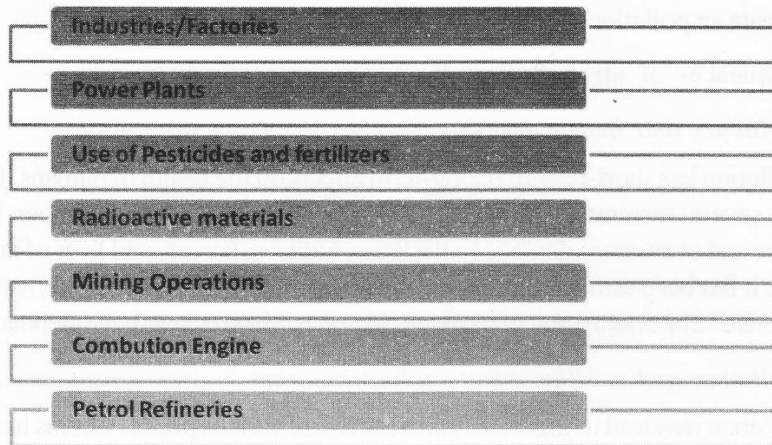
Carbon monoxide is the major individual pollutant, with a tonnage nearly twice as great as all other pollutants together. The toxicity of the pollutants are also related to weighting factors.

<i>Pollutant</i>	<i>Tolerance Levels</i>		<i>Relative toxicity (weighting factor)</i>
	<i>PPM</i>	<i>hg/m<sup>3</sup></i>	
CO	32.0	40,000	1.00
HC		19,300	2.07
SO <sub>x</sub>	0.50	1,430	28.0
NO <sub>x</sub>	0.25	514	77.8
Part		375	106.7

Applying the weighting factors of the abovementioned primary pollutant source table to the data of pollutant weighting factors table, the mass of each pollutant is multiplied by the appropriate weighting factor.

## Causes of air pollution

Today, air pollution is a global problem of immense importance. It is adversely affecting the environment. There are various causes for air pollution. Some of the more important causes are listed below.



## NOTES

### *Industries/factories*

Industries and factories are a big source of wastes that pollute the air. Most of the industries and factories use energy for the manufacturing of industrial goods and products. These processes produce heat and several harmful gases such as sulphur dioxide, aerosols, carbon dioxide, nitrogen oxide, carbon monoxide, etc., resulting in huge amount of air pollution.

### *Power plants*

Many power plants such as nuclear power plants, chemical plants and other industrial plants like asphalt and cement plants release emissions that lead to air pollution.

### *Use of pesticides and fertilizers*

An excess use of pesticides and fertilizers for the protection and growth of plants leads to air pollution.

### *Radioactive wastes*

Even discrete radioactive fallout from nuclear energy or other source can also lead to air pollution. If inhaled, it may cause serious health problem.

### *Mining operations*

Mines perform various operations and a release variety of particles into the air resulting in air pollution.

### *Combustion engines*

Various combustion engine vehicles exhaust harmful gases such as carbon monoxide, nitrous oxide and gaseous oxide to the environment causing into huge



air pollution. This type of air pollution generates smog which is a mixture of toxic gases that are present in the air.

*Petroleum refineries*

**NOTES**

Hydrocarbons and various other particulates are released from petroleum refineries that create air pollution.

**Consequences of air pollution**

*Air pollution and human health*

Air pollution has short-term and long-term effects on the health of humans. It can lead to several respiratory diseases, cardiovascular diseases, lung cancer, heart diseases and even cause damage to the brain, kidneys, nerves, and liver of human beings. It has been estimated that every year half a million people die prematurely in the United States as a result of smoking cigarettes which creates huge air pollution.

*Air pollution and wildlife, plant and environment*

Air pollution may lead to the reduction in growth of various plants. Various harmful gases produced in the air enter the stomata and cause acute and chronic diseases in plants, resulting in their death. It has been found that many animals die after eating these contaminated plants. The air pollution also hampers the proper functioning of photosynthesis in plant.

In addition, air pollution is one of the major causes of acid rain. Acid rain gradually affects aquatic and plant life. Air pollution, also allows the entry of the ultraviolet radiation coming from the sun by destroying the ozone layer, as a result of which many animals, humans and plants can die. Air pollution can also damage the lung tissues of animals and humans.

*Air pollution and economy*

Besides hampering the health of man and animal and degrading the plants and the entire environment, air pollution also has an adverse effect on the economy of the world. It may lead to loss in income from employees being absent from work due to several health problems caused by air pollution. It can decrease the productivity by damaging the crops and plants.

**3.4.4 Noise Pollution**

Noise is undesired and unpleasant sound. The sources of noise are limitless. It starts from the house and continues wherever you go. Over time, noise is becoming an increasingly widespread and serious source of discomfort and danger. It is becoming an unjustifiable interference and imposition upon human comfort, health and the quality of modern life.

Encyclopedia Britannica (1968) defines acoustic noise as any undesired sound. Generally, noise is a mix of various tones that come together non-musically. Encyclopedia Americana defines noise as unwanted sound: What sounds unpleasant