

to some might be an endearing pleasant sound for some other's ear. This like or dislike of a sound will be dependent on various psychological factors. If light and sweet music distracts a person reading a book, it is noise for that person.

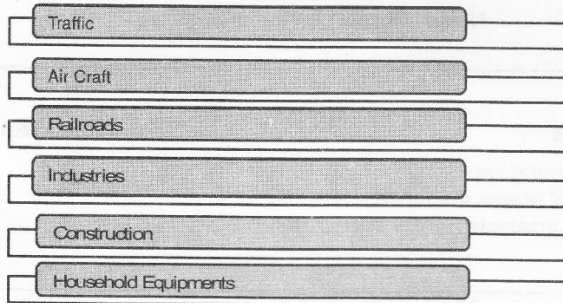
### Noise pollution

Noise pollution is defined as an unnecessary sound that enters the environment which can adversely affect the health of a person, can cause discomfort and can produce ill effects in other living things.

Basically, there are two types of noise pollution in the environment. These are industrial and non-industrial noise pollution. The industrial noise pollution includes noise generated by big machines of various factories and industries. Non-industrial noise pollution is mainly caused by vehicular traffic/transport and other neighbourhood sounds.

### Causes of noise pollution

There are various contributing factors that lead to the generation of polluting noise. Some of the most common causes are:



#### Traffic

A major cause of noise pollution is the traffic noise generated from various vehicles such as autos, trucks, buses and motorcycles. They not only create air pollution but also create huge noise pollution.

#### Aircrafts

The level of noise pollution has drastically increased due to the aircrafts soaring in the skies.

#### Railroads

Railroads are another major source of noise pollution. The various noises of train engines, whistles and horns and the various railway yard operations like shunting and switching create a great amount of noise pollution.

#### Industries

Besides producing air pollution, the various industries are also responsible for noise pollution. Industries use compressors, motors and other machinery that are extremely noisy and add to noise pollution.

## NOTES

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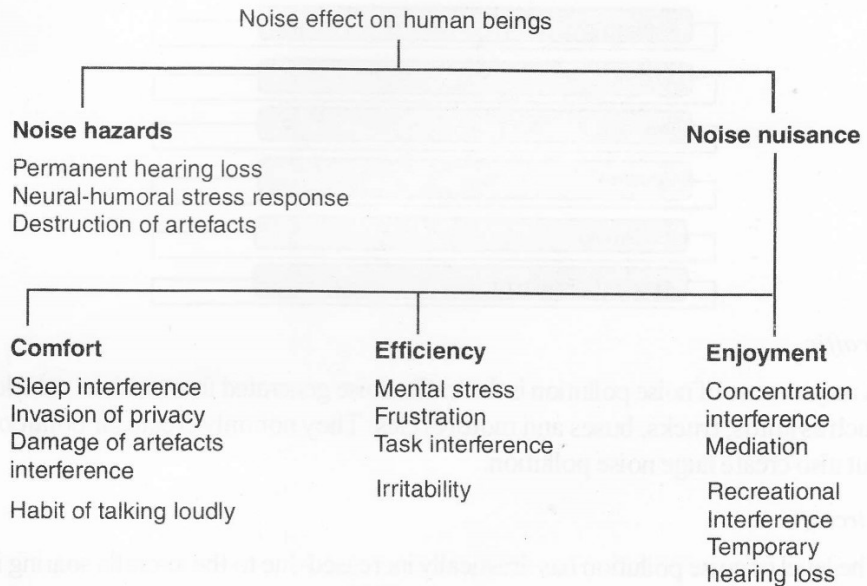
Urbanization has led to the construction of cities, buildings, roads, highways, etc. All the construction machines like dumpers, loaders, bulldozers, air compressors and pneumatic hammers generate huge amounts noise in the surrounding areas.

*Household equipments*

In-house noise produced by various household equipments such as boilers, generators, air conditioners, fans, vacuum cleaners, mixers and other kitchen appliances are also a huge source of noise.

**Consequences of noise pollution**

The noise pollution produced by the abovementioned sources may lead to temporary or permanent deafness. Various researches show that human's working efficiency decreases with noise pollution and goes up when noise pollution decreases. Excess of noise breaks the rhythm of work, and affects the productivity of human beings.



*Consequences of Noise Pollution on Humans*

Noise pollution also leads to the generation of raised stress level among humans. People can become victims of diseases such as blood pressure, heart attack, mental illness, etc. Among animals, noise pollution damages their nervous system.

In terms of environmental damage, noise pollution can indirectly affect the vegetation. Every plant needs a peaceful environment for growth. But with the increasing noise pollution, the growth and quality of plants fall.

Thus, it is very essential that everyone should come forward to control noise pollution. *Environmental Degradation*

### CHECK YOUR PROGRESS

9. A biological, chemical or physical factor that causes aesthetic deterioration or has a detrimental effect on aquatic life and on those who consume the water is termed as
  - (a) Water pollution
  - (b) Air pollution
  - (c) Soil pollution
  - (d) Noise pollution
10. Unwanted sound which gets dumped into the environment is known as
  - (a) Water pollution
  - (b) Air pollution
  - (c) Noise pollution
  - (d) Soil pollution
11. Air pollution may exist in three distinct categories; these are
  - (a) Land-air pollution
  - (b) Atmospheric pollution
  - (c) Occupational air pollution
  - (d) Community air pollution
12. Encyclopedia Americana defines noise as an
  - (a) Unknown sound
  - (b) Sound
  - (c) Unwanted sound
  - (d) Industrial sound

### NOTES

### 3.5 POLLUTION CONTROL BOARDS AND MEASURES TO CONTROL POLLUTION

Over the years, pollution has become a global concern. Every country is trying hard to fight with the disaster of pollution. With this respect, the Government of India has set up 'Pollution Control Boards' both at the central and state levels. It is the national body for the measurement, control and monitoring of pollution in air and water. The Boards provide advice to the Central Government on matters related to the control and prevention of pollution of noise, water and air. Over the years, the Boards have been given additional tasks which include the following:

- Air (Prevention & Control of Pollution) Act, 1981
- Bio-medical Waste (Management & Handling) Rules, 1998

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- Environment (Protection) Act, 1986 and Rules
- Hazardous Waste (Management & Handling) Rules, 1989
- Manufacture, storage and Import of Hazardous Chemicals Rules, 1989
- Municipal Solid Waste (Management & Handling) Rules, 2000
- Plastics wastes Rules, 1999
- Coastal Regulation Zone Rules, 1991
- Public Liability Insurance Act, 1991
- Water (Prevention & Control of Pollution) Cess Act, 1977

The Central Pollution Control Board (CPCB) is an independent body of the Ministry established in September, 1974, under the provisions of the Water (Prevention and Control of Pollution) Act, 1974. The various functions of Central Pollution Control Board are:

- To advise the Central Government on matters relating to pollution
- To coordinate the activities of the State Boards
- To provide Technical assistance to the State Boards, carry out and sponsor investigations and research relating to control of pollution
- To plan and organize training of personnel
- To collect, compile and publish technical and statistical data, prepare manuals and code of conduct
- To lay down standards
- To plan nationwide programme for pollution control

The Pollution Control Board organizes the actions of the State Pollution Control Boards (SPCBs) and the Pollution Control Committees (PCCs). The CPCBs, SPCBs, and the PCCs hold responsibility for implementing the legislations that describe the standards for emissions and effluents of air and water pollutants and noise level. The various functions of the State Pollution Control Boards are:

- To advise the State Government on matter relating to pollution and on siting of industries
- To plan programme for pollution control
- To collect and disseminate information
- To carry out inspection
- To lay down effluent and emission standards
- To issue consent to industries and other activities for compliance of prescribed emission and effluent standards

The various programmes and activities implemented by the State Pollution Control Boards (SPCBs) include:

- Pollution control in 17 categories of highly polluting industries
- Reestablishment of environmental quality in critically polluted areas



- Monitoring of water and ambient air quality in the states
- Hazardous waste management
- Bio-medical management of municipal solid wastes
- Pollution control from industries discharging waste water into rivers and lakes
- Inventorization of polluting industries in the state and ensuring their compliance to the pollution control norms

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The various measures to control vehicular pollution by the Pollution Control Board are:

- **Emission standards for tractors:** Emission norms for tractors were notified on 8.9.1999 under the Central Motor Vehicle Rules is effective from 1.10.1999.
- **India 2000 Emission Norms are akin to Euro-I Norms:** Emission norms known as India 2000 akin to Euro I norms were notified on 28.8.1997 under the Central Motor Vehicle Rules is effective from 1.4.2000 for the entire country, required major modifications in the engine designs.
- Establishment of Ambient Air Quality Monitoring throughout India.
- Notification of Ambient Air Quality Standards under Environment (Protection) Act.
- Notification of vehicular emission norms for year 1990–91, 1996, 1998, 2000, 2001
- Improving fuel quality by phasing out lead from gasoline, reducing diesel sulphur, reducing gasoline benzene, etc.
- Introduction of alternate fuelled vehicles like CNG/LPG.
- Improvement of public transport system.
- Phasing out of grossly polluting commercial vehicles.
- Public awareness & campaigns.

Various measures taken by the Pollution Control Board to control noise pollution:

- Ambient standards for noise have been set based on different categories of areas such as industrial, commercial and residential. Silence zones are listed out by the Environment (Protection) Act, 1986.
- Equipment at the manufacturing stage, construction, home appliances and automobiles, all have prescribed noise limits.
- For coal mines, crackers and gensets standards have been developed and duly notified.
- Regulatory agencies have directions to put into force the standards that have been created for regulation and control of noise pollution.

In March 2001, the Central Pollution Control Board initiated a study to measure the levels of the noise caused by the firecrackers used these days. This study was

## NOTES

carried out in association with National Physical Laboratory (NPL) and showed of the firecrackers tested, 95 per cent did not comply with the standards and crossed the noise limits that had been prescribed. Therefore, to control the noise pollution created by firecrackers, the Pollution Control Board has taken the following measures:

- On 5 October 1999 Govt. of India vide G.S.R. 682(E), laid down standards for noise pollution caused by firecrackers.
- All State Pollution Control Boards or their Committees were asked to control fire-cracker sale. This could be carried out in consultation with their respective local administrations.

The Pollution Control Board has taken the following measures to control the noise pollution created by loud speakers:

- A loud speaker or a public address system shall not be used except after obtaining written permission from the authority.
- A loud speaker or a public address system shall not be used at night (between 10.00 p.m. to 6.00 p.m.) except in closed premises for communication within, e.g. auditoria, conference rooms, community halls and banquet halls.

On the whole in order to control noise pollution the Pollution Control Board in collaboration with Central and State Government has taken following measures:

- In the year 1989, an ambient noise standard was notified. The notification states the basis over which the State Pollution Control Boards can take action against violating source.
- In order to reduce the traffic noise, the Ministry of Science and Technology formulated a notification called the vehicular noise standards in the year 1990. These standards were made more rigorous in another notification that was implemented in the year 2000.
- To control and reduce noise pollution produced from generators, the noise standards for diesel genset was implemented in the year 1998. The implementation of the standards was made by the Government in association with State Pollution Control Boards, and generator manufacturer. With time, these standards are revised and modified. Through modification, the generator manufacturers will be able to provide acoustic inclusion at the manufacturing stage itself and will leave a dominant effect on the noise from DG sets.
- In October 1999, a noise standard for firecrackers was implemented. Under this, the Central Pollution Control Board will perform a testing task for the fire crackers that are available in the market or that are available in the Department of Explosives.

- In September 2000, the noise standard for petrol and kerosene generator sets was notified under which the sale of petrol and kerosene generator sets was banned. It can only be available for sale if it is licensed by the testing agencies and is recognized for the purpose.
- To control noise produced from Public Address System or loud speakers, the Noise Rules, 2000 were implemented. These rules not only regulate the noise but also provide measures for noise complaint management.
- For aircraft noise, the Central Pollution Control Board is working in Indira Gandhi International Airport and has prepared standards and guidelines for aircraft noise control.

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### Pollution Control Board and air pollution

For controlling air pollution, PCB has implemented National Air Quality Monitoring Programme (NAMP). It is an all-India programme to monitor the quality of ambient air. Across the nation, a standard monitoring will be done on the following pollutants:

- Respirable Suspended Particulate Matter (RSPM/PM<sub>10</sub>)
- Suspended Particulate Matter (SPM)
- Oxides of Nitrogen as NO<sub>2</sub>
- Sulphur Dioxide (SO<sub>2</sub>)

Meteorological parameters like temperature, relative humidity, direction of wind and the speed of wind will also be monitored. 104 observations will be made in one year for the pollutants. The pollutant monitoring will be conducted for 24 hours and two times in a week, where particulate matter sampling will be done every 8 hours and gaseous pollutants will be sampled every 4 hours.

The basic objectives of the National Air Quality Monitoring Programme (NAMP) are:

- To determine status and trends of ambient air quality
- To ascertain whether the prescribed ambient air quality standards are violated; to Identify Non-attainment Cities
- To obtain the knowledge and understanding necessary for developing preventive and corrective measures
- To understand the natural cleansing process undergoing in the environment through pollution dilution, dispersion, wind-based movement, dry deposition, precipitation and chemical transformation of pollutants.

### Pollution Control Board and water pollution

In order to control the water pollution, the Pollution Control Board in collaboration with Central and State Government have established an all India network for the monitoring of water quality. The network covers 6 Union Territories and 27 states and comprises 1019 stations. The objective of water quality monitoring comprises the monitoring of 321 wells, 17 drains, 13 canals, 3 creeks, 3 ponds, 5 tanks,

60 lakes and 200 rivers. Of the total of 1019 stations, 321 are groundwater stations, 3 are on ponds, 3 are on creeks, 5 are on tanks, 13 are on canals, 17 are on drains, 65 are on lakes and 592 are on rivers.

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The Board has taken following measures to check the quality of water:

- The inland water quality-monitoring network follows a three-tier programme comprising: Yamuna Action Plan (YAP), Monitoring of Indian National Aquatic Resources System (MINARS) and Global Environment Monitoring System (GEMS).
- Analysis of water samples, besides field observations, is done on 28 parameters consisting of 19 physico-chemical and bacteriological parameters, 9 core parameters.
- Selective samples are analysed for 22 different pesticides besides 9 trace metals. At some locations, bio-monitoring also takes place.
- Due to resources being limited only some pollution related parameters can be monitored. Analysis of Micro pollutants (Toxic Metals & POPs) is done annually. Water quality data report is entered into the Water Quality Status Year Book.

### CHECK YOUR PROGRESS

13. The Central Pollution Control Board (CPCB) was set up in the year
  - (a) 1974
  - (b) 1975
  - (c) 1944
  - (d) 1970
14. Noise standards for fire-crackers were developed in the year
  - (a) 1989
  - (b) 1999
  - (c) 1949
  - (d) 1969
15. In order to control air pollution the Pollution Control Board has executed
  - (a) Air (Prevention & Control of Pollution) Act
  - (b) Environment (Protection) Act
  - (c) National Physical Laboratory
  - (d) National Air Quality Monitoring Programme

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### 3.6 SUMMARY

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- You have come to know how the environment is degrading and losing its natural assets. We have explained deforestation, depletion of water resources, and water, soil, air and noise pollution.
- Special attention has been given to on environmental issues, their causes and consequences, and the several governmental approaches to control the persisting environmental problems have been explained.
- The role and responsibilities of the national and state-level Pollution Control Boards and the various measures offered by them to keep a check on pollution and depletion have been analysed.

### NOTES

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### 3.7 KEY TERMS

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- **Deforestation:** It is the removal of a forest or trees where the land is thereafter converted to non-forest use.
- **Wildfires:** Due to rise in temperature, volcanic eruption and dry nature of climate large tracts of forests are burned. This is termed as wildfire.
- **Ecology:** It is the scientific study of the relation of living organisms to each other and their surroundings.
- **Climate:** It is the statistics of temperature, humidity, atmospheric pressure, wind, rainfall, atmospheric particle count and other meteorological elements in a given region over a long period of time.
- **Pollution:** It is the introduction of contaminants into the natural environment that causes instability, disorder, harm or discomfort to the ecosystem.
- **Water pollution:** It is the impairment of water quality due to mixing of sewage or industrial wastes.
- **Eutrophication:** It is the addition of artificial or non-artificial substances, such as nitrates and phosphates, through fertilizers or sewage, to a fresh water system in order to enhance its nutrients strength with intention of increasing phytoplankton in a water body.
- **Soil pollution:** Pollution in soil refers to the persistent increase in the soil of disease causing agents, materials that are radioactive, salts, chemicals or toxic compounds.
- **Air pollution:** 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 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.



## NOTES

- **Noise pollution:** It is defined as an unnecessary sound that enters the environment which can adversely affect the health of a person, can cause discomfort and can produce ill effects in other living things.
- **NPL:** National Physical Laboratory
- **CPCB:** Central Pollution Control Board.
- **SPCB:** State Pollution Control Boards.
- **PCC:** Pollution Control Committees.

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### 3.8 ANSWERS TO 'CHECK YOUR PROGRESS'

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1. (d) 2. (c) 3. (b) 4. (a) 5. (a) 6. (a), (b) 7. (c)  
8. (d) 9. (a) 10. (d) 11. (c, d) 12. (c) 13. (a) 14. (b)  
15. (d)

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### 3.9 QUESTIONS AND EXERCISES

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#### Short-Answer Questions

1. How do overpopulation and agriculture cause deforestation?
2. Write a short note on noise pollution.
3. Write a short note on air pollution.
4. Write a short note on water pollution.
5. What are the objectives of the National Air Quality Monitoring Programme (NAMP)?

#### Long-Answer Questions

1. Write a detailed note on the causes and consequences of deforestation.
2. What is air pollution? What are the various causes and consequences of air pollution?
3. Explain the causes and effects of depletion of water resources.
4. How do the Pollution Control Boards control pollution?

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### 3.10 FURTHER READING/REFERENCES

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#### **NOTES**



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# UNIT 4 ENVIRONMENTAL PLANNING

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**NOTES****Structure**

- 4.0 Introduction
- 4.1 Unit Objectives
- 4.2 Strategies for Afforestation
- 4.3 Strategies for Water Conservation
- 4.4 Strategies for Soil Conservation
- 4.5 Treatment of Waste and Environmental Pollution
- 4.6 Summary
- 4.7 Key Terms
- 4.8 Answers to 'Check Your Progress'
- 4.9 Questions and Exercises
- 4.10 Further Reading/References

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## 4.0 INTRODUCTION

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Degradation of the environment has become a major problem. Initially, it was less but with the passage of time and with the pressure of human population, the pace of degradation has increased. Looking at this scenario, various environment management strategies and methods have been formulated to keep a check on environmental issues. This unit will cover various strategies of environmental conservation.

In this unit, you will learn the meaning, objectives and strategies of afforestation. Afforestation is the direct human-induced conversion of land that was not covered by trees, to forested land through planting and seeding, and the human-induced promotion of natural seed sources. This is a very important method of maintaining biological diversity.

The key component of overall environmental resource planning is conservation of air, water and soil. Here, in this unit, you will learn the definitions and meaning of air, water and soil conservation and the strategies being adopted for their conservation.

Today, the waste and environmental pollution is a severe ecological problem which not only affects the entire spectrum of our biota (man, animals, and plants) but also the non-living natural resources of the earth. A variety of pollutants are continuously added in large amounts into the environment rendering it highly toxic. This unit also deals with certain educational, legal, and technical steps for the treatment of waste and environmental pollution.

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## 4.1 UNIT OBJECTIVES

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

- Define afforestation
- List the various strategies for afforestation
- Explain the meaning of water conservation and the strategies for achieving water conservation
- Explain the meaning of soil conservation
- Enumerate the various strategies for soil conservation
- Describe the treatment of waste and environmental pollution

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## 4.2 STRATEGIES FOR AFFORESTATION

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Forests are important part of environment. Imagine the earth five decades ago; it was full of thick forest with lots of animal and plant life. But with time, most of the forest land has vanished or is replaced by tall buildings, roads, houses, dams, etc. To get back into the same environment when earth was full of plants and trees, the only way is afforestation.

Afforestation is the way to establish forests on the earth by planting new trees and plants on barren tracts of land. A general definition of afforestation is the direct human-induced conversion to unforested land that was not covered by trees through planting, seeding, and the human-induced promotion of natural seed sources. Thus, the process of afforestation is mainly dependent on the intervention of human beings.

### Objectives of afforestation

Protection and production or the combinations of both are the main objectives of afforestation. Protection may comprise the following:

- Control of soil erosion by wind, water, or the force of gravity
- Control of water by temporarily holding up precipitation where it falls, releasing it gradually into streams, thereby regulation stream flow, preventing flood and silting
- Fixation of sand dunes, marine or inland
- Protection of crops, livestock and residences from wind by the formation of wind breaks or shelter belts
- Protection of roadsides, river banks, irrigation canal banks
- Amelioration of swamp lands



**Benefits of afforestation**

- Afforestation maintains biological diversity
- Afforestation can prevent floods and safeguard future of the tribal people
- Afforestation prevents soil erosion and brings soil together.
- Afforestation works as windbreak
- Afforestation stabilizes the forest products and climate
- Afforestation acts as catchments for the soil and water conservation
- Reforestation can stabilize soils by increasing interception
- Afforestation restores ecological balance of all ecosystems

**NOTES****Strategies for afforestation**

When afforestation has to be done on a site which has remained deforested for a long period of time, it is very much necessary that there be special strategies for afforestation. Till now, the various steps and strategies with regard to afforestation in India can include:

- In order to increase the number of trees in a state, the state pollution control board has formulated massive plantation programmes.
- In order to increase awareness about afforestation amongst the common mass, the country has taken help of media and professional advertisement agencies.
- For afforestation and tree planting, it is essential to alert India's rural population. One way to achieve this is through enactment of scenes, drama, folk songs based on afforestation which will be engaging and will motivate the rural population to enforce afforestation.
- Education is another most important strategy for afforestation. It is necessary to educate town and city planners on the importance of afforestation and how it can efficiently improve the quality of environment.
- A day for tree plantation is another positive strategy for afforestation. The government could initiate a national day for tree plantation, so that all people of the country can get involved in afforestation.

**CHECK YOUR PROGRESS**

1. Planting of forests is termed as
  - (a) Afforestation
  - (b) Deforestation
  - (c) Reforestation
  - (d) Evaporation

*Contd. ...*

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2. Afforestation acts as a factor of
  - (a) Climate change
  - (b) Global warming
  - (c) Windbreaks
  - (d) Rainfall
3. Soil erosion is mainly controlled by
  - (a) Deforestation
  - (b) Irrigation
  - (c) Continues farming
  - (d) Afforestation

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### 4.3 STRATEGIES FOR WATER CONSERVATION

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Water conservation is a key component of overall water resource planning. Conservation programmes that are carefully designed and implemented can bring many benefits. Among these are the efficient utilization of available sources of supply, public recognition and participation, and improved support for water pricing adjustment.

Water conservation can be defined as a technology and technique that improves the efficiency of water use. Increased efficiency expands the use of the water resource, freeing up water supplies for other uses, such as for a growing population, new industry, and environmental conservation.

#### Why conserve water?

Efficient use of water is possible through an effective water conservation program. The specific reason will be different for each utility, and the appropriate level of conservation for a utility should be tailored to its specific needs. There is a broad array of reasons to pursue efficient water use and conservation. Some examples for consideration are included below:

**Cost saving:** Lowering water extraction and distribution cost will reduce operation cost and possibly defer capital cost. Conservation is often an important part of a least-cost future water supply plan.

**Waste water treatment and disposal benefits:** Reduction of interior water which leads to decrease in the flow of wastewater. This results in reduction of cost and a decrease in the environmental impacts of wastewater disposal material that is so treated.

**Environmental benefits:** Protection of endangered species often requires a reliable source of good quality water.

**Competing beneficial use:** Conserved water could be efficiently used for agriculture, power production, recreation, aesthetic enjoyment, etc.

**Water supply limitations:** Water conservation can preserve the existing supplies, whether supply is from ground water or surface water, for future use.

**Utility stewardship and sustainability:** Utilities that conserve water demonstrate leadership in resource management and are working toward a goal of sustainability.

**Energy savings:** Reducing water production will save energy and reduce greenhouse gas emission.

### Strategies for water conservation

Conserved water can be considered a reliable water source. For successful water conservation, the governments of all parts of the world have formulated certain programmes and strategies, each having one goal, i.e., 'Save Water'. Some of the most important strategies for water conservation which every country needs to follow include:

#### Strategies for water conservation in the agricultural sector

- Do not overuse water for plantation. Provide only that much amount of water that is actually required.
- During the process of irrigation, it is essential to install the irrigation equipment in an appropriate manner so that it functions correctly and less water is wasted.
- In confined areas or narrow strips of turf, it is good to use low-volume and sub-surface irrigation technique.
- In agriculture, use drip irrigation technique. This way you can save lot of water.
- While selecting sprinkler heads or low-angle heads, consider strong prevailing wind patterns. This way you can reduce wind-blown overspray.
- Provide water early morning of the day because when watering is done in the heat of the day, the chances of evaporation are very high and very less water reaches the plants.
- In order to harvest rainwater, use rain barrels or cisterns.

#### Strategies for water conservation over landscape

- In a landscape, group together plants with similar water requirements.
- Reduce the use of turf areas. This is basically due to the reason that the turf generally requires more water than beds of well-adapted plants.

#### Other measures to conserve water

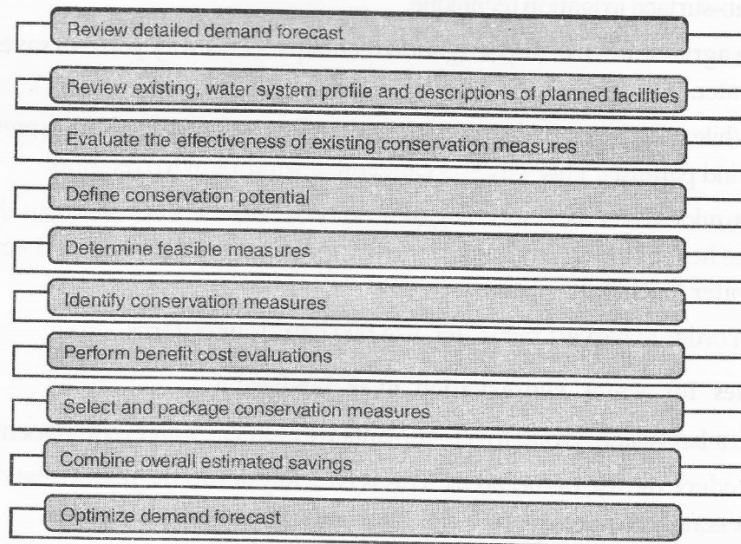
- For car washing use commercial car washers. Here, most of the water is cleaned and recycled back into the system.

## NOTES

## NOTES

- Always keep check on taps for water leaks. It has been estimated that one drop per second leak will amount to over 2500 liters of water waste per year.
- In order to reduce water use in lavatories and sinks, use faucet aerators.
- Take short period showers, use low-flow showerhead and turn off the water while lathering/applying soap. In this way, you can save more water.
- While shaving and brushing your teeth, turn off the water until you are ready to rinse or wash.
- At the time of washing vegetables, fill a bowl instead of rinsing with running water. When the vegetables are cleaned, utilize the used water in the kitchen garden or in your house plants.
- In order to avoid sending cold water down the drain while waiting for hot water, use a hot water recirculation pump.
- Use a soapy wash side and a hot, rinsed side of the sink for washing dishes by hand. This way you can conserve a lot of water for other purposes.
- Use a rainwater tank to conserve water. You can reuse that water in gardens, toilet flushing, washing, for hot water requirements, etc. This is also known as rainwater harvesting in which water is gathered from rooftop. This is the simplest way to conserve water.

Besides the abovementioned strategies, various organizations in collaboration with the Government have formulated several water conservation programmes. To develop a cost-effective programme to conserve water, one should follow the below mentioned guidelines and strategy.



### *Review detailed demand forecast*

A baseline forecast of the water use analyses and the demographic projections should be created. The impacts of current and selected additional conservation measures can be superimposed on the baseline forecast.

*Review existing water system profile and descriptions of planned facilities*

As water demand increases, utilities need to maintain information necessary to develop and update a system profile from an inventory of existing resources and conditions. A review of this information is essential for accurately targeting water conservation measures as also appropriate emerging needs.

*Evaluate effectiveness of existing conservation measures*

If the existing conservation measures are present in the water use analyses, the degree of current and prospective conservation stemming from these measures needs to be quantified. Some of this effect could be naturally occurring if it results from code requirements.

*Define conservation potential*

A detailed assessment of the indoor and outdoor water use for existing and new customers is essential to determine the conservation potential.

*Determine feasible measures*

Not all the conservation measures will be practically, potentially, or economically feasible for a given utility. To complete the feasibility analysis, the number of accounts that could and would use each measure and the specific savings overtime that would accrue to its implementation must be determined. In addition, the existence of legislative and institutional obstacles to implementation needs to be researched.

*Identify conservation measures*

Even though many water conservation measures are transferable among locations, water conservation measures should be tailored on a case by case basis to develop the most effective programme for local conditions within a given area.

*Perform benefit-cost evaluations*

If supply is critical, the benefits of conservation are virtually priceless; it is a matter of having enough water for essential indoor residential and commercial needs. Under less extreme circumstances, however, it is necessary to conduct a basic benefit-cost analysis that relates the value of water saved to the cost of implementing the program.

*Select and package conservation measures*

Individual conservation measures should be packaged into a comprehensive program for implementation. The package will include that array of justifiable outdoor and indoor measures that meet the payback criteria and will achieve the needed and targeted results. This package must also be acceptable to the utility management and governing bodies to be included in the long-ranged demand forecast.

**NOTES**



*Combine overall estimated savings*

Once an optimal means of conservation measures has been determined, an overall estimate of water conservation programme can be developed with a cautious summation that avoids counting estimated water saving from individual measures.

**NOTES***Optimize demand forecast*

The baseline demand forecast should be modified for quantification of demand reductions and geographical comparison of water forecast with and without conservation. Modification of demand forecast may be done iteratively with different cost-effective packages of conservation measures to meet desired conservation targets.

Thus, water conservation can protect and save the environment of today and future. Investing in water conservation strategies can save energy and money and can create green jobs, prevent unnecessary government spending, and encourages innovation. It will also protect the ecosystem of the environment.

**CHECK YOUR PROGRESS**

4. The various water conservation devices are
  - (a) Soil moisture sensors
  - (b) Drip irrigation technique
  - (c) Faucet aerators
  - (d) Check valves
5. In order to increase the efficiency of the irrigation cycle, use
  - (a) Soil moisture sensors
  - (b) Evapo-transpiration (ET)
  - (c) Drip irrigation technique
  - (d) Faucet aerators
6. Water conservation is mainly for
  - (a) Energy savings
  - (b) Educational training
  - (c) Cost saving
  - (d) Urbanization
7. To reduce the use of water in lavatories and sinks, one should use
  - (a) Soil moisture sensors
  - (b) Evapo-transpiration (ET)
  - (c) Drip irrigation technique
  - (d) Faucet aerators

## 4.4 STRATEGIES FOR SOIL CONSERVATION

Existence of human beings is very much dependent on a thin layer of soil from which they produce most of their food. In fact, soil is the most fundamental and basic resource.

If used for the right purpose and managed well, soil can continue to produce and provide for the human needs indefinitely. But if the soil is put to wrong use, and badly managed, soil can quickly degrade, decline in fertility and lose its potential to provide for us. Therefore, to eradicate the problem of wrong use of soil, soil conservation is being implemented.

### What is soil conservation?

Soil conservation is mainly defined as the scientific use and protection of land, including wise choice of land use and the pursuit of necessary measures of soil management and of erosion control. It is the best way to make sure that whatever land we as a human use is protected from the harmful effects that can be caused by human activities.

### Need for Soil Conservation

#### *Historical lessons*

History shows us that neglect and abuse of soil resources has led, in many instances, to human suffering and even to the downfall of countries and civilizations. Human tragedy repeated periodically on the banks of the Yellow River provides a well-known example of suffering caused by misuse of watershed. Some countries of Asia, Near East and North Africa, due to the abuse of soil resources, once green and productive lands have changed into barren deserts. Land described in Bible as 'flowing with milk and honey' three thousand years ago is now badly eroded, leaving bare hills and bedrocks. Countries which were the granaries of the Roman Empire present the same picture. In this way, the entire world shows the same picture of soil erosion over time. Today, the situation is getting worse. Therefore, the need for soil conservation is becoming a pressing need in every corner of the world.

#### *Soil vulnerability*

Soils are the basis of our existence. Throughout the past, in the present and in the foreseeable future, soil will remain the foundation of our food supply chain—a vital, limited and capital resource of each nation. People should be keenly aware that the soil mantle which supports human life is very thin and that soil formation is a slow process. Once the thin top layer gets eroded, it is difficult to restore it. Even damage that is invisible to the naked eye may seriously affect productivity. Soils are much more vulnerable than are generally thought. Only under proper management can they be regarded as renewable resources.

## NOTES

In most corners of the world, the phenomenon of soil erosion is very common. When exposed due to improper farming and cultivation the soil can be badly eroded in a short time. Therefore, the need for careful soil conservation is very apparent and urgent.

## NOTES

### *Pressing world problems*

**Land degradation:** A study by Food and Agriculture (FAO) and United Nations concluded that between 5 and 7 million hectares of land worldwide are lost to production annually through soil degradation. If this rate of land degradation continues, close to one third of the world's arable land will be destroyed. Of all the forms of land degradation, soil erosion is the major problem.

**Population increase:** Regardless of major efforts to encourage birth control, world population is increasing every day. Most of the increase is found in developing nations which are still agricultural nations and dependent on land for subsistence. With an increase in population, more of the pressure is placed on land which is already degrading.

**Food supplies:** Food and Agriculture (FAO) estimated that the number of severely undernourished people in the developing world increased from about 360 million in the year 1969-1971 to about 435 million in the year 1974-1976, an increase of 20 per cent in only five years. The 1985 the famine in Ethiopia and other African countries has vividly illustrated the seriousness of the problem of undernourishment.

Food and other agricultural production levels need to be doubled in most of the developing countries in the coming years to keep pace with a population which is increasing more rapidly than the food supply. Some developed countries have the capacity for increased production but in supplying the needs of developing countries there are attendant problems of transportation and distribution. Accordingly, 'self-sufficiency' is probably a wise agricultural policy for many developing countries to pursue but, as more land is brought under food production, greater effort will be needed to conserve the soil.

### **Strategies for soil conservation**

The list of strategies required for soil conservation is

- Plantation
- Crop rotation
- Terrace cultivation
- Contour ploughing
- No-till farming
- Soil organisms
- Soil pH
- Salinity management

### *Plantation*

One of the most important strategies of soil conservation is planting trees. By planting on a land, we increase the holding capacity of the soil on that land. Soil which is always under a vegetative cover has very low chances of getting eroded. Excess of plantation can prevent soil from soil erosion and conserve its natural elements for a longer period of time.

### *Crop rotation*

The other method to conserve soil is crop rotation. Due to continuous cultivation of the same type of crops for long periods of time in a field, the soil of that field loses its fertility. To avoid this adverse effect, the method of crop rotation is employed. In this method, dissimilar crops are cultivated sequentially on the same piece of land which ultimately improve the structure and fertility of soil.

### *Terrace cultivation*

In order to conserve soil, terrace cultivation is one of the most prominent methods. Under terrace cultivation, the hilly area is cut to equal level for the purpose of cultivation. This cutting is done to form different levels of cultivable surface and this gives a stepped appearance to the hilly land area. Terracing aids in slowing down the washing away of the surface soil.

### *Contour ploughing*

Contour ploughing is a method in which cultivation is done on the contour lines of a slope to reduce the speed of the water run-off. This is yet another important strategy of soil conservation by keeping a check on easy washing away of soil along the slope and percolation of water into the soil.

### *Till farming*

Soil preparation by the process of ploughing for the purpose of cultivation is called tilling which is another most important strategy of soil conservation. Through tilling, soil gets an appropriate mixing of minerals and fertilizers. This way the soil maintains its natural balance.

### *Soil organisms*

For the process of soil conservation, it is advisable to increase the ratio of soil organisms like earthworms and several other soil microbes in the soil. These soil microbes through aeration of soil, enhance the rate of macronutrients in soil. They also improve the porosity of soil. This way, it is not only the soil that gets conserved but the fertility rate of soil also increases.

### *Soil pH*

In many places, the quality of soil gets contaminated by acidic pollutants from the environment and by acid rains. These usually alter the optimum pH level of the soil which gradually affects the availability and uptake of nutrients in soil. Therefore, it

## NOTES

## NOTES

is very important to maintain the pH balance of the soil. In doing so you can not only increase the nutrient level of the soil but can also conserve the soil to a great extent. In order to adjust the pH level of the soil, the addition of alkalis to nutrient solution is very common. In addition, elemental sulphur can be a powerful tool in maintaining a pH level in the soil.

### *Salinity management*

Due to excessive accumulation of salts in the soil, the soil becomes saline. Salinity of soil has a negative impact on the metabolism of the crops. Excess of salinity in soil can lead to crop damage and altogether can cause soil erosion. Therefore, management of salinity of soil is very essential. In doing so, an appropriate drainage system at the time of irrigation is very important. The drainage system normally lowers the concentration of salt in water and thus maintains the soil salinity.

### **Benefits of soil conservation strategies**

A better appreciation of the value of soil conservation is obtained by recognizing two categories of benefits; on-site benefits and off-site benefits. Many people equate soil conservation with erosion control. Certainly, measures that minimize erosion and reduce sedimentation and flood damage are very important but, in developing nations especially, soil conservation programmes can generate other major benefits which are often overlooked. These other general benefits of soil conservations strategies are:

#### *Inducing permanent farming*

Given proper soil conservation and soil management, many areas could be farmed permanently and much more intensively without risking undue erosion. For instance, the construction of bench terraces would permit settled farming in many areas where shifting cultivation is presently being practiced.

#### *Increasing the population supporting capacity on land*

Well-planned soil conservation introduces a better choice of improved farming practice, land use, soil moisture conservation and other measures designed to increase agricultural production and thus raise the population supporting capacity of the land.

#### *Developing new land safely*

The world requires more new hectares land for production. According to the Food and Agriculture Organization (FAO), it has been estimated that to feed the world in the year 2000 an additional 150 to 200 million hectares of new land has to be brought under production. This expansion will inevitably embrace land inherently less favorable for farming. Thus, soil conservation measures will be essential to the safe development of these kinds of land on a sustainable basis.

#### *Modernizing unplanned farming*

More intensive use of hilly uplands in many countries seems inevitable. In the tropics where the low lands are hot, the uplands and hill regions often offer



climatically ideal places to produce many high value crops for domestic use and export. Upland farming in many countries remains primitive because the hilly terrain is rough and remote. Properly designed conservation structure in these areas will not only protect the hill slopes but will also provide better access, better drainage and increased potential for mechanization and irrigation.

*Providing employment opportunities*

Soil conservation and land use intensification activities could create the much needed employment opportunities in the rural areas of many developing countries. Most traditional soil conservation practices are highly labour intensive. A simple soil conservation structure may require 60 to 80 person-days per hectare. Thus, a substantial national soil conservation programme with government financial support could effectively alleviate rural unemployment problem prevalent in many developing countries.

**NOTES**

**CHECK YOUR PROGRESS**

8. The scientific use and protection of land is termed as
  - (a) Land conservation
  - (b) Water conservation
  - (c) Afforestation
  - (d) Soil conservation
9. Strategies required for soil conservation includes
  - (a) Use of rainbarrels or cisterns
  - (b) Rain shut-off
  - (c) Plantation
  - (d) Soil moisture sensors
10. The process in which dissimilar crops are cultivated sequentially is called
  - (a) No-till farming
  - (b) Crop rotation
  - (c) Contour ploughing
  - (d) Terrace cultivation
11. A simple soil conservation structure may require
  - (a) 60 to 80 people-days per hectare
  - (b) 80 to 90 people-days per hectare
  - (c) 70 to 80 people-days per hectare
  - (d) 60 to 70 people-days per hectare