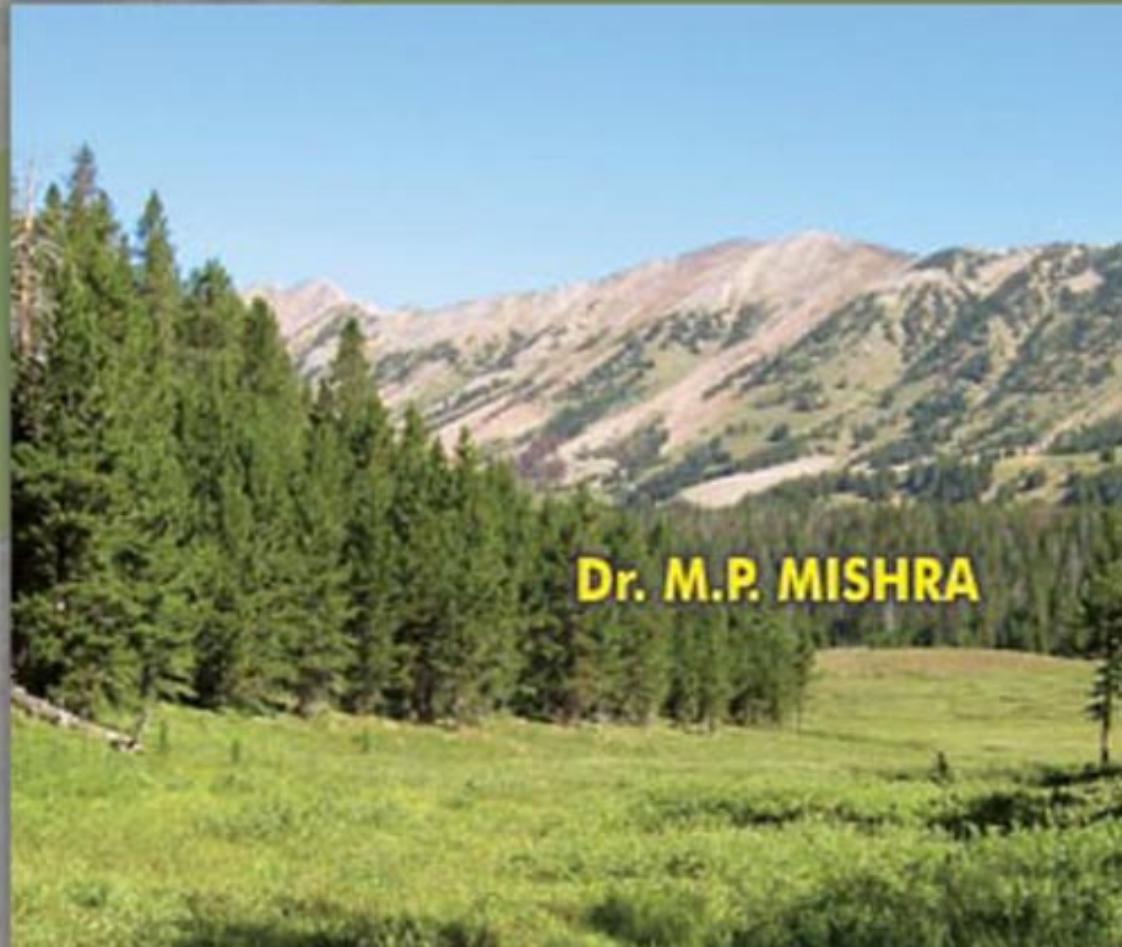


**S. Chand's**

# **ICSE ENVIRONMENTAL EDUCATION**

**FOR CLASS X**

**AS PER CISCE SYLLABUS**



**Dr. M.P. MISHRA**

**S. CHAND**



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Class X

AS PER THE LATEST ICSE SYLLABUS

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*First Edition 2009*

*Thoroughly Revised Edition 2011*

**ISBN :** 81-219-3186-X

**Code :** 34A 006

# PREFACE

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Issues of environment have gained sufficient momentum throughout the world now. Through the last few decades, the nature itself has taught people the world over, the lesson that conservation is not just an option for some responsible persons but a way of life for all the citizens of the world. As the sense of conservation sprouted, various social organizations and governments started educating the people about its different aspects and resources. Currently, some of the major issues being seriously talked about are different types of pollutions causing problems on local, national and global levels; problems of wastes; deforestation and its consequences; poaching of wild animals; extinction of species; loss of biodiversity; profligate use of common property resources; erosion of traditional indigenous knowledge, ethos and values.

Our children are future custodians of the earth, its environment and resources. Hence, it is very important to sensitize them to the environment and associated problems, and at the same time to equip them with all the necessary knowledge and skills in a holistic manner, so as to enable them solve the environmental problems through positive and sustainable ways. For this, it is further required that positive attitudes, social values and serious concern towards sustainable development are stimulated in them. The infusion of environmental aspects in syllabi of different subjects was welcomed by responsible people in the initial stage but later it was found that the experiment could not produce the desired results. Some educationalists are of the opinion that the original components of environmental knowledge and mechanism infused in fragments in different subjects, burdened the spirits of those subjects (like literature), secured for themselves the images of “weeds in the crop fields” and hence, remained neglected by testing and evaluation. Various surveys conducted earlier, reveal that students retain 10% of what they read, 50% of what they see and 90% of what they do. The “doing” component probably missed somewhere in our earlier integrated or infusion model. The conditions of environment we experience today, are matters of serious concern and hence, can not be taken up lightly.

## THIS BOOK

This book has been prepared according to the latest ICSE syllabus of Environmental Education incorporating all the significant elements of the content, process, teaching- learning strategies & expected learning outcomes. It is hoped that this book will provide direct and systematic knowledge of environmental concepts, theories, considerations, issues, and actions through classroom- and outdoor learning. It is further hoped that this book will stimulate among students a true love for nature by encouraging them to undertake project formulation, surveys, observations, interviews, field trips, collections, compilations and documentations of mini research activities. With the expression of intrinsic abilities for fact finding through classroom- and outdoor learning, students can bring about improvements in their local environment.

I am heartily thankful to Shri Ram Sagar Pathak, my father-in-law, for his blessings and emotional supports. I am thankful to Smt. Kumud Lata Mishra, Latika, Prabhanshu and Rolie for their physical, emotional and technical supports during the preparation of the manuscript of this book.

I am thankful to Management and Editorial team of S.Chand's Company Limited, New Delhi for undertaking this publication and bringing it out in a record time.

All the constructive suggestions to improve the quality and standard of this book will thankfully be acknowledged. Hon'ble Teachers and dear students are requested to send feed backs so as to enable the author improve the quality and standard of the book.

**This book is dedicated to all the school teachers and students who can jointly lead the world towards a peaceful, pleasant and sustainable environment.**

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# **ENVIRONMENTAL EDUCATION**

## **SYLLABUS**

**AS PER THE COUNCIL OF INDIAN SCHOOL CERTIFICATE EXAMINATION (CISCE)**

## **CLASS X**

*There will be one paper of two hours duration carrying 80 marks and Internal Assessment of 20 marks.*

*The theory paper will have two sections:*

**Section A (Compulsory)** will contain short answer questions covering the entire syllabus

**Section B** will consist of questions, which will require detailed answers. There will be a choice of Questions in this section.

### **THEORY – 80 Marks**

#### **1. Restoring Balance in Ecosystem**

- (a) Need for adopting control measures to check for spoilage of landscape.
- (b) Need for conservation and management of water - integrated watershed management, recharging of ground water including rain water harvesting, development of appropriate technology.
- (c) Conservation and management of forests, grasslands, semi-arid ecosystems.
- (d) Conservation and management of ocean resources - marine and coastal eco-systems, importance of coral reefs.
- (e) Conservation and management of soil - alternate cropping, judicious use of inputs the water, fertilizers, pesticides; use of manure, bio-fertilizers and bio-pesticides; plantation and conservation of grasslands to check soil erosion; forest conservation including Joint Forest Management (JFM), afforestation including social forestry and agro-forestry.
- (f) Measures to conserve wild life - national parks, sanctuaries and bio-reserves; breeding programmes for endangered species; preventing poaching, hunting and bio-piracy; enforcement of legal provisions.
- (g) Application of bio-technology.
- (h) Public awareness programmes concerning conservation of water, soil, air forests and other resources.
- (i) Relevance of indigenous practices.
- (j) Tribal culture and its linkages to forest resources and their conservation.

#### **2. Restoring Balance in Ecosystem**

- (a) Type of pollution - air, water (fresh and marine), soil, radiation and noise.
- (b) Sources of pollution and major pollutants; oil spills.
- (c) Effects of pollution on - environment, human health and other organisms.
- (d) Abatement of pollution.

### **3. Issues of the Environment**

- (a) Decline in forest, agricultural and marine productivity and its effects on the economy.
- (b) Resettlement and rehabilitation of people.
- (c) Energy crisis - urban and rural sectors.
- (d) Greenhouse effect and global warming.
- (e) Climatic changes.
- (f) Acid rain.
- (g) Ozone layer depletion.
- (h) Disaster - natural and manmade; disaster management and its mitigation.

### **4. Striving for a Better Environment**

- (a) Use of efficient and eco-friendly technology.
- (b) Sustainable use of resources.
- (c) Adoption of indigenous practices; sacred groves.
- (d) Consumer education - consumer rights, making correct choices while buying different items; food adulteration.
- (e) Community participation for ecological restoration and conservation.
- (f) Protection of wild life; cruelty to animals.
- (g) Enforcement of acts, laws and policies.
- (h) Some success stories - use of CNG, *Chipko Movement*, water harvesting, Silent Valley and the like.

### **INTERNAL ASSESSMENT – 20 Marks**

Students are required to complete one case study and one project from the list given

The activities suggested below are neither exhaustive nor prescriptive. Teachers may design their own set of activities keeping in view the overall objectives of teaching and learning of Environment Education at this state. They will have to make use of local flora and fauna and the available resources and facilities and take cognizance of local environmental problems. The learners should be encouraged to initiate action on their own.

#### **Suggested list of assignments**

1. Organize a discussion/ debate on issues of environment, such as pollution of air, water and soil, depletion of resources, disposal of plastics and urbanization.
2. Collect data from owners/drivers of private/commercial vehicles through interview-cum-discussion method and prepare a report. Information may be sought on:-
  - frequency of checking air pressure;
  - maintenance of vehicles;
  - types of horns fitted in vehicles and frequency of their use;
  - frequency of checking pollution;
  - average driving hours per day;
  - state of driver's personal health.
3. Collect data from different households through interview-cum-discussion method. Discuss and suggest ways and means for saving electricity and fuels. Information may be collected on:

- types and quantity of fuel used per month in the kitchen;
- amount of electricity used per month or the fuel used for generator or any other sources used for lighting;
- amount of fuel used per month in car, motor cycle, scooter, tractor;
- measures/steps taken for saving fuel and electricity.

- Find out the sources of pollution of water bodies in the locality and determine the quality of water.
- Prepare plans for the beautification on the school campus or a park in the locality. Identify suitable plants and trees, undertake plantation and look after them. (This may be introduced as a class/group activity as a part of *van mahotsva* for eco-club programme.)
- Visit a water treatment plant, sewage treatment plant or garbage dumping or vermi composting sites in the locality and study their working.
- Collect information about global environmental issues and problems and communicate your findings through appropriate modes (like posters, charts, collages, cartoons, handouts, letters, street plays, etc. to all concerned).
- Participate in eco-clubs and activities like debates, quizzes, exhibitions, essay competitions on the themes related to environmental concerns and problems. Synthesize information gathered from books, journals, magazines and internet.

## Evaluation

The project work is to be evaluated by the subject teacher and by an External Examiner. The External Examiner shall be nominated by the Principal and may be a teacher from the faculty, **but not teaching the subject in the relevant section/class**. For example, a teacher of Environment Science of Class XI may be deputed to be the External Examiner for Class X Environmental Education project work.

The Internal Examiner and the External Examiner will assess the candidate's work independently.

## Award of marks (20 marks)

Subject Teacher (Internal Examiner): 10 marks

External Examiner: 10 marks

The total marks obtained out of 20 are to be sent to the Council by the Head of the School.

The Head of the School will be responsible for the entry of marks on the marks sheets provided by the Council.

## Teaching-Learning Strategies

Teaching-learning needs to be so designed that it facilitates enhancement and concretization of understanding, refinement of habits, attitudes, values and skills. Besides, linkages between theory and practices need to be strengthened. This would ensure learners' proactive role in addressing environment related problems. The strategies may involve the following.

- | Providing opportunities for the application of knowledge gained and understanding acquired.
- | Providing opportunities through simple projects to identify environmental problems which

catch the student's attention.

Encouraging independent handling of projects and activities.

Providing opportunities for critically analyzing data and information collected on environmental issues.

Encouraging nature study using the case study approach.

Involving learners in surveys pertaining to environment related problems/phenomena.

Involving learners in community based environment improvement programs.

Arranging excursions and visits and preparing reports.

Organizing brainstorming sessions to identify areas of action.

Encouraging self-learning through hands-on experiences.

Utilizing group activities for nurturing leadership qualities.

# CONTENTS

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## RESTORING BALANCE IN ECOSYSTEM



1. Conservation and Management: Landscape and Water
2. Conservation and Management: Forest, Grassland and Semi – Arid Ecosystems
3. Conservation and Management: Soil
4. Conservation and Management: Wildlife
5. Biotechnology and Its Applications
6. Public Awareness Programmes and Conservation

2

## POLLUTION



7. Types and Sources of Pollution
8. Effects and Abatement of Pollution

3

## ISSUES OF ENVIRONMENT



- 9. Decline in Productivity and Effects on Economy
- 10. Resettlement and Rehabilitation of People
- 11. Energy Crisis—Urban and Rural Sectors
- 12. Global Issues of Environment
- 13. Disasters: Types, Management and Mitigation

4

## STRIVING FOR A BETTER ENVIRONMENT



- 14. Sustainable Environment
- 15. Consumer Education
- 16. Ecological Restoration and Conservation

## SPECIAL SECTION

How to write Project-Reports and Activity— Reports in EE

# 1 RESTORING BALANCE IN ECOSYSTEM



**1. Conservation and Management: Landscape and Water**

**2. Conservation and Management: Forest, Grassland and Semi – Arid Ecosystems**

**3. Conservation and Management: Soil**

**4. Conservation and Management: Wildlife**

**5. Biotechnology and Its Applications**

## **6. Public Awareness Programmes and Conservation**

# Conservation and Management: Landscape and Water

## FACTS & CONCEPTS



- ♦ Introduction
- ♦ Conservation and Management of Landscapes
  - ◆ Causes of Spoilage of Landscapes
  - ◆ Need for Adopting Control Measures to Check Spoilage of Landscapes
  - ◆ Measures to Check the Spoilage of Landscapes
- ♦ Need for Conservation and Management of Fresh Water
  - ◆ Why do We Need to Conserve Fresh Water?
  - ◆ Practices of Conservation of Fresh Water
  - ◆ Integrated Watershed Management
  - ◆ Recharging of Ground Water

- ◆ Rainwater Harvesting,
- ◆ Development of Appropriate Technology
- ◆ Traditional Practices of Water Conservation
- ◆ Conservation and Management of Ocean Resources
  - ◆ Major Stresses on Marine and Coastal Ecosystems
  - ◆ Conservation and Management of Marine and Coastal Ecosystems
  - ◆ Importance of Coral Reefs

## 1.1. INTRODUCTION

Our ecologists and economists say that the rates of exploitation and consumption of resources by human beings, have reached to infinite levels since last few decades. Now, since these conditions are not compatible with the finite resources of the earth, these are undermining the wellbeing of its both the economic and the ecological systems. The imbalances thus caused in natural ecosystems are leading to various types of environmental problems some of which are being mentioned below.

- The spoilation of landscapes.
- The crisis in fresh water and oceanic resources.
- The degradation of forests, grass lands and semi-arid ecosystems.
- The degradation of soil.
- The extinction of species of plants and animals (wildlife).

The above conditions of environment aided with various types of pollutions are giving birth to various problems on natural and global levels. For these reasons the conservation and management of our natural resources have become the most important challenge that is being faced by the human race in different parts of the world. In this chapter, we are going to study about the need of checking the spoilation of landscapes as well as conservation and management of water resources including the oceanic resources.

## 1.2. CONSERVATION AND MANAGEMENT OF LANDSCAPES

About one third of the earth's surface is land. It covers an area of 140 million km<sup>2</sup>. The land provides us different resources like soil, land cover and landscape. The **soil** is the basis of agriculture and food production. The **land cover** includes forests and other vegetation. It is important for maintaining natural conditions of environment. The **landscapes** are important components of human habitations, peace and welfare. Since last few decades, vast areas of landscapes have been spoilt due to various types of human activities and natural disasters. Hence, there is an urgent need of checking the spoilation of landscapes.



**Fig.1.1.** A Spoilt Landscape.

### 1.2.1. Causes of Spoilage of Landscapes

The landscape is principally spoilt due to -1.Human activities and 2. Natural Disasters.

**The human activities** causing spoilage of landscapes are – bad agricultural practices and removal of natural vegetation. The **bad agricultural practices** include: excessive use of synthetic fertilizers, synthetic pesticides and low efficiency of irrigation schemes. These factors cause considerable damage to soil. The application of **synthetic fertilizers** alters the soil quality and makes it unproductive. The **synthetic pesticides** often kill the soil organisms and cause **bio-magnification** in animals by joining food-chains in ecosystems. **Low efficiency irrigation schemes** often cause wastage of water and flooding of lands. Flooding of land makes the soil saline and ruins its productivity. The removal of natural vegetation spoils the land and vast areas of barren lands spoil the landscapes.



**Fig. 1.2.** Removal of natural vegetation.

**The natural disasters** cause serious damages to landscapes. The principal factors causing natural disasters are – floods, earthquakes, volcanic eruptions etc.

**Table 1.1: Causes of land degradation**

Causes	Extent of Soil Degradation (Million ha)
Deforestation	580
Overgrazing	680
Fuel consumption	137
Agricultural mismanagement	550
Industry and urbanization	19.5



**Fig. 1.3.** Volcanic Eruption: A Natural cause of Land Spoilage.

### **1.2.2. Need for Adopting Control Measures to check Spoilage of Landscapes**

The spoilage of landscapes has become a major environmental problem now. Hence, adoption of control measures is necessary for checking the further spoilage and degradation of land. Some very important steps needed for checking the spoilage of landscapes are being described here.

#### **(i) For Controlling Soil Erosion**

The soil is essential for the growth and development of vegetation that controls most of the environmental processes. Secondly, it is the basic resource for agricultural production. The process

of soil formation may take thousands of years but the same soil is taken away within a very short period of time by natural forces like wind and rain. Human activities of clearing of vegetation, overgrazing by cattle, careless mining activities etc. facilitate the process of soil erosion which severely alters the functions of soil and spoils the landscape heavily.

### The Soil Erosion Alters Soil Functions in Following Ways-

- ◆ It destroys the ability of soil to act as a filter for pollutants.
- ◆ It destroys the ability of soil to keep up the *bio-geo-chemical cycles* like the water-cycle and the nitrogen cycle.
- ◆ It destroys the ability of soil to provide *habitat* and support the *biodiversity* at a particular place.

So far, about 2000 million ha of soil has been degraded through human activities. Soil erosion by water has alone degraded about 56 percent of soil. Degradation of soil through wind erosion, overgrazing, clearing of vegetation and industrial activities are 28, 35, 7 and 1 percent respectively. In the light of these facts, we can say that soil erosion and the spoilage of landscape are inter-related.

### **The erosion of soil can be controlled in following ways-**

1. By mechanical protection of soil like building of bunds and terraces along hill slopes and other slopey areas to control the speed of surface runoff.
2. By biological methods of soil protection like planting of trees, checking of deforestation and controlling overgrazing by cattle.
3. By water conservation and integrated system of soil protection, like protecting the land from water logging and adopting proper methods of land tilling.

### **(ii) For Controlling Desertification**

The United Nations defines the desertification in following ways-

*Land degradation in arid, semi- arid and dry sub- humid areas brought about by factors such as climatic variations and human activities, is called as desertification. In fact, it is land degradation process which occurs in dry sub-humid areas as a result of changes in climate and human activities.*

The desertification of land leads to major consequences. It has become a major problem in many parts of the world and different nations are worried to control the advancement of deserts. Around 3600 million ha of the world's dry lands were degraded by desertification up to the year 2000. In view of increase in the problem of desertification, it is felt that appropriate preventive measures and reclamation strategies must be taken up to combat this problem.

## CAUSES AND CONSEQUENCES OF DESERTIFICATION

Scientists across the world, are of the opinion that desertification is the result of climatic variations and atmospheric changes. But all of them now accept that some human activities are the **real causes** behind the desertification in the current age. The whole world agrees that desertification has many **serious consequences** that cause suffering and dangers to the whole life existing in the particular areas, and also, that disrupt many of the environmental processes in those areas. Some of the remarkable causes of desertification and its consequences are mentioned below.

## CAUSES OF DESERTIFICATION-

- (i) Massive deforestation for various activities like extension of agriculture, pasture development, industrialization, mining, urbanization etc.
- (ii) Overgrazing by cattle that renders the earth- surface bare, infertile, and thus unproductive.
- (iii) Over cultivation that depletes most of the organic content of the soil and makes it prone to soil erosion by wind and water.
- (iv) Growth of human population and consequent degradation of land through increasing human activities.
- (v) Unscientific irrigation practices and flooding of fields makes the soil saline and unproductive.

### **CONSEQUENCES OF DESERTIFICATION -**



**Fig.1.4.** One of the consequences of desertification.

- (i) It reduces the ability of land to support life.
- (ii) It adversely affects the lives of wild species, domestic animals, agricultural crops and people.
- (iii) Desertification reduces plant cover from the earth surface and accelerates soil erosion through wind and water. Here is an example: South Africa is loosing about 300 to 400 million tones of top soil every year.
- (iv) Desertification is a self-reinforcing process. It means, once the process of desertification starts, the conditions are set for continual deterioration of land.
- (v) Desertification causes a drop in biological productivity which leads to decline in economic productivity. It further forces farmers into poverty and compels them to migrate.

**Control of desertification** According to **United Nations Environmental Programme (UNEP)**, following measures can be adopted for controlling desertification –

- ◆ Banning of goat farming, which is destructive to the environment;

- ◆ Reclaiming desertified land for increased productivity through a comprehensive approach;
- ◆ Developing appropriate farming practices suited to the fragile semi-arid region;
- ◆ Refining of economically viable traditional practices in land degradation control and rehabilitation;
- ◆ Improving the living conditions and income of farmers in affected villages to lift them out of poverty.

### **(iii) For Controlling Degeneration of Biodiversity and Checking Extinction of Species**

We know that the *species richness at any place is called as its biodiversity*. It is very essential to maintain the biodiversity because every species has a key role to play in the environment. Secondly, all the species and their characteristics are properties of our planet.

The biodiversity can be maintained by proper management of landscapes. For this clearing of vegetation, habitat destruction, use of pesticides in agriculture, heavy and careless mining etc. activities must be stopped.

### **(iv) For Controlling Deforestation and Associated Problems**

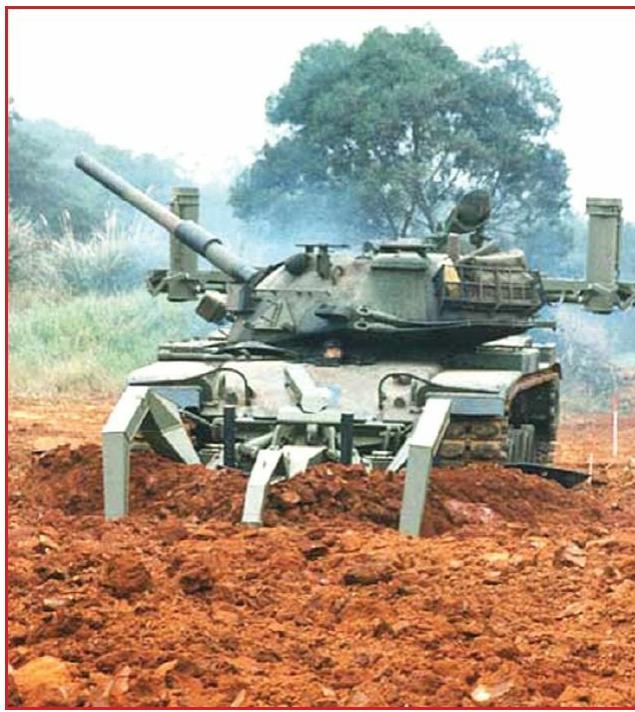
The vegetation including forests and grasslands is essential for the maintenance of landscapes. But forests and grasslands are at serious risk due to various types of human activities like industrialization, urbanization, agricultural expansion, pasture development, and various types of construction activities. More than 220 million ha of tropical forests were destroyed during 1975-90 for the expansion of agriculture for food production. The loss of vegetation cover allows an imbalance in the atmospheric composition of gases. Under these conditions the concentration of carbon dioxide increases in the atmosphere which further contributes to *global warming and change of climate*. Under these conditions it is essential to adopt control measures for checking the spoilage of landscapes.

### **(v) For Checking Soil Pollution**

Lands are becoming seriously polluted due to dumping of wastes in different areas. The soil pollution from acid rains and industrial wastes is another environmental issue associated with land degradation, desertification, loss of vegetation and degeneration of biodiversity. About 12 percent of the soil degradation is caused by dumping of wastes from chemical industries alone. In China, vast areas of good agriculture land are threatened by chemical pollution. All these environmental problems are further compounded to cause the spoilage of landscapes. Hence, the adoption of control measures for these problems is very important.

### **(vi) For Reclamation of Land Spoilt by Industries**

Vast areas of land have been made useless through various Industrial activities like heavy mining, overburden dumps, accumulation of wastes and construction activities. These activities put serious stresses on land and cause spoilage of landscapes. Hence, it is essential to adopt control measures to stop the spoilage of landscapes. The land which is made useless through industries should be reclaimed for productive purposes.



**Fig.1.5.** Reclamation of land.

**What is the Reclamation of Land?** Restoration of a land area to more natural state is called as **Land Reclamation**. It is the process through which seriously disturbed surfaces of land are stabilized against the hazards of wind and water erosion.

Sometimes, land reclamation involves creating new land from sea or riverbeds. Such type of reclamation has become an old practice in many coastal areas of the world. Creation of artificial islands is also an activity of land reclamation. **The Kansai International Airport in Osaka, and Hong Kong International Airport, Palm Island, Hotel Burj- al- Arab in UAE** are examples of **artificial islands**. However, new reclamation projects are restricted or no longer allowed by the Laws of Environmental Protection, in some countries.

## LAND REFORM

Various measures such as division of large portion of land into smaller ones, that are taken to bring about a more equitable apportionment of agricultural land is called as Land Reform. In other words, deliberate change in the way the agricultural land is held or owned, the method of its cultivation, or the relation of agriculture to the rest of the economy is called as land reform. It has both the political and environmental objectives-

1. A common political objective of land reform is to abolish feudal or colonial forms of landownership.
2. The environmental or other objective includes improving the social status of farmers and coordinating agricultural production with industrialization programme.

### **1.2.3. Measures to check the spoilage of landscape**

Following measures are adopted to check the spoilage of landscape-

- (a) Prevention of soil erosion,
- (b) Maintenance of soil fertility, and
- (c) Management of land.

Spoilage of land and landscape can be reduced or minimized by proper planning of land use.

**Planning for proper utilization of land for different purposes is called as Land use Planning.**

Some of the major advantages of land use planning are- (i) Checking land degradation (ii) Sustainable development and, (iii) Soil conservation.

## 1.3. NEED FOR CONSERVATION AND MANAGEMENT OF FRESH WATER

According to the **National Water Policy – 1987**, *water is a scarce and precious resource to be developed and conserved on an integrated and environmentally sound basis*. The **Planning Commission of India** has estimated that the Annual Water flow in our rivers is 1869 cubic kilometres of water out of which we can use 550 cubic kilometres which accounts for 30 percent only. The remaining 70 percent either goes to the sea, gets wasted or causes floods enroute. We are facing irrigation problems from thousands of years due to water logging, salting or silting.

### 1.3.1. Why do we need to conserve fresh water?

There is an urgent need of water conservation because of the facts mentioned below-



**Fig. 1.6.** About 1.1 billion people in the world lack access to safe drinking water.

- ◆ Water is the most essential substance for life processes. It is essential for drinking, bathing, cooking, irrigation, industry, and for the survival of plants and animals.
- ◆ The global supply of water is uneven. Due to this, many parts of the world frequently suffer from water crisis, drought, and crop-failure.
- ◆ Most of our fresh water sources like ground water, reservoirs, rivers etc. are under increasing environmental stress. This stress on water is caused due to overuse, water pollution and degradation of ecosystems.
- ◆ According to the *United Nations Environmental Programme* (UNEP), some 80 countries of the world suffered from serious water- crisis up to mid-1990s. The *World Water Council* in its report of the year 2000, stated that the demand for water use is expected to increase by 40 per cent by the year 2020. The agriculture will require 17 per cent more water for producing food for our growing population by that time.

- ◆ About 1.1 billion people in the world lack access to safe drinking water. The surface and ground water has been contaminated by toxic chemicals, wastes, and pathogens. Poor water supply and problems of water sanitation are causing the spread of many water borne diseases in many parts of Asia and Africa. Some of these diseases are- *cholera, diarrhoea, dysentery, eye infections, scabies, trachoma, ascariasis* etc. According to a report of the UNEP, *about 3 million people in Africa die due to water borne diseases.*
- ◆ Dumping of toxic wastes has polluted ground water through seepage. Landfill sites too, contribute a lot in the pollution of the underground water. Secondly, the overuse and misuse of ground water is causing the depletion of water table in many parts of the country.

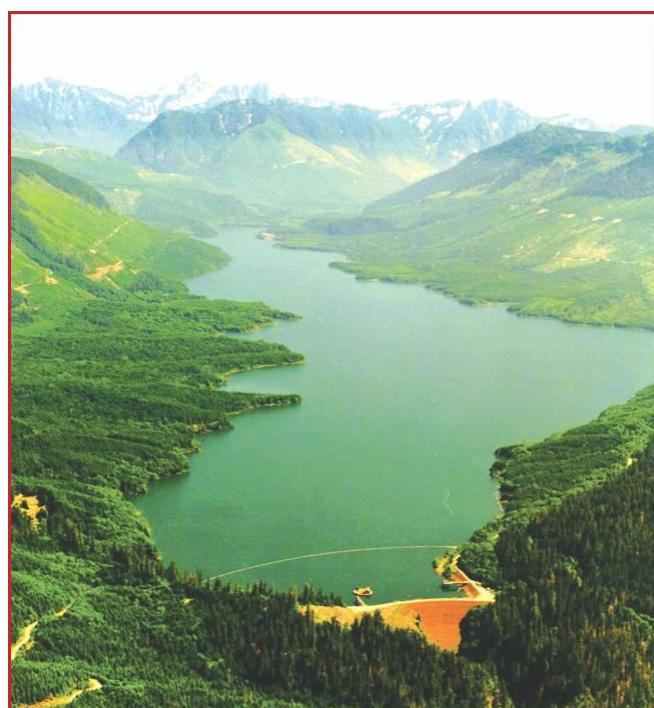
### 1.3.2. Practices of water conservation

Management of watersheds; recharging of groundwater through various methods and technologies; and traditional water harvesting techniques are important practices of conservation of water. These practices have been described ahead.

#### A. INTEGRATED WATERSHED MANAGEMENT

*A Watershed is the reservoir in which the rainwater falling on a vast hilly area is made to accumulate for recharging the water-table and for keeping it reserved for domestic and agricultural purposes of local communities.*

In watershed development, the water is conserved at source i.e. the rain water falling on hills is stored and conserved in valleys. Civil structures like *contour bunds, trenches, gully plugs, check dams and percolation tanks* are constructed to conserve water and to recharge the ground water. The Watershed Management also aims at protecting precious top soil from getting eroded due to rain water run offs. The Integrated Watershed Management incorporates full participation of villagers at local level.



**Fig.1.7.** A Watershed.

Watershed is the basic unit of development which involves a manageable subunit of water cycle. The **Integrated Watershed** involves various other elements that are linked with the watershed. These elements are: **conservation, regeneration and judicious use of natural resources**. Besides this, the integrated watershed keeps a balance between human demands and availability of the resource.

Some of the major objectives of Watershed Management are -

1. Conservation of soil & water
2. Recharging the ground water-table

## I. Major areas covered under Integrated Watershed Management

The Integrated Watershed Management covers different areas of environment which are listed below-

- (i) Management of soil and water,
- (ii) Development of sustainable agriculture,
- (iii) Improvement in cattle rearing or the animal husbandry,
- (iv) Development of fodder for cattle,
- (v) Development of Agro-forestry i.e. growing commercially useful trees on demarcation lines of crop fields,
- (vi) Management of rural energy, and
- (vii) Development of community.

Presently, the Integrated Watershed Management is mainly carried out as a major project in Orissa, Tamil Nadu, Karnataka, and Madhya Pradesh. However the development of watersheds is going on in many other states also on community basis. The Watershed Management is ideal at a place which experiences short rainfall and which has meagre arrangements for irrigation.

## II. The Need of Integrated Watershed Management

The implementation of Integrated Watershed Management is needed for the sustainable development of communities in a particular area. It is most needed in water scarce areas for following activities –

- (i) For increasing production oriented works like increasing the agricultural production and doing other income generating activities,
- (ii) For implementing Agro-forestry and Soil Conservation Programmes (The agro-forestry programmes in Karnataka and Agriculture Development Activities in Orissa are some examples),
- (iii) For the empowerment of local communities so that they can generate resources and can maintain watersheds themselves,
- (iv) For solving water and environment related problems,
- (v) For planting trees to meet the demands of fibre and fodder,
- (vi) For managing and stabilising hill slopes and terraces,
- (vii) For controlling soil degradation through salinity and water logging,

(viii) For assuring adequate quantity and quality of usable water through --

- (a) The cultivation of less water –consuming crop varieties,
- (b) The protection of water bodies,
- (c) The construction of check dams,



**Fig. 1.8.** A Check Dam.

- (d) The development of irrigation facilities,
- (e) The development of water treatment facilities,
- (f) Proper disposal of waste water and recharging the ground water.

(ix) For controlling floods and damages caused due to floods by-

- (a) The construction of flood control dams along river banks,
- (b) The plantation of trees in river basins to check soil erosion,
- (c) The protection of wetlands,
- (d) The construction of water diversion channels, and
- (e) The control on overgrazing.

## B. RECHARGING OF GROUND WATER

*Getting back the required level of ground water is called as recharging of ground water.* For this, the water accumulated on the earth-surface is facilitated to enter into the earth and to raise the level of ground water.

### (i) Need of recharging of ground water

Concrete buildings, roads etc. cover big areas of land which do not allow the rainwater to enter into the earth. Secondly, the slopes of hills too, do not allow the flowing water to enter into the earth.

On the other hand, more than 80 percent of the domestic demand is met by ground water sources. Irrigation alone consumes 90 percent of the extracted ground water. The extraction of the underground water is being done at the rate higher than the natural recharge and snow- melts. These are the reasons due to which recharging of ground water level is essential.

## (ii) Techniques of recharging of ground water

The recharging of ground water is principally done through Rain water harvesting and the development of appropriate technology. Let us consider the rain water harvesting first.

### 1. RAIN WATER HARVESTING

**The collection and transfer of rainwater from the catchment's area to the place of storage and use is called as rainwater harvesting.**

The rainwater harvesting aims at-

- (i) checking the rainwater from flowing far away causing en-route soil erosion and flooding vast areas,
- (ii) meeting the demands of water in water scarce areas,
- (iii) recharging the ground water and raising its level, and
- (iv) Checking the rainwater from becoming seriously polluted or contaminated.

The collection and use of rainwater is a traditional practice adopted in water scarce areas of India since long. In those areas, people have been harvesting rain water since long. Now that the overuse of the ground water in most parts of the world has pushed down the ground water at a critical level, it has become most essential to bring back the depleted water level. For this, recharging of the ground water is essential by allowing the rain water to run down inside the earth.

The water of rain can be harvested in many ways. Now that vast areas of land are occupied by buildings and tarred roads, very less area is left open to catch the rain water and to allow it to go inside the earth. Under these conditions the rooftop water harvesting for domestic uses and for recharging of ground water is a novel option.

For the recharging of the ground water, following structures are usually constructed-

- (a) Sub strata dykes
- (b) Inverted tube wells
- (c) Ponds and lakes with shafts and dug wells

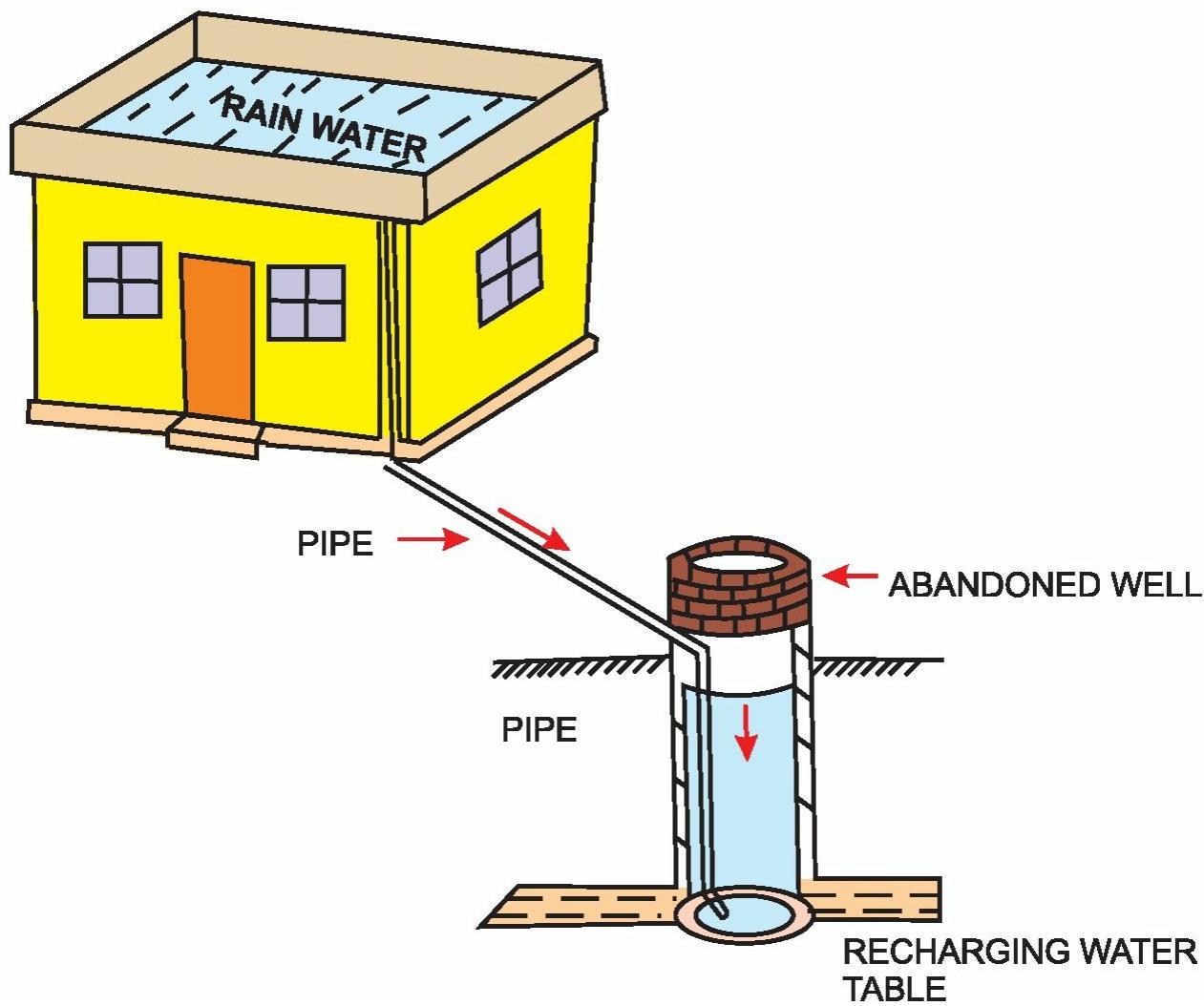
### ROOF-TOP RAIN WATER HARVESTING

***The technique, through which the rainwater is captured from roof catchments and stored for further use, is called as roof – top rain water harvesting or the domestic water harvesting.***

The roof-top water harvesting and conservation system comprises six components which are being introduced below-

- (i) The catchments area or roof: It is the surface of the top of a house where the rain water falls.
- (ii) Gutters and downspouts: These are transport channels from the catchments surface to the storage area.

- (iii) Leaf screen and roof washers: These are the systems that remove contamination and debris.
- (iv) Storage Tanks: These are containers or permanently built structures to store water for cleaning and the domestic use.
- (v) Water treatment: For this, filters and equipments are used and disinfectants are added to purify water.



**Fig.1.9.** Roof – top Rain Water Harvesting.

This approach requires connecting the outlet/drop pipe from roof of the building to divert the rain water, to either existing wells/tubewells/bore wells or specially, designed structure.

For the roof-top rain water harvesting, the roof-top should be clear and safe. If the area of the roof-top is located in Delhi, it is 100 sq m in area and the average rainfall is 0.6 m, the volume of the water harvested will be 5, 1000 L.

The rainwater collected on roof can be sent to recharge trench or to a recharge well, dug properly in the ground. It helps in improving the ground water level. The recharge trench or the recharge well may also be an abandoned well in the area.

**The Roof-Top water Harvesting is Traditional Practice of Water Conservation in Mizoram.** Since most of the villages in the state are situated on hill tops, the Mizo-community has to face acute shortage of water during most part of the year. The Government of the state started rainwater harvesting work in 1986 with a number of projects on collection, storage and purification of

rainwater. As per records, about 24185 Rainwater Harvesting Tanks, and 32 impounding reservoirs had been constructed in the state by 2006-07.

## 2. DEVELOPMENT OF APPROPRIATE TECHNOLOGY

Some very common technologies applied for the recharging of ground water are being introduced below –

### (i) Construction of check dams

*A permanent or temporary wall constructed against the flow of water current in order to check it against going away and also in order to raise the existing water level, is called as a check dam.*

Temporary check dams are constructed by using different types of locally available materials like wood, pebbles, rock pieces, or wire nets. Accordingly, they are called as wood dams, rock dams, or wire dams. The concept of check dams was applied by Shri Rajendra Singh for the conservation of water in Rajasthan. He is called as “**the water man of India**”.

### (ii) Construction of Irrigation Ponds

These are artificially constructed ponds in the area of water sheds for the collection of water for irrigation. This practice is very much popular in South India where more than 2,000150 irrigation ponds have been constructed to irrigate about 4 million ha of land.

### enviro\_Facts : 1.1.

#### PANI- PANCHAYAT

The World Bank and governments are proposing the privatization of water as a solution to the water scarcity. Environmentalists think that it is privatization of water that has created the crisis. Water conservation and sustainable use of water can only be possible on the basis of the democratic control over water resources.

In Pune of Maharashtra state in India, an NGO named Gram Gourav Pratishthan launched a movement named Pani-Panchayat in the year 1972. The central idea under the formation of the Pani – Panchayat was-no individual should be deprived of a rightful share of the limited water resources on which life and the livelihood depends. To ensure justice, the Pani-Panchayat manages water as a community resource and not as a private property. The cultivation of sugarcane was completely banned for being inconsistent with the principle of responsible and sustainable resource use in drought prone regions.

### (iii) Construction of Percolation Ponds or Percolation Pits

These are artificially constructed ponds in low lying areas to collect the rain water. Inverted tube wells and dug wells are constructed in the bottoms of ponds so as to allow easy percolation of water inside the ground and to recharge the ground water level.

### (iv) Construction of Tunnels

These are deep structures in the ground, dug in order to collect the rain water in them. The rain water so collected, in tunnels, recharges the ground water table.

### (v) Construction of farm-ponds

These are structures constructed to collect the rainwater overflowing the crop fields or farms. This water can be re-used for irrigation during dry seasons or for Pisciculture. Such ponds are also useful in recharging of ground water. However, these are frequently subjected to eutrophication as their water contains plenty of plant nutrients.

#### (vi) Sub strata-Dykes or Sub- surface dams

These are long thick walls built underground in the bed of some streams to stop flooding on to a low area of land or checking the sub-surface flow of water.

#### (vii) Inverted Tube wells

These are deep bore wells through which the rainwater is allowed to enter into the earth to recharge the ground water.

#### (viii) Gully Plugs

*The deep incision that cuts into the bedrock due to surface runoff of water is called as gully.* Gullies are formed in steep areas due to the erosion of soil by rain water. Gully plugs are stones, sand bags or wood logs that are used as obstructions against the flow of water through gullies. This practice checks the further erosion of soil as the speed of water flowing through gullies is reduced by gully plugs.

### C. TRADITIONAL PRACTICES OF WATER CONSERVATION

Water has been harvested in India since the ancient period. The need of Conservation and Management of Water was felt even by the people of the Harappa and Mohenjo-Daro, about 5000 years ago. Here is a historical account of the practice of water conservation in India, after which we will study about various water harvesting practices and structures that have been traditionally popular in the different parts of the country.

#### (i) The Historical Account of Water Harvesting in India

The Archaeological Studies show that India's Great Rann of Kutch had several reservoirs to collect rain water run off in the extremely dry region of Dholavira, dating back to the 3<sup>rd</sup> millennium before the Christ.

Kautilya's Arthashastra that was written in the 3<sup>rd</sup> century B.C. has a mention of irrigation by rain-harvested water through community participation.

Junagarh Inscriptions dating back to 2<sup>nd</sup> century A.D. inform us about the restoration of Sudarsana Lake, which is not seen now since 9<sup>th</sup> century A.D.

The Vijainagar Tradition of Vijainagar Kingdom (1336-1564 A. D.) laid much emphasis on the development of irrigation and water harvesting for the improvement of agriculture.

The kings of olden days like Krishnadeo Rai (1509- 1530) etc. emphasized that prosperity of the empire depended on the construction of irrigation channels and water tanks.

The Gond Tradition emphasized on the repairs of channels, embankments, distributaries, tanks or Talabs etc. The Rani Talab of Jabal Pur is a glaring example of water harvesting tradition of Gond Tribes.

The Bengal Tradition laid emphasis on irrigation on irrigation with the water collected through rain water harvesting.

The Karikala Chola of 2<sup>nd</sup> century A.D. built a Grand Anicut across the river Cauvery to divert water for irrigation.

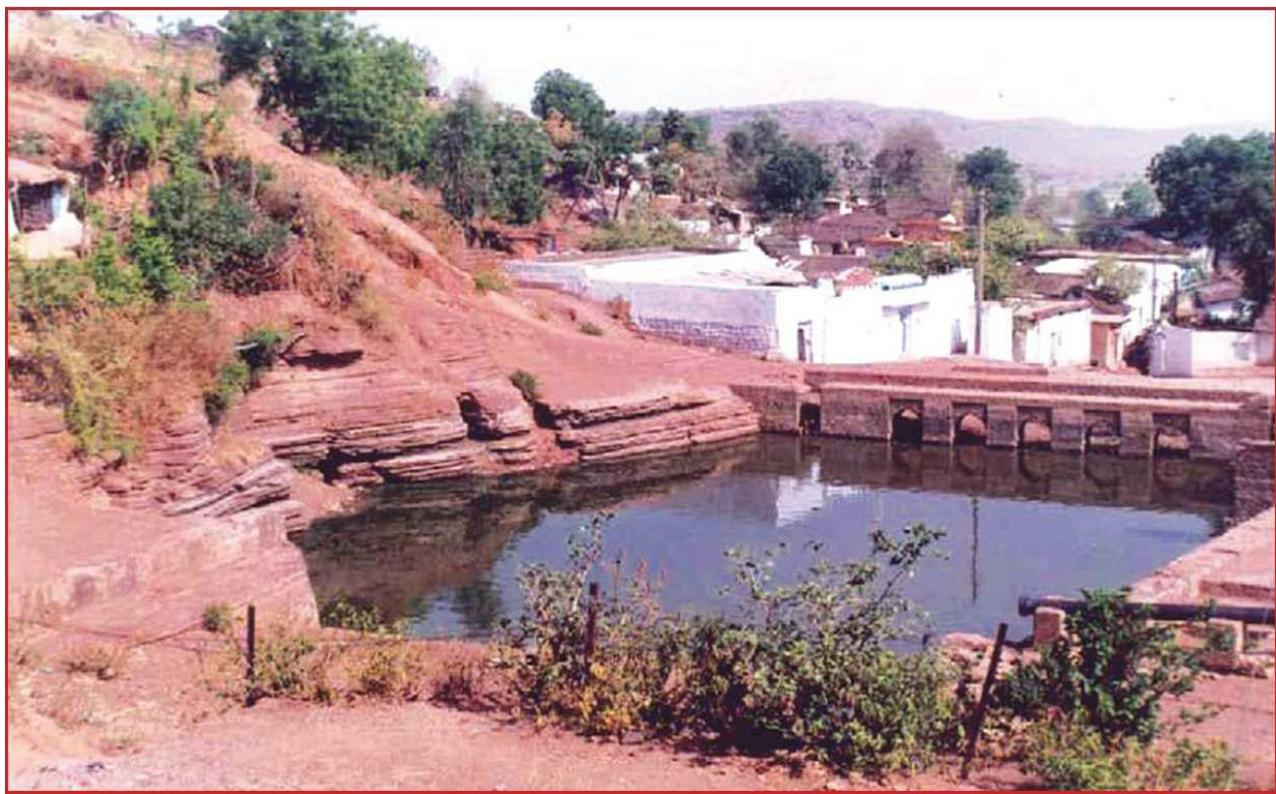
Raja Bhoj of Bhopal built the largest artificial lake (65,000 acres) in India. That lake was fed by streams and springs. Kalhan in his Raj Tarangini (12 century A.D.) has described a well maintained irrigation system in Kashmir.

## (ii) Traditional Water Harvesting Systems in India

In respect of availability and non- availability of water, India can be divided into 15 Ecological regions, ranging from dry, cold desert of Ladakh to the dry hot desert of Rajasthan, from the sub-temperate mountain of the Himalayas to the tropical high mountain of Nilgiri.

**Table 1.2. Traditional Water Harvesting Systems in different Ecological Zones of India**

S.No.	Ecological Zone	Traditional Water Harvesting system/ structures
1.	Trans- Himalayan Region	Zing
2.	Western Himalayan Region	Kul, Naula, Kuhl, Khatri
3.	Eastern Himalayan Region	Aptani
4.	Northern Hill Ranges	Zabo, Cheo-oziihi, Bamboo- drip irrigation
5.	Brahmaputra Valley	Dongs, Durgs /Jampois
6.	Indo-Gangetic Plain	Ahars-pynes, Bengal's inundation channels, Dighis, Baolis. Etc.
7.	Thar Desert	Kunds, Kundis, Baoris, Jhalaras, Nadi, Tabas, Tankas, Khadins, Virdas, Paars etc.
8.	Central Highlands	Talab, Bandhis, Saza Kuva, Johad, Naada, Bandh, Tank, Chandella, Bundela Tank etc.
9.	Eastern Highlands	Katas, Mundas, Bandhas etc.
10.	Decan Plateau	Cheruvu, Kohli, Tanks, Bhandaras, Phad, Kere, etc.
11.	Western Ghats	Surangam
12.	Western Coastal Planes	Virdas
13.	Eastern Ghats	Korambu
14.	Eastern Coastal Plains	Eri, Ooranis
15.	The Islands	Jack Wells



**Fig.1.10.** Baori constructed in the forte of Rajasthan.

**Some of the Water Conservation Systems mentioned above are being introduced below-**

## **ZING**



**Fig. 1.11.** Zing- the water harvesting structure of Ladakh.

Melting glaciers and snows are the only sources of water for the people residing in Ladakh region. The people of this region make intelligent use of their limited resources and make agriculture possible in this dry and barren land. The snow and ice melt slowly through the day and water is available in the streams only in the evening, when it is too late for irrigation. The water in the streams is hence led by channels to storage tanks and used the next day. These storage tanks are called as ZING.

## **APTANI SYSTEM**

This system is practiced in Arunachal Pradesh by Aptani tribes. The Aptani system of Arunachal

Pradesh was practiced by the Aptani tribes. Under this system the stream water is blocked by constructing a wall 2 to 4 m high and 1 m thick near forested hill slopes. This water is taken to the agricultural fields through channels. The valleys are terraced into plots separated by 0.6 m high earthen dams with inlet and outlet channels (to the next plot) that help to flood or drain the plots as and when required.

## **ZABO SYSTEM**

This traditional system is practiced in Nagaland. The term Zabo means ‘impounding run-off’. Zabo is practiced in Nagaland. When rain falls on terraced hill slopes, the runoff collects in ponds in the middle terrace. The runoff then passes through slopes where there are cattle yards, and finally reaches the paddy fields at the foot of the hills. Thus it is through this system that not only the irrigation of paddy fields is brought about, but the fertility of the crop- field is also improved.

## **BAMBOO DRIP IRRIGATION & TRICKLE DRIP IRRIGATION**

Under this system the rapidly flowing water from streams and springs is captured by bamboo pipes and transported over hundreds of metres to drip irrigate black pepper cultivation in Meghalaya. Many bamboo pipes of varying diameters and lengths are laid to manipulate and control the flow of water through this system of water conservation.

The Trickle Drip System is a system of irrigation that was first developed in 1960s by farmers to check wastage of water during irrigation.

In this system water is allowed to pass through a narrow route drop by drop directly to the plant roots. This system delivers the correct quantities of water to the roots of the plant, thereby not wasting any of the precious water. This method of irrigation does not waste water, and allows the crops to be adequately watered all year round. This technology was quickly adopted by the world community. By 1995 over 20 million irrigation systems were in use world wide. This technology has been changing rapidly to correct for specific problems. The latest system on the market (the fifth generation) widens water passages to increase water flow and create a “clog-free” system.

## **AHAR-PYNE**

Ahar-pyne is a traditional floodwater harvesting system indigenous to South Bihar. Here the terrain has a marked slope, the soil is sandy, groundwater levels are low and rivers flood their banks only during the monsoon. The ahar is the catchment basin embanked on three sides, while the fourth side is the natural slope. Pynes or artificial channels start out from the river, and meander through fields to end up in an ahar.

## **TANKAS**

Tankas are round or rectangular structures usually constructed to store water in Bikaner of India. Rainwater from the roof or terrace is directed towards an opening in the floor which leads to the tanka. The rain water thus stored in tankas is used for various purposes.

## **JOHAD**



**Fig. 1.12.** Khadin.

*Johads* are small earthen check dams that capture and conserve rainwater, improving percolation and groundwater recharge. This practice was started in 1984 in Rajasthan. So far some 3000 *Johads* have been constructed across more than 650 villages in Alwar district of the state. What about other districts? Well other districts are also moving along the same path. This has resulted in a general rise of the groundwater level by almost 6 metres and a 33 percent increase in the forest cover in the area. Five rivers that used to go dry immediately following the monsoon have now become perennial, such as the River Arvari, has come alive.

## **KHADIN**

A *Khadin*, also called a *dhora*, is an ingenious construction designed to harvest surface runoff water for agriculture. Its main feature is a very long (100-300 m) earthen embankment built across the lower hill slopes lying below uplands. Sluices and spillways in the area allow excess water to drain off to the catchment.

The *Khadin* system is based on the principle of harvesting rainwater on farmland and subsequent use of this water-saturated land for crop production. First designed by the Paliwal Brahmins of Jaisalmer, Western Rajasthan in the 15th century, this system has great similarity with the irrigation methods of the people of Ur (present Iraq) around 4500 BC and later of the Nabateans in the Middle East. A similar system is also reported to have been practiced 4,000 years ago in the Negev desert, and in southwestern Colorado 500 years ago.

## **KUNDS OR KUNDIS**

As in many parts of the country, the people of Rajasthan have learnt to live with scarcity of water. In Churu, Bikaner, and Sikar of the state people have learnt to harvest rain water in Kunds or Kundis. What are Kunds or Kundis?

Dome shaped structures over an underground tank surrounded with an artificially paved catchment sloping towards the centre is called as Kund or Kundis. Traditionally, these tanks were made up of lime, which acted as disinfectant but currently scarcity and demand hassled people to construct Kunds of cement.



**Fig. 1.13.** Panikheti- the conservation of water on terraces.

The system of rice cultivation on terraces developed by the Angami and Chakesang tribes of Nagaland state of the North-eastern India is called a Panikheti. Rather, Panikheti is the term applied to the beautiful rice terraces in the North-eastern Hill Region of India. In this system of farming on terraces, water is supplied to plants by channels that carry water from streams. About 10 to 15 cm of water level is maintained in the fields and rest of the water is allowed to flow down to the lower terraces. This traditional practice ensures that there is no wastage of water while protecting the rights of farmers over the use of water.

## 1.4. CONSERVATION AND MANAGEMENT OF OCEAN RESOURCES

Seas and oceans provide various types of resources to human beings and habitats to numerous species of plants and animals. They play very important roles in the economy of a nation and its people. Still, the marine and coastal ecosystems are under severe stress due to human activities. Hence, the conservation of these resources is very important, today.

### 1.4.1. Major Stresses on Marine and Coastal Ecosystems

Our marine and coastal ecosystems are under heavy stress due to various types of human activities.

#### **Major Stresses on Marine Ecosystems are Listed Below-**

1. Pollution of marine water due to disposal of municipal, industrial, chemical and toxic wastes in the sea water.
2. Dumping of various biodegradable and non- biodegradable wastes including plastics and torn fishing nets etc. into sea water.
3. Over exploitation of living marine resources.
4. Heavy sedimentation of sea water.
5. Global climatic and atmospheric changes induced by human activities leading to atmospheric pollution.

6. Introduction of exotic species, in a habitat, for example introduction of Jelly fish in the black sea.
7. Oil spills on water surface from ships and natural sources.
8. Eutrophication : A condition of enrichment of water bodies with nutrients, is called as Eutrophication. It encourages growth of aquatic plants who utilize most of the oxygen dissolved in water. It leads to death of aquatic animals.

### **Major Stresses on Coastal Ecosystems are Listed Below-**

1. Increasing pressure on terrestrial and marine natural resources cause coastal degradation.
  2. Dumping of wastes in coastal areas intoxicate the coastal and estuarine waters.
  3. Population growth, increasing urbanisation, industrialization and tourism in coastal areas damage coastal ecosystems.
  4. Pollution of coastal water by industrial wastes is damaging coastal and estuarine ecosystems. Deaths of sea birds due to intoxication of sea-water by pesticides (DDT in particular) and outbreak of *Mina Mata* disease in *Japan* from mercury contaminated seafood are two examples of serious pollutions of coastal ecosystems.
  5. Exploitation of living resources from coastal areas is causing excessive pressures on coastal ecosystems.
  6. Contamination of sea water with sewage is causing nutrient enrichment of coastal ecosystems. It is further leading to a serious condition of eutrophication. The sewage discharge into sea water has increased dramatically in the past three decades. Several enclosed or semi-enclosed seas like the *Black Sea* are experiencing serious problem of *eutrophication*.
  7. The contamination of coastal water by sewage borne pathogens is causing serious public health problems.
  8. Port dredging, land filling, coastal solid waste dumps, coastal constructions, beach and reef-mining, damage from tourism and recreation are causing serious impacts on these ecosystems.
  9. Destruction of mangrove vegetation has put severe stresses on these ecosystems.  
The salt-tolerant plants of tropical and sub-tropical, intertidal regions are called as Mangrove – Vegetation, or simply “Mangrove”. Mangroves are highly productive but extremely sensitive and fragile.
    - Mangroves save lives and property during natural hazards like–Cyclones, storm-surges and erosion.
    - Mangroves act as breeding, feeding and nursery grounds for estuarine and marine organisms.
- On the Indian coastline, Andaman-Nicobar Islands and Gulf of Kachchh are the major Mangroves.

#### **1.4.2. Conservation and Management of Marine and Coastal Ecosystems**

According to a report of the UNEP, the degradation of marine and coastal ecosystems has intensified since last 30 years. The progress in the protection of these ecosystems has so far remained very slow. Fortunately, there is an emerging concern in some parts of the globe that the loss of living marine resources is as dangerous to the health of marine and coastal ecosystems as marine pollution. Some of the major threats to these ecosystems that have been identified are-pollutions,

overexploitation of marine living resources and loss of coastal habitats.

Major strategies of conservation and management of marine and coastal ecosystems are described below.

India has a coastline of over 7,500 km. It has about 2 million sq km area within the **Exclusive Economic Zone** (EEZ). It has been authorised to explore about 150,000 sq km of marine area in the Indian Ocean by Seabed Authority which offers immense scope for exploration and study of ocean resources.

The Government of India created the **Department of Ocean Development** (DOD) in July 1981. An Ocean Policy Statement was brought out in 1982 by this department. Some of the features of this policy are- *Exploratory survey; Assessment and sustainable utilization of ocean resources; Technical advances geared to the utilisation and preservation of the marine and coastal ecosystems; Integrated Coastal and Marine area Development; and Coastal Community Development.*

**The Government of India has created following systems for the conservation and management of marine and coastal ecosystems-**

- (i) Coastal Area Monitoring and Prediction System (OMAPS)-1990.
- (ii) Two Coastal Research Vessels (under National Institute of Ocean Technology) namely: Sagar Purvi and Sagar Paschimi. These vessels are meant for the monitoring of marine and coastal pollutions for Integrated Coastal and Marine area Management.

**The Integrated Coastal and Marine Area Management Programme** (ICMAM) is a project under implementation since 1997. This project has two major components- (a) Capacity building, and (b) Development of infra structure for research and development.

### **THE CAPACITY BUILDING COMPONENT OF ICMAM INCORPORATES**

- (a) Development of information system for critical habitats of India such as Gulf of Khambat, Karwar Island, Gulf of Kutch, Cochin Islands, Sunder bans, Malwan, Kadmat Island, Gulf of Mannar, Pichavaran, Caring and Gahirmatha.
- (b) Development of guidelines for *Environmental Impact Assessment*.
- (c) Development of *Model Integrated Coastal and Marine Management Plans* for Chennai, Goa, and Gulf of Kutch.

On global level, India ratified the **UN Convention on Law of the Sea** (UNCLOS) in June 1995. The *Department of Ocean Development* is a nodal agency for the implementation of the provisions of UNCLOS in India. Soon after the enforcement of UNCLOS, some institutions like the *International Seabed Authority* (ISBA) and *Commission on the Limit of Continental shelf* (CLCS) were formed.

#### **1.4.3. Importance of Coral Reefs**

**Ridge or elevated part of a relatively shallow area of the sea floor approaching the surface of the sea is called as coral reef.**

Corals are massive wave resistant structures built largely by coral and consisting of skeletal and chemically precipitated material. These are made by polyps i.e. animals belonging to the class Coelenterata.

There are basically three types of coral reefs- **Fringing reefs**, Barrier reefs and Atoll. The

fringing reefs develop along the shoreline of an island and usually extend outwards. The **barrier reefs** develop away from the shoreline and form a channel or lagoon between the reef and the shore. The **atolls** are islands made of corals.

In Indian seas, coral reefs are found in the Gulf of Mannar, Pak-bay, Lakshdweep (atolls), Gulf of Kutch, and Andaman and Nicobar sea areas. The health of coral reefs has been declining over the past several decades. The pollution of sea water, destructive fishing practices, algal blooms, and eutrophication, coral diseases and coral bleaching are some serious causes of depletion of coral reefs.



**Fig. 1.14.** A Coral Reef

## enviro\_Facts : 1.2.

### CORAL BLEACHING

#### What is Coral Bleaching?

The whitening of coral colonies due to the loss of symbiotic zooxanthellae from the tissues of polyps is called as Coral Bleaching.

Zooxanthellae are unicellular algae that provide colour to corals. They also provide food to corals and their deaths lead to breakdown of the symbiotic relationship between them. This breakdown of symbiotic relationship causes starvation and resultant deaths of coral polyps. This condition exposes the white calcium carbonate skeletons of the coral colony.

There are a number of stresses or environmental changes that may cause bleaching. These causes include disease, excess shade, increased levels of ultraviolet radiation, sedimentation, pollution, salinity changes, and increased temperatures.

#### Other causes of coral bleaching include -

- ◆ Increased exposure to ultraviolet (UV) radiation;
- ◆ Large amounts of storm water from heavy rains flooding the reef;
- ◆ The exposure of coral to certain chemicals or diseases;
- ◆ Sediments such as sand or dirt covering the coral;
- ◆ Excess nutrients such as ammonia and nitrate from fertilizers and household products entering the reef ecosystem.

(The nutrients might increase the number of zooxanthellae in the coral, but it is possible that the nutrient overload increases the susceptibility of coral to diseases.)

## **STEPS TO PROTECT CORALS FROM BLEACHING**

- We should not pour gas, oil, dry cleaning fluid or other harmful chemicals into the sink, into canals or even onto the soil.
- We should recycle all batteries. When put into the trash, their toxic chemicals, such as mercury or cadmium, will leach into the soil and water; and water finally reaches to the sea.
- We should learn about coral reefs and educate others about their ecology.
- We should inform others by writing articles for the news paper, school news magazine or other publication.
- We should Support legislation that protects the reefs.
- We should Support laws that prohibit pollutants from reaching the reefs.
- We should reduce our carbon footprint by supporting carbon neutral programmes.
- We should not drop litter or dispose of unwanted items on beaches, or in the sea.
- Everyone must recognize and make specific decisions about the costs of waste disposal. Anyone may either accept the costs of waste treatment before it is discharged into waterways, or accept environmental impacts. Anyone can no longer simply assume that the sea is the cheapest and most effective place to dispose of sewage, urban, agricultural and industrial waste.

The coral reefs are most complex ecosystems found on the earth. These are found in great concentrations between 4 degrees north and south latitudes in western portions of all major oceans. They generally extend to about 30 degrees north and south of the equator. They develop at a temperature not less than 20 degree Celsius. This is the reason why *they are not found in very cold seas.*

### **Coral Reefs are Important in Following Ways –**

- (i) Coral reefs provide shelter to the world's most colourful fishes. These support fish production up to 2.5 lakh tonnes per year.
- (ii) Coral reefs control the concentration of carbon dioxide in the lower atmosphere and in the sea water.
- (iii) Coral reefs provide different types of raw materials for industries.
- (iv) Coral reefs check sea waves against going towards sea coasts by reducing their speed.
- (v) Coral reefs are helpful in controlling Green House Effect as they absorb carbon dioxide.
- (vi) Corals are used as medicines by human communities living along coasts.
- (vii) Coral reefs form important ecosystems. They also provide food to different types of sea animals like star fish.

1

## **TOWARDS A BETTER ENVIRONMENT...**

### **DOON VALLEY PROJECT**

Doon Valley (India), was facing wide spread degradation of ecosystems and falling life standards of people, about 20 years back. A project was initiated in 1993 entitled "Doon Valley Integrated Watershed Management" so as to solve the problem of ecological degradation and human suffering. The aims of the project were –

1. Regeneration and replenishment of forests;
2. Regeneration of water bodies;
3. Reduction of Soil Erosion through afforestation;
4. Controlled grazing.

The project was sponsored by the European Commission Association and was launched in 302 villages of Doon Valley by Gaon Resource Management Association (GAREMA). The GAREMA has been the centre piece of the strategy of the project which addressed the collective management of watersheds.

# IMPORTANT DEFINITIONS

<b>SPOILAGE</b>	:	The conditions of making the land bad and useless by human activities.
<b>CONSERVATION</b>	:	Careful and judicious utilization of resources.
<b>DEGRADATION</b>	:	The condition of damage of something including natural resources.
<b>WILDLIFE</b>	:	All the life forms existing in the wild.
<b>LAND COVER</b>	:	Anything, usually vegetation which covers the soil.
<b>DESERTIFICATION</b>	:	The condition of productive land going unproductive due to human activities.
<b>BIODIVERSITY</b>	:	The species richness of an ecosystem.
<b>INTEGRATED WATERSHED MANAGEMENT</b>	:	A set of complex activities of water conservation linked with Animal Husbandry, Community Development and Income Generation.
<b>RECHARGING OF WATER LEVEL</b>	:	Getting back the required level of water.
<b>POLYP</b>	:	Animals of class Coelenterata living in seas in corals.
<b>DYKES</b>	:	Long and thick walls built underground in the bed of some stream to stop Flooding on to a low area of land or checking the sub-surface flow of Water.

## MODEL QUESTIONS AND EXERCISES

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. What is the percentage of degradation of land through overgrazing?
2. How much of the tropical forests were destroyed during 1975 -90?
3. What is the full form of the abbreviation UNEP?
4. Name any one traditional Indian practice of conservation of water.
5. Make a mention of any one technology applied for recharging the ground water.

### II. SHORT ANSWER TYPE QUESTIONS

[2 Marks Each]

1. What do you mean by Spoilage of Landscape? How are landscapes spoilt?  
(ICSE specimen Question)
2. Mention any two causes of the spoilage of landscape.  
(ICSE specimen Question)
3. State any two needs for adopting control measures to check the spoilage of landscape.  
(ICSE-2005; 2006)
4. List any two control measures to check the spoilage of landscape.  
(ICSE specimen Question)
5. How do industries contribute to the spoilage of land?  
(ICSE-2005; 2006)
6. How would you define the term 'desertification'? Mention any two natural causes of land degradation.  
(ICSE-2005; 2006)
7. What is desertification? What are its consequences?  
(ICSE 2010)
8. Define the term Land Reclamation. How is it useful to mankind?  
(ICSE 2010)
9. Mention any two causes of desertification. How can the desertification be controlled?  
(ICSE 2010)
10. How are soil erosion and spoilage of landscape inter-related?  
(ICSE 2010)
11. (i) Explain the term Land reform.  
(ICSE 2010)
- (ii) State two advantages of planning land-use.  
(ICSE 2010)
12. Why is water called as the elixir of life?  
(ICSE 2010)
13. Why is there an urgent need to understand the limit of our water resources?  
(ICSE 2010)
14. Which place is known as the wettest place on earth but still the same faces severe drought-conditions? Mention reasons behind this tragedy.  
(ICSE 2010)
15. Name the causes that have accelerated the fresh water crisis in India.  
(ICSE 2010)
16. How is agriculture supposed to be a great exploiter of fresh water?  
(ICSE 2010)
17. What does the management of water mean?  
(ICSE 2010)

18. What is a Watershed? Where is the operation of watershed ideal?
19. Why is the management of watershed considered to be very important?
20. Mention any two objectives of watershed management.

(ICSE Specimen Question)

21. What role does water harvesting play in water conservation?
22. What are Johads?

(ICSE-2008).

23. (i) Name any two water harvesting systems practiced in India.

(ICSE-2007).

- (ii) What is Trickle drip irrigation. State any two advantages of such an irrigation system.

(ICSE 2010)

24. What are Gully Plugs? Where are they used?

25. What are Kunds or Kundis, and Zings?

26. Briefly explain the method of water harvesting in Mizoram.

(ICSE-2005)

27. What is rain water harvesting? Mention any two methods of rain water harvesting?

28. List any two advantages of rain water harvesting.

29. What are percolation pits?

(ICSE- 2008)

30. Mention any two ways through which oceans are useful to us.

(ICSE – 2007)

31. How are the ocean-resources threatened?

32. What is meant by the term coastal zone?

33. What is a coral reef? Give one example of it.

34. State the importance of coral reefs in a marine biome.

(ICSE Specimen Question)

35. Name two human activities which are having adverse impacts on coral reefs.

36. Where do coral reef ecosystems occur in India? Why are coral reefs important?

37. What is meant by Panikheti?

38. Why are the marine ecosystems under threat?

39. Define Eutrophication.

40. Name the institute in India where research on coral reefs is being conducted. What is its contribution to the coral reef-ecosystems?

### III. DETAILED ANSWER TYPE QUESTIONS

(4 to 6 Marks Each)

1. Explain briefly various factors that lead to the spoilage of landscape.

2. What are the steps that can be taken to check the spoilage of landscape?

3. Describe briefly the man-made causes of desertification.

(ICSE-2005)

4. What are different technologies that can be developed for the recharge of the Ground Water? Describe any two of such technologies.

5. Discuss any two methods of rainwater harvesting.

(ICSE – 2008)

6. Discuss the success of water harvesting in ancient India. Write a few success stories on it.

7. “Watershed Management can succeed only when it is based on foundation of both qualitative and quantitative knowledge of ecological processes going on in the ecosystem” Explain.

8. Describe the importance of coral reefs in the marine ecosystem.

(ICSE – 2007)

9. Describe the importance of Coastal Ecosystem.

10. Write the role of coral reefs in biodiversity preservation and ecotourism. What is Coral Bleaching?

(ICSE-2008)

11. What are the aims of conserving marine and coastal ecosystems? Write steps of conservation of marine ecosystem.

12. What are major stresses on oceanic resources? Describe the efforts of the Government of India for the conservation and management of marine and coastal ecosystem.

13. How is the Marine Ecosystem being degraded day by day? What should be done for its conservation?

#### IV. OBJECTIVE TYPE QUESTIONS

##### A. Multiple choice type questions

Tick (✓) the correct option

1. The area of land surface on earth is –
  - (a) 135 m sq km
  - (b) 230 m sq km
  - (c) 140 m sq km
  - (d) 410 m sq km
2. The extent of soil degradation on earth through deforestation is –
  - (a) 580 m ha
  - (b) 850 m ha
  - (c) 380 m ha
  - (d) 530 m ha
3. The species richness at any place is called as –
  - (a) fauna
  - (b) flora
  - (c) biodiversity
  - (d) forest
4. The percentage of soil degradation caused by dumping of wastes is –
  - (a) 12
  - (b) 10
  - (c) 8
  - (d) 11
5. The Integrated Watershed Development also incorporates –
  - (a) development of community
  - (b) education of children at school
  - (c) improvement of crops
  - (d) pest control

##### B. Fill in the blanks

1. .... includes forest and other vegetation.
2. Low efficiency irrigation schemes often cause.....
3. Floods, earthquakes and volcanic eruptions are natural causes of spoilage of.....
4. Bunds and terraces provide mechanical.....
5. Around.....m ha of the world's dry land were degraded up to the year 2000.

#### ANSWERS

##### I. VERY SHORT ANSWER TYPE QUESTIONS

1. 35, 2. 220 m ha, 3. UNEP = United Nations Environment Programme, 4. Tankas and Johads, 5. inverted Tube wells, check dams.

##### IV. OBJECTIVE TYPE QUESTIONS

##### A. Multiple Choice Type Questions

1. (c), 2.(a), 3.(c), 4. (a), 5.(a)

##### B. Fill in the blanks

1. Land cover, 2. Wastage of Water 3. Land, 4. Protection, 5. 3600 m ha

#### PROJECTS & ACTIVITIES

#### Act for Environment

##### 1.1 EXPERIMENTATION

Collect samples of soil from three different places and find out rates of percolation of water through these samples. You will need funnels, water, and three different soil samples like sand, gravel, dirt or so.

Make layers of soil in different ways in each of the funnels and make records of sequence of different layers in each funnel. Now, pour the clean water through funnels one by one and note the time taken in percolation for all the three cases. Collect a sample of dirty water from a nearby drain and pour one by one through these funnels. Compare the qualities of the dirty water after percolation through different funnels. Now write the project report in proper format incorporating following headlines –**Project Title, Objective, Materials, Methodology, Interpretation of data and Analysis, Conclusion, Acknowledgements and References.**

### **1.2. SURVEY**

Do a survey of traditional systems of water harvesting (like dams, check dams, Tankas, johads etc.) in your locality. Try to find out –

1. How many people use this system?
2. What are the patterns of the use of water?
3. What is the general quality of water being harvested?
4. What are the factors that are adversely affecting the quality of water harvested?
5. What improvements in your opinion, can be made to improve that traditional method for maximum benefits?

Write a complete report and show it to your teacher.

### **1.3. DRAWING / PAINTING**

Make a poster on the basis of the knowledge gained while doing the project -2, under the title – Water Harvesting in.....  
(Name of the area)

# Conservation and Management : Forest, Grassland and Semi-Arid Ecosystems

## FACTS & CONCEPTS



- Introduction
- Stress on Forest, Grassland and Semi-Arid Ecosystems
  - Stress on Forest Ecosystems
  - Stress on Grassland Ecosystems
  - Stress on Semi-Arid Ecosystems
- Conservation and Management of Forests
  - Global Scenario of Conservation and Management of Forests
  - National Scenario of Conservation and Management of Forests
  - Conservation and Management of Forests by Local Communities

**u** Principal Measures to Conserve Forests

**u** Legal Provisions

**u** Conservation and Management of Grasslands

**u** Conservation and Management of Semi-Arid Ecosystems

## 2.1. INTRODUCTION

We know that an ecosystem is the interacting unit of the biotic community and the physical environment at any place. It may be terrestrial or aquatic. The terrestrial ecosystems are the ecosystems on land. These may be forests, grasslands and semi- arid ecosystems of various types. As for aquatic ecosystems, they are – fresh water and marine. We already know about these ecosystems.

Forests, grasslands and semi- arid ecosystems are formations that cover the land surface and protect it. Various types of forests are spread across the globe and so are grasslands. The **Prairies** of Canada and U.S.A., the **Pampas** of South America, the **Steppes** of Europe and Asia and the **Veldts** of Africa are major types of grasslands. The semi- arid ecosystems are the ecosystems that are partly dry and partly wet. Most of these ecosystems comprise very less and peculiar types of vegetation. Scanty flora and fauna are principal characteristics of these ecosystems. The increasing economic activities of human beings are putting severe stresses on these ecosystems. Most parts of these ecosystems are severely stressed due to overexploitation and mismanagement. In this lesson, we are going to study about the stresses on forests, grasslands and semi- arid ecosystems, and their conservation and management.

## 2.2. STRESS ON FOREST, GRASSLAND AND SEMI-ARID ECOSYSTEMS

Some of the major stresses on forests, grasslands and semi- arid ecosystems and their underlying causes are mentioned below.

### 2.2.1. Stress on Forests

Forests perform various productive and protective functions. Checking the erosion of soil and spread of deserts are two of their major protective functions. Forests absorb **Carbon Dioxide**. Thus **they acts as carbon dioxide sinks**. The growth of human population created fresh requirements of land for **housing, agricultural expansion, farming practices, development of pastures, mining, human settlements, and industrial developments**. All the requirements were fulfilled by clearing of vast tracts of forests across the globe. Over harvesting of industrial wood, fuel wood, other forest products, overgrazing and many natural factors like insect pests, diseases, forest fires and disasters created additional stress on forests.

### FOREST FIRES: CAUSES, IMPACTS AND CONTROL MEASURES

The event of something burning is called as fire. An uncontrolled **fire** often occurring in **wild land** areas, but which can also consume houses or agricultural resources is called as forest fire. Wildfires tend to be most common and severe during years of drought and occur on days of strong winds. With extensive urbanization of forest lands, these fires often involve destruction of suburban homes located in the wild land urban interface, a zone of transition between developed areas and undeveloped wild land. The term Forest Fire is also called as **wildfire** which refers to all **uncontrolled** fires that burn surface vegetation (grass, **weeds**, grain fields, brush, **chaparral**, tundra,

and forest and woodland); often these fires also involve structures. In addition to the wildfires, several million acres of forest land are intentionally burnt each year under controlled conditions to accomplish some silvicultural or other land-use objective or for hazard reduction.

## **CAUSES OF FOREST FIRES**

Forest fires may be caused by many different types of factors. These factors are mentioned below-

**A. Natural causes-** fires caused by lightning, and fires caused by volcanic eruption,

**B. Accidental causes-** fires caused by sparks from wheels of trains or certain locomotives, and other causes

**C. Negligence –** These causes include –

**(i) Fires caused by cigarette stubs or matches-** along roadways, - in rural areas, - in wooded areas, and along railway lines.

**(ii) Fires caused by agricultural and forestry activities-** for the clearing of uncultivated land, for the clearing of plant residue (forestry and agricultural processing), for the renewal of pastures, for the burning of stubble and for the clearing of road and railway embankments.

**(iii) Fires caused by other forms of negligence-** fires caused by recreational and tourist activities, - fires caused by the firing of fire-crackers and rockets, blasting of landmines or explosive, - fires caused by the use of motor, flame, electric or mechanical devices, - fires caused by military manoeuvres or shooting exercises, fires caused by the burning of waste in illegal dumps, fires caused by bad maintenance of electrical lines or by the breakage or falling of wires, and fires caused by negligence not otherwise defined.

**D. Arson-** These include-

**(i) Fires caused in connection with profit seeking-** Examples of these causes include - fires caused by the creation or renewal of pastures at the expense of forests; fires caused by the will to regain agricultural terrain at the expense of forests for cultivation or to activate funding from European Union; fires caused with the intent of earning from the removal of vegetation for the purpose of agricultural cultivation ; fires caused with the intent of earning from the removal of vegetation for the purpose of building speculation; fires caused with the intent of seeking advantage (opening of forestry trails, agricultural operations to save on labour, destruction of forestry mass); fires caused by occupational questions related to laborers hired by local administrations; fires caused with the intent of destroying by fire; badly executed forestry operations; fires caused with the intent of being included in firefighting efforts; fires caused by inappropriate activity referable to poaching; fires caused to obtain products deriving from fire passage; fires caused by organized crime.

**(ii) Fires due to manifestations of protest, resentment or insensitivity toward forests-** fires caused as revenge or retaliation against public administration; fires caused by conflicts between or revenge against owners; fires caused as protest against limitations imposed in conservation areas; fires caused for fun or games by minors; fires caused with the intent of devaluing tourist areas; fires caused by matters relating to political contrast; fires caused by terrorist acts, fires caused by dissatisfaction; social dissent, behavioral disturbances (pyromania and mythomania).

**(iii) Fires due to dubious causes -** fires caused by arson not otherwise defined.

Common causes of forest fire include **lightning**, human carelessness, **slash-and-burn** farming, **arson**, **volcano** eruption, **pyroclastic** cloud from active volcano, and **underground coal fire**. **Heat waves**, **droughts**, and cyclical **climate changes** such as **El Niño** can also dramatically increase the risk of wildfires.

There are two types of forest fire i) Surface Fire and ii) Crown Fire

**Surface Fire** - A forest fire may burn primarily as a surface fire, spreading along the ground as the surface litter (senescent leaves and twigs and dry grasses etc) on the forest floor and is engulfed by the spreading flames.

**Crown Fire** - The other type of forest fire is a crown fire in which the crown of trees and shrubs burn, often sustained by a surface fire. A crown fire is particularly very dangerous in a coniferous forest because resinous material given off burning logs burn furiously. On hill slopes, if the fire starts downhill, it spreads up fast as heated air adjacent to a slope tends to flow up the slope spreading flames along with it. If the fire starts uphill, there is less likelihood of it spreading downwards.

## **IMPACTS OF FOREST FIRES**

Forest Fires cause wide ranging adverse ecological, economic and social impacts. In a nutshell, forest fires cause following adverse impacts-

- ✓ Loss of valuable timber resources and depletion of carbon sinks
- ✓ Degradation of water catchment areas resulting in loss of water
- ✓ Loss of biodiversity and extinction of plants and animals
- ✓ Loss of wild life habitat and depletion of wild life
- ✓ Loss of natural regeneration and reduction in forest cover and production
- ✓ Global warming resulting in rising temperature
- ✓ Loss of carbon sink resource and increase in percentage of CO<sub>2</sub> in the atmosphere
- ✓ Change in micro climate of the area making it unhealthy living conditions
- ✓ Soil erosion affecting productivity of soils and production
- ✓ Ozone layer depletion
- ✓ Health problems leading to diseases
- ✓ Indirect effects on agricultural production: Loss of livelihood for the tribals as approximately 65 million people are classified as tribals who directly depend upon collection of non-timber forest products from the forest areas for their livelihood.

After a countrywide study in 1995, the Forest Survey of India gathered data on fire fires. These data attribute about 50 percent of the forest area as fire-prone. Out of 63 million ha of forests in India 3.73 million ha can be presumed to be affected by fires annually. At this level the annual losses from forest fires in the country has been estimated at Rs.440 crores.

## **IMPACTS OF FOREST FIRES ON BIOLOGICAL ENVIRONMENT**

Forest fires also pose serious health hazards by producing smoke and noxious gases, as the events in Indonesia after the forest fires on the islands of Sumatra and Borneo in 1977 have shown. The burning of vegetation gives off not only carbon dioxide but also a host of other, noxious gases (Green house gases) such as carbon monoxide, methane, hydrocarbons, nitric oxide and nitrous oxide, that lead to global warming and ozone layer depletion. Consequently, thousands of people suffered from serious respiratory problems due to these toxic gases. Burning forests and grasslands also add to already serious threat of global warming. Recent measurement suggest that biomass burning may be a significant global source of methyl bromide, which is an ozone depleting chemical.

## **PREVENTION AND CONTROL MEASURES FOR FOREST FIRES IN INDIA**

The Ministry of Environment and Forests, Government of India issued guidelines for prevention and control of forest fires to all states in June 2000. Some of those important guidelines or measures

of prevention and control of forest-fires in India are –

1. Identification and mapping of all fire-prone area.
2. Compilation and analysis of data-base on the damage due to forest fire.
3. Installation of Forest Danger Rating Systems and Fire-Forecasting Systems.
4. Items of forest protection to be treated as a Plan Item in order to raise their profile and thereby increase their Budget Allocation.
5. All preventive measures are to be taken before the beginning of the fire season like summer season.
6. Recruitment of a Nodal Officer to coordinate with various agencies including the Government of India on issues of forest-fire.
7. A ‘Crisis Management Group’ should be constituted at the state headquarters, district headquarters, and at block levels to monitor the situations during fire period, coordinate various preventive and control measures, and arrange adequate enforcement of men and materials in case of any eventuality.
8. Communication network to be set up for quick flow of information and movement of materials and man-power to the fire site.
9. JFM Committees and Forest Protection Committees are to be actively involved in the prevention and control of forest fires. Other people living in and around forest areas and getting benefits from the forest should also be involved actively.
10. Regular training of Government Staff and communities as Fire -Fighters should be organized by the government.
11. Public awareness should be created against ill effects of forest fires- a Fire -Week should be celebrated to create mass awareness.
12. Legal Provisions for fire prevention and control should be implemented forcefully.

**Precautions:** The followings are the important precautions against fire:

1. To keep the source of fire or source of ignition separated from combustible and inflammable material.
2. To keep the source of fire under watch and control.
3. Not to allow combustible or inflammable material to pile up unnecessarily and to stock the same as per procedure recommended for safe storage of such combustible or inflammable material.
4. To adopt safe practices in areas near forests viz. factories, coalmines, oil, stores, chemical plants and even in household kitchens.
5. To incorporate fire reducing and fire fighting techniques and equipment while planning a building or coal mining operation.
6. In case of forest fires, the volunteer teams are essential not only for fire fighting but also to keep watch on the start of forest and sound an alert.
7. To arrange fire fighting drills frequently.

The Government of India has implemented a Master Plan called as Forest Fire Control and Management. This Master Plan is a blend of modern and Traditional methods and Technologies for which the Government has made provisions for the allocation of adequate funds. These are –



**Fig. 2.1.** Spraying Fire- retardant Chemical over Forest Fire by a Helicopter.

- (a) Building up of a strong communication network of wireless system and satellite phone.
- (b) Arrangement of effective transportation.
- (c) Improved fire-resistant clothing.
- (d) Fire- finders.
- (e) Fire Tender or Tractor- trolley mounted with water tanker.
- (f) Back pack pumps.
- (g) Fire fighting machines, helicopters, fire extinguishing materials, **Fire- retardant sprays by helicopters** etc. and other technological innovations.

### enviro\_Facts : 2.1.

In the Constitution of India, the subject of forests is on the Concurrent List. It means that the Central Government and State Governments are both competent to legislate on the issue of forest – fires etc. Issues relating to policy, planning, and finance are primarily the responsibility of the Government of India. On the other hand the field administration of forests is the responsibility of the different State Governments. Fire Prevention and Control Measures are therefore carried out by the State Departments of Forest.

In India, forests are protected and managed through well prepared Forest- Working Plans, and Prevention and Control of Forest- fires has always been at the place of priority. Some of the important prescriptions included in the working plans are – employing traditional practices of fire control like:

- Creation and maintenance of fire-lines, fire-tracks, controlled burning, engaging fire-watchers during fire seasons etc.
- Villagers inhabiting in and around forest areas are legally supposed to assist the forest department staff in extinguishing fires.

The Government of India implemented a UNDP Project during 1985-1990 to address the problem of resource damage from uncontrolled forest-fires. A pilot project was launched in Uttar Pradesh and Maharashtra where severe fires had damaged about 50 percent of the forest area. The Haldwani and Chandrapur forest-fire incidents were reduced up to 90 percent through the pilot project. An air operation wing was also formed in 1991 through which latest fire-fighting technologies including helicopters and fixed wing aircrafts are being applied in needful areas. UNDP has provided two helicopters and aircraft along with spare parts etc and services of these were taken extensively in the states of Haryana, Himachal Pradesh, Uttar Pradesh, Madhya Pradesh, Rajasthan, Punjab, and Delhi.

Most of the forests of the world have been destroyed over the period of last thirty years. The **Food and Agricultural Organisation (FAO)** and the **United Nations Environmental Programmes (UNEP)**, have declared that the rate of destruction of tropical forests is 11.3 m ha per year.

#### 2.2.2. Stress on Grasslands

About 260,000 species of plants are found on earth out of which major part is occupied by

grasses. These form a dense cover on soil and protect it from being washed away by water during rains or blown away by wind. More than 40,000 ha of land are during rains affected annually by severe wind and water erosions. **The maximum loss of the top soil in India is caused due to the destruction of grass cover on earth.** But, human pressure on grasslands has put the earth surface under critical conditions. So far, man has altered virgin landscapes by destroying vast areas of grasslands and has converted these areas into croplands. Much of the grassland ecosystems have been destroyed through building of large dams, mining and other industrial activities, water logging, salination, urban encroachments and construction of settlements etc. In addition, the introduction of exotic grass species has caused the destruction of many grassland ecosystems.



**Fig. 2.2.** A Grassland Ecosystem.

### **2.2.3. Stress on Semi- arid Ecosystems**

An ecosystem which receives low annual rainfall (250-500mm) is called as Semi-arid ecosystem. The climate of semi-arid ecosystem remains intermediate between the desert climate and humid climate. These ecosystems are relatively more vulnerable to human activities due to excessive pressure of conversion into crop fields and reclamation for different purposes. The extraction of ground water for irrigation and domestic purposes is causing water scarcity in many of these areas. **Overgrazing by sheep and goats has put severe stress on the health of soils of these ecosystems.**

#### **WHAT IS OVERGRAZING? AND WHAT IS ITS IMPACT?**

Overgrazing can be defined as grazing plants before they have recovered from a previous grazing. When a plant is grazed severely, it uses energy stored in its roots to support regrowth.

As this energy is used, the roots die back. The dying of roots depends on the severity of grazing. This root dieback is not a bad thing. It adds organic matter to the soil, which increases soil porosity, the infiltration rate of water and the soil's moisture-holding capacity. After enough leaves have regrown, the roots will regrow as well.

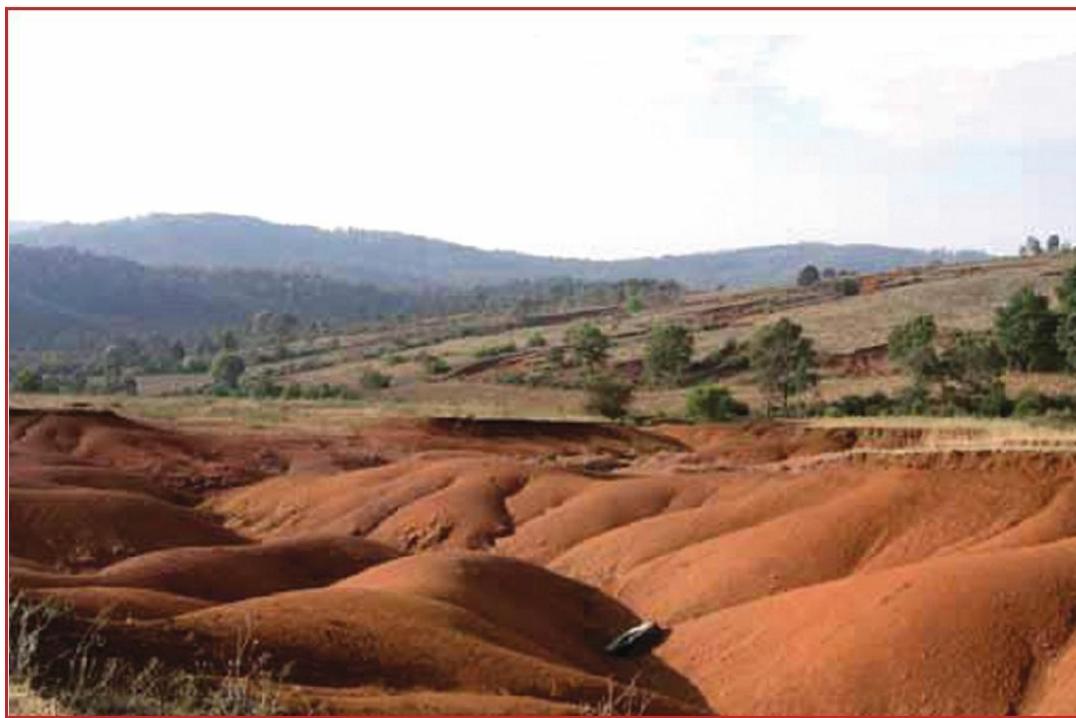
#### **IMPACTS OF OVERGRAZING**

A plant is overgrazed when it's re-grazed before the roots recover. Overgrazing can reduce root

growth by 90%. Because there's less root growth, pastures are less productive.



**Fig. 2.3. A-** Overgrazing.

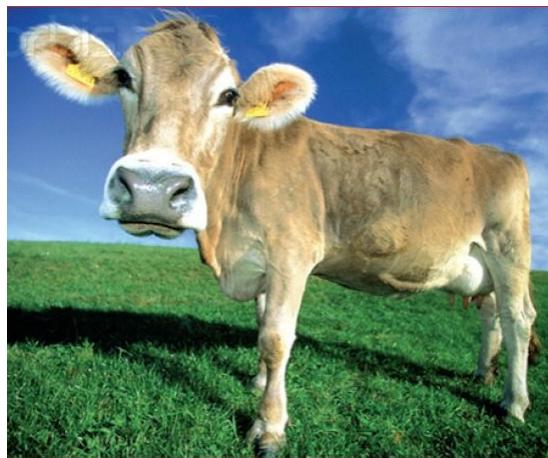


**Fig. 2.3. B-** Impacts of overgrazing.

### **Following are some of very dangerous impacts of overgrazing -**

1. Soils have less organic matter and become less fertile due to overgrazing.
2. Porosity of soils decreases due to overgrazing.
3. The infiltration rate and moisture-holding capacity drop due to overgrazing.
4. Desirable plants become stressed, while weedier species thrive in these harsher conditions.

Weeds do not make the land unhealthy. They appear because the land is unhealthy. Overgrazing is often the cause of this adverse and undesirable condition.



**Fig. 2.4.** Even one cow in a big pasture will overgraze plants if she is kept there long enough.

5. Animals graze selectively. Given a chance, they will overgraze. The newest growth is the most palatable, nutritious forage in the pasture. Even one cow in a big pasture will overgraze plants if she's kept there long enough.

6. Overgrazing isn't a function of animal numbers. It's a function of time. Overgrazing happens when animals are kept in a paddock too long or brought back too soon.

7. As overgrazing destroys the vegetation completely the entire area becomes prone to desertification and heavy soil erosion that may cause siltation of any river leading to severe floods that may claim large number of lives and great property.

## **CONTROL ON OVERGRAZING**

1. To stop overgrazing, producers must move livestock out of a pasture before regrowth of plants begins again. During the periods of fast growth, overgrazing will occur if livestock are kept in a paddock for more than three or four days.

2. Herders need to make sure that they don't bring the animals back before plants have recovered.

3. Overgrazing can be stopped with 8-10 paddocks. When growth of plants is fast, recovery periods of four to six weeks may be adequate.

4. Economic sustainability can't be achieved without environmental sustainability. The first step to achieving environmental sustainability is to stop overgrazing. That's essential when one is ranching for profit.

5. Overgrazing by cattle indicates towards irresponsible attitudes of cattle owners. Hence, awareness or some sort of legislation to stop overgrazing is urgent for protecting the land against the consequences of this incidence.

These ecosystems harbour restricted vegetation during the favourable growth seasons. Crop plants grown in these ecosystems need repeated irrigation due to which the deposits of salt takes place in the soil and make it unfit for further use. Technological operations, building of roads, tourism, recreation etc. can have considerable impacts on the viability of these ecosystems.

## **2.3. CONSERVATION AND MANAGEMENT OF FORESTS**

**Protection, preservation and development of forests together with the sustainable use of forest resources are called as conservation and management of forests.**

The need and importance of conservation and management of forests is being felt the world over.

Different countries are trying to conserve and manage their forests. Governments have framed their **Forest Policies** and have enacted laws to protect forests whereas local communities in different parts of the world are making their own efforts for the protection and management of their forests by making plans of their own.

Forests control and affect the global environment also. Hence, nations of the world have planned to protect global forests through joint efforts.

### 2.3.1. Global scenario of Conservation and Management of Forests

Forests retain much of the rain water either through the stems and leaves or through roots of trees. This is why forests are called as sponges. They control and maintain global as well as local environmental processes. The **Stockholm Conference** of 1972, **values forests as ‘largest, most complex and self- perpetuating ecosystems’**.

**The conference made following recommendations-**

- ◆ Countries of the world should strengthen basic and applied research for improved forest planning and management with emphasis on environmental functions of forests,
- ◆ Countries of the world should modernise their forest management concepts by including multiple functions and reflecting the cost and benefits of the amenities provided by forests,
- ◆ Countries of the world should incorporate environmental values in land use and forest management, and
- ◆ Countries of the world should establish appropriate monitoring systems for continuous surveillance of the forest cover of the earth.

Following the Stockholm Conference (1972), many countries in the world banned cutting of trees in view of conservation and management of their forests and the devastating natural calamities like landslide and flooding. The **Kyōto Protocol** to the **United Nations Framework Convention on Climate Change** (UNFCCC) has focussed attention on the role of forests in controlling world climates and changes occurring in them. Parties to UNFCCC have reached to an agreement on rules and modalities for accounting the roles of forests.

Now the world community is focussing on the **Sustainable Forest Management** (SFM). According to this management scheme, **countries of the world should utilize their forest resources keeping in minds the needs of future generations**. By 2000, nine international initiatives were launched incorporating the development of implementation of schemes in 85 percent forests on the global level. An **Intergovernmental Panel on Forests** (IPF) and **Intergovernmental Forum on Forests** (IFF) have worked for common management, conservation and sustainable development of all types of forests under **United Nations Commission on Sustainable Development** (1997-2000). A **United Nations Forum on Forests** (UNFF) was formed in October 2000.

The **IUCN** (International Union for Conservation of Nature and natural resources) and the **WWF**(World Wide Fund for nature) together with the **Food and Agricultural Organisation**(FAO), are surveying the status of forests of the world and are launching projects for their conservation and management.

### 2.3.2. National Scenario of Conservation and Management of Forests

Forests of India have been under continuous pressure due to a number of factors. According to a

report of the World Bank (2005), some major factors that cause pressures on India's forests are:

- | Growth of human population; expansion of agriculture;
- | Utilization of forest land for industrialization;
- | Clearing of forests for mega river-valley projects;
- | Overgrazing (up to 78%);
- | Fire- risks;
- | Shifting cultivation, and different types of encroachments on forest land etc.

The Government of India has been conducting a number of conservation programmes, and it is due to these efforts that the **Forest Cover in India has increased by six percent between 1999 and 2001**. The national target of the forest cover in the country is 30%. For achieving up to this target the government has formulated a number of plans and projects for which surveys of forest areas and forest cover are being done from time to time.

Any effort to conserve and manage forests at national level, involves **Survey and Assessment of Total Forest Area** and the **Forest Cover**, at the initial stage. **What is a forest area?** A Forest Area is the area of land recorded as forest in revenue records or proclaimed to be forest under a forest law or Act. In other words, we may define a 'Forest- area' as an area recorded as forest in the government records. On the other hand 'Forest Cover' is different from the forest area. **It is the total forest area recorded by the technology of Remote Sensing through a satellite.** Thus the record of forest cover is based on the capability of **Remote Sensing Satellite Sensor**. It is completely independent of the legality of land use or land ownership. The data of forest cover is provided by the **Forest Survey of India (FSI)**. **The Forest Cover of India, as per the Report of the Forest Survey of India- 2001 is 675,538 sq Km** (excluding non- forest and scrub areas). It constitutes 20.55 percent of the total geographical area of the country. A **National Afforestation and Eco-development Board** was constituted in August 1992, in order to expand forest cover.

**Table 2.1. Forest Cover in India as Per the Forest Survey of India- Report 2001**

CLASS/ Forest Cover	Area (km <sup>2</sup> )	Percent of Geographic Area
a) Dense	416,809	12.68
b) Open	258,729	7.87
<b>Total Forest Cover</b>	<b>675,538</b>	<b>20.55</b>
Non-forest		
Scrub	47,318	1.44
Total Non-forest	2,611,725	79.45
<b>Total Geographic Area</b>	<b>3,287,263</b>	<b>100.00</b>

The Ministry of Environment and Forests, Government of India, constituted the **National Forest Commission** on 7 February 2003. This commission reviews the working of Forest and Wildlife

sector. Now, if someone wants to divert a forest land for non forest purposes, he is bound to take permission from the Central Government under the **Forest (conservation) Act, 1980**.

The Indian Government introduced **Joint Forest Management** (JFM) in 1990. Under this programme, about 45000 village communities in 21 states, are managing more than 11 million ha of the degraded forests.

The Central Government has formulated an **Integrated Forest Protection Scheme** by merging “**Forest Fire Control and Management**”, and “**Bridging of Infra structure Gaps in Forestry Sector in eastern region and Sikkim**”. This scheme has been extended to all the states and Union Territories during the tenth Five Year Plan.

### **2.3.3. Conservation and Management of Forests by Local Communities**

Human Communities living near forests or in forest- villages tend to care forest- resources as most parts of their livelihood depend on these resources. It was after independence that the Government of India started managing its forests through its own management systems. Thus, forests came directly under the ownership of States and it became a little difficult for communities to use the forest-resources.

The growing population of human beings and of the livestock- accompanied with the demands from industries, caused pressures on forests from many sides. These pressures caused severe depletion of India’s Forest Resources, and the traditional Government –run System of management of forests was declared to be ineffective by many environmentalists.

The persistent encroachments by local communities, and other parties, and Peoples’ movements in many parts of the country stimulated the Government to develop a new system of forest management which emphasizes on the **participation of the local people**. This new system of management is officially called as **Joint Forest Management** or JFM.

*The practice of management of forest resources jointly by the Forest Department and the local communities is called as Joint Forest Management. It is officially abbreviated as JFM. The system of Joint Forest Management entitles local communities in sharing of forest products in lieu of their works pertaining to the protection and management of forest resources.*

The communities living near forests remain dependent on them for their livelihood. On the other hand, now they are being increasingly aware of the roles of forests in the environment. Hence, they tend to oppose every stress on their forests caused by contractors and other people including the government officials. The CHIPKO (1973, Uttarakhand), the APPIKO (1983, Karnataka), the Social Fencing of Shivalik Hills (1986), the Silent Valley Movement (1963, Kerala) and Joint Forest Management (J.F.M.) in West Bengal (1981, Midna Pur, Bankura and Purulia districts), are some examples of conservation and management of forests through the efforts of local communities in India. Inspired by the J.F.M. in Bengal the Joint Forest Management was introduced in India, on government level in 1990.

#### **enviro\_Facts : 2.2**

There are several examples of management of forests by local communities on the global level also. More than 500,000 ha of forests in **Vietnam** have been given in the charge of indigenous people fighting for their rights on forests. In **Philippines** too, a system of Integrated Protected Areas have been developed which protects the biodiversity involving local communities in the management of forests. In **Jharkhand** (India) too, the local tribal people (including tribal women) in different areas, have started taking charge of the conservation and management of local forests.

### 2.3.4. Principal Measures to Conserve Forests



**Fig. 2.5.** Felling of trees should be matched by plantation of trees.

1. The extraction of timber should be done judiciously and it should not interfere with the local watersheds.
2. Felling of trees should be minimized and it should be matched by plantation of trees.
3. The use of fire wood should be discouraged and alternate sources of energy should be promoted.
4. Modern techniques of promotion, protection and regeneration of forests like promotion of silvi-culture, disease and pest management, weed control, breeding of endangered tree species and application of techniques of tissue culture should be promoted.
5. Forest conservation and management rules should be enforced properly.
6. All the interference in forests should be banned completely.
7. Poaching and hunting of wild animals should be banned.

### 2.3.5. Legal Provisions for Conservation and Management of Forests in India

The Indian forests are protected through a definite **Forest Policy** since 1894, which has been revised twice, in 1952 and in 1988, respectively. It is aimed at protection, conservation and development of forests.

Besides the Indian Forest Policy, our forests are also protected by a number of legal provisions like Indian Forest Act, 1927; Forest (conservation) Act, 1980; Forest (conservation) Rules, 2003 etc. In July 2002, the Ministry of Environment and Forest made a separate wing entitled **Animal Welfare Division**. The central government has established **State Animal Welfare Boards** in 24 states and union territories. Another step forward is, the **National Afforestation and Eco –Development Board**, which was established in August 1992.

## 2.4. CONSERVATION AND MANAGEMENT OF GRASSLANDS

The conservation and management of grasslands are brought about through a number of

practices. These practices are - control on overgrazing, Afforestation, watershed development, adoption of appropriate cropping pattern and adoption of proper land management practices.

## 2.5. CONSERVATION AND MANAGEMENT OF SEMI- ARID ECOSYSTEMS



**Fig 2.6.** A Semi-arid Ecosystem.

Semi- arid ecosystems are usually governed by the extent of availability of water. Most of these are dependent on rain-water which often remains irregular and unreliable. The rain fall pattern is badly disturbed due to cutting of trees and clearing of vegetation cover. Under these conditions most of the water needed for irrigation is extracted out from the ground. The underground water table is being depleted due to increasing number of bore- wells.

The semi –arid ecosystems can be conserved and managed through following ways

- ◆ Conservation of habitat through afforestation, and ban on illegal mining -Activities.
- ◆ Control on conversion of cultivable land for other purposes.
- ◆ Water rationing and ban on extraction of ground water for irrigation. Construction of check - dams and, development and management of watersheds.
- ◆ Adoption of social forestry and agro forestry techniques. **Social forestry** is the practice of growing trees and shrubs in village common lands and waste lands in view of production of fuel wood and fodder. The **agro forestry** is the practice of growing commercially useful trees with minor canopy on field boundaries.



## TOWARDS A BETTER ENVIRONMENT...

The Forest Management Council or the Van Panchayat is one of the community institutions that are officially recognised and legally supported under the IFA (Indian Forest Act) 1927. The Forest Management Councils in India were formed in 1931, after great and repeated agitations by the people living in and around forests, against the new rules and regulations on forest –use, were imposed on the people.

As most of our forests are located on hills and mountains, people living in these areas have sufficient knowledge about the conservation and management of forests. The British people, who agreed to create Van Panchayat, after continued agitations by the people living in hill forests, were aware of the capacity of people for the management of forests. This was, probably the reason why the British did not include Van Panchayats under the Indian Forest Act of 1927. But, the repeated amendments in this Act have reduced the powers of VPs, and have brought them under the control of the Act. This is not being liked by many Indian environmentalists. How ever VPs are functioning very well in some states of India under the district administrations. Uttarakhand is one such state.

### IMPORTANT DEFINITIONS

<b>BIOTIC COMMUNITY</b>	:	Group of different species of organisms at a certain place is called as a community or the biotic community.
<b>SEMI- ARID</b>	:	Partly dry and partly wet.
<b>STOCKHOLM CONFERENCE</b>	:	The first major international conference on environmental issues, which was held in Stockholm, Sweden, in 1972 and was sponsored by the UN.
<b>KYŌTO PROTOCOL</b>	:	An international treaty which was adopted in 1997 in order to set concrete targets for developed countries to reduce the emissions that contribute to global warming, also known as Climate Change. It is a supplementary treaty to the United Nations Framework Convention on Climate Change (UNFCCC). It went into force in February 2005. more than 130 countries are party to it.

### MODEL QUESTIONS AND EXERCISES

#### I. VERY SHORT ANSWER TYPE QUESTIONS

1. Name the grasslands of –
  - (a) Canada
  - (b) America
  - (c) Europe and Asia
  - (d) Africa
2. Mention any two direct causes that threaten our forests.
3. Who had sponsored the Stockholm Conference in 1972?
4. How has the Stockholm Conference valued the global forests?
5. When was the National Forest Commission constituted?
6. When was the Indian Forest Policy formulated for the first time?
7. Name any one factor responsible for the degradation of grasslands?

#### II. SHORT ANSWER TYPE QUESTIONS

1. What do you know about the semi –arid ecosystem?
2. Define conservation and management.

**(2 Marks Each)**

(ICSE 2008)

3. Write full forms of -
    - (a) IGFF
    - (b) CITES
    - (c) UNFCCC
    - (d) JFM.
  4. Give a brief account of the steps taken up by the Central Government for the Conservation and Management of forests in India.
  5. How are our forests conserved and managed by the local people?
  6. What are the legal provisions for the protection of forests in India?
  7. Mention two measures for the control of overgrazing.
- (ICSE 2005)
8. Mention two natural causes of Forest Fires.
- (ICSE 2005)
9. What are carbon dioxide sinks? Explain how.
- (ICSE 2006)
10. Mention any two protective functions of forests.
- (ICSE 2006)
11. Mention any two tribal practices aimed at conservation of Forest Resources.

### **III. DETAILED ANSWER TYPE QUESTIONS**

**(4 to 6 Marks Each)**

1. What do you know about the conservation and management of forests in India? Suggest any three appropriate measures.
2. How do human beings threaten our grasslands and semi-arid ecosystems? Suggest conservation measures two each for these ecosystems.
3. How can Afforestation practices like the social forestry and agro forestry, reduce different types of stresses on our forests?

### **IV.OBJECTIVE TYPE QUESTIONS**

#### **A. Multiple choice type questions**

**Tick (✓) the correct option**

1. The FAO and UNEP have assessed that the rate of annual destruction of forests in the world is –
  - (a) 11.3 mha
  - (b) 15.1 mha
  - (c) 13.5 mha
  - (d) 21.3 mha
2. The ecosystem relatively more vulnerable to human activities is –
  - (a) forest ecosystem
  - (b) grassland ecosystem
  - (c) arid ecosystem
  - (d) semi-arid ecosystem
3. The Stockholm Conference was held in the year –
  - (a) 1972
  - (b) 1971
  - (c) 1977
  - (d) 1911
4. The United Nations Forum on Forests was formed in the year –
  - (a) 2000
  - (b) 1974
  - (c) 1985
  - (d) 2006
5. The Indian Forest Act was enacted in the year –
  - (a) 1972
  - (b) 1927
  - (c) 1995
  - (d) 2000

#### **B. Fill in the blanks**

1. An ecosystem is an interacting unit of the biotic community and the .....environment.
2. Over grazing by cattle like sheep and goat cause stress on..... .

3. The depletion of grasslands causes degradation of.....
4. The United Nations Forum on forests was formed in.....
5. The communities living near forests remain dependent on them for their.....

### C. True / False questions

Write T against the statement which is true and F against the statement which is false.

1. The semi –arid ecosystems are purely dry ecosystems.
2. Overgrazing is an important reason of degradation of grassland ecosystems.
3. Some countries are imposing restrictions on the export of wood.
4. The CHIPKO movement was launched in Karnataka in the year 1973.
5. Water logging and salination of soil are necessary for the development of grassland ecosystems.

## ANSWERS

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. (a) prairies, (b) pampas, (c) steppes, (d) veldts,
2. (i) over harvesting of industrial wood, (ii) overgrazing,
3. United Nations, 4. ‘as large, most complex and self- perpetuating ecosystems’
5. 7 February 2003, 6. 1894, 7. overgrazing

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice Type Questions

1. 11.3 mha, 2. (d), 3. (a), 4. (a), 5. (b).

#### B. Fill in the Blanks

1. physical, 2. grassland ecosystem, 3. land, 4. Oct. 2000, 5. livelihood,

#### C. True / False

1. F, 2. T, 3. T, 4. F, 5. F.

## PROJECTS & ACTIVITIES

### Act For Environment

#### 2.1. SURVEY

Select an area measuring 1sq m in a grassland. Find out how many different types of grass species are growing in the area. Count the number of plants of each species and write these numbers in your note book. Repeat the same practice at three different places in the same grassland and note down the numbers of plants in the same manner. Now, you can easily calculate the density and the frequency of different species of grass in the field. Write the experiment properly in your Record Book.

You can calculate the density and frequency through the following formulae –

- (i) Density = no. of sq. units in which a particular species occurred / area of one sq. unit
- (ii) Frequency = no. of sq. units in which a species occurred / no. of sq. units examined.

#### 2.2. TEAM WORK

Arrange a discussion with some of your friends in the class on – **Beautification of the School Campus**. Make appropriate plans and write them down in your note book. Include all possible measures and decide how to implement your plans including all possible requirements and their arrangements. Receive guidelines from your teacher after the approval of the Principal of your school. Write a project –report. This project should be implemented as a work of the eco – club of your school.

# Conservation and Management: Soil

## FACTS & CONCEPTS



- Introduction
- What is Conservation of Soil?
- Practice of Conservation and Management of Soil
  - Proper Tillage and Land Use Management
  - Alternate Cropping
  - Judicious Use of Inputs
  - Use of Manure, Bio-Fertilizers and Bio-Pesticides
  - Prevention and Control of Soil Erosion
- Forests and Their Importance to Human Beings
- Conservation of Forests
  - Joint Forest Management
  - Afforestation

We know that, soil is the loose material which covers land surface of the earth, supports the growth of plants and acts as a habitat for numerous types of organisms. It is a loose combination of physical (organic and inorganic) and biotic materials. The development of soil (called as Paedogenesis) takes thousands of years. So, it can be called as a non-renewable resource. In spite of being a non-renewable natural resource, soil is under heavy stress due to bad practices of agriculture; overuse of inputs like water, fertilizers and pesticides; deforestation; overgrazing; over-development and pollutions. In this chapter, we are going to study about the conservation and management of soil.

### 3.2. WHAT IS CONSERVATION OF SOIL?



**Fig. 3.1.** Degraded land.

**Making the best use of soil, together with protecting it from all types of factors that may cause its degradation is called as soil conservation.**

Soil is a vital life support system. No life is possible without soil as plants, our food-providers, can not grow without it. It provides shelter to numerous types of microorganisms and animals.

The conservation of soil is needed urgently because degradation of soil across the world has become a matter of particular concern today. According to a report of the *United Nations Environmental Programme*, it is estimated that about 13 percent of land in Asia and Pacific has been degraded due to clearance of forests and introduction of invasive species.

The agricultural mismanagement is causing chemical soil degradation which is seen in the form of acidification and salinization of soil. Out of about 1977 m ha dry land in Asia, more than one half is affected by desertification. All these cases of land degradation are related directly or indirectly to the land use practices like agricultural expansion and intensive agriculture.

### 3.3. PRACTICES OF CONSERVATION AND MANAGEMENT OF SOIL

**The judicious use of soil, maintenance of its fertility and prevention of its loss by all possible means, is called as Conservation and Management of Soil.**

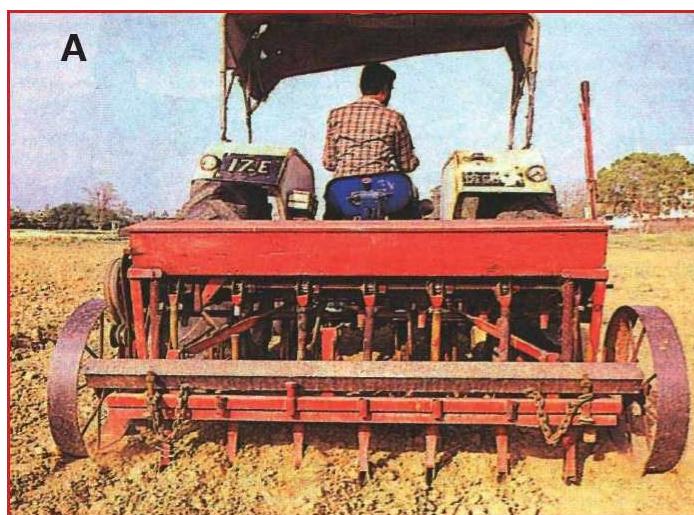
**The Conservation and Management of Soil involves a number of practices. These practices are—**

- ◆ Proper tillage of land and Land use Management,
- ◆ Judicious use of inputs like water, fertilizers, and pesticides,
- ◆ Use of manure like compost and green manure,
- ◆ Use of bio-fertilizers on the place of synthetic chemical fertilizers,

- ◆ Use of bio- pesticides on the place of synthetic chemical fertilizers, &
  - ◆ Prevention and control of soil erosion through various different methods— like, plantation conservation of grasslands and forests and, through Social Forestry and Agro- forestry.
- Let us discuss these practices of conservation and management of soil one by one.

### 3.3.1. Proper Tillage and Land use Management

Tillage in traditional terms is the *preparation of soil for growing crops*. It is accomplished by using a plough, tilling machine, tractor etc. which cuts into the ground and turns over the soil.



**Fig. 3.2.** Modern devices for Land-Tilling. : A-Tractor-tiller B. Garden-Land cultivator.

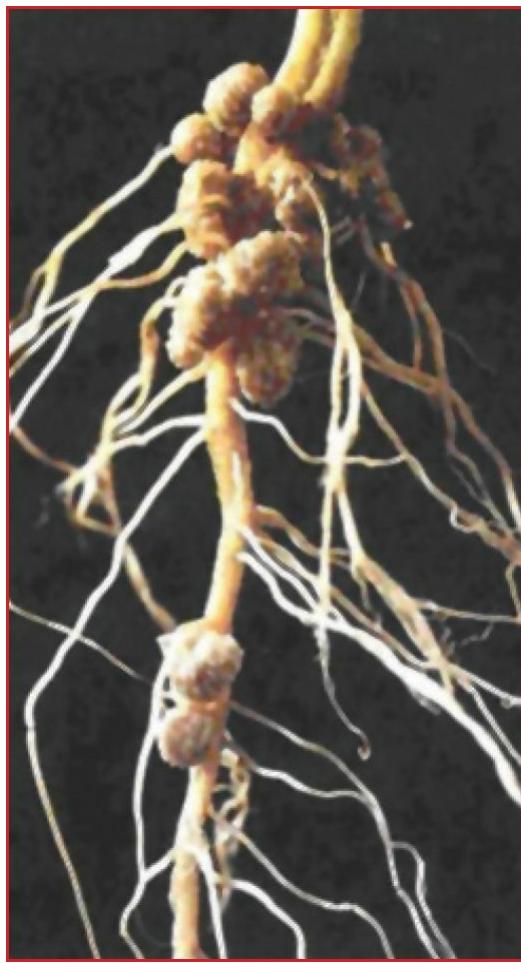
#### Farmers get following benefits from tilling the lands-

- ◆ Tillage removes the weeds that grow in crop fields,
- ◆ It makes the soil loose by breaking up the surface layers,
- ◆ It provides a bed of soil which holds sufficient moisture continuously over many years,
- ◆ Proper tillage facilitates the aeration of soil. Aeration provides free circulation of oxygen and water, results in the increased biological activities in the soil and allows the Nitrogen Fixing Bacteria to do their duties.
- ◆ It contributes to the health of plants by inhibiting plant diseases and by discouraging the developments of various types of insects that harm plants.

Proper tillage practices help the conservation of soil in many ways. The uphill and downhill direction of furrows promotes soil erosion. But, by ploughing across the slope, water is directed to enter into the soil. This type of ploughing is known as contour ploughing.

**The utilization of a particular type of land for a suitable purpose is called as land use management.** Lands are utilized for growing crops, developing pastures, growing forests, developing and protecting wildlife, constructing houses etc. But all types of land should not be used for all types of purposes. For example, a fertile and well drained land should be used for agriculture only and forest lands should not be used for agriculture.

### 3.3.2. Alternate Cropping



**Fig. 3.3.** Root-nodules on roots of a leguminous plant.

### **Growing different crops in a set pattern of alternation is called as Alternate Cropping.**

Most often it is also called as the *Crop Rotation*, in which crops are grown in a particular field in a cyclic fashion. In winter, cover crops are sown to protect the soil. Often leguminous (like Pea, Soybean, Pigeon Pea etc.) crops are sown as cover crops and these crops help in the enrichment of soil with nitrogen. The roots of leguminous crops allow a number of nitrogen fixing bacteria to live in their nodules and to fix nitrogen for them. This process is called as **Biological Nitrogen Fixation**. There is an un-usual leguminous plant called *Sesbania rostrata*. This plant has nodules on its stems in addition to nodules on roots. Farmers use it as Biofertilizer crop.

In an Alternate Cropping pattern, leguminous crops follow non-leguminous crops. The plants of leguminous crops have tap root systems that draw water and minerals from the lower layer of soil. On the other hand, the non-leguminous crops have fibrous root systems that draw water and minerals from the superficial layer of soil. Thus the fertility of soil is retained and promoted through alternate cropping pattern or through the pattern of the crop rotation.

#### **3.3.3. Judicious use of Inputs**

**Water, fertilizers, and pesticides** are principal inputs of agriculture. These inputs, if not in adequate quantity, create such conditions which are harmful to the whole soil system.

Flooding of fields with **water**, during irrigation causes an increase in the salt content of the soil and makes it saline. A saline soil is always unfit for the growth of plants.

**Fertilizers** too, damage soil composition if applied in excess quantities. Many of the synthetic fertilizers used in our fields for increasing crop production, are unsafe and seriously harmful to the

soil and soil organisms if applied in excess quantities. The excessive application of these chemicals increases salt content of the soil.

The **synthetic pesticides** applied on crop plants cause serious soil pollution and kill various types of soil organisms inhabiting it. Many of the synthetic pesticides are non- biodegradable and hence persist in the soil; for longer periods.

### 3.3.4. Use of Manure, Bio-fertilizers, and Bio-pesticides

**Manure** is a mixture of organic materials prepared under natural conditions through the decomposition of bio- wastes and agricultural residues. It is often done in a deep pit called as compost. Hence, the manure so produced is also called as **compost**. It is very useful for crops as well as for soils. It improves soil fertility by adding important nutrients to it, improves soil composition and upgrades its ability of water retention. It is through the preparation of manure that the problem of disposal of agricultural waste and waste from animal husbandry can be solved in proper ways.

Manure may be of different types- like **composts**, **worm composts** and **green manures**. Compost is the manure prepared from crop residues and animal wastes in scientifically dug compost pits either through aerobic or anaerobic ways. Manure or similar fertilizers are also called as **Organic Fertilizer**.

#### enviro\_Facts : 03

#### GREEN MANURE

The Sunn hemp (*Crotolaria juncea*) and Dhaincha (*Cymopsis tetragonoloba*), are plants utilized for preparing green manure. When plants like Sunn hemp etc. are ploughed in soil and allowed to decompose under natural conditions, they are converted into green manure. Crops like paddy, maize, cotton or wheat are grown after mixing green manure into the soil.

#### FARM YARD MANURE

The manure prepared through the decomposition of crop residues layered for some days on the floor of cattle sheds, is called as farm yard manure. It usually contains Nitrogen (0.5%), Phosphorus pentaoxide (0.2 %) and Potassium (0.5 %).

**Bio-fertilizers** are specific types of living organisms like symbiotic bacteria, *Cyanobacteria* (also called as blue green algae), sea weeds etc. that can bring about nutrient enrichment of soil in many different ways. *Anabaena azollae*, *Anabaena cycadae*, *Azolla pinnata* and *Nostoc* are different plants that enhance the productivity of soil when added to it.

Bacteria like *Rhizobium* fix nitrogen for plants and *Nostoc*, *Azolla*, and *Cyanobacteria* that are great nitrogen fixers, are used as bio- fertilizers in crop fields, most frequently.

#### Bio-fertilizers are useful in the Conservation and Management of soil in following ways –

- (i) These are helpful in the replenishment and enhancement of soil fertility.
- (ii) These fertilizers improve water holding capacity, aeration, porosity and drainage of soil.
- (iii) These fertilizers are helpful in reclamation of unproductive soils.
- (iv) These fertilizers are helpful in preventing soil erosion.

Bio- pesticides are biological agents that are helpful in controlling plant pests.

There are basically two types of bio-pesticides: Bio-herbicides and bio- insecticides.

**Bio-herbicides** are living organisms which destroy herbs. These may be insects that feed on

specific weeds or micro organisms that may cause diseases in weeds. Here are some examples –

- (1) **Mycoherbicide:** This is derived from a fungus called as *Phytophthora palmivora*. It controls the growth of milk weed vines in citrus.
- (2) **Cochineal insect (*Cactoblastic cactorum*):** This insect eats away cactus plants. This is being introduced in controlling overgrowth of cacti in India and Australia.

Recently, **transgenic plants** of vegetables like tomato and tobacco have been developed through genetic engineering. These plants are so engineered genetically that these can develop resistance against herbicides. Garlic, Cloves, Cedar wood oil etc. have been tested indigenously and have been found useful in repelling certain insect- pests. Besides these, **Pheromones** like *Xanthenes* and **Plant Hormones** like *Auxins*, *gibberellins* etc. are also used as bio- pesticides.

**The natural enemies of particular insects and certain other substances that are used for killing or repelling insect pests in a particular area are called as bio- insecticides.** There are following categories of bio- insecticides –

- (1) Disease causing organisms (pathogens), parasites and predators.
- (2) Pheromones or insect hormones.
- (3) Natural Insecticides like tobacco extract, neem oil, and specific bacterial toxins (called as Thuriosides).
- (4) Viral bio- insecticides like *Bioculoviruses* that affect insect pests.
- (5) Fungal agents or different fungi, that are useful in controlling insect pests.
- (6) Insect insecticides like Lady Bird and Praying Mantis that eat away many types of insects (Fig. 3.4).



**Fig.3.4.** Lady Bird (a) and Praying Mantis (b) work as insect- insecticides.

The use of synthetic chemical pesticides causes health hazards and ecological imbalances. In view of this, the Government of India has adopted Integrated Pest Management Programme (IPM) as main strategy of plant protection. The IPM is an eco- friendly strategy which aims at minimum use of synthetic pesticides. The Government of India spent Rs. 1,500 lakh as grant –in –aid during 8<sup>th</sup> and 9<sup>th</sup> Five Year Plans for the establishment of **30 state laboratories** for the development of biopesticides and biological pest control agents. The consumption of pesticides came down from 72,133 MT during

1991-92 to 41,020 MT during 2003-04 due to the IPM.

### 3.3.5. Prevention and control of Soil Erosion

The depletion of top productive soil by the agency of water or wind is called as soil erosion. Some farming methods also cause soil erosion through these agencies. Those farming methods are – Mono agriculture or Mono cropping, wrong methods of ploughing or tilling the land, overgrazing by cattle like goats and sheep, deforestation etc.

There are many different **methods of controlling soil erosion**. Those methods are –

- (i) Rotation of crops or Alternate Cropping,
- (ii) Construction of proper drainage or outlets to carry away the water of fields without causing soil erosion,
- (iii) Plantation – like Afforestation, reforestation, Compensatory Plantation etc.
- (iv) Control on overgrazing,
- (v) Terracing on hill slopes to check direct flow of water,
- (vi) Adoption of proper methods of cultivation,
- (vii) Putting ban on the farming on land near river banks.

## A. PLANTATION

Growing plants on hill slopes and uncovered land is called as plantation. Plantation checks soil erosion in following ways –

- (a) Canopies of trees check raindrops against falling on the earth surface directly. Thus the velocity of raindrops is reduced due to which they become unable to break the layer of the top soil.
- (b) Roots of plants and trees bind soil particles and do not allow them to flow away with water.

## B. CONSERVATION OF GRASSLANDS

Grasses have highly branched fibrous root systems. Hence, they are effective in binding soil particles and in checking the erosion of soil. The **overgrazing** in grasslands, cause complete destruction of grasses. Thus overgrazing is a menace. Soil-erosion, loss of fertility and desertification are three most serious impacts of overgrazing. If overgrazing is accompanied by lack of water, or drought, the whole grassland may get converted into a desert. Hence, conservation of grasslands is necessary for the conservation of soil. The conservation of grassland is done through following ways –

- (i) Overgrazing should be stopped so as to allow the growth of grasses,
- (ii) If grazing is allowed, it should be on rotational basis,
- (iii) Shrubs and weeds should be removed from the grassland, as these impose adverse impacts on the development of grasses,
- (iv) The loss of soil and water from the grassland should be checked effectively.

## 3.4. FORESTS AND THEIR IMPORTANCE TO HUMAN BEINGS

Let us have a fresh look on forest. In fact, a *forest is a complex and dynamic ecosystem*

consisting mainly of trees that form a buffer for the earth to provide shelter to innumerable life forms and to provide food to them. The trees which make up the main area of the forest create a special environment which, in turn, affects the kinds of animals and plants that can exist in the forest.

## **FORESTS ARE MOST IMPORTANT TO HUMAN BEINGS. HOW? LET US RECALL SOME MAIN POINTS –**

1. Forests provide social, economic, medicinal, and environmental benefits to human beings.
2. They provide raw materials to many industries.
3. Forests absorb carbon dioxide and act as major sinks for it. In this way forests maintain gaseous balance in nature and control air pollution as well. Thus, forests play important roles in reducing warming of the earth or the global warming.
4. Human beings are connected to all life forms including vast varieties of animals and plants. Forests provide not only shelter to animals, they provide them food and protection to them as well. Thus forests help in human survival indirectly by helping the survival of animals and plants or the biodiversity.
5. Forests have been the homes of many tribal cultures where these cultures flourished and developed.
6. Forests are helpful in controlling soil erosion and thus protecting the agriculture which is the major source of food for human beings. If soil erosion is checked, the siltation of rivers will be checked and the danger of floods will automatically be removed up to major extent.

In spite of their great values, human beings are destroying forest at a fast rate. Felling or cutting of forest trees is called as **deforestation**. The rate at which deforestation is being done today is of great concern. Currently, 12 million hectares of forests are cleared annually. At this rate all the moist tropical forest could be lost by the year 2050, except for isolated areas in Amazonia, the Zaire basin, as well as a few protected areas within reserves and parks. Some countries such as Ivory Coast, Nigeria, Costa Rica, and Sri Lanka are likely to lose all their tropical forests by the year 2010 if, no conservation steps are taken.

## **FOLLOWING ARE SOME OF THE BASIC CAUSES OF DEFORESTATION-**

- (i) Conversion of forests and woodlands to agricultural land to feed growing numbers of people;
- (ii) Development of cash crops and cattle ranching, both of which earn money for tropical countries;
- (iii) Commercial logging (which supplies the world market with woods such as meranti, teak, mahogany and ebony) destroys trees as well as, it opens up forests for agriculture;
- (iv) Felling of trees for firewood and building material; the heavy chopping of foliage for fodder; and heavy browsing of saplings by domestic animals like goats.

To compound the problem, the poor soils of the humid tropics do not support agriculture for long. Thus people are often forced to move on and clear more forests in order to maintain production.

## **CONSEQUENCES OF DEFORESTATION**

1. Forests act as a major carbon store because carbon dioxide ( $\text{CO}_2$ ) is taken up from the atmosphere and used to produce the carbohydrates, fats, and proteins that make up the tree. When

forests are cleared, and the trees are either burnt or rot, this carbon is released as CO<sub>2</sub>. This leads to an increase in the atmospheric CO<sub>2</sub> concentration. CO<sub>2</sub> is the major contributor to the greenhouse effect. It is estimated that deforestation contributes one-third of all CO<sub>2</sub> releases caused by people.

2. Trees draw ground water up through their roots and release it into the atmosphere (transpiration). In Amazonia, over half of all the water circulating through the region's ecosystem remains within the plants. With removal of part of the forest, the region cannot hold sufficient water. The effect of this could be a drier climate.

3. With the loss of a protective cover of vegetation more soil is lost.

4. Deforestation leads to soil erosion, which causes *Silting of water courses, lakes and dams*.

5. Destruction of forests results into *Extinction of species* which depend on the forest for survival. Forests contain more than half of all species on our planet - as the habitat of these species is destroyed, so the number of species declines.

6. Deforestation leads to *Desertification*. The causes of desertification are complex, but deforestation is one of the major contributing factors.

## 3.5. CONSERVATION OF FORESTS

A number of programmes are being carried on by the government and non-government organizations on different levels. Some of these programmes are being described below -

### 3.5.1. Joint Forest Management (JFM)

India framed its Forest Policy in 1988. The Ministry of Environment and Forest (MoEF- 1990) passed several subsequent resolutions through which it stressed on the needs of 'People's Participation' in the management of natural forests. It has been mentioned in the Policy Document that local communities should be motivated to take active parts in the protection and preservation of forests and to derive their share of benefits from them.

*The practice of management of forest resources jointly by the Forest Department and the local communities which would entitle them in sharing of forest produce in lieu of their participation in protection and management of forest resources is called as Joint Forest Management or JFM..*

Under JFM, **Forest Protection Committees** are formed between villagers and forest officials. These committees safeguard and protect the forest areas that are prone to illicit felling. Villagers elect members of these committees from among themselves. Now, there are separate Village Forest Committees as well. These committees are constituted by villagers themselves and members of these committees remain responsible for rejuvenation of forests through the conservation of soil moisture and plantation. As of March 2006, there were 1,06,482 committees managing an area of about 22million hectare in 28 states and Union Territory of Andaman and Nicobar islands.

Recent years have seen a number of changes in the management of forests. There is a major shift towards a more decentralized and people oriented forestry. Responding to scarcities, villagers have started organizing themselves to reverse degradation and restore productivity. The result has been a renewal of degraded ecosystems.

The destruction of natural forests for timber, cropland, fuel- wood, pasture, urbanization etc. have had an impact on many poor rural families who are dependent on forest resources for fuel, fodder, food, medicine, and housing etc. The deterioration of forests has accelerated soil erosion,

sedimentation of rivers, increased flooding, and has overtaxed the land's capacity to regenerate and sustain. It is now being recognized that local communities need to be involved in establishing sustainable Forest Management Systems.

### 3.5.2. Afforestation

The generation of fresh artificial forests by planting trees is called as **Afforestation**. It is important for the conservation of soil by increasing vegetation cover on land together with solving the problem of fuel wood, fodder and rural energy. The government of India set up the National Afforestation and Eco- Development Board (NAEB) in AUGUST 1992. The aims of the establishment of this board were-

- (a) The Promotion of Afforestation,
- (b) Plantation of trees,
- (c) Ecological Restoration, and
- (d) Eco- development

The NAEB has developed various schemes for the promotion of Afforestation and development of Management Strategies. It formulates different programmes and implements them. It has set up Ecological Task Force (ETFs) of Ex-service Men who are employed in remote areas. The ETFs are responsible to undertake restoration of degraded ecosystems by measures like Afforestation, soil conservation etc. The **Social Forestry** and **Agro- forestry** are two ambitious schemes which are based on the community participation under the Joint Forest Management Programme.



**Fig. 3.5.** Trees plantation along roadsides.

#### A. SOCIAL FORESTRY

Plantation of trees in village common lands, along road sides and along rail tracks etc., useful in view of production of fuel wood and fodder, is called as **social forestry**.

The term '**Social forestry**' was first used in 1976 by the National Commission on Agriculture, Government of India. It was then that India embarked upon a social forestry project with the aim of checking deforestation and making use of all **unused and fallow land**.

Government forest areas that are close to human settlement and have been degraded over the years due to human activities needed to be afforested. **Trees** were to be planted in and around agricultural fields. Plantation of trees along **railway lines** and **roadsides**, and **river** and **canal banks** were carried out. They were planted in village common land, Government **wasteland** and **Panchayat** lands.

Social forestry also aims at raising plantations by the common man so as to meet the growing demand for **timber**, **fuel wood**, **fodder**, etc, thereby reducing the pressure on the traditional forest area. This concept of village forests to meet the needs of the rural people is not new. It has existed through the centuries all over the country but it was now given a new character.

With the introduction of this scheme the government formally recognized the local communities' rights to forest resources, and is now encouraging rural participation in the **management of natural resources**. Through the social forestry scheme, the government has involved community participation, as part of a drive towards **afforestation**, and **rehabilitating** the degraded forest and common lands.

This need for a social forestry scheme was felt as India has a dominant rural population that still depends largely on fuel wood and other biomass for their cooking and heating. This demand for fuel wood will not come down but the area under forest will reduce further due to the growing population and increasing human activities. Yet the government managed the projects for five years then gave them over to the **village panchayats** (village council) to manage for themselves and generate products or revenue as they saw fit.

At present in almost all the countries where social forestry programmes have been taken up, both **commercial** and **non commercial farm forestry** is being promoted in one form or the other. Individual farmers are being encouraged to plant trees on their own farmlands to meet the domestic needs of the family. In many areas, this tradition of growing trees on the farmland already exists. Non-commercial farm forestry is the main thrust of most of the social forestry projects in the country today. It is not always necessary that the farmer grows trees for **fuel wood**, but very often he is interested in growing trees without any economic motive. He may want it to provide shade for the **agricultural crops**; to act as **wind shelters**; to promote **soil conservation** or to use his wasteland.

## **COMMUNITY FORESTRY**

Another scheme taken up under the social forestry programme is the raising of trees on community land and not on private land as in farm forestry. All these programmes aim to provide for the entire community and not for any individual. The government has the responsibility of providing seedlings and fertilizer but the community has to take responsibility of protecting the trees. Some communities manage the plantations sensibly and in a sustainable manner so that the village continues to benefit. Some others take advantage and sell the timber for a short-term individual profit. Common land being everyone's land is very easy to exploit. Over the last 20 years, large-scale plantation of **Eucalyptus**, as a fast growing exotic tree, has occurred in India, making it a part of the drive to reforest the subcontinent, and create an adequate supply of timber for rural communities under the augur of 'social forestry'.

**Planting of trees on the sides of roads, canals and railways, along with planting on wastelands is known as 'extension' forestry.** Under this project there has been creation of wood lots in the village common lands, government wastelands and panchayats lands. Schemes for **afforesting** degraded government forests that are close to villages are being carried out all over the country.

## **OBJECTIVES OF SOCIAL FORESTRY**

Social forestry, schemes that have been started all over the country have made a considerable difference in overall forest cover in a short time. **Afforestation** outside the conventional forest area is done for the benefit of rural and urban communities. The main objectives of Social Forestry are to:-

1. Improve the **environment** for protecting **agriculture** from adverse climatic factors,
2. Increase the supply of fuel wood for domestic use, small timber for rural housing, fodder for livestock, and minor forest produce for local industries,
3. Increase the **natural beauty** of the landscape; create **recreational forests** for the benefit of rural and urban population,
4. Provide **jobs for unskilled workers**,
5. Reclaim wastelands, and
6. To raise the **standard of living** and **quality of life** of the rural and urban people.

## **MISSION OF SOCIAL FORESTRY**

- ◆ To carry out a need based and time bound programme of afforestation with special emphasis on fuel wood and fodder development on all degraded and denuded lands/forests.
- ◆ Afforestation of abandoned **Jhoom lands** and mined areas.
- ◆ Linear strip plantation of fast growing species on sides of public roads, rivers, streams and irrigation canals.
- ◆ Afforestation on unutilized lands under State/Corporate, institutional or private ownership.
- ◆ Generation of Green belts in urban/industrial areas.
- ◆ Creation of Shelter belt (generally more extensive than the wind breaks) for the purpose of shelter from wind and sun, covering areas larger than a single farm on a planned pattern.
- ◆ Generation of Farm forestry in the form of raising rows of trees on bund or boundaries of fields and individual trees in private agricultural land as well as creation of wind breaks round a farm or orchard by raising one or two lines of trees.
- ◆ Raising flowering trees and shrubs mainly to serve as recreation forests for the urban and rural population.
- ◆ Elicit people's participation involving women and young people in conservation of forests, wildlife and environment.
- ◆ Environmental awareness generation and celebration of **vanamahotsava**, **environment day**, **wildlife week** etc.

## **BENEFITS FROM SOCIAL FORESTRY**

1. The waste lands near villages and semi urban areas can be conserved and developed through this programme.
2. The problem of fuel wood and fodder in rural areas can be solved through social forestry.
3. The pressure on existing forests can be reduced through this programme.
4. It helps in the protection of soil from soil erosion.
5. It provides housing facilities to local birds and animals.

## **B. AGROFORESTRY**

The practice of growing crops between rows of trees is called as Agro- forestry. Tea- and coffee farms are important examples of this practice in which tea and coffee bushes are grown

between rows of trees having less canopy areas. Cropping between rows of trees like Coconut, Sal, Teak etc. and growing different types of trees like Papaya, Kusum etc. on demarcation lines of fields yield additional benefits to farmers.

The practice of agro-forestry has been traditionally adopted in India in the form of Jhum cultivation. How ever, this is not an environmentally sound practice as it involves clearing of bushes and trees in a particular area and growing crops in the ash mixed soil, after burning those bushes and trees.

### **The benefits from agro-forestry are listed below-**



**Fig. 3.6.** A Tea-farm dotted with Trees is an example of Agroforestry.

1. This practice provides additional benefits to farmers by increasing their income,
2. Trees provide shelter to numerous birds that eat away insect pests of crops,
3. This practice is important as it is helpful in checking soil erosion and increasing moisture content of air over the crop fields.

The practice of agro forestry requires adequate knowledge about nature and demands of different crops together with a complete knowledge about different trees that are to be combined in the agro forestry system.

4. Agro forestry is helpful in improving soil fertility as leaves of trees falling on the ground decompose and increase soil fertility.

## **TOWARDS A BETTER ENVIRONMENT...**

“Earth Eco Task Force” of ex-servicemen has been active in Pithoragarh, Uttarakhand. In addition to their earlier activities in Rajasthan, Jammu & Kashmir and Uttar Pradesh, it undertakes ecological restoration work in selected environmentally degraded areas, particularly in unapproachable and hostile territories. The “Forest Survey of India Report” (1993) which was based on satellite images, showed that our forest cover had increased from 6,00,000 sq. km (1990-1991) to 6,40,107 sq. km in 1993. The afforestation work has been specially speeded up during the last some years and over 30 lakh hectares have been afforested since then. Besides, 3760 lakh seedlings have been distributed for plantation on private lands. The World Bank is

actively helping both technically and financially in the implementation of various afforestation projects. These include **Arawali project**, **Indira Gandhi Canal Area Afforestation Project**, **Dhanbad Project**, **Kulu Manali Project**, **Western Ghats** and **Andhra Pradesh Afforestation Project** and **Greening of Haryana Project etc.**

## IMPORTANT DEFINITIONS

<b>CONSERVATION MANAGEMENT OF SOIL</b>	<b>AND :</b>	The judicious use of soil, maintenance of its fertility and prevention of its loss by all possible means, is called as conservation and management of soil.
<b>DESERTIFICATION</b>	<b>:</b>	The process of conversion of productive land into unproductive and dry land (or desert) is called as desertification.
<b>BIO FERTILIZER</b>	<b>:</b>	The biological agents or substances that improve the fertility of soil, are called as bio fertilizers.
<b>BIO- PESTICIDES</b>	<b>:</b>	The biological agents or substances of biological origin that can kill or repel pests, are called as bio pesticides.
<b>TILLAGE</b>	<b>:</b>	Preparation of soil for growing crops accomplished by using a plough which cuts into the ground and turns over the soil.
<b>TRANSGENIC PLANTS</b>	<b>:</b>	Genetically engineered crop plants resistant to pesticides/pests, are called as transgenic plants.
<b>PHEROMONES</b>	<b>:</b>	Insect hormones usually secreted during their sexual activities to attract the opposite sex are called as Pheromones.
<b>SOCIAL FORESTRY</b>	<b>:</b>	Plantation of trees in village common lands, waste – Lands, along rail tracks, along road sides etc. is called as social forestry.
<b>AGRO- FORESTRY</b>	<b>:</b>	Plantation of trees on demarcation lines of fields and in tea / coffee farms is called as agro forestry.

## MODEL QUESTIONS AND EXERCISES

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. What type of natural resource is soil. Renewable or Non- renewable?
2. What is the Land Use Management? Answer in one sentence.
3. Name any one Nitrogen Fixing Bacteria.
4. Name any one bio- herbicide.
5. Name any one insect which acts as bio-insecticide.
6. Which of the following trees cannot be combined in agro- forestry?
  - (a) banyan
  - (b) papaya
  - (c) coconut
  - (d) palm
7. What help do agro forestry trees provide to the environment besides adding to the income of farmers?

### II. SHORT ANSWER TYPE QUESTIONS

(2 marks each)

1. What do you mean by Conservation of Soil? List any two indigenous methods of soil conservation.  
(ICSE 2008)
2. How does excess use of inputs cause harm to the soil?
3. How are the applications of manure, bio-fertilizers and bio- pesticides helpful in the conservation of soil?
4. Describe in brief any two practices that are helpful in the prevention and control of soil erosion?
5. What is Joint Forest Management? How, in your opinion, is it helpful in the proper Conservation and Management of our Forest Resources?
6. Write Note on Joint Forest Management (JFM).  
(ICSE 2008)
7. What are Forest Protection Committees ?

8. Mention two objectives of JFM (Joint Forest Management).

(ICSE 2006, 2008)

9. Mention any two ways by which Social Forestry is useful to us.

(ICSE 2008)

10. What is Social Forestry? In what ways is it beneficial to

- (a) rural populations
- (b) environment?

11. (i) Define agro forestry.

(ICSE 2007)

(ii) State any two advantages of agroforestry.

(ICSE 2010)

12. Write any two protective Functions of Forests.

(ICSE 2008)

### III. DETAILED ANSWER TYPE QUESTIONS

(4 to 6 marks each)

1. What do you mean by conservation and management of soil? Describe in brief some important practices for the conservation and management of soil?

2. What is Forest Conservation? How is it linked with soil conservation? Describe any two important practices of management of forests.

3. Explain Importance of Forests to Mankind.

(ICSE 2007)

4. "The primary objective of Social Forestry was recommended by the National Committee on Agriculture, Government of India in 1976." Mention Six objectives of this agricultural programme.

(ICSE 2006)

5. Briefly describe the process of composting. State any two advantages of compost.

(ICSE 2010) [Hint: Elaborate on the basis of your study in previous classes]

6. Explain any three causes and three effects of soil erosion.

(ICSE 2010) [Hint : Elaborate on the basis of your study in previous classes.]

7. Overgrazing is a menace. Explain three impacts of overgrazing. Discuss any three measures to control this menace.

(ICSE 2010)

8. What are organic fertilizers? State any two advantages of using them.

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice Type Questions

**Tick (✓) the correct option**

1. Tillage is accomplished by using a...

- (a) tube well
- (b) plough
- (c) harvester
- (d) combine

2. The utilization of a particular type of land for a suitable purpose is called as....

- (a) soil erosion
- (b) development of pasture
- (c) land use management
- (d) drainage

3. Nodules are found on the roots of....

- (a) banana
- (b) papaya
- (c) leguminous plant
- (d) azolla

4. The root system found in a non-leguminous plant is...

- (a) fibrous root system

- (b) tap root system
  - (c) no root system
  - (d) both tap and fibrous
5. Many of the synthetic pesticides are...
- (a) biodegradable
  - (b) non-biodegradable
  - (c) fertilizers
  - (d) herbicides

#### **B. Fill in the blanks**

1. By ploughing across the slope, the water is allowed to ..... into the..... .
2. Proper tillage practices facilitate the aeration of..... .
3. Nitrogen fixing bacteria live inside the ..... of leguminous plants.
4. Alternate cropping may also be called as crop..... .
5. Leguminous crops have..... root system.

#### **C. True / False**

Write T against the statements that are True and F against the statements that are False.

1. Water, fertilizers and pesticides are principal inputs of agriculture that should be applied in plenty.
2. Fertilizers too damage soil composition if applied in excess quantities.
3. Manures are inorganic materials which are prepared through the decomposition of under natural conditions.
4. Transgenic plants are developed through genetic engineering.
5. Pheromones are plant hormones or phytohormones.

## **ANSWERS**

#### **I. VERY SHORT ANSWER TYPE QUESTIONS**

1. non-renewable, 2. The utilization of a particular type of land for a suitable purpose is called as land use management.,3. *Rhizobium*, 4. Cochineal insect (*Cactoblastic cactorum*), 5. Lady Bird, 6. (a) banyan, 7. agro forestry trees provide shelter to birds and animals.

#### **IV. OBJECTIVE TYPE QUESTIONS**

##### **A. Multiple Choice Type Questions**

1. (ii), 2. (iii), 3.(iii), 4.(i), 5. (ii)

##### **B. Fill in the blanks**

1. enter, ground 2. soil, 3. root-nodules, 4. rotation, 5. tap

##### **C. True / False**

1. F, 2. T, 3. F, 4. T, 5. F.

## **PROJECTS & ACTIVITIES**

### **Act for Environment**

#### **3.1. SURVEY**

Do a survey of the area nearby your school and observe cases of soil erosion. Discover all possible causes of soil erosion in each case and prepare a project on Soil Conservation and Management in..... (Name of the area). Write a project report.

#### **3.2. DISCUSSION**

Organise a discussion through the eco-club of your school on ‘Roles of grasslands in soil conservation’.

#### **3.3. FIELD WORK**

Contact the Forest Officer of your district and find out about the Social forestry and Agro Forestry programmes being implemented in the district. Prepare a report on your visit.

# Conservation and Management: Wildlife

## FACTS & CONCEPTS



- Introduction
- Wildlife in Distress
  - The Global Scene
  - The Indian Scene
- Causes of Loss of Species of Wildlife
- Need of Conservation and Management of Wildlife
- Measures of Conservation and Management of Wildlife
  - National Parks
  - Wildlife Sanctuaries and Bio-Reserves,
  - Breeding Programmes for Endangered Species
  - Prevention of Poaching, Hunting and Bio-Piracy
  - Enforcement of Legal Provisions

## 4.1. INTRODUCTION

The word “wild” relates to “the nature” and “life” relates to “living organisms”- plants, animals and micro- organisms. Thus, Wildlife is a broad term which incorporates all the undomesticated organisms of the biosphere.

The term wildlife is often restricted to wild animals. In this case, it means just the animals living in the wild. But, in broad sense, the term wildlife comprises nearly half of the environment. Its next half is the physical environment.

All the species of organisms inhabiting a particular area (land or water) are together termed as BIODIVERSITY or Biological Diversity of that area. In other words, “**Species-richness of a place is called as its biodiversity.**” According to the world Resource Institute, IUCN and UNEP (1992) - “**Biodiversity is the totality of genes, species, and ecosystems in a region.**”

Habitat destruction, extensive mining, deforestation, hunting and poaching, pollution and climate change are acting as potential causes of the loss of biodiversity today. (Elaborate these causes on the basis of year studies).

As per reports of UNEP-2000, we have been able to describe about 1750000 species of wildlife in the world so far, whereas the possibility of the total number of species existing in the world is expected to be 14000 000.

Since, the biological and the physical components together constitute the natural environment; both the components must be conserved and managed properly. In this chapter, we are going to study about the importance of wildlife, principal factors causing loss of species and about various strategies that are being adopted on the national and the global levels for the conservation and management of wildlife.

## 4.2. WILD LIFE IN DISTRESS

The wildlife is in distress in the whole world. Besides facing threats from natural calamities, animals are facing additional threats from human activities too. The increasing demand for different types of resources and pollutions of air, water and soil are some of the factors that have put wildlife in distress across the globe.

### 4.2.1. The Global Scene

According to the IUCN- Red list-2000, about 1130 species of mammals and 1183 species of birds have been declared to be threatened on the global level. As per assessment made in 1996, there were about 169 species of mammals and 168 species of birds considered to be critically threatened in the world. These numbers increased considerably by the year 2000 and the number of critically threatened species of birds increased unto 182. The wildlife experts in the world are of the opinion that with the current trend of loss of species or the extinction, about 15 to 20 percent loss of species of wildlife is feared to occur over the next 100 years.

**Extinction may be defined as a condition when no live individual of a particular species exists anywhere in the world, either in its natural habitat (in situ) or in captivity (ex- situ).** Some species of wildlife are known to play more significant roles in a particular ecosystems than other species. Such species are called **as key- stone species.** The loss of such species becomes seriously

destructive to ecosystems.

IUCN or the International Union for Conservation of Nature and natural resources has categorized plants and animals according to their Ecological Status in the wild. Some of these categories are mentioned below-

- F **Extinct:** A species that no longer exists anywhere around the world.
- F **Critically Endangered:** A species that is going to face an extremely high risk of extinction in the wild in the immediate future.
- F **Endangered:** A species that is going to face a high risk of extinction in the wild in the near future.
- F **Vulnerable:** A species that is going to face high risk of extinction in the wild in the medium-term future.
- F **Conservation dependent:** A species that is currently the focus of a conservation program. If the program is halted, the species would suffer and would qualify for one of the threatened categories above within a period of five years.
- F **Near Threatened:** A species that does not qualify for Conservation Dependent status, but is close to qualifying for vulnerable status.

#### 4.2.2. The Indian Scene

The **Zoological Survey of India** and the **Botanical Survey of India** have surveyed more than 70% of the total geographical area of India for the assessment of total number of species of plants and animals. So far, about 81,000 species of animals and 49,000 species of plants, have been recorded by these two institutions, respectively.

According to the IUCN- red list, released on 28<sup>th</sup> September 2000, the environmental status of species of plants and animals in India is detailed below.

**Table 4.1. Status of species of plants and animals in India**

S. No.	Status	Indian Plant Species	Indian Animal Species
1.	Extinct and threatened	227	318
2.	Critically Endangered	37	2
3	Endangered	28	47
4.	Vulnerable	128	44
5.	Conservation Dependent	3	103
6.	Near Threatened	23	84

#### 4.3. CAUSES OF LOSS OF SPECIES OF WILDLIFE

The number of species of wildlife is declining through out the world at an unprecedented rate. Some of the important causes of this loss of species are mentioned below.

### **4.3.1. Habitat Destruction or Conversion of Land**

Vast areas of forest lands are being converted into agricultural land, mining land, pasture land etc. Industrial, residential and municipal construction works grab vast areas of productive land at a fast rate due to explosion of human population. The varying pattern of land use like agricultural development, logging, construction of dams, and urban development lead to serious modifications of habitats. Water bodies like lakes and ponds, wetlands and even coastal lands are being reclaimed for different purposes. All these practices of habitat destruction are causing decline in the number of species of wildlife.

Virtually every type of habitat has come under stress over the past three decades. According to an estimate made by FAO, the forest covers in developing countries declined by 2 million sq. km in the world annually from 1980 to 1995. About 20 percent of the fresh water species have gone extinct or threatened.

### **4.3.2. Climate Change**

The climate change has emerged as one of the major potential threats to the existence of wildlife especially to the small animals. The bleaching of coral reefs has been reported to occur due to rise in the global temperature. In Indian Ocean, bleaching of coral reefs caused mass mortality of corals (up to 90%) in an area of more than thousands of sq. kilometres. The decline of amphibian population in the Tropical Montane forests and mysterious extinction of the golden toads of Florida, have been reported to be caused due to the changes in the climate. Studies done on the depletion of the ozone layer reveal that excess ultra violet radiations reaching to the earth are killing embryos of Salamanders due to which these are being vanished from the earth.



**Fig. 4.1.** Facing Extinction: The Golden Toad of Florida.

### **4.3.3. Deposition of Nitrogen**

The increasing use of fertilizers is causing the deposition of nitrogen in soil which is leading to the loss of soil organisms. Water bodies are subjected to nitrogen deposition due to joining of surface run offs from crop fields. This condition leads to eutrophication, increase in the toxic algal bloom and deaths of aquatic organisms.

The oil spills are causing loss of species of marine animals. A total of 108000 tonnes of oil were spilled into marine and inland environments as a result of 215 incidents in the world during the year 1998.

#### 4.3.4. Hunting, Poaching and International Trade

Hunting and poaching are dangerous practices causing mass scale loss of species of wild animals. Animals are being hunted for meat, sports and illegal trade in their body parts since time immemorial. One of the most significant forms of hunting is whaling as a result of which stocks of whales have gone to the brink of extinction in many parts of the world. The international trade in animal body parts and products derived from them has reached up to the international value of US\$ 10 000 million per year.

#### 4.3.5. Invasive Species

**Plants, animals, fungi, or microorganisms that spread rapidly and cause harm to other species are called as Invasive Species.** Invasive species are sometimes so harmful and damaging that they threaten an entire ecosystem. An “**invasive species**” is defined as a species that is -

- (i) Non-native (or alien) to an ecosystem, and
- (ii) Whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

In fact **invasive species may be the species of some foreign organisms that cause harm to organisms of a new ecosystem when introduced in it.** Here are two examples of invasive species and the impacts of their introduction into new habitats –

1. *Euglandina rosea* is a species of snails (called as Wolf Snails) found on large scale in Australia. When some snails of this species somehow reached to Polynesia, they started feeding on the native snails of the island. Thus the snails of the new species caused serious loss of endemic land snail species of the Polynesian islands. **Polynesia** is a **sub region of Oceania**, comprising a large grouping of over 1,000 **islands** scattered over the central and southern **Pacific Ocean**.

2. The Tasmanian Brush-tail Possum (*Trichosurus vulpecula*) is a carnivorous animal that is found everywhere in *Australia*. When some individuals of this species were introduced in New Zealand, they started eating away most of the native birds, and the population of native birds declined severely in that area.

#### 4.3.6. Pollutions

The pollutions of air, water and land are killing vast varieties of birds, insects and aquatic organisms. The use of different types of deadly pesticides in agriculture is causing mass scale deaths of field sparrows, pea cocks and other birds. **The population of the white-backed vultures is declining** due to the presence of *diclofenac* in the dead bodies of cattle once treated with this anti-inflammatory drug. Fortunately, our scientists have become successful in synthesizing a new alternate drug named *Meloxicam*. Now the application of diclofenacs has been banned in India.

### 4.4. NEED OF CONSERVATION AND MANAGEMENT OF WILDLIFE

We know that our environment cannot remain complete or balanced without the existence of wildlife. We need to conserve and manage our wildlife due to following reasons-



**Fig. 4.2.** A vulcher dead due to consumption of Diclofenac - containing flesh of a dead animal.

1. Living organisms regulate gaseous composition of atmosphere, hydrological cycles, and climate and soil fertility.
2. Marine organisms are important for the protection of coastal zones.
3. Micro- organisms and certain other animals are important for the disposal and breakdown of wastes.
4. A large number of insects, birds and other animals are associated with the pollination of crops and other flowers.
5. Plants play important roles in the absorption of pollutants.
6. Wild organisms serve as important sources of medicines for human health. As per reports of UNEP-2000, out of 25 top selling drugs in 1997, 10 were derived from wild sources alone. The global market value of medicines derived from wild sources has been estimated to be US\$ 75000 to 150 000 million annually. About 75 percent of the world population rely for health care on traditional medicines that are directly derived from plants and animals growing in the wild.
7. Wild life are regarded as social, cultural, and national assets in India. Hence, we have National Bird and National Animal as well as State Bird and State Animal on government levels.
8. Wildlife constitutes the biological basis for world food security and support for human livelihood. So many types of wild plants are of great importance to global and national economies. They are our important genetic resources also.

## 4.5. MEASURES OF CONSERVATION AND MANAGEMENT OF WILDLIFE

India has a rich heritage of wildlife. It has a long history and tradition of conservation of plants and animals. Principles of conservation are mixed in religious texts and practices in this country. **Kautilya's Arthashastra** contains the concept of making **Forest Reserves** (Abhayaranyas) for the protection of state elephants during 3<sup>rd</sup>. century B.C. Conservation of wildlife has been put into two major categories-(A) **in situ** conservation or “on-site conservation” in which wildlife is conserved inside National Parks, wildlife Sanctuaries and biosphere reserves ; (B) **ex-situ** conservation or “conservation outside the natural habitat of wilflife” Keeping Gene-Banks, microbial culture and

captive breeding are some examples of ex-situ conservation. Following are some of the most important measures that are being taken up for the conservation and management of wildlife in India and abroad –

#### 4.5.1. NATIONAL PARKS

**A National Park is an area protected and preserved by law for the protection and preservation of flora and fauna within its boundary.** Grazing of cattle, removal of any wildlife from its habitat is strictly prohibited in a national park and all rights are reserved with the government. **The law defines a national park as an area which is of ecological, faunal, floral and geomorphologic importance.** The Corbett National Park, established in 1935, is considered to be **India's first national park.** *The yellow Stone National Park -USA, is considered as first national park in the world.* It was established in 1872 and it has an area of 8983sq km.

According to a report, William Henry Jackson, a photographer and Thomas Moran, an artist, visited Yellow Stone region in 1871 and brought several photographs from there. Those photographs moved the public of America and US government and persuaded them to preserve the area. President Ulysses S. Grant signed a bill creating Yellow Stone a, National Park in 1872.

There are 80 national parks in India. Some of those important national parks are being briefly introduced here.

**1. Corbett National Park:** Spread along the bank of the river Ramganga in Uttarakhand (earlier U.P.), it is India's First National Park, which was constituted in 1936. This park is spread in an area of 52,082 hectares. Important wildlife kept in this park are – tiger, elephant, deer, wild boars, otters and a number of species of birds.



**Fig. 4.3.** Scene of a National Park. (Gate of Kanha National Park)

**2. Hazaribagh National Park:** Located in Hazaribagh district of Jharkhand state, this national park has a wide variety of animals like wild boar, sambhar, nilgai, tiger, leopard, sloth bear, hyena, and gaur. It has an area of 184 km of thick tropical forest. This national park was notified in the year 1976 and its total area is 18, 625 hectares.

**3. Kanha National Park:** This Park is basically a Tiger Reserve. It is located in Madhya Pradesh. Some important animals kept in this park are –leopards, langurs, mongoose, Cats, hyena, porcupine, etc. Sal and bamboos are principal trees in this park besides wide variety of other plants. This national park was notified in the year 1955 and its area is 94, 000 hectares.

**4. Bandhav Garh National Park:** This Park is located in Madhya Pradesh. The principal animal kept in this park is the White Tiger. Notified in the year 1968, this nation park is spread in the area of 44,884 hectares.

**5. Kajiranga National Park:** It is located on the bank of the river Brahmaputra in Assam. It is famous for one Horned Rhinoceros. Besides rhinos, other animals protected in the park are swamp deer, bison, tiger, leopard, hoolock gibbon, wild buffaloes, pythons, monitor lizards, elephants etc. Principal plants found in the park are tall elephant grass, Sal trees and different types of bushes. This national park was notified in the year 1974, and its area is 42, 996 hectares.

**6. Dudwa National Park:** Located in Lakhimpur Khiri district of Uttar Pradesh, this National Park supports wide variety of wild animals including re- introduced one- horned rhinos and swamp deer etc. Other animals in this park are – crocodiles, leopards, jackals, sambhars and sloth beers. Principal plants comprise grass species, Sal trees etc. This national park was notified in the year 1977 and its area is 49, 029 hectares.

**7. Pench National Park:** Located on the southern edge of Madhya Pradesh, this park is named after the river Pench which flows through this park from north to south. It is the **19<sup>th</sup> Project Tiger Reserve** in the country. This national park was notified in the year 1977 and it is spread in the area of 29, 286 hectares.

**8. The Sundarban National Park:** Located in Sundarbans in West Bengal, this national park has an area of 11, 710 hectares. This is the principal habitat of Royal Bengal Tigers. This park has largest mangrove vegetation in the world. Other animals supported by this park are deer, chital, rhesus monkeys etc.

**9. Dachigam National Park:** This National Park was notified in the year 1981 in the Jammu and Kashmir (India). This park has an area of 14, 100 hectares. Some of the animals protected in this park are Kashmiri Stag and Hangul.

**10. Gir Forests:** This National Park is located in Kathiawar district of Gujarat state of India. This national park was notified in the year 1965. It is spread in an area of 115, 342 hectares. It is famous for Gir Lions.

**11. Ranthambor National Park:** This National Park is located in Rajasthan state of India. Constituted in the year 1980, this park is spread in an area of 39, 200 hectares. The principal wildlife protected in this park is crocodile, nilgai, gazelle, sambhar etc.

**12. Palamu National Park:** Located in Dalton Ganj District of Palamu area of Jharkhand (previously in Bihar) state of India. This National Park was notified in the year 1986. It has an area of 21, 300 hectares. The flora of this national park comprises thick tropical forests due to which it has been selected for the Project Tiger, an ambitious project for the protection and propagation of tigers

in India. The fauna of this national park comprises tiger, elephant, deer, panther, sloth bear, chital, gaur, nilgai, chinkara, and mouse deer etc.

**13. Simlipal National Park:** Located in the district Mayurbhanj of Orissa state of India, this National Park comprises dense Sal forest due to which this park has been chosen for the Project Tiger. The fauna of this national park comprises tiger, elephant, deer, pea foul, talking mainas, chital, sambhar, panther, gaur, hyena, and sloth bear. Notified in the year 1978, this national park is spread in the area of 135,500 hectares.

**14. Tadoba National Park:** Located in Chandra Pur district of Maharashtra state of India, this National Park was notified in the year 1955. It is spread in an area of 11, 655 hectares and it supports the populations of tiger, sambhar, sloth bear, lion, chital, chinkara, barking deer, blue bull, four horned deer, langur, pea foul and crocodile.

#### **4.5.2. Wildlife Sanctuaries And Biosphere Reserves**

##### **A. WILDLIFE SANCTUARY**

**A Sanctuary is a protected area where wild animals and birds are kept and encouraged to increase their population.** Presently, there are more than 490 sanctuaries in India covering a total area of 1, 48,848 sq km.

**In wildlife sanctuaries, rare and endangered species are encouraged to breed in human controlled environments with restricted settings. This is called as captive breeding.** This is a successful technique to increase the populations of rare and endangered species of animals. When the populations of such animals are increased through captive breeding in the captivity the animals are safely released into the wild.

**The technique of captive breeding has following advantages –**

1. It helps to increase the populations of rare and endangered species of animals and to save these animals from extinction.
  2. The birth rates, hatching rates and survival rates of captivity –produced animals remains much higher than in case of higher bleedings.
  3. This technique helps us to raise the population of wild animals up to the desired levels.
  4. This technique is useful in developing desired characters or traits in organisms.
- Some important wildlife sanctuaries are being introduced here in [Table 4.2](#).

**Table 4.2. Some important wildlife sanctuaries in India**

S. N.	Name of Sanctuary	State of India	Area	Plants and Animals protected	Year Notification
1.	Bandipur Sanctuary	Karnataka	874 Sq km	Thick forest gaur, leopard, elephant, wild dog, chital, panther, barking, deer, langur	1941
2.	Bharatpur Bird Sanctuary (keoladeo Ghana)	Rajasthan	29 Sq km	indigenous water birds, migratory birds black buck etc.	1981
3.	Gir wildlife sanctuary	Gujarat	1295 Sq km	asiatic lion, spotted deer, antelope, crocodile, birds etc.	1965
4.	Jaladapara wildlife sanctuary	West Bengal	65 Sq km	rhinoceros, gaur, elephant, tiger, deer, reptiles, birds, etc.	1941
5.	Mudumalai wildlife sanctuary	Tamil Nadu	—	wild, elephant, sambhar, barking deer, mouse deer, tiger, panther, bornet monkey	1940
6.	Manas wildlife sanctuary	Assam	430 Sq km	rhinoceros, elephant, wild buffaloes, bison, tiger, birds, etc.	1928
7.	Mundanthurai wildlife sanctuary	Tamil Nadu	520 Sq km	panther, tiger, sambhar, chital etc.	1962
8.	Periyar wildlife sanctuary	Kerala	77 Sq km	wild elephant, gaur, leopard, nilgai, langur etc.	1950
9.	Sariska wildlife sanctuary	Rajasthan	800 Sq km	water birds, tiger, sambhar, bison, chital, crocodile etc.	1958
10.	Chandra Prabha wildlfe sanctuary	U.P.	—	Crocodile, second home of Gir lion	1957
11.	Dalma wildlife sanctuary	Jharkhand	—	Elephant, deer, sambhar, birds, etc.	1976

**There are following differences between a National Park and Wildlife Sanctuary**

1. The boundaries of a National Park are usually well marked and circumscribed whereas those of sanctuaries are often not well defined.
2. A National Park is established under the provisions of Section 35, section 38(2), and Section 66(3) of the Wild Life (Protection) Act of 1972. On the other hand a Wildlife Sanctuary is an area that is established under the provisions of Section 26-A, Section 38(1), and Section 66(3) of this Act.
3. An area can not be notified as a National Park, if it is a reserve Forest. However this is not the case with a Wildlife Sanctuary in which an area can directly be notified as a Wildlife Sanctuary even if it is a reserve forest.
4. As defined by IUCN (1975), a National Park is a large area of land containing ecosystems that have not been materially altered by human activities, and including plant and animal species, landscape features, and habitat of great scientific interest, or of beauty, or recreational or educational interest; and the public is allowed to visit it for inspirational, cultural, and recreational purposes. On the other hand an Area set aside by the state to protect characteristic wildlife, especially migratory bird communities, or to protect threatened animal or plant species etc. is called as a Wildlife Sanctuary. All forms of hunting, killing or capturing of wildlife are prohibited except for scientific research authorized by the minister.
5. A national Park is established by the government in view of protection of all the flora and fauna of certain area. But a Wildlife sanctuary is meant for the protection, breeding and propagation of individuals of an endangered species.

In spite of some differences, National Parks and Wildlife Sanctuaries have basic **similarities**. It can be said that both the National Park and the Wildlife Sanctuary are protected areas, and no biotic interference is allowed in both of these areas. Both of these protected areas are established in India under the provisions of the Wild Life (Protection) Act of 1972. Both of these are small forest reserves ranging on an average to the area of 100 sq Km to 500 sq Km.

## B. BIOSPHERE RESERVES

*A specified area in which multiple use of land is allowed by dividing it into different zones and each zone, of which remains specified for a particular activity, is called as Biosphere Reserve.*

A number of biosphere reserves have been established by *United Nations Educational Scientific and Cultural organisation (UNESCO)* under its *Man And Biosphere Programme (MAB)-1986* in different countries. The biosphere reserves have international networks.

Each of the biosphere reserve has been divided into three zones-

- (a) *Core Zone*, where human interference is banned completely.
- (b) *Buffer Zones*, where human interference is allowed up to limited extent.
- (c) *Manipulated Zone or Transition Zones*, where humans are free to perform their activities.

The biosphere reserves are planned, managed and protected through joint efforts of the government, non-governmental organizations and the local people.

**India has declared 14 areas as biosphere reserves. These areas are aimed at –**

- (i) Conservation of biodiversity (species, ecosystem, and landscapes).
- (ii) Development of economic and human infrastructures.

(iii) Promotion of education, information – exchange and research pertaining to conservation and development.

### **The Biosphere Reserves have following functions-**

1. The biosphere reserves are helpful in the conservation of ecosystems, species and other resources.
2. The biosphere reserves are helpful in the promotion of economic development.
3. Biosphere reserves are helpful in promoting scientific research and education.

**Wet lands** are habitats for a large number of species of plants and animals. What are wet lands?

Well, these are areas where the water table is just beneath or at the land surface. In wet lands, the land is covered by shallow water. These lands play important roles in the regulation of water. In India, about 18 percent of land is covered by wet lands but most of them are under cultivation of paddy crop. The Indian Government has enacted laws for the preservation of wet lands and protection of wildlife.

Being inspired by the importance of wet lands, the world community came down to develop Convention on Wetlands of international importance. The **Ramsar Convention** on the conservation and Management of Wetlands was held in on February 2, 1971 in the Iranian city Ramsar, which provided a framework for national actions and international co-operation on this issue. February 2, is celebrated as the “World Wetland Day” across the globe.

### **4.5.3. Breeding Programmes for Endangered Species**

In India, efforts are underway to address the problem of species loss and extinction. Seriously threatened wild animals are being bred in captivity. When their population increases, animals are released to go in the wild and to live freely. It is through captive breeding that the population of Hawaiian goose or nene has increased over 2500.

India has a goal of covering one third of its land area with existing or planted vegetation. It has achieved tremendous success in species conservation through its **breeding programmes**. The **Project Tiger** and **Crocodile Breeding and Management Project** are two world renowned programmes of increasing the populations of tigers and crocodiles respectively. **Some of the principal aims of these projects are conservation and management of these animals, raising their population and maintaining biodiversity and ecological balance.**

Under Project Tiger, 9 special Tiger Reserves covering an area of 37761 sq km have been established for breeding and increasing the population of tigers. Corbett National Park, Bandhav Garh National Park, Kanha National Park, Sundarbans National Park are some major reserves under this project. Due to this, the population of tigers in the country doubled by 1989. The Project Tiger was launched during the period of 1973-74. WWF offers technical and financial assistance to the project.

Another ambitious project which aims at long term survival of the existing population of elephants is the **Project Elephant**. This project was started in the year 1992 in 12 states of India.

### **4.5.4. Prevention of Poaching, Hunting and Bio- Piracy**

Poaching, Hunting and Bio- piracy are terms that relate to gradual extinction and destruction of our biotic resources due to human activities, usually oriented towards commercial benefits. However, these terms are very much different in their meanings from each other. So, let us discuss these terms separately.

## A. POACHING

*According to law, shooting, trapping or taking of game or fish from private property or from an area where such practices are especially reserved is called as Poaching.* In other words, **poaching is an illegal practice of hunting and killing of game or fish, for food and commercial benefits.** But, **what is the game?** Well, wild animals, birds or fish, that are hunted for sporting and getting their flesh, is called as GAME. Game is the term, often applied to edible portion of wild animals (poultry, wild birds and mammals) also.

## B. HUNTING

*The practice of chasing and killing wild animals and birds as a sport or for food is called as hunting.*

In 17<sup>th</sup> and 18<sup>th</sup> centuries laws were passed to restrict the right of hunting to landlords, kings and their sons. Due to this, illegal hunting in the legally forbidden areas was started by gangs of organised hunters or poachers who used to hunt by breaking the law. **Poaching** is a profession similar to that of a thief but unlike the profession of a thief, the profession of a poacher involves chasing, deceiving and capturing a wild animal, killing it or cutting out its body parts for trade, without letting any one ( govt. or any law enforcement agency ) know about his activities. Now that hunting has been banned altogether, the illegal hunting i.e. poaching is going on almost in every part of the world for illegally gaining big commercial benefits.

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CITES or Convention on International Trade in Endangered species have framed International Laws to be applicable world wide. These laws protect endangered species and limit the illicit trade in wildlife, in their body parts and in the products derived by killing them across the world. This convention was drawn by the United Nations in 1973 and it came into force in 1975 when 18 nations of the world including the United Nations, signed an agreement to co- operate in the enforcement of laws framed by CITES for **the international safeguard of wildlife**. By January 1, 1998, 143 nations of the world had become members of this international organisation. The CITES is concerned with the international co- operation to control only the illegal trade in endangered species whereas the TRAFFIC is concerned with the monitoring of both the legal as well as the illegal trade in wildlife across the world.

On international level, the IUCN and the WWF established Trade Records Analysis of Flora and Fauna in International Commerce (TRAFFIC) in 1976. The secretariat of the TRAFFIC has strengthened the efforts of the International Community to monitor and control illegal trade in wildlife and in their body parts. On the National Level we have different laws that are in force to check poaching and hunting of animals and also to check trade in their body parts. The Convention on **International Trade in Endangered Species** (CITES) of wild flora and fauna, the Interpol, World Custom Organisations and a large number of organisations on global level, are establishing networks to check the international trade in animals and in their body parts or in their products derived by killing them mercilessly.

## C. BIOPIRACY

**The illegal collection and patenting of the biological materials originally belonging to some other community, state or nation; is called as the bio-piracy.** The **Patenting** is the act of gaining an official right of ownership. By patenting any thing or any biological material, a person, a corporation, a research institution or a country gains the officially legal authority of being the only owner of that

thing or the biological material.

### The term Bio-piracy relates to-

- (a) illegal unauthorised use of biological material like plants, animals or their products,
- (b) illegal and unauthorised use of traditional knowledge of some other society or community about the application of certain biological product(s),
- (c) unlawful sharing in the benefits by the patent holder and deprivation of indigenous communities or people who are the real owner of the biological material / knowledge used for making benefits.

### 4.5.5. ENFORCEMENT OF LEGAL PROVISIONS

The Article 48-A of the Indian Constitution directs;

“The State shall endeavour to protect and improve the environment and to safeguard the forests and **wildlife** of the country.”

Further, Article 51–A (g) of the Indian Constitution has imposed the duty on Indian citizens-

“to protect and improve the natural environment including forests, lakes, rivers and **wildlife**, and to have compassion for living creatures.”

Thus, the Indian Constitution has laid a joint responsibility on both the state and every citizen of India to protect the natural environment and to check its deterioration.

Earlier legislations of most of the countries were environmentally blind, probably because, the ill effects of the environmental problems had never been felt so deeply. The first cases to attract the attention of people of India towards animals were “**Cruelty to Animals**”, and the “need of protecting wild elephants”. In order to prevent the infliction of unnecessary pain or suffering on animals and for that purpose to amend the law relating to the Prevention of Cruelty to Animals an act was passed on December 26, 1960 by the Indian Parliament.

(1) This Act is called as the Prevention of Cruelty to Animals Act- 1960.

(2) It extends to the whole of India, except the State of Jammu and Kashmir.

*It has been stated in the act that- It shall be the duty of every person having the care or charge of any animal to take all reasonable measures to ensure the well-being of such animal and to prevent the infliction upon such animal of unnecessary pain or suffering*

This act bans all types of atrocities often done by human beings on animals. How ever, it was thought that the act was ineffective in certain cases. Hence it was amended in 1982. According to the amendment; it shall be the duty of every person having the care or charge of any animal to take all reasonable measures to ensure the well being of such animal and to prevent the infliction upon such animal of unnecessary pain or suffering. In pursuance to this act, some norms for transporting animals from place to place without hurting them have also been laid down. In this spirit, an amendment was made in this act in 2004, in it's Section 38 to ensure safe and comfortable transport of animals. . So far, the government of India has formulated about 200 laws including their amendments, for the protection of wildlife. The other act is the **Wildlife Protection Act- 1972**. Following are the objectives of the **Wildlife (Protection) Act 1972** – (also see enviro\_Facts: 16.2.)

1. The protection and preservation of different species of plants,
2. Ban on the hunting of wildlife and the organisation of Wildlife Authority,
3. Declaration and organisation of wildlife parks, protected areas, bio- reserves, wildlife sanctuaries, zoos and Central Zoo Authority of India,
4. Penalties for violations of directives and legal provisions,

## TOWARDS A BETTER ENVIRONMENT...

The monitoring and management of endangered species has been made easier by the application of microchips. Today a tiny microchip bearing address of a particular animal is hiddenly implanted in the body of an animal. In case of piracy, the animal can be recovered and re-established in its original habitat as it can be traced by establishing a connection with the microchip. Microchips are being used by veterinarians also, for the identification of individual endangered animal. Earlier, the microchip technology was used in the management of captive breeding programmes only. But now, experts are using this technology to mark wild animals to mark inconspicuously.

### IMPORTANT DEFINITIONS

<b>WILDLIFE</b>	:	All the undomesticated organisms (plants, animals and micro- organisms ) are called as wildlife.
<b>CONSERVATION MANAGEMENT</b>	<b>AND</b>	Protection, preservation, and propagation of resources through planned efforts is called as conservation management of resources.
<b>IUCN- RED LIST</b>	:	A data- list published by conservation- union (IUCN) from time to time. It incorporates names of species of wildlife that are threatened with extinction.
<b>MAMMAL</b>	:	An animal having mammary glands, like cow, goat, elephant, bat, rat, dog and human being.
<b>EXTINCTION</b>	:	The condition when no live individual of a particular species exists anywhere in the world either in-situ or in ex- situ.
<b>BLEACHING OF CORAL REEFS</b>	:	Discolouration and deaths of corals in coral reefs due to rise in the global oceanic temperatures, is called as bleaching of coral reefs.
<b>HUNTING</b>	:	The practice of chasing and killing wild animals and birds as a sport or for food are called as hunting.
<b>POACHING</b>	:	Shooting, trapping, or taking of game or fish from private property or from a place where such practices are especially reserved is called as poaching.
<b>INVASIVE SPECIES</b>	:	Foreign organisms that colonise native ecosystems are called as invasive species.
<b>NATIONAL PARK</b>	:	An area protected and preserved by law for the protection and propagation of flora and fauna within its boundary is called as a national park.
<b>SANCTUARY</b>	:	A protected area where wild animals and birds are kept and encouraged to increase their population is called as a sanctuary.
<b>PROJECT TIGER</b>	:	It was a project launched in India in 1973 for the protection and breeding of tigers so as to increase their population. Different tiger reserves were established in different parts of the country under this project. It was by 1997 that the number of tiger reserves, rose up to 27 and the number of tigers rose up to 1500, in India.
<b>PROJECT ELEPHANT</b>	:	It was a project launched in India so as to protect the population of wild elephants .This project was launched in 1992 simultaneously in 12 states. Inspite of this project, the population of wild elephants is coming down due to massive deforestation and disruption of their migration routes by human activities.
<b>PROJECT CROCODILE</b>	:	It is a project formulated to protect crocodiles from the impending danger of their extinction in 1975. Under the project crocodile breeding centres were established on different places of the country in order to increase their population. Today, more than 30 centres are in operation across the country.
<b>WETLAND</b>	:	Areas where water table is just beneath or at the land surface.

# MODEL QUESTIONS AND EXERCISES

## I. VERY SHORT ANSWER TYPE QUESTIONS

1. Why are species of toads and frogs vanishing fast from the world?
2. In which district of Jharkhand state is the Hajari Bag National Park situated?
3. Which sanctuary has been considered as the second home for Gir lions?
4. Which national park is considered as the first national park in the world?
5. When did the Ramsar Convention take place? For what purpose was this convention organised?
6. Write full forms of – WWF, CITES, IUCN, TRAFFIC.
7. What is the basic reason behind the bleaching of coral reefs?

## II. SHORT ANSWER TYPE QUESTIONS

(2 marks each)

1. Define –
  - (i) National Park
  - (ii) Sanctuary
  - (iii) Poaching
  - (iv) Hunting
2. What do you mean by the term wildlife?
3. (i) Define biodiversity.  
(ICSE 2010)
- (ii) State two aims of Project Tiger.  
(ICSE 2010)
4. What are important causes that have put the wildlife in distress?
5. What is a National Park? Distinguish between a national park and a wildlife sanctuary.  
(ICSE 2007)
6. What is a rare species?  
(ICSE 2005)
7. How is the change in the climate associated with the extinction of species of some wild animals?
8. Name any two Acts in India that are aimed at conservation of wildlife.  
(ICSE 2007)
9. Define Endangered species.  
(ICSE 2006)
10. Mention two objectives of wildlife protection Act 1972.  
(ICSE 2006, 2008)
11. State one advantage and one disadvantage of captive breeding.  
(ICSE 2008)
12. What do you mean by the Invasive Species? How can invasive species cause extinction of other species?
13. Why is it essential to protect wildlife? OR What is the need of conservation and management of wildlife?
14. What is Bio-piracy? What are its different forms?  
(ICSE 2008)
15. What is a Biosphere Reserve? How is it helpful in the conservation of wildlife?
16. State any two objectives of the Wildlife (Protection) Act, 1972.  
(ICSE 2010)
17. Expand : CITES, TRAFFIC  
(ICSE 2010)
18. What do you mean by the term wildlife?  
(ICSE 2010)
19. Discuss any four causes for the loss of biodiversity.  
(ICSE 2010)

## III. DETAILED ANSWER TYPE QUESTIONS

(4 to 6 marks each)

1. What do you mean by the conservation and management of wildlife? Why is it essential?
2. What are principal measures adopted for the conservation and management of wildlife? Describe any two of them.

3. Mention different factors that threaten wildlife in nature and describe any two of them.
4. What is Captive Breeding ? Mention any four advantages of captive Breeding.

(ICSE 2007)

#### IV. OBJECTIVE TYPE QUESTIONS

##### A. Multiple Choice Type Questions

Tick (✓) the correct option

1. The term wildlife relates to –
  - plants
  - animals
  - plants and animals in the wild
  - only animals
2. The number of species of mammals declared threatened on the global level as per the red list of IUCN is –
  - 1130
  - 182
  - 180
  - 168
3. The bleaching of coral reefs is caused by –
  - Climate change
  - Ozone layer depletion
  - Acid Rain
  - Water Pollution
4. The predatory snail species *Euglandina rosea* is –
  - invasive species
  - extinct species
  - domestic species
  - endangered species
5. Which one is considered as India's first national park –?
  - Hajari Bagh National Park
  - Pench National Park
  - Gir Forest
  - Corbett National Park
6. The word 'Ramsar' is associated with –
  - Ram
  - wet land
  - national park
  - an ocean

##### B. Fill in the blanks

1. India has a rich ..... of wildlife.
2. Increasing use of nitrogenous fertilizers is causing deposition of ..... in the soil.
3. Foreign species that colonise native ecosystems are called as ..... species.
4. The Palamau National Park is located in the state of .....
5. Unauthorised collection and patenting of biological materials is called as .....

##### C. True/False

Write T against the statement which is true, and F against the statement which is false.

1. India has a national goal of covering one –fifth of its land area with existing or planted vegetation.
2. All the forests of a country are called as its wildlife.
3. Vast areas of land are being converted into agricultural lands.
4. Embryos of salamanders are dying out due to ultraviolet radiations reaching to the earth.
5. The concept of developing Abhayaranyas (forest reserves) was first developed in India by Kautilya.
6. The Pench National Park is situated in the United States of America.
7. A number of Biosphere Reserves in India have been established by United States of America.

ANSWERS

## I. VERY SHORT ANSWER TYPE QUESTIONS

1. Species of toad, frogs, and salamanders are vanishing due to climate change. 2. Jharkhand, 3. Chandra Prabha Sanctuary, Varanasi, 4. Yellow Stone National Park, USA, 5. 1971; Conservation of Wetlands, 6. WWF= World Wildlife Fund, CITES = Convention on International Trade in Endangered Species of wild fauna and flora, IUCN =International Union for Conservation of Nature and Natural Resources. 7. Global Warming.

## IV. OBJECTIVE TYPE QUESTIONS

### A. Multiple Choice Type Questions

1. (c), 2. (a), 3. (a), 4. (a), 5. (d), 6. (b)

### B. Fill in the blanks

1. heritage, 2. nitrogen, 3. invasive, 4. Jharkhand, 5. bio-piracy

### C. True / False

1. F, 2. F, 3. T, 4. T, 5. T, 6. F, 7. F.

# PROJECTS & ACTIVITIES

## Act for Environment

### 4.1. FIELD TRIP (Group Activity)

(a) Visit a forest area. Record instances of tree-cutting and natural death of trees.

(b) Select a tree for your study. Stand below it. First try to identify it. Then see its different parts\_stem, branches, leaves, flowers and fruits. Record your observation in the following format—

1. Animal activity on and around the trees:

- (i) Number of insects moving around the tree.
- (ii) Number of insects moving on the trunk.
- (iii) Number of organisms found under the bark.
- (iv) Number of nests on the tree, and names of the birds living in tree.

2. Measure the trunk with a measuring tape, and record it.

3. Collect fruit/seed. Don't climb. Just record while standing on the ground. Observe a fruit and note its special features that help in its dispersal.

Make a report of your findings. Show it to your teacher.

### 4.2. PROJECT FORMULATION AND PROJECT WRITING

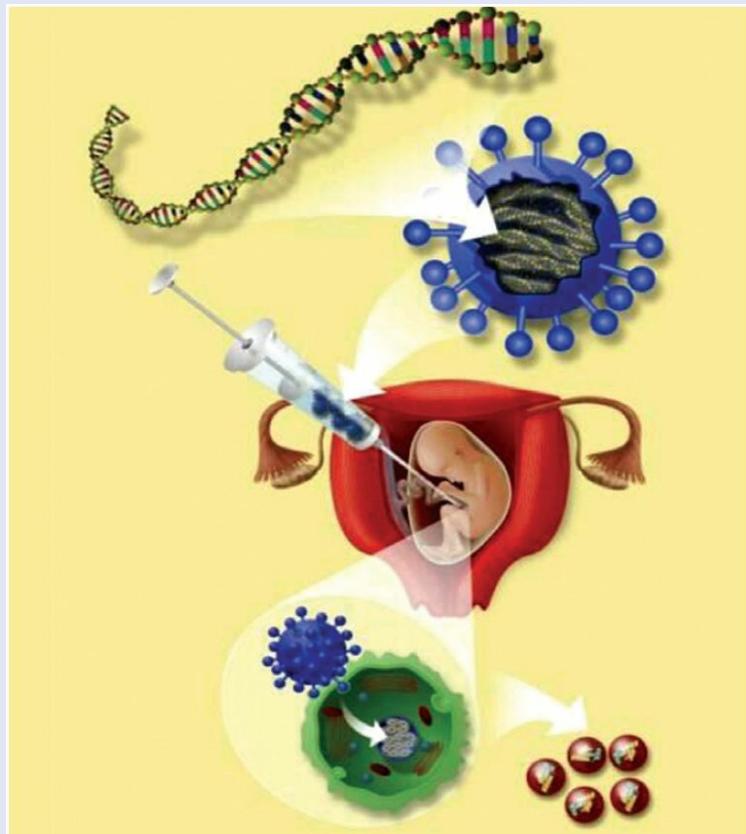
Prepare a project on the protection and welfare of birds in your area and write a Project Report.

### 4.3. DEBATE

Organize a debate in your class on the topic – Animal Sacrifice: Should it be banned?

# Bio-Technology and Its Applications

## FACTS & CONCEPTS



- ◆ Introduction : What is Bio-Technology?
- ◆ The Origin and Development of Bio-Technology
- ◆ Scope of Bio-Technology
- ◆ Bio-Technological Applications
  - ◆ Specific Applications
  - ◆ General Applications
  - ◆ Application of Biotechnology in Environmental Conservation

### 5.1. INTRODUCTION

#### What is biotechnology?

The scientific knowledge which is applied to practical ways in industry for the benefit of human beings is called as technology. The biological sciences have recently passed through more advanced technologies in different spheres of life and activities. One of those advanced technologies is the Bio-technology.

**The applications of advances made in the techniques and instrumentations in research in biological sciences are called as Bio-technology.** Some people define bio- technology as – **the manipulation of organisms to make products that benefit human beings.** In this chapter, we are going to study about bio- technology and it's different applications in order to make a better world.

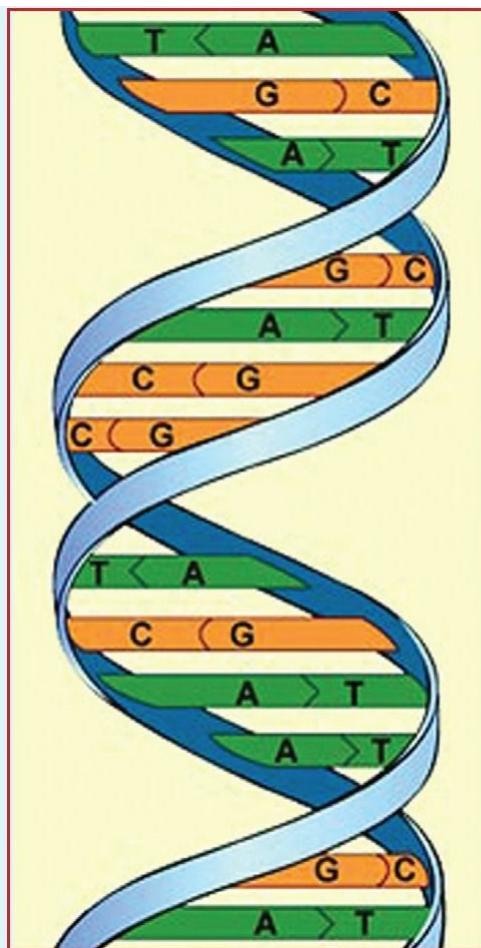
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### DNA- THE BASIS OF BIOLOGICAL ACTIVITIES



**Fig. 5.1.** Rosalind Elsie Franklin(1920-1958) : The Pioneer of the discovery of DNA.

The characteristics of a living organism are determined by some physical units called as genes that are arranged on chromosomes found inside the nucleus of a cell. A gene is made of molecules of deoxyribonucleic acid (DNA), which is called as the Genetic Blue Print of each living cell. The characteristics and structure of DNA was studied by Rosalind Franklin, Francis Crick, James Watson and Maurice Wilkins (1953), for which Crick, Watson and Wilkins were awarded Nobel Prize for the year 1962. The contribution of Rosalind Franklin remained un-noticed and she died four years earlier to the award of the Nobel Prize to her fellow workers. Later, Dr. H.G. Khorana, R.H. Holley and M.W. Nirenberg were awarded Nobel Prize for the year 1968, for their pioneering works related to the synthesis of gene. These studies of gene and DNA formed the basis of development of biotechnological studies in India and abroad. The presentation of double helical model of DNA and discoveries pertaining to gene, mark the beginning of the modern era of Bio- technology.



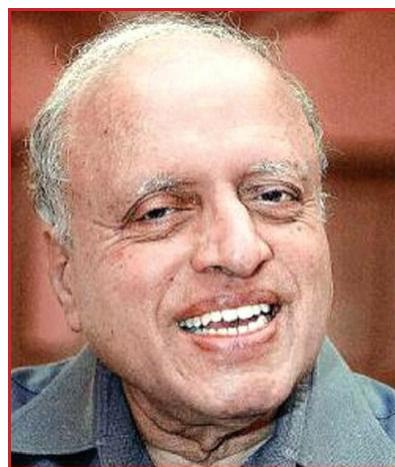
**Fig. 5.2.** Helical Structure of DNA Molecule.

## 5.2. THE ORIGIN AND DEVELOPMENT OF BIO- TECHNOLOGY

The pioneering achievement in the field of Bio- technology was the production of greater genetic varieties of plants and animals through the techniques of **Hybridization** in 5000BC. It was through hybridization that present day **High Yielding Varieties** of plants and animals were evolved. This technique is being continuously used in improved forms in our programmes concerned with food production. **Norman E. Borlaug**, the American Agriculturist, received the Nobel Prize for the year 1970 for his important contribution of increasing the world food supply through different techniques like hybridization, Selective Breeding and Gene Transfer. **Hybridization is the technology or process of crossing individuals of opposite sex of different species so as to produce off springs of combined character.** The Indian Scientist **Dr. M.S. Swaminathan** (1967) initiated and developed technologies for increasing food production in India. Dr. Swaminathan is now being called as the **Father of Economic Ecology**.



Norman E. Borlaug



Dr. M.S. Swaminathan

**Fig. 5.3.** Norman E. Borlaug (left) and Dr. M.S. Swaminathan (right).

In 1960, **Werner Arber** discovered specific enzymes called as **Restriction Enzyme** in bacteria. These enzymes can cut the DNA strand of an organism at a precise point. Further, in 1973, **Stanley Cohen** and **Herbert Boyer** became successful in removing a specific gene from a bacterium and inserting it into another bacterium by the application of the restriction enzyme. This discovery led to the development of the **Recombinant DNA Technology** which is commonly called as **Genetic Engineering**.

Another major achievement in the field of biotechnological development was the manipulation of bacteria to produce **Human Protein** (1977). Afterwards, the American Molecular Biologist Lydia Villa- Komaroff developed basic bio- technology for the production of **Rat Insulin** with the help of genetically engineered bacteria. By using genetically engineered bacteria, scientists became successful in producing **Human Insulin** in 1978 and within a period of 5 years the Human Insulin became the **first biopharmaceutical product** in the market to control **Diabetes Mellitus**.

### 5.3. SCOPE OF BIO-TECHNOLOGY

Bio-technology has scope in the fields of Agriculture and Animal Husbandry, Molecular Medicine, Forensic Science, Microbial Genetics, Environmental Sciences etc.

### **5.3.1. Agriculture and Animal Husbandry**

The scope of bio- technological applications in Agriculture and Animal Husbandry is concerned with- the development of disease and pest resistant varieties of plants and animals; the production of food containing high nutrient value; the production of vaccines and the development of drought resistant crop varieties.

### **5.3.2. Molecular Medicine**

This field of Bio-technology incorporates-disease diagnosis through cultural and different biotechnological methods and through Gene Therapy (cure of diseases through improvement and modification of genes).

### **5.3.3. Forensic Science**

This science relates to the identification of criminals and researches pertaining to crime. This field of bio- technology incorporates- the DNA- matching tests; the establishment of genetic relationships; DNA-mapping; DNA- Fingerprinting and Genetic Analysis etc.

### **5.3.4. Microbial Genetics**

This field of bio- technology incorporates- Study of microorganisms and their genetic make up; the study of genetic behavior and possibilities of genetic alterations; recombination etc. The microbial Genetics is also concerned with the study of bio- weapons; bio-wars and bio- fuels.

### **5.3.5. Environmental Science**

This field of bio- technology incorporates-studies pertaining to the detection of microorganisms causing health hazards; environmental pollutions and the monitoring of environmental problems concerned with the living world.

## **5.4. BIO-TECHNOLOGICAL APPLICATIONS**

The application of bio- technology can be put into two board categories: Specific Applications and General Applications

### **5.4.1. Specific Applications**

**(a) Genetic Engineering:** The experiments of Stanley Cohen and Herbert Boyer (1973) pertaining to the removal of specific gene from a bacterium and the insertion of the same gene into another bacterium, marks the beginning of the **Recombinant DNA- technology** which is also called as the Genetic Engineering. In their experiments, the “restriction enzymes” were used for cutting the segments of DNA. ***The Enzymes are specific proteins which can speed up biochemical processes without being altered in the chemical reactions.***

**The science of changing the pattern of development and behavior of an organism by making alterations in its genes is called as genetic engineering.** The organisms produced by altering genetic make up through DNA recombinant technology or through genetic engineering are

called as **Genetically Modified Organisms** or GMOs. In agriculture, GM-crops are also being produced through genetic engineering. The food produced from genetically modified crops is called as **GM- food**.

The genetically engineered organism in which a foreign gene has been introduced to obtain desired results is called as a **Transgenic Organism**. Such an organism may be a plant, an animal, bacteria or fungi. These organisms are developed by injecting a foreign gene into the embryo or the fertilized egg of an organism.

### **Importance of genetic engineering**

- ◆ Through genetic engineering the alterations in the genetic make up of an organism can be done successfully,
- ◆ Genetic engineering can be employed in increasing food production from plants and animals **by producing new strains of crops and animals.**
- ◆ It is applied in the diagnosis of diseases and improvements in the medical treatment.



**Fig. 5.4.** Tissue Culture in a laboratory.

**(b) Plant Tissue Culture:** The technique of growing plant tissues on artificial nutrient medium under laboratory conditions, so as to produce new plants, is called as plant tissue culture. These may be the Meristem Culture, Embryo Culture, Anther Culture and so on.

**(c) Monoclonal Antibody:** The specialized types of protein molecules produced in the laboratory are called as **monoclonal antibodies**. These are produced naturally in our bodies when any bacteria or virus invades it. Monoclonal antibodies are produced in our blood and these antibodies protect us from different types of diseases. These bodies are used in identifying different types of cells. These are also employed in many diagnostic tests for bacteria and viruses. The

experiments on using monoclonal antibodies for fighting against cancer are also going on across the world.

The genetic engineers have engineered the bacterial species *E. coli* to synthesize a specific protein called as **Interferon**. These proteins are produced naturally by body cells to oppose viral infections. The biologically synthesized interferon has been tested and found successful.

**(d) Synthesis of Enzymes:** The proteinaceous chemical substances of biological origin that accelerate biochemical reactions without undergoing any change are called as enzymes. The term "enzyme" was coined by William Kuhne in 1867 on the basis of his studies on yeast.

Specific enzymes can be synthesized through the application of bio-technology. These enzymes are used in various processes like removal of stains, softening of fabrics, preparation of digestible foods, processing of meat and, even the treatment of cancer.

**(e) Synthesis of Biodegradable Plastics:** Bio-technology is currently employed in the synthesis of plastic which is biodegradable i.e. unlike other plastics; this plastic can be broken down into simpler substances by microorganisms.

The biodegradable plastic is made from lactic acid which is produced at the time of bacterial fermentation of plant materials like discarded stalks of corn. In the process, molecules of Lactic Acid are chemically grouped to form the biodegradable plastic. In fact, the biodegradable plastic is a material which has most of the properties of plastic except the property of being non-biodegradable.

**(f) Blood Substitute:** Today the number of people needing blood transfusion is increasing due to frequent accidents and diseases. In view of these facts, biotechnologists are trying to synthesize artificial blood through bio-technology. The biotechnologists like **Mary L. Nucci** and **Abraham Abuchowski** (1998) are likely to get success in their experiments in this regard.

**(g) Bio-technology and Mining:** Different types of bacteria are being currently employed in the extraction of different metals like copper, zinc, lead and other metals. These bacteria act on the metallic compounds available inside the earth and help in the isolation of respective metals.

**(h) Bio-technology and Blood Clotting Protein:** Bio-technology has many types of dramatic applications in the field of medicine. It has produced **Factor- VIII** (1986), which is a blood clotting protein and which is not produced in haemophilic persons. Under these conditions the haemophilic people are always at the risk of bleeding to death. In the process of synthesis of Factor VIII, the human genes having codes of production of blood clotting protein are transplanted into the haemophilic person. The factor VIII is being produced commercially since 1992.

The biotechnology which is applied to medical processes is called as **Red - Biotechnology**. The production of antibodies and Genomic Manipulation are done under Red - Biotechnology.

**(i) Cloning:** The bio-technology of production of cells or organisms that are originally derived from a single original cell or organism by asexual method under laboratory conditions is called as cloning. The copies of organisms produced during cloning have identical genetic make up and are known as clones. We can define a clone as an individual cell or organism which has been grown by a single body cell and which is genetically identical to its parent cell.



**Fig. 5.5.** The First Cloned CAT- the - cc.

During 1950s, scientists cloned frogs and by 1980s they cloned mice. During 1996, **Ian Wilmut** and his team of researchers achieved success for the first time in cloning an adult sheep. They named the clone as **Dolly**. Scientists at Texas A & M University in College Station produced the **first cloned cat** on Dec. 22, 2001 through the **Nuclear Transfer Technique**. They named the clone – **cc** or the **carbon copy**. It is hoped that scientists may one day become successful in cloning extinct animals also.

## **CLONING OF ENDANGERED ANIMALS**

Cloning is an important technique as it is helpful in protecting endangered species as well as in bringing back extinct species of animals. An endangered ox called as Gaur of South East Asia was successfully cloned by scientists in 2000. Scientists are trying to clone some other endangered animals like African bongo, Sumatran Tiger, Giant Panda and the Mountain Goat(*Spanish ibex*).

### **5.4.2. General Applications**

**(a) Applications in Food and Beverage Industry:** A number of food products are produced on industrial scale through the fermentation technology. Some of those products are wine, idlis, yoghurt, cheese, mycoproteins, quorn, bread etc. Besides this bio- technology helps in the production of different vitamins, amino acids and vinegar etc.

**(b) Application of Bio-technology in Pharmaceuticals:** Modification of microorganisms, animals and plants so as to get maximum yield of medicinally useful substances is called as **pharmaceutical bio- technology**. Some important examples are being given below-

- (I) Production of human insulin from non- human sources.
- (ii) Production of hormones like Interferon, Cytokinins, Steroids and human growth hormones.
- (iii) Gene-therapy for prevention and control of diseases.
- (iv) Development of vaccines and antibodies.

**(c) Application of bio- technology in Agriculture:** Tissue culture, cloning and hybridization

are important bio- technologies that are promoting our agriculture today. Tissue culture is important for the propagation of high yielding varieties of plants for agriculture and floriculture. Hybridization is the technique of combining properties of two plants or animals to produce one better hybrid plant or animal. Though this process frequently occurs in nature, the adoption of this technology has supported the agriculture to produce more food to feed growing population in many countries. Similarly, hybridization technology has supported animal husbandry to produce more milk and meat.

The application of bio- technology in agriculture can make it more sustainable. The introduction of bio-fertilizers in soil can improve its composition besides making it fertile in a natural way. Similarly, the introduction of bio-pesticides can control pests through natural ways without contaminating the natural environment. The development of disease resistant and pest resistant crop varieties through bio- technological methods has further supported the agriculture.

Scientists are continuously experimenting for the improvement of crop plants like potato, tomato, cabbage and other vegetables and fruits as well as other crop plants like sugarcane, wheat, maize etc. to obtain better yield. Some new crop varieties like *Triticale* (a man made cereal) have also been developed to add nutrients in our food and increase food production. Crop-varieties producing High Yield are called as High Yielding Varieties (HYV).

#### **5.4.3. Application of Biotechnology in Environmental Conservation**

**(a) Application of Bio-technology in Pollution Control:** The natural tendency of microorganisms can be exploited through bio- technology for solving the problem of wastes in the environment. The crop residues and animal waste are used in making manure by the activity of aerobic and anaerobic bacteria. The bacterial species *Pseudomonas aeruginosa* has been developed to eat away the oil spilled on the sea surface. Solid wastes like crop residues can be put inside a biogas digester to produce biogas, a most suitable source of rural energy.

In nature, green plants control atmospheric carbon dioxide by utilizing it in photosynthesis. Hence, plantation of more and more fast growing trees may be an important bio- technological method of controlling carbon dioxide level of atmosphere. Plants fix carbon dioxide by the help of specific enzyme **Ribulose-bi-phosphate Carboxilase**. The function of this enzyme is controlled genetically. Hence, scientists are trying to manipulate this enzyme to increase the rate of photosynthesis for greater reduction of atmospheric carbon dioxide level.

**(b) Application of Bio- technology in Waste Water Treatment:** The treatment of waste water comprises three major steps- the Primary Treatment, the Secondary Treatment and the Tertiary Treatment.



**Fig.5.6.** Waste Water Treatment plant.

The **primary treatment** comprises many sub-steps like sedimentation, chemical coagulation and precipitation. These sub-steps remove most of the physical impurities or pollutants. The **secondary treatment** comprises biological process involving bio- technology of employing **bacteria, fungi, algae** etc. for the breaking down of complex pollutants. In this process, the effluent is passed through a microbial slime layer. The microbes present in this layer break down the organic and nitrogenous waste liberating carbon dioxide and nitrogen dioxide. Different types of microorganisms present in the slime layer are categorized below-

- Bacteria : *Pseudomonas* sp., *Flavobacterium* sp. and *Alcaligenes* etc.  
Fungi : *Yeast* and *Saprolegnia* sp. etc.  
Algae : *Stigeoclonium*, *Ulothrix*, *Phormidium* and *Chlorella*.

**(c) Application of Bio-technology in the degradation of pesticides:** Different species of bacteria and fungi tend to degrade pesticides. These microorganisms can be genetically manipulated to degrade more and more of them. Some species of bacteria like *Pseudomonas* sp., *Flavobacterium*, *Azotobacter*, *E. coli* and *Acromobacter* tend to degrade different pesticides. It has been reported that a mixture of *Phenerocheate* (a fungus) and enzyme peroxidase in suitable proportion can degrade DDT.

**(d) Bioremediation:** *The application of biotic agents like microorganisms in the correction and recovery of environmental damage is called as bioremediation.* The removal of oil spilled on sea water by the help of bacteria is one example of bioremediation.

**(e) Industrial Applications of Bio-technology:** Bio-technology is currently being applied in many areas of industry like the production of stain remover, detergents, bread, biotech-polyester, vitamins; stone washed jeans, bleached paper etc. Here are some examples-

- (i) Detergents containing protease enzyme can remove stains of proteinaceous nature both on fabrics and lenses,
- (ii) Detergents containing lipase enzyme can remove stains of oil and grease, and those containing amylase can remove starch grains stuck with fabrics.

Now a days, polyesters are being synthesized from corn starch feed stock through the application of bio- technology. The enzyme cellulase is used for fading of jeans. The biotechnology applied in industrial processes is called as **White Biotechnology** or **Grey Biotechnology**. It is through this technology that less resources are utilized in industrial processes.

## TOWARDS A BETTER ENVIRONMENT...

The microbial action on solid wastes breaks it into simpler form.

Some of the waste matter is converted into gases (mostly carbon dioxide, CO<sub>2</sub>) and the rest becomes simple to be taken in by plants. Fungi like *Asparagus*, *Mucor* and *Penicillium* etc. give out specific chemicals called ENZYMES. These enzymes react with wastes and break them up into simpler forms. Carbon dioxide is released in this process and the bulk of wastes is reduced. Fungi that feed on dead wastes are called as SAPROPHYTIC FUNGI. Other micro-organisms like bacteria decompose wastes under two types of conditions — (1) Aerobic conditions (2) Anaerobic conditions. Bacteria acting in presence of oxygen are called ‘aerobic’ where as those acting in absence of oxygen are called “anaerobic bacteria”.

Aerobic bacteria decompose solid wastes in air and produce carbon dioxide. They absorb nitrogen, carbon and phosphorus from the decomposed wastes. Anaerobic decomposition occurs in the absence of oxygen. Anaerobic bacteria give out enzyme which breaks down the wastes and produce Methane or Marsh Gas (CH<sub>4</sub>). The sulphur content is converted into sulphur dioxide (SO<sub>2</sub>). The nutrients like nitrogen, phosphorus and carbon etc. are then taken in by anaerobic bacteria. Very much heat (upto 80°C) is produced due to anaerobic decomposition. It kills seeds of weeds and germs present in the waste. The solid waste, for this type of decomposition has to be covered in a pit properly to cut off oxygen supply from the air.

### IMPORTANT DEFINITIONS

<b>BIO- TECHNOLOGY</b>	:	Applications of advances made in the techniques and instrumentations of research in biological sciences are called as bio-technology.
<b>DNA</b>	:	Deoxyribonucleic acid, called as the genetic blue print of each living cell.
<b>ENZYMES</b>	:	Catalytic proteins, those are produced by living cells and are helpful in mediating and promoting chemical processes of life without themselves being altered in any way.
<b>BIODEGRADABLE PLASTIC</b>	:	Plastics produced by bacterial fermentation of plant materials are called as biodegradable plastics. These are formed by chemical grouping of lactic acid.
<b>FERMENTATION</b>	:	A chemical process employed in household or industries for the manufacture of products such as alcohols, acids, cheese, etc. by the action of yeasts, molds and bacteria. This process is also known as zymosis.
<b>CLONING</b>	:	The Bio- technology of production of cells which are originally derived from a single original cell by asexual methods, under laboratory conditions. The clones are genetically identical to their parents.
<b>TISSUE CULTURE</b>	:	Growing living tissues (of plants or animals, microorganisms) on an artificial nutrient medium under laboratory conditions. This method is applied on large scale in horticulture for the propagation of plants through asexual methods. Artificial cultures are done for the propagation of disease causing microorganisms also, for their identification.
<b>MONOCLONAL ANTIBODIES</b>	:	Specialized proteins produced in laboratory for injecting into the bodies of organisms in order to develop immunity.
<b>GENE THERAPY</b>	:	The treatment of any physical problem or illness through replacement or introduction of a particular gene in the body cell of a sick person, is called as gene therapy.
<b>VACCINE</b>	:	A vaccine is a solution of weak disease causing microorganisms which is injected in the body of a person in view of developing resistance / immunity against a particular disease.

### MODEL QUESTIONS AND EXERCISES

#### I. VERY SHORT ANSWER TYPE QUESTIONS

1. Who is called as the Father of Economic Ecology in India?
2. A scientist discovered restriction enzyme in bacteria in 1960. Mention the name of this scientist.
3. Which enzyme helps plants in fixing atmospheric carbon dioxide?
4. Write the Term applied for the food modified through Genetic Engineering.
5. Name a man made creal.

## II. SHORT ANSWER TYPE QUESTIONS

(2 marks each)

1. What is the bio- technology?
2. Define Genetic Engineering.
3. What is the Tissue Culture?
4. What is the scope of bio- technology in the field of environmental science?
5. What are enzymes?
6. Mention any two applications of biotechnology.
7. Mention the role of bio- technology in medicine.
8. How is the bio- technology helpful in the treatment of wastes?
9. Mention any two advantages of biotechnology.

(ICSE specimen Question)

## III. DETAILED ANSWER TYPE QUESTIONS

(4 to 6 marks each)

1. Describe the scope of Bio- technology.
2. "Biotechnology has tremendous scope for improving the quality of life." Discuss some applications of biotechnology that are useful to mankind.
3. Explain the role of biotechnology in Environmental Conservation.
4. What is the Genetic Engineering?
5. Describe any five major applications of biotechnology in the field of agriculture.
6. Describe –
  - (i) Applications of bio- technology in the treatment of waste water.
  - (ii) Monoclonal Antibody.
  - (iii) Applications of bio- technology in pollution control.
  - (iv) Applications of bio- technology in industry.
  - (v) Application of bio- technology in the degradation of pesticides.
7. Expand: DNA, HYV.

(ICSE 2010)

## IV. OBJECTIVE TYPE QUESTIONS

### A. Multiple Choice type Questions Tick (✓) the correct option

1. The manipulation of organisms to make products that benefit human beings is called as-
  - (a) bio- technology
  - (b) biology
  - (c) technology
  - (d) conservation
2. The genetic blue print of each cell is called as –
  - (a) chromosome
  - (b) DNA
  - (c) nucleus
  - (d) gene
3. Dr. H.G. Khorana, R.H. Holley and M.W.Nirenberg were awarded Nobel Prize for their work related to the synthesis of gene for the year –
  - (a) 1968

- (b) 1971  
 (c) 1945  
 (d) 2000
4. Norman E. Borlaug, the American Agriculturist is known for his contributions related to –  
 (a) bio- technological instrumenta-tion  
 (b) food production  
 (c) plant diseases  
 (d) DNA-fingerprinting
5. The enzyme used in cutting segments of DNA is called as –  
 (a) restriction enzyme  
 (b) lipase  
 (c) monoclonal antibody  
 (d) cellulase

#### **B. Fill in the Blanks**

1. The biodegradable plastic is made from .... acid produced through bacterial fermentation of corn stalk.
2. ..... are proteinaceous chemical substances of biological origin which accelerate biochemical reactions without undergoing any change.
3. Factor- VIII is a blood clotting protein not produced in a ..... person.
4. Plants in nature produce their clones through ..... reproduction.
5. Genetic engineers have engineered the species of bacteria *E. coli* to synthesize a specific protein called as .....
6. The Recombinant DNA Technology is also called as .....

#### **C. True / False**

Write T against the statement which is True and F against the statement which is False –

1. Wine is produced through a technique known as fermentation.
2. The application of bio- technology in agriculture is a dangerous practice.
3. The application of biotic agents in the correction of environmental damage is called as bioremediation.
4. Some pesticides can be degraded by the activities of specific bacteria.
5. New DNA molecules can be created by DNA-fingerprinting technology.

## **ANSWERS**

#### **I. VERY SHORT ANSWER TYPE QUESTIONS**

1. Dr. M.S. Swaminathan, 2. Werner Arber 3. Ribulose- biphosphate- carboxylase, 4. GMO Food, 5. Triticale.

#### **IV. OBJECTIVE TYPE QUESTIONS**

##### **A. Multiple Choice Type Questions**

1. (a), 2. (b), 3. (a), 4. (b), 5. (a)

##### **B. Fill in the Blanks**

1. lactic, 2. enzymes, 3. haemophilic, 4. asexual, 5. interferon, 6. Genetic Engineering,

##### **C. True / False**

1. T, 2. F, 3. T, 4. T, 5. F.

## PROJECTS & ACTIVITIES

### Act for Environment

#### **5.1. FIELD WORK**

Contact any five farmers and find out about the indigenous biotechnological methods they apply in agriculture.

#### **5.2. PROJECT WORK**

Prepare a project on “the Application of Bio- technology for Rural Development.”

#### **5.3. AWARENESS**

Prepare a write- up for display, on the topic “Biological Alternatives to Chemical Pollutants at Home”.

# Public Awareness Programmes and Conservation

## FACTS & CONCEPTS



- Introduction : What is Awareness?
- Concepts and Issues to be incorporated in a Public Awareness Programme
- Institutions, Organizations and Individuals concerned with Public Awareness Programmes
- Means of Communication in Public Awareness Programmes.
- National Efforts and Public Awareness Programmes
- Public Awareness Programmes Concerning Conservation
- Relevance of Indigenous Practices
- Linkages of Tribal Culture with Forest Resources and their Conservation.

### 6.1. INTRODUCTION : WHAT IS AWARENESS?

Enormous stress has been laid on natural resources since last few decades. Due to this stress, a number of environmental problems have emerged out on global, national and regional levels.

Environmental problems are to be solved by the people on all the different levels through individual and joint efforts. For this, all the different problems concerning natural resources like water, soil, air, forests and others; and their causes are to be understood properly by every one including common people. Those who already understand environment, its manifestations, causes of stress etc. can devise programmes for conservation and implement those programmes involving common people. For common people, some sort of stimulation towards conservation of natural resources is necessary which can be done by creating awareness.



**Fig. 6.1.** A Public Awareness Programme in progress.

The dictionary meaning of awareness is – **Knowing or realizing something or knowing and realizing that something exists and that is important.**

In the context of environment, awareness means; **knowing about environment, realizing different types of environmental problems caused by human activities and feeling those problems with a deep sense of responsibility.**

The public awareness can be generated through different types of programmes. **What is a public awareness programme?**

Well, a programme formulated and designed to make the public know about general processes of environment, its different resources, needs and ways of conservation of those resources etc., is known as **Public Awareness Programme**.

## 6.2. CONCEPTS AND ISSUES TO BE INCORPORATED IN A PUBLIC AWARENESS PROGRAMME

The environmental problems are numerous and these problems vary from place to place on global, national and regional levels. Public Awareness Programmes are designed and conducted to develop proper insights into the basic environmental concepts and issues listed below.

1. The Biosphere and its components like plants, animals, and microorganisms,
2. Physical resources like water, air, soil etc.

3. Energy, its resources and availability,
4. Human activities causing stress on environment,
5. Nature, extent and impact of human activities and all possible measures to avert the bad impacts of these activities.

### **6.3. INSTITUTIONS, ORGANISATIONS AND INDIVIDUALS CONCERNED WITH PUBLIC AWARENESS PROGRAMMES**

The Public Awareness Programmes concerning conservation of resources like water, soil, air, forests, wild animals and others, are being carried on by governments, non-government organizations, local bodies, corporations, educational institutions, village Panchayats etc.

**International Organizations** like **WWF** (World Wide Fund for nature), **Green Peace**, **PETA** (People for Ethical Treatment to Animals) etc. are running **campaigns for the awareness regarding conservation of nature and natural resources**. The fundamental aims of these international organisations are :-

- (i) Building awareness about the importance of protection of wildlife
- (ii) Formulating, designing and implementing wildlife conservation programmes; and running campaigns across the world.

**Indian Organizations** like: the **Centre for Science and Environment**, New Delhi; **Vigyan Prasar**, New Delhi, Govt. of India; **Centre for Environment Education**, Ahmedabad; **Bombay Natural History Society**, Mumbai; **Wildlife Institute of India**, Dehradun; **Zoo Outreach**, Coimbatore, Tamil Nadu People for Animals-New Delhi, India; several government agencies and non- govt. organizations are running different types of Awareness and Conservation Programmes in most effective ways.

**Film Producers** like **Jacques Cousteau** and **David Attenborough** have made documentaries on several endangered species of animals so as to stimulate sense of conservation among masses. **Zoo 2000**, **Expedition to the Animal Kingdom**, **Earth Watch** etc. are names of some programmes designed to generate awareness. Besides these, some Television Channels work round the clock for generating awareness regarding everything related to the conservation of environment.



**Fig. 6.2.** The Vigyan Rail.

A number of books and magazines are being brought out by different organizations for the creation of awareness about the conservation of natural resources. **Down to Earth** (published by the Society for Environmental Communications, New Delhi), **Journal of Bombay Natural History Society** (BNHS), **Hornbill** (published by BNHS-Mumbai), and **Sanctuary** (602, Maker Chamber, Nariman Point, Mumbai) - are names of some important magazines in this regards. The “**Silent Spring**” – the book authored by **Rachel Carson**, is a world famous book on the Pesticide Poisoning.

The Vigyan Prasar, New Delhi (India); has been running various types of programmes for the popularization of science and conservation of environment across the country. The **Vigyan Rail** is its latest effort to generate awareness about science and environment.

The **Central Pollution Control Board** ( Ministry of Environment and Forest, Govt. of India), Vigyan Prasar ( Ministry of Science and Technology, Govt. of India), National Council of Science and Technology Communications (Ministry of Science and Technology, Govt. of India), WWF-India etc. organizations are catalyzing different programmes run by other organizations and functioning of various Eco- clubs, Nature clubs etc. in different schools of India for the generation of awareness and development of students as environmentally conscious citizens of the world.

#### **Factors behind Planning an Awareness Programme**

**(a) Ecological Factor** – It relates to the importance of wise use and careful maintenance of living systems.

**(b) Ethical Factor** – This factor relates to the right or wrong of doing something for conservation like: whether it is our duty to conserve natural resources and to save the earth for future generations.

**(c) Aesthetic Factor** – It relates to the beauty of landscape and promotion of different religious, cultural and traditional practices of conservation.

**(d) Economic Factor** – It relates to the growth of economy through conservation and expenses involved in the awareness programme.

## 6.4. MEANS OF COMMUNICATION IN PUBLIC AWARENESS PROGRAMMES

There are several ways of communicating messages in public awareness programmes like Tree Plantation, Commercial Advertising, News Paper Articles, Postal Stationary, Films, books etc. Puppet Shows, Folk Songs, Street Hoardings, Padyatras, Nukkar Nataks(street theatres), Rallies, Radio Broadcasts, Nature Walk, Eco- tourism, Class Room Lectures, Seminars, Symposia etc. are some other effective ways of communication in such programmes. Besides these, visual displays (like flipcharts, posters etc.), handouts, slides, overhead projectors and transparencies, videos, film shows, street hoardings, competitions in schools (like essay writing, painting, poster making, debates, discussions, exhibitions etc.,) are other effective means of communication in public awareness programmes where constraints of space, time and money come in the way.



**Fig. 6.3.** Scene of a Puppet Show.

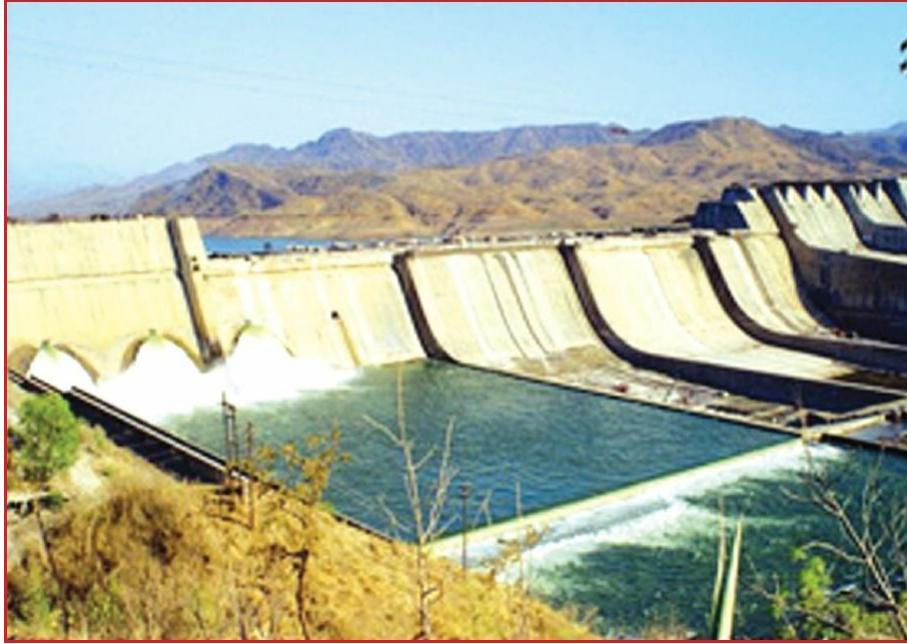
## 6.5. NATIONAL EFFORTS AND PUBLIC AWARENESS PROGRAMMES

The Government of India is promoting Public Awareness through its different programmes. It has created an Environmental Information System (ENVIS) – network to disseminate information about environment. The Ministry has launched a portal at URL <http://www.envis.nic.in>, to connect all the ENVIS- centers. The inclusion of Environmental Education as a separate and compulsory subject in the education curricula at all levels is a major step towards creation of environmental awareness.

The Central Ministry of Human Resources Development (HRD) organizes different types of training programmes, seminars, workshops, eco- clubs, **National Green Corps** (NGC) etc. for the creation of awareness among different sections of the Indian societies. The Central Ministry of Environment and Forests has been organizing **National Environmental Awareness Campaigns** (NEAC) every year through various reputed non- government organizations in different regions of the country. Currently, the Government of India is conducting **Global Learning and Observation to Benefit the Environment** (GLOBE) and International Scheme and Education Programme. These programmes are being conducted with hands-on participatory approach.

## 6.6. PUBLIC AWARENESS PROGRAMMES CONCERNING CONSERVATION

Conservation in the current age has become economic, religious, cultural and political issue. Pad Yatras, Rallies and Marches are being conducted by people in different parts of the country in order to conserve water, soil, forests, air and wildlife through peoples' own ways. We have studied about the CHIPKO movement of Garhwal Himalayas (June, 1973) in class VIII. The chipko movement was started under the leadership of sarvodaya workers Chandi Prasad Bhatt, Sarala Dewi and Sundarlal Bahuguna etc., under the banner of **Dashouli Gram Swarajya Sangh(DGSS)**. We have also studied about many other conservation programmes run by local people, like- **Appiko, Sukhomanjari, Silent Valley Movement, Joint Forest Management** in West Bengal, **Bisnois** and the **Narmada Bachao Andolan**. The Narmada Bachao Andolan is still continued under the leadership of the social activist Medha Patkar since last two decades. After the construction of the Sardar Sarovar Dam(SSD), the NBA is continued against raising the height of the dam( from the current 110.64 meters to 121.92 meters) and in favour of rehabilitation of 24000 families of 177 villages.



**Fig. 6.4.** The Sardar Sarovar Dam: A Mammoth Project.

The seriousness of the problems with water, soil, air, forests and wildlife is important to be known for devising appropriate strategies for their conservation. The pollution of water, soil and air; the depletion of forests; the degradation of soil and loss of species of flora and fauna are primary problems of environment that need to be solved through making the public aware of the seriousness of these problems.

Different awareness programmes for conservation of these resources like Tree Plantation, **Van Mahotsav**, Regeneration of forests, Social forestry, Agro- forestry, Installation of Solar Energy Devices, application of Pollution Free Technologies, cleaning of rivers and lakes etc. are certain programmes that are being conducted for the conservation of resources. Not only governments alone, but thousands of non-government organizations are busy round the year for creating public awareness concerning the status and conservation of these resources.

## 6.7. RELEVANCE OF INDIGENOUS PRACTICES

India has a long history of conservation. The sense of conservation is deeply rooted in the traditions and cultures of different Indian societies. In many other countries also, the traditional societies are conserving their resources through indigenous practices since long. The social forestry or raising Village Gardens in the villages of Java is one important example in this regard.

### enviro\_Facts : 06

Some important indigenous practices of conservation observed in India are:

- (a) The construction of ponds for water storage and community water supply have been ancient practices of water conservation in India. The Archaeological Survey of India has reported about a 2000 years old pond at Shringavera Pur in Allahabad district of U.P.
- (b) The collection and use of rain water.
- (c) Growing Sacred Groves as a part of religious and cultural practice by the tribal people of Jharkhand, Madhya Pradesh, Andhra Pradesh, Tamil Nadu and other Indian states and even of many other countries like Greece and Rome etc.
- (d) The worship of the sun, the moon, the earth, rivers, stones, animals and trees in traditional Hindu societies.
- (e) The indigenous practices of storage of grains, management of pests and weeds, treatment of humans and cattle by the application of medicinal herbs.
- (f) The indigenous practice of summer cultivation of fields for solarisation, destruction of weeds and insect- pests.
- (g) The celebration of festivals connected to the worship of nature like the celebration of Sarhul, Karma etc. by the tribal people of Jharkhand and other Indian states and the Earth Dance of tribal people of Jharkhand.

#### Following is the relevance of indigenous practices in nature conservation -

- (i) The indigenous practices of conservation are carried on by local people as participatory activities. These practices are helpful in strengthening the local resource bases.
- (ii) The sense of conservation, rooted deep in religions and cultures is very important in view of conservation of nature.
- (iii) The construction of community ponds, check dams and other water harvesting systems are very important for the maintenance of microclimate.
- (iv) The indigenous techniques of conservation are cheaper and sustainable.

## 6.8. LINKAGES OF TRIBAL CULTURE WITH FOREST RESOURCES AND THEIR CONSERVATION

The word ‘tribal’ is usually associated with another word which is ‘forest’. The tribal communities of different types have been living in forests in different parts of the world, since time immemorial. Thus forests serve as habitats for those people and in true sense, these habitats provide them everything for their livelihood. So, forests and forest resources have close linkages with tribal communities and with their culture. Some of the important linkages of the tribal culture with conservation of resources are reflected in following examples.

- (i) Since most of the tribal people live in forests, forests are as dear to them as their homes. Hence, they do their best to protect forests from other people.
- (ii) The tribal people derive seeds and fruits from forests.
- (iii) Some most traditional tribal societies living in remote forests still cover their bodies with leaves; make leaf- umbrellas and grass- huts.
- (iv) The tribal people derive medicines from forest trees and herbs and they have rich knowledge of medicinal herbs.
- (v) Many tribal societies earn money by selling forest produce like ber, mahua(*Madhuca*

*indica)*, tree leaves( for making plates and selling them in markets) and even wood.

- (vi) Tribal societies get protection in forests and worship forest trees and grasses (especially doob or durva = *Cynodon dactylon*) during their social customs and religious ceremonies.

We have already studied that tribal people of Jharkhand and some other states of India, worship sacred groves they call as Sarana(in Jharkhand), Dewarakadu(in Karnataka), Deorais(in Madhya Pradesh) etc. Sarana is the name of tribal religion also, in Jharkhand.

6

## TOWARDS A BETTER ENVIRONMENT...

### RAIN WATER HARVESTING IN THE NORTH-EASTERN INDIA (With Special Reference to Mizoram)

Mizoram is one of the smallest states in India having an area of only 21,000 sq. Km. It is located in the extreme North East of India bordering Myanmar and Bangladesh. The state is entirely mountainous covered with lush green vegetation. The mountains range in a North - South direction and the rivers flow in either a North or South direction. The highest peak namely Blue Mountain is only 7100 feet high and the climate of Mizoram is moderate. Towns and villages in Mizoram are mostly located on hilltops or on the upper reaches of the hills. Since perennial streams and rivers are located much below the habitations, scarcity of water in the dry season is very common. The whole state enjoys abundant monsoon rainfall during the rainy season extending five or six months in a year.

Springs on the hill slope and valleys are the main water supply sources in the villages. In the dry period the yield from springs gets reduced drastically. During the worst dry periods one has to wait long hours to obtain just a bucketful of water from the spring sources. Spring water supplemented by rainwater harvesting still remains today, the main means of water supply in many villages and outskirts of towns.

Through their skill and experience, the people living in hills and mountains of North-eastern India have developed a number of novel practices of farming, checking soil erosion, preventing landslides, and yes – of conserving water. Cropping in terraces along hill slopes is an age-old practice developed by tribal people. **Tribals of Mizoram and Nagaland** are expert in cutting beautiful terraces along mountain slopes. This system of cropping is beneficial in retaining fertility of soil; preventing land slides and checking soil erosion. Secondly, it is helpful in retaining the moisture of soil and conserving water, also. How are the terraced fields irrigated? Well, here is the answer.

The terraced fields are irrigated by a **network of water- channels of bamboos** that reach to every field. The terraces are graduated in so nice and scientific ways that water flows conveniently through the bamboo channels and irrigates the crop fields. Sometimes holes are made in the bamboo-pipes that facilitate the flow of water in drips. Thus the water is saved against any wastage during the process of irrigation. This system of irrigation is called as “**Bamboo-drip Irrigation System**”.

The loss of forests and less density of trees in certain regions has altered the pattern of rainfall in some districts of the North – eastern India including Mizoram and Nagaland. The water cycle in these regions has badly been altered and the sources of water have become inefficient. With the skill and experience, the people of these areas have developed a novel method of rain water harvesting and water conservation which is called as **Zabo System** of Rain water Harvesting.

The word “Zabo” means – impounding of water. *The indigenous system of conservation of rain water in Mizoram and Nagaland, through which water is collected and stored in ponds for irrigation and other purposes, is called as the Zabo system of water conservation.* The harvesting of water through this system is done by collecting rain water in catchments along mountain slopes. A Pond is dug to store water of the catchment area and all the water flowing down through terraces is facilitated to accumulate into it. The water thus accumulated in ponds is used for various purposes including irrigation. The Government of Mizoram has started a number of projects of water conservation. Rainwater harvesting and spring developments were taken up as a Government Programme. The Rajiv Gandhi National Drinking Water Mission, aiming at providing drinking water to every person, sanctioned a substantial fund for rooftop rainwater harvesting tanks. As many as 198 villages in Mizoram have benefited from the scheme.

## IMPORTANT DEFINITIONS

<b>ENVIRONMENTAL AWARENESS</b>	: Knowing about environment, realizing different types of environmental problems caused due to human activities and feeling those problems with deep sense of responsibility is called as environmental awareness.
<b>PUBLIC AWARENESS PROGRAMME</b>	: A programme formulated and designed to make the public know about general process of environment, its different resources, needs and ways of conservation of those resources etc., is known as public awareness programme.
<b>CAMPAIGN</b>	: A series of planned activities that are intended to achieve a particular social, commercial or political aim is called as a campaign.
<b>NCSTC</b>	: National Council of Science and Technology Communications, New Delhi (India) - It does the work of science and technology communications, popularization of science and technology; awareness of environment and inculcation of scientific temper among the people.
<b>VIGYAN RAIL</b>	: The NCSTC (the government of India), declared the year 2004, as the year of Scientific Awareness. The Vigyan Rail, Scientific Jathas, interaction of scientists with common men, were some of the activities undertaken to celebrate the year of scientific awareness.
<b>POSTAL STATIONARY</b>	: The Vigyan Rail or the Science on Wheels, is a train of Indian Railways equipped with exhibits of science and technology by Rashtriya Vigyan Evam Prodyogiki Sanchar Parishad (RVPSP), Department of Science and Technology, Govt.of India. In the year 2005, this rail was flagged off on 26th April, from Safdarjung Railway Station (Delhi) by Union Minister of State for Science and Technology and Ocean Development. Now, it is being called as Vigyan Mail. The stationary belonging to the postal Department, like postal stamps, envelops inland letters, aero grams, money order forms etc.

## MODEL QUESTIONS AND EXERCISES

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. A number of environmental problems have emerged out on global, national and regional levels since last few decades. Why? Answer in one sentence.
2. What do you mean by awareness? Answer in one sentence.
3. Name any one national and any one international organization encouraging environmental awareness programmes on their own levels.
4. In which Indian city is the Wildlife Institute of India located?
5. The indigenous techniques of conservation of environment are being given much importance now a days. Why? Answer in one sentence.
6. Mention names of any two states where sacred groves are found.
7. Name any one ancient practice of water harvesting.

### II. SHORT ANSWER TYPE QUESTIONS

**(2 marks each)**

1. What do you mean by the Public Awareness Programme?
2. What are important concepts and issues that should be incorporated in a public awareness programme?
3. How are institutions, organizations and individuals associated with public awareness programmes concerning conservation of natural resources? Mention main points only.
4. How can films and television channels co-operate in creating public awareness for the protection of our environment? Answer as per your own thought and experience.
5. 'You are the secretary of the eco- club of your school'-Mention any four programmes you can organize through your eco-club for building awareness among students for the protection and preservation of school environment.
6. What is an Eco- club? Why and how is it formed?
7. What is the relevance of indigenous practices in the conservation of natural resources?
8. How is the culture of the tribal people linked with the resources of forests and their conservation?
9. Write the full form of PETA. State one aim of this organisations.

10. List any two methods of insitu conservation.

11. Name any two techniques by which new crop strains are produced.

### III. DETAILED ANSWER TYPE QUESTIONS

(4 to 6 marks each)

1. What may be the principal means of communication in a Public Awareness Programme? Name some national and international organizations encouraging and supporting public awareness programmes for the conservation of natural environment.
2. Write an essay on ‘Importance of Public Awareness Programmes for the conservation of nature.’
3. Explain- “Water Harvesting in Mizoram.”

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice Type Questions

**Tick (✓) the correct option**

1. Sanctuary – is the name of-
  - (a) a book
  - (b) a film
  - (c) a magazine
  - (d) a sacred tree
2. Which one of the following can not be used as means of communication in a Public Awareness Programmes for environmental conservation ...?
  - (a) postal stationary
  - (b) street theatre
  - (c) video
  - (d) a flower show
3. The functions of the National Green Corps (NGC) are related to –
  - (a) environment
  - (b) awareness
  - (c) military training
  - (d) forest guards
4. Which one of the following is not an environment friendly activity...?
  - (a) tree plantation
  - (b) nature worship
  - (c) water harvesting
  - (d) whaling
5. The World Environment Day is celebrated on-
  - (a) 26 January
  - (b) 5 June
  - (c) 15 August
  - (d) 14 November
6. The Chipko Movement was led by –
  - (a) Sundar Lal Bahuguna
  - (b) C.P. Bhatt and Sarla Dewi
  - (c) Medha Patkar
  - (d) Arundhati Roy

#### B. Fill in the Blanks

1. The indigenous practice of digging ..... is related to community water supply.
2. The solarization of fields is related to the destruction of .....
3. Sarana is the religion of ..... people.
4. Dewarakadu is the name of sacred groves in ..... state of India.
5. Films and educational resource materials can be used in ..... awareness programmes.

#### C. True / False

Write T against the statement which is True and F against the statement which is False-

1. Knowing about maximum utilization of natural resources is called as environmental awareness.
2. Awareness Programmes are designed and conducted to develop insight into environmental concepts and issues.
3. WWF is the organization basically concerned with wrestling.
4. Jacques Cousteau and David Attenborough jointly wrote the book Silent Spring.
5. Vigyan Prasar, New Delhi, is running various types of programmes related to popularization of science, technology and environment.

## ANSWERS

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. Because, enormous stress has been laid down on natural resources.
2. Knowing or realizing something,
3. National Organization: Centre for Science and Environment, New Delhi (India); International Organization: Green Peace, Washington DC, USA.
4. Dehradun,
5. Because, these techniques are cheap and sustainable,
6. Karnataka, Madhya Pradesh,
7. Construction of ponds.

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice Type Questions

- 1.(c), 2.(d), 3.(b), 4.(d), 5.(b), 6.(b)

#### B. Fill in the Blanks

1. Ponds, 2.insect- pests
3. Tribal, 4.Karnataka, 5.public.

#### C. True / False

- 1.F, 2.T, 3.F, 4.F, 5.T,

## PROJECTS & ACTIVITIES

### Act for Environment

#### 6.1. PROJECT

Design a project for the creation of awareness about the conservation of water in your area.

#### 6.2. SURVEY

Do a survey of indigenous knowledge about the conservation of natural resources, available in your area. Make a list of all those activities and explain - how they are important. Can you make suggestions for improving those practices? If yes, mention them separately. Now, prepare a complete report including importance of these practices and your suggestions for further improvement.

# **2**

# **POLLUTION**



**7. Types and Sources of Pollution**

**8. Effects and Abatement of Pollution**

# Types and Sources of Pollution

## FACTS & CONCEPTS



- Introduction : Types of Pollution
- Air Pollution
  - Sources of Air Pollution
  - Major Air Pollutants
- Water Pollution
  - Sources of Water Pollution
  - Major Water Pollutants
- Soil Pollution
  - Sources of Soil Pollution
  - Major Soil Pollutants
- Radiation Pollution
- Noise Pollution
- Marine Pollution: Oil Spills

- u Sources of Marine Pollution
- u Major Pollutants Causing Marine Pollution
- u The Oil Spills

## 7.1. INTRODUCTION : TYPES OF POLLUTION

Our natural resources are known to have some specific qualities of their own. These qualities are known as **natural qualities**. It is due to specific natural qualities that different natural resources have been useful to us and to the whole biosphere. But now, the condition has changed considerably. Most of our natural resources like air, water and soil have gone bad due to pollution of different types. **What is pollution?**

**The condition of mixing unwanted and harmful substances in our natural resources so as to alter their natural qualities and to make them unfit for use, is called as pollution.** Agents causing pollution are known as **pollutants**.

Different types of pollutions are – **Air Pollution, Water Pollution, Soil Pollution, Radiation Pollution and Noise Pollution.** In this chapter, we are going to study about different types of pollutions and their sources.

Pollutants, on the basis of their origin, have been divided into two different categories – Primary and secondary. A **primary pollutant** is the pollutant emitted directly from a source. On the other hand, a **secondary pollutant** is not directly emitted as such, but formed when other pollutants (primary pollutants) react in the atmosphere. Examples of secondary pollutant include ozone, which is formed when hydrocarbons (HC) and nitrogen oxides (NO<sub>x</sub>) combine in the presence of sunlight; NO<sub>2</sub>, which is formed as NO combines with oxygen in the air; and acid rain, which is formed when sulfur dioxide or nitrogen oxides react with water.

Pollutants have been divided into biodegradable and non-biodegradable categories-

**Biodegradable pollutants** are the ones that can be broken down and processed by living organisms, including organic waste products, phosphates, and inorganic salts. These pollutants can be neutralized and converted into harmless compounds by the activities of microorganisms. However, it is important to remember that these pollutants can be serious if released in large amounts in small areas, thus exceeding the natural capacity of the environment to “assimilate” them.

**Non-biodegradable pollutants** are the ones that cannot be decomposed by living organisms and therefore persist in the ecosphere for long periods of time. These include bottles, cans, plastics, metal, some pesticides and herbicides, and radioactive isotopes. Non-biodegradable pollutants are dangerous because living organisms have neither enzymes capable of processing these pollutants nor defensive systems against them.

## 7.2. AIR POLLUTION

**The condition of mixing of undesirable substances in the air so as to alter its natural quality is called as air pollution.** According to the **World Health Organization (WHO)**, the air pollution can be defined as – **the condition produced due to ‘substances put into air by the activity of mankind into concentration sufficient to cause harmful effects to his health, vegetables, property or to interfere with the enjoyment of his property’.**



**Fig. 7.1.** Scattering of Pollen Grains: A Natural source of air Pollution.

### 7.2.1. Sources of Air Pollution

The air pollution is caused either through **natural processes** or through **human activities**. On this basis sources of air pollution have been divided into two broad categories: A- Natural Sources and, B-Anthropogenic Sources.

#### A. NATURAL SOURCES

The natural phenomena like volcanic activities, dust storms, forest fires, scattering of pollen grains, and release of hydrocarbons from plants are natural sources of air pollution.

#### B. ANTHROPOGENIC SOURCES

These sources comprise sources of air pollution connected to human activities. Different types of anthropogenic sources of air pollution are being discussed below.

**1. Domestic Sources:** Heating and cooking activities in homes produce different types of pollutants like-Carbon dioxide, Carbon monoxide, Sulphur dioxide, Nitrogen dioxide, Carbon particles, and dusts etc. These pollutants cause indoor air pollution in unscientifically built houses. Heating plants employed in homes and apartments are considered to be fourth largest source of air pollution.

**2. Automobile Sources:** **Automobiles** are regarded as greatest sources of air pollution. Cars,

scooters, motor cycles etc. are some of the automobile sources of air pollution. About one-fifth of the air pollution in cities is caused through these sources.

**Pollution caused by emissions joining the atmosphere through tailpipes of vehicles, is called as vehicular pollution.** The pollutants so released into the atmosphere, are called as Primary Pollutants. Once, the primary pollutants get released into the atmosphere, they react with other pollutants in the air and form more serious pollutants. Now, these pollutants are called as secondary pollutants. The large majority of today's cars and trucks run by using internal combustion engines that burn gasoline or other fossil fuels. The process of burning gasoline to power cars and trucks contributes to air pollution by releasing a variety of emissions into the atmosphere. Emissions that are released directly into the atmosphere from the tailpipes of cars and trucks are the primary source of vehicular pollution. But motor vehicles also pollute the air during the processes of manufacturing, refueling, and from the emissions associated with oil refining and distribution of the fuel they burn.



**Fig. 7.2.** Smoke from diesel rail engine causing pollution.

**3. Industrial Processors:** Metallurgical plants and smelters, chemical plants, petroleum refineries, pulp and paper mills, sugar mills, cotton mills, synthetic rubber manufacturing plants etc. come under this category of industrial sources of air pollution.

**4. Transport Industry:** Public Transport System, ships, aeroplanes, trucks, diesel rail engines, etc. come under this category.

**5. Agricultural Sources:** These sources include many chemicals like insecticides, herbicides, fungicides, rodenticides, pollen grains, crop residues etc.

**6. Construction and demolition sources:** Construction and demolition activities generate lots of wastes. Different types of paints and other chemicals used in furnishing of houses and furniture cause serious pollutions.

**7. Industrial Accidents:** Accidents used to occur in different industries from time to time due to carelessness of workers and old machines. These accidents cause serious pollutions that produce long lasting impacts on life and property.

An accident occurred in the **Union Carbide** factory of **Bhopal** city of Madhya Pradesh state of India on December 3, 1984. This industrial accident resulted in the immediate deaths of more than 3,000 people, according to the Indian Supreme Court. A more probable figure is that 8,000 died within two weeks, and it is estimated that an additional 8,000 have since died from gas related diseases. A **Union Carbide** subsidiary **pesticide** plant released 42 tonnes of **Methyl Isocyanate** (MIC) gas, exposing at least 520,000 people to the toxic gas. The Bhopal disaster is frequently cited as the world's worst **industrial disaster**. The **International Medical Commission on Bhopal** was established in 1993 to respond to the disasters.

**8. Dumps of Wastes:** Large amounts of wastes are routinely generated through human activities. These wastes are dumped carelessly here and there to create ugly scenes. The biodegradable wastes gradually decompose to produce **methane** ( $\text{CH}_4$ ) which is a serious pollutant if generated in big volumes. A number of germs of diseases develop at dumping sites and get disseminated through the agency of wind and water.

## 7.2.2. Major Air Pollutants

Substances that cause pollution of air are called as air- pollutants. These pollutants can be put into two broad categories A. Gaseous Pollutants, and B. Particulates.

### A. GASEOUS POLLUTANTS

The gaseous pollutants causing air pollution are numerous. Some remarkable gaseous pollutants in the present context are being mentioned below.

**1. Sulphur dioxide:** Sulphur dioxide ( $\text{SO}_2$ ) and sulphur tri- oxide ( $\text{SO}_3$ ) are produced largely by the combustion of coal and petroleum. These are also produced through smelting of ores of sulphide, copper, zinc, and lead; and decomposition of bio-mass. Some industries that emit sulphur dioxide are industries manufacturing sulphuric acid ( $\text{H}_2\text{SO}_4$ ), oil refineries, fertilizer industries and paper industries.

**2. Hydrogen sulphide:** It is a colorless toxic gas which is produced from decaying vegetation and animal materials particularly in shallow fresh water and marine environment. It also comes out from sulphur springs, volcanoes, coal pits and sewers.

**3. Carbon monoxide:** It is a poisonous gas which originates from incomplete combustion of carbonaceous materials. It can also be oxidized to carbon dioxide which too is a poisonous gas.



**Fig. 7.3.** Bleaching of Plant leaves by Air Pollution.

**4. Hydrogen fluoride:** It naturally comes out from volcanoes. However, it is produced from blast furnaces and industries concerned with the production of brick, tiles and super phosphates. It also comes out during combustion of coal.

**5. Hydrogen chloride:** It comes out during the combustion of coal, paper, plastics and chlorinated hydrocarbons.

**6. Hydrocarbons:** Chemical compounds made of hydrogen and carbon, are called as hydrocarbons. Methane, ethylene and aniline are three examples of hydrocarbons. **Methane is the principal constituent of the natural gas.** Major sources of release of hydrocarbons are organic matter, seepage from natural gas and oil fields and emissions of **Volatile Organic Chemicals** (VOCs). Hydrocarbons are also produced due to incomplete combustion of fuels, automobile exhausts, petroleum refineries, burning of crop residues, cracking of natural gas in petrochemical plants etc.

**7. Ammonia:** This gas is principally generated through refrigerator pre-cooler system of cold storage, manufacture of anhydrous ammonium fertilizers, nitric acid and domestic incineration etc. The emission of ammonia causes **bleaching of plant-leaves**, reduction of root and shoots growth, browning and softening of fruits, reduction in the rate of germination etc.

**8. Nitrogen Oxides:** Nitrogen oxide and Nitric Oxide are principal gaseous pollutants emitted through human activities. Nitrogen oxides have been reported to cause fading of colours of clothes, deterioration of nylon and cotton and corrosion of metals.

**9. Tobacco Smoke:** Smoking of cigarettes and allied things generate tobacco smoke. It is a potent pollutant in closed atmosphere like buses; trains e.t.c. It causes lung cancer, pulmonary and coronary heart diseases. Even passive smokers may be caught by a pulmonary or a coronary disease.

## B. PARTICULATES

**Solid and liquid aerosols that remain suspended in the atmosphere are called as particulates.** These are produced by human activities related to condensation or dispersion. The particulate matter can produce toxicity and respiratory problems like **bronchitis** and **emphysema**. Fluorides, lead, cement dust, potassium salts etc. are example of some other particulates.

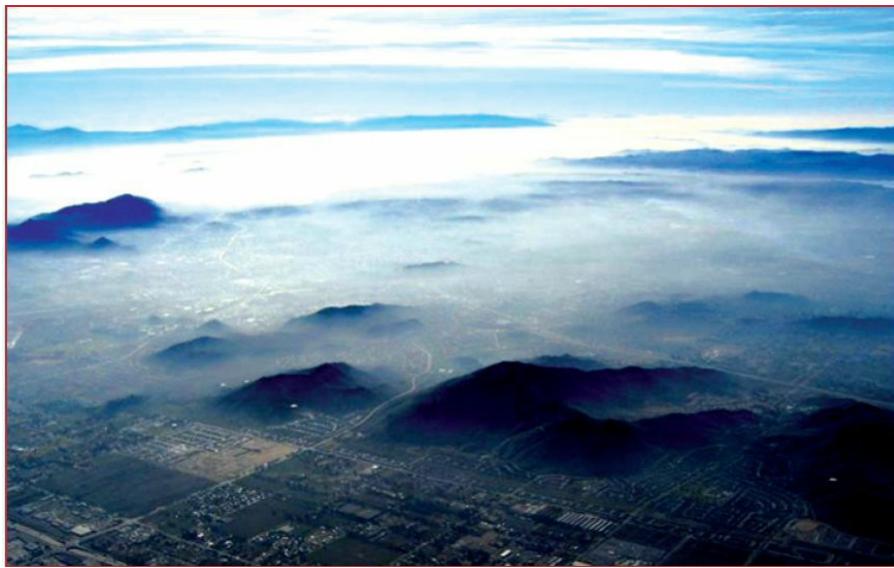


**Fig. 7.4.** Arjuna: A dust collecting tree

Particulate matter present as pollutant in the air can be put into different groups like dust, smoke, soot, aerosols, fumes, smog, haze and mist.

**1. Dust:** Particles of different sizes (from 1 micron to 200 microns) produced due to crushing of stones, weathering of rocks and digging of upper crust of the earth are called as dust. The dust particles are blown away and lifted up in air due to stormy conditions of atmosphere. However, they settle down due to gravitational pull of the earth or are washed down by rain water.

**2. Smoke:** Fine carbon particles (0.50 to 1 micron) along with gases produced due to the incomplete combustion of organic matter is called as smoke.



**Fig. 7.5.** Smog: It reduces visibility and often causes serious health hazards.

**3. Soot:** Bigger particles of carbon (1 to 10 micron) hanging in air along with tar, are called as soot.

**4. Aerosol:** Fine particles of solids, liquids or gases suspended in air are called as aerosol.

**5. Fumes:** Particles of gaseous pollutants (0.08 to 1 micron) in the state of condensation are

called as fumes.

**6. Smog:** Mixture of smoke particles and vapors of liquids formed due to photo- chemical reactions is called as smog. It reduces visibility and often causes a serious health hazard.

**7. Haze:** Dust particles and water vapour present in air so as to reduce visibility, is called as haze.

**8. Mist:** The suspension of liquid particles in air ranging from 40 to 500 microns is called as mist.

## 7.3. WATER POLLUTION

**Mixing of different solid, liquid or gaseous substances and microorganisms into water, so as to alter its natural qualities is called as water pollution.** According to the **National Water Commission** (1973), “water gets polluted if it has not been of sufficiently high quality to be suitable for the highest uses people wish to make of it at present or in future.”

### 7.3.1. Sources of water pollution

The sources of water pollution can be grouped into different heads, like **Municipal sources, Industrial sources, Agricultural sources, Shipping sources and Underground sources.**

**1. Municipal Sources:** These sources of water pollution comprise residential colonies, mohallahs, hospitals, small industries, offices, institutions etc. The pollutants released from these sources reach to drains from where they are carried to ponds, lakes and rivers.

**2. Industrial Sources:** Petrochemical workshops, synthetic fertilizer industries, oil refineries, paper mills, textile industries, sugar mills, iron and steel industries, leather industries, wine industries, rubber industries, fiber industries, plastic industries, and many others are sources of water pollution. These industries produce different types of poisonous by- products that are released into streams which join rivers.

**3. Agricultural Sources:** Different types of agrochemicals like synthetic fertilizers, pesticides, hormones, soils of crop fields, dung of cattle, wastes of dairies etc. are remarkable agricultural sources of water pollution.



**Fig. 7.6.** Ships carrying wastes contaminate marine water day and night.

**4. Shipping Sources:** Ships moving in seas and oceans release lots of wastes into water. Besides human wastes, lots of oil and other products from ships contaminate marine water, day and night.

**5. Sources of Underground Pollution:** The underground water is polluted by mixing of wastes seeped into the earth from the heaps of wastes and industrial dumps. Different types of germs of diseases that are produced in the accumulated wastes on ground, also seep into the earth and contaminate the ground water.

### 7.3.2. Major Water Pollutants

There are different types of pollutants that mix into water and make it unfit for use by humans, animals, and even by plants. These pollutants can be kept under different groups like sewage, infectious microorganisms, plant nutrients, organic chemicals, inorganic chemicals, and sediments etc.

**1. Sewage:** Some materials get mixed into water where microorganisms start their degradation to produce carbon dioxide, methane and other gases. The oxygen found dissolved in water is consumed in this process of degradation. Due to this an artificial crisis of oxygen into water is created which kills many aquatic organisms.

*The oxygen needed for complete degradation of sewage found in the polluted water is called as Biological Oxygen Demand. Testing of BOD is a 5- day long laboratory process. BOD is measured in mg / L.*

**2. Infectious Microorganisms:** The effluent released from leather industries, slaughter houses and toilets contain numerous types of bacteria and microorganisms. Dumps of wastes near water bodies produce vast varieties of germs that go into the water during rains through the surface runoffs. These germs may be the germs of **cholera, typhoid, diarrhea, dysentery and skin diseases**.

**3. Plant Nutrients:** Plant nutrients like nitrogen and phosphorous reach to water bodies and

stimulate the growth of aquatic plants in them. Thus, the water gets enriched by nutrients causing **eutrophication**. It is the eutrophication which gradually converts lakes and ponds into marshes and swamps.

**4. Exotic Organic Chemicals:** Surfactants and detergents, pesticides etc., are called as exotic organic chemicals. Many of these substances are non- biodegradable.

**5. Inorganic chemicals and inorganic compounds:** These pollutants enter into water from municipal and industrial wastes and urban runoffs.

**6. Sediments:** Considerable amounts of soil and silt are washed away from logged hillsides, ploughed fields and construction sites. These fine particles carried away by water are called as sediments. The sediments that join streams reach to rivers and estuaries where they cover gravel beds and deprive fishes like **Trout and Salmon** against spawning. Sediments block gills of fishes also.

## 7.4. SOIL POLLUTION

**Mixing of different types of substances in soil which affects its natural qualities and causes reduction in its fertility, is called as soil pollution.** Some environmentalists define soil pollution as – build up of toxic chemical compounds, salts, pathogens or radio active materials in soil that can affect plant and animal life adversely.

A polluted soil often contains varieties of germs of diseases. Some of those diseases are – anthrax, typhoid, leptospirosis, bacillary dysentery, cholera etc. A big amount of soil is lost due to soil erosion, storms, overgrazing and deforestation. This loss of soil is often called as **negative soil pollution**.

### 7.4.1. Sources of Soil Pollution

There are many different sources of soil pollution. These are being introduced ahead.

**A. Domestic Sources of Soil Pollution:** Wastes produced due to domestic activities are called as domestic wastes. Food leftovers, peeling of fruits and vegetables, ash, paper bits, packets, polythene bags, glass bottles, tin cans, used tyres, expired medicines etc. are some examples of domestic wastes that are often dumped on the ground. These wastes alter the soil composition and make it bad for the growth and development of plants.

**B. Municipal Sources:** Different types of municipal wastes dumped on the ground cause bad impacts on soil. These wastes act as shelter homes of various types of insects and germs of diseases.

**C. Industrial Sources:** Industries dump lots of wastes on land. These wastes create ugly scenes on ground and contaminate soil making it unfit for productive utilization. A number of toxic wastes seep into the ground and cause underground water pollution.

**D. Agricultural Sources:** Agro- chemicals used in agriculture produce adverse effects on soil. Synthetic fertilizers, if used continuously for a long time alter the composition of soil, making it unfit for the growth and development of plants.

Faulty irrigation practices cause water logging. The water is evaporated in the sun leaving behind salts in the soil. Thus soil gradually becomes saline and unfit for plant growth.

**E. Mining Sources:** Mining activities cause long lasting damages to the soil. Tailings, slags, stones etc. that come out of mines are dumped near them. Besides these, different types of toxic chemicals are exposed due to mining which further cause serious soil and water pollution during rains.

**F. Wastes:** The electronic wastes generated through the disposal of electronic goods, like computers, televisions, wires, and plastic cabinets etc. which are often dumped on the ground, create serious pollution on land.

#### 7.4.2. Major Soil Pollutants

- (i) Toxic Chemicals from industries,
- (ii) Pesticides, herbicides and synthetic fertilizers,
- (iii) Fly ash from thermal power stations,
- (iv) Chemicals from sugar mills, pulp and paper mills, refineries, distilleries etc.
- (v) Wastes from leather and rubber industries,
- (vi) The domestic garbage dumped on land,
- (vii) E- Wastes Or Wastes generated from electronics industries like computers CDs, Floppies, wires, Mother boards etc.,

### 7.5. RADIATION POLLUTION

Any form of ionizing or non-ionizing radiation that results from human activities is called as Radiation Pollution. The most well known radiation results from the detonation of nuclear devices and the controlled release of energy.

Radiation Pollution or Radioactive pollution can be defined as **the release of radioactive substances or high-energy particles into our natural resources as a result of human activity, either by accident or by design**. In other words, radio active pollution is **uncontrolled distribution of radioactive material in a given environment**. Even a small amount of **radiation exposure** can have serious (and cumulative) biological consequences. Many radioactive wastes remain toxic for centuries. Hence, radiation pollution is a serious environmental concern.

Nuclear Power Plants, transport and disposal of nuclear wastes, mining of radioactive substances, fall out of bomb explosions, nuclear weapons, testing of nuclear devices and nuclear accidents etc. are major sources of radiation pollution. These sources cause permanent damages to life and property. A nuclear reactor accident took place in 1986 in Chernobyl, Ukraine which killed at least 31 people and forced more than 200,000 people to vacate and relocate.

Radiation pollution may be both – Natural and Man- made. Cosmic radiations, ultra violet radiations etc. are examples of Natural Radiations. The application of explosive devices, testing of bombs, leakage from nuclear reactors etc. are man made sources of radiation pollution.

Radio active substances emit rays like alpha ( $\alpha$ ) rays, gamma ( $\gamma$ ) rays and beta ( $\beta$ )rays. These rays are emitted from unstable radioactive substances so as to become stable. In this way these are gradually reduced in their value. **The time taken by a radioactive substance to get reduced up to the half of its initial value is called as half life period.** The unit applied to express the decay of a radio active substance is called as **Becquerel**.

The problem of radioactive pollution is compounded by the difficulty in assessing its effects. **Radioactive waste** may spread over a broad area quite rapidly and irregularly. The radiations emitted from these radioactive substances penetrate human bodies and those of other organisms and get deposited therein. These radiations produce dangerous effects into the form of cancer or other chronic disease even after a decade.

## 7.6. NOISE POLLUTION

**Sound without value is called as noise.** In other words, **unwanted sound is called as noise.** It is observed in daily life that **what is pleasant to some people may be extremely unpleasant to others.** This depends on a number of factors out of those human health conditions and daily life situations are more common. If you are preparing for your examinations that are overhead, you cannot tolerate the high pitched sound of a loudspeaker broadcasting some film-song or even a bhajan. The music reaching to your ears from the loudspeaker disturbs the natural and routine process of your study, and hence it is causing noise pollution for you. Others may not take it as noise pollution. But a high pitched sound is always harmful for your ears, and the brain at least. You might have seen hoardings having written “Silence Please” or “thanks for not blowing horns” – near a hospital or a school.

**The emission of noise in air which disturbs natural processes or causes harms to human beings is called as noise pollution.**

Pressure horns of cars and other vehicles, noise produced through loud speakers during social and religious functions, noise produced by heavy machines, irresponsible practice of hearing high pitched sound of music systems, televisions etc. are some remarkable sources of noise pollution.

The popular unit of sound measurement is decibel (db). This unit has been named after **Sir Alfred Bell.** The human ear is sensitive to sound from 0 to 180 db. However, the sound beyond 140 db is harmful.

### enviro\_Facts : 07

#### Maximum acceptable levels of sound inside buildings

Place	Sound Level (db)
Hospitals	40 – 50
Schools	45 – 50
Libraries	40 – 45
Radio, TV Studios	25 – 30
Residential Buildings	45 – 55
Restaurants	40 – 55
Factories	60 – 65
Music Rooms	30 - 35

## 7.7. MARINE POLLUTION: OIL SPILLS

The Marine Pollution, as defined by the **International Oceanographic Commission (IOC)** for **United Nations Educational and Scientific Commission**, the introduction by man, directly or indirectly, of substances into the marine environment, resulting in such deleterious effects as harm to living resources, hazards to human health, or hindrance to marine activities and reduction of amenities is called as marine pollution.

### 7.7.1. Sources of Marine Pollution

Sources of Marine Pollution are –

1. Marine Commerce,
2. Industrial Effluents joining seas and oceans,

3. Dumping of radio active substances into sea water,
4. Sewage brought to the sea by rivers,
5. Offshore oil rigs,
6. Recreational activities,
7. Agricultural pollutants brought to the sea by rivers.

### 7.7.2. Major Pollutants causing Marine Pollution

The pollutants associated with marine environment are pathogens, sediments, solid wastes, heat, brine, toxic organic substances, petroleum, nutrients, radio active materials, acids and bases etc.

### 7.7.3. The Oil Spills

The layer of oil spread on the surface of the sea water, is called as oil spills. The oil on the surface of the sea water gets spread due to following reasons –

1. Damage caused to oil tankers by accidents,
2. Natural seepage of water,
3. Offshore production losses associated with oil refineries ([Fig. 7.7](#)),
4. Disposal of used automobile lubricants etc. into sea water.

The oil spread on the sea water acts as an insulating layer between air and water. Due to this, the oxygen of the atmosphere can not mix with water. The deficiency of dissolved oxygen in water kills varieties of sea animals. The sea birds that catch fish by dipping into sea water become unable to fly due to oiling of their wings.



**Fig. 7.7.** An Oil Refinery.

It is due to frequent oil spills that sea otters, many sea birds, whales and many other species of

## TOWARDS A BETTER ENVIRONMENT...

Most often, we remain unable to detect pollution in our natural resources, merely by visual observation. Under such a condition, we go for a laboratory test. One of the quickest and effective ways of judging pollution through visual observation is the observation and knowledge of bio-indicators.

**Living organisms that show the status of environmental quality through their sensitivity, are called as bio-indicators.** The bio-indicators are very useful in finding out pollution because they help in identification of the type of pollution. Let us take a few examples-

- (i) The presence of *Coliform* bacteria indicates water pollution due to faecal matter.
- (ii) Movement of *Catla* and *Labeo* (Rohu) fish species away from their habitat shows pollution of water due to industrial waste. Similarly, the death of *Amphibians* and fish in pond water shows Eutrophication.
- (iii) Abundance of *diatoms* and *Eichhornia* in water indicate pollution due to mixing of sewage in water.
- (iv) Growth of some algal species like *Chara* shows water pollution by organic and industrial wastes.

## IMPORTANT DEFINITIONS

<b>HYDROCARBONS</b>	:	Compounds of hydrogen and carbon are called as hydrocarbons. Examples- Methane ( $\text{CH}_4$ ), Ethane etc. Petroleum is a mixture of many hydrocarbons.
<b>PARTICULATES</b>	:	Liquid droplets or tiny solid particles suspended in air including nitrogen oxides, sulphur dioxide and carbon monoxide etc.
<b>RADIATION POLLUTION</b>	:	Contamination of environment due to mixing of various radiations emitted from radioactive substances contaminating natural resources is called as radiation pollution.
<b>DECIBEL</b>	:	Unit used to compare sound intensities and subsequently electrical or electronic power outputs.
<b>OIL SPILLS</b>	:	Leakage of petroleum from an oil tanker or other vessel is called oil spills.
<b>AUTOMOBILE</b>	:	Self-propelled vehicle used primarily on public roads but adaptable to other surfaces.
<b>VOLATILE CHEMICALS</b>	<b>ORGANIC</b> :	Organic Chemicals, with the tendency to become vapour at specified conditions of temperature and pressure.
<b>SEDIMENTS</b>	:	Rich deposition of fine grained material on river and sea bed.

## MODEL QUESTIONS AND EXERCISES

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. Mention any two sources of industrial pollution.
2. Mention any two sources of air pollution.
3. Name any one disease caused due to inhalation of tobacco smoke.

4. Name any two diseases caused by soil pollution.
5. What is half life period?
6. What is a decibel?

## II. SHORT ANSWER TYPE QUESTIONS

(2 marks each)

1. What is pollution?
2. Name pollutants two each for air and water pollution.
3. Name any two sources of soil pollutions
4. State any two consequences of air pollution.
5. What is water pollution?
6. What do you know about radiation pollution?
7. What is noise pollution?
8. "Oil spills have an adverse impact on marine life" - Explains

(ICSE 2005)

(ICSE 2008)

## III. DETAILED ANSWER TYPE QUESTIONS

(4 to 6 marks each)

1. What is air pollution? Mention four sources of Air Pollution.
2. What is oil spill? Mention principal causes and effects of oil spills.
3. Vehicular Pollution in cities has become a major nuisance. Suggest six measures to reduce this problem.
4. What is air Pollution? Mention four sources of air pollution.

(ICSE 2006)

(ICSE 2008)

(ICSE 2006)

## IV. OBJECTIVE TYPE QUESTIONS

### A. Multiple Choice Type Questions

Tick (✓) the correct option

1. A condition which is characterized by mixing of undesirable and harmful substances in our natural resources is called as –
  - acid rain
  - ozone layer depletion
  - pollution
  - eutrophication
2. A pollutant gas which can be blamed for bleaching of plant leaves and softening of fruits is –
  - ammonia
  - sulphur dioxide
  - carbon dioxide
  - methane
3. Sources of air pollution like petrochemicals and oil refineries are –
  - agricultural sources
  - industrial sources
  - municipal sources
  - shipping sources
4. The spawning of fish species like Salmon and Trout is badly affected by –
  - deposit of sediments on gravel beds
  - methane gas in the water
  - carbon dioxide in water
  - contamination of water with sewage
5. The offshore oil rigs cause –
  - air pollution
  - marine pollution
  - eutrophication
  - global warming

**B. Fill in the Blanks**

1. Hydrogen fluoride naturally comes out into the air from .....
2. ....is the principal constituent of the natural gas.
3. The effluent released from slaughter houses, toilets and leather industries contain numerous .....
4. .... gradually converts lakes and ponds into marshes and swamps.
5. Synthetic fertilizers used in agriculture alter the quality of ..... adversely.

**C. True / False**

Write T against the statement which is True and F against the statement which is False –

1. Radiation pollution may be both the natural and man made.
2. Faulty irrigation facilities may cause water logging.
3. Chemical compounds made of carbon and hydrogen are called as hydrocarbons.
4. The microbial activities on sewage produce ozone gas.
5. A number of toxic wastes seep into the ground to cause the acid rain.

**ANSWERS****I. VERY SHORT ANSWER TYPE QUESTIONS**

1. Petroleum refineries and pulp and paper mills
2. Natural Sources & Anthropogenic Sources
3. emphysema,
4. anthrax,
5. typhoid,
6. The time taken by a radioactive substance to get reduced up to the half of its initial value is called as half life period.
7. Unit used to compare sound intensities and subsequently electrical or electronic power outputs.

**IV. OBJECTIVE TYPE QUESTIONS****A. Multiple Choice Type Questions**

1. (c), 2.(a), 3.(b), 4.(a), 5.(b)

**B. Fill in the Blanks**

1. Volcanoes
2. Methane
3. Bacteria
4. eutrophication
5. soil

**C. True / False**

1. T, 2. F, 3. T, 4. F, 5. F.

## PROJECTS & ACTIVITIES

### Act for Environment

#### 7.1. OBSERVATION

Concentrate yourself and find out the names of chemical substances used routinely in your home. Make a list of those chemicals grouping similar substances together. Think, if some or all of them can be replaced by suitable natural alternatives. How can you promote the use of natural things in your home by replacing artificial things?

#### 7.2. SURVEY

Make a survey of various types of pollutions in an area closer to your school, village or housing colony. Prepare a report of your survey indicating – types of pollutions, names of principal pollutants (as you observe); possible adverse impacts on the local environment; control measures that can be taken up; any government or voluntary effort already being taken up – if so, your suggestions to improve it further and make it more efficient.

#### 7.3. AWARENESS

'The global consumption of pesticides was 18.17 lakh tones in 1980, which was increased up to 45 lakh tones by 1995. Total expenses on pesticides in India are worth rupees 555.64 crores. According to reports presented by United States' National Research Council and FAO experts, over 650 species of weeds, insects and fungi have become resistant to pesticides and herbicides'. –on the basis of this information prepare a bulletin board for public awareness about the threats of consumption of synthetic pesticides.

# Effects and Abatement of Pollution

## FACTS & CONCEPTS



- Introduction
- Effects of Pollution
  - Effects of Pollution on Environment
  - Effects of Pollution on Human Health
  - Effects of Pollution on Other Organisms
- Abatement of Pollution
  - Principles and Guidelines for the Abatement of Pollution
  - Practices of Abatement of Pollution

### 8.1. INTRODUCTION

In the previous chapter, we studied that several undesirable substances produced mostly due to human activities, get mixed up with the components of the natural environment and alter their natural qualities. Those substances are called as Pollutants and the harmful condition produced by the pollutants is called as Pollution. Since pollution of any type is harmful to environment, it has to be prevented and controlled effectively. For this, effective pollution control strategies based on strongly effective principles, are important to be planned and implemented at all levels- local, regional, national and international. Here, in this chapter, we are going to study about various harmful effects of pollution and their abatements.

## 8.2. EFFECTS OF POLLUTION

Pollution proves hazards to general health of environment, causes loss to economy; interrupts bio-geo-chemical cycles and damages historical monuments. Now, let us discuss the effects of pollution on environment in general and after that, on the health of human beings, animals, plants and microorganisms in particular.

### 8.2.1. Effects of Pollution on Environment

Some of the major problems created by pollution in different components of the global environment are being mentioned below.

- (i) **Problems in the Atmosphere:** Ozone Layer Depletion, Global warming (green house effect or climate change) and Acid Rain.
- (ii) **Problems in Hydrosphere:** Eutrophication, Siltation of Rivers and Bleaching of Coral Reefs.
- (iii) **Problems in Soil:** Degradation and Desertification.

A Detailed study of these environmental problems will be done in the chapter ahead.

The components of environment are linked closely through bio-geo-chemical cycles, food-chains and transfer of energy. Hence, pollution of anyone component, is sure to affect other components. That's why we come across a number of environmental problems being experienced the world over.

The **depletion of ozone layer** is the environmental problem caused due to air pollution. The ozone belt which absorbs UV-radiations is being eaten up by **Chlorofluorocarbons (CFCs)**, **oxides of nitrogen** etc. The UV -radiations coming to the earth is reportedly causing a number of serious problems in the living world.

Pollutants that go up into the atmosphere are washed down during rains to cause pollutions of soil and water. We already know that rain containing acids, is called as **Acid Rain**. Besides pollutions, it is causing damage to forests, living beings and monuments. **Eutrophication** is another environmental problem caused in water bodies due to their enrichment with nutrients including phosphates and nitrates.



**Fig. 8.1** Big amount of sand and silt accumulate to fill the belly of a river.

The pollution of air, water and soil has a dramatic effect on different ecosystems like forests, wetlands, coral reefs etc. across the globe. The contamination by pollutants has far reaching consequences which may not be obvious immediately. For example, we can not see a hole in the ozone layer though scientists can do with the aid of advanced technologies. Further, scientists too can only speculate on different potential impacts of depletion of ozone layer.

The degradation of soil and desertification are the problems associated with **soil pollution** and improper practices of waste disposal. The unhealthy practices of soil management have caused serious degradation of soil quality, soil pollution and enhanced soil erosion. Big amounts of sand and silt have accumulated to fill the bellies of many rivers. As a result, those rivers have become unable to carry water to the sea in proper ways. Due to this, floods wash away many lives and take away all the property with them.

Vast areas of land are being turned into desert due to deforestation, pollution and other human activities. Thus, whole of the environment is passing through serious stresses basically caused due to pollutions.

### 8.2.2. Effects of Pollution on Human Health

As man is the top consumer in most of the food-chains; his health remains especially vulnerable to the effects of many non-biodegradable pollutants. Let us see how different types of pollutions affect the human health.

Until and unless a pollutant comes into contact of a person, no injury or harm can occur to him, no matter how toxic or prevalent it may be in the environment. **The contact of a pollutant with a person is called as exposure.** The exposure to a particular pollutant may cause harm or injury to a person. **The harm or injury to a person by exposure to a particular pollutant is called as risk.**

Some risks, like risks due to chewing of tobacco, pan masala and gutkha; and smoking of cigarette are willingly accepted by different people. These risks are called as **voluntary risks**. Though, risks of this type cause serious health problems (like cancer of lungs, mouth and throat) in the long run, the addicted people go on doing the same, again and again.

However, some pollutants come into contact of a person and cause immediate injury or illness

and the person some times does not know about the exposure to those particular pollutants. Such type of risks is called as **involuntary risk**.

## A. Effects of Air Pollution on Human Health

Air pollution causes various types of risks to human health, either directly or indirectly. The air pollution by gases like sulphur dioxide and nitrogen oxides (NO<sub>x</sub>), causes acid rains which affects all the components of the environment including human beings. **Drinking of water contaminated with water of acid rain may cause serious neurological disorders in man.** Similarly, pollutants emitted from industries and automobile can cause irreparable damages to human health. A detailed account of different air pollutants, their sources and impacts on human health is being given in the [Table 8.1.](#), for a ready reference.

**Table 8.1. Different Types of Air Pollutants, their sources and impacts on Human Health**

S. No.	Pollutant	Source	Impact on Human Health
1.	Arsenic	Metallurgical operations	Deaths of red blood corpuscles, jaundice
2.	Carbon mono oxide	gasoline ,smokes from automobile, burning of coal	Reduction in the capacity of blood to transport oxygen, produces strain on heart, fatal over 1000ppm concentration.
3.	Chlorine	Bleaching of clothes, flour etc.	Damages respiratory tract and mucous membranes of eyes.
4.	Hydrogen cyanide	Fumigation, blast furnace, metal plating.	Nervous disorders, drying of throat, headache.
5.	Hydrogen sulphide	Refineries, chemical industries, burning of bituminous coal.	Diseases of eye and throat.
6.	Sulphur dioxide	Burning of coal and oil	Congestion of chest, head ache,diseases of respiratory tract, coughing.
7.	Asbestos	Cement industry	Asbestosis (occupational disease).
8.	Ammonia	Refrigerator, cold storage, ammonium fertilizers etc.	Bleaching of leaves, reduction of root and shoot growth, reduction in the rate of seed germination.

S. No.	Pollutant	Source	Impact on Human Health
9.	Suspended particulates (smoke and dust)	Burners, thermal power stations, other industries.	Diseases of respiratory tract, lung cancer etc.
10.	Dust of coal	Coal mines etc.	Black lung disease (Pneumoconiosis): an occupational disease.
11.	Textile dust	Textile industries	Byssinosis (brown lung disease): an occupational disease.
12.	Silica dust	Silica industry, pottery,	Silicosis (lung disease of miners, ceramics etc. industrial workers and potters): an occupational disease.
13.	Smoke of cigarette	Tobacco, cigarettes	Lung cancer, emphysema etc.
14.	Lead	Automobile exhaust, lead arsenate (insecticide), smelting complexes, ceramics, lead orate used in plastic-industries, paints etc.	Damage to muscular, circulatory and nervous systems; damages kidneys, liver and gastro-intestinal systems.
15.	NO(x)	Inefficient combustion of fuel in automobiles.	Helps in the formation of PAN (peroxyacetyl nitrate) which is an active ingredient of smog ozone (a toxic gas on earth), chest and congestion and respiratory troubles.

## B. Effects of Water Pollution on Human Health

Sewage, infectious microorganisms, plant nutrients, organic and inorganic substances and sediments are principal pollutants that cause water pollution. Out of these, the pollutants harmful to human health may be categorized as microorganisms and chemical agents.

**Infectious microorganisms** from sewage, municipal drains, slaughter houses, leather industries, sanatoria and hospital drains may contaminate our water sources. If potable water is contaminated with these organisms, the contamination may cause several types of diseases like **cholera**, **typhoid**, **gastroenteritis**, **diarrhoea**, **dysentery** and skin diseases. These diseases frequently endanger the community health.

Various **organic and inorganic** substances contained in polluted water cause serious health hazards. Inorganic substances like **mercury**, sulphur compounds, cyanides, arsenic, lead, fluorides, nitrates, cadmium etc. join our water bodies from industrial and mine sources. Phenols, detergents,

pesticides etc. join our water bodies from domestic and agricultural sources. These pollutants cause serious health problems by entering into human bodies through food and water.

The Pollutants that enter into our bodies get stored inside fatty tissues. The continuous deposition of these harmful pollutants inside human bodies causes biomagnifications resulting into serious diseases. So is the case of Minamata. **What is minamata?** Well minamata is the name of a deadly disease which killed many people living in Minamata bay of Japan in 1956 and afterwards.

A factory named **Chisso Corporation** located in **Minamata bay** started the production of acetaldehyde using mercury as a catalyst. Organic mercury from the factory effluent started to get accumulated in fish and shellfish on the city bay, which were captured by local fishermen and distributed in the market. The pollutant also accumulated inside the human body, through food chains and caused Neurological Syndrome due to mercury poisoning. This deadly disease came to be known as **Minamata disease**. Symptoms of the disease include ataxia, numbness in the hands and feet, general muscle weakness, narrowing of the field of vision and damage to hearing and speech. In extreme cases, insanity, paralysis, coma and death follow within weeks of the onset of symptoms. A congenital form of the disease can also affect foetuses in the womb.

**Dumps of wastes** on open grounds and landfill sites cause pollution of underground water through leaching. Different types of infectious diseases like **cholera, hepatitis, dysentery, diarrhoea, gastroenteritis** etc. are caused in human beings due to contamination of underground water. Ambala, Ludhiana, and Sonepat industrial areas of Punjab (India) were reported to contain nickel, iron, copper, chromium and cyanides in their ground waters. Effluents of metal industries that contaminate water contain cyanogens, phenol, coke, limestone, alkali, oils, mill scale, fine suspended solids, chromium, zinc, copper, silver, acids, alkaline cleansers, grease etc. The exposure to different heavy metals causes toxic effects on human health which is detailed in the following table.

**Table 8.2. Pathological effects of water polluted with heavy metals**

S.N.	Name of the metal	Pathological effects on human health
1.	Mercury	Haemolysis, abdominal pain, diarrhoea, chest pain, headache, Mina-mata disease (first reported from Mina-mata bay of Japan, in 1956).
2.	Lead	Damage of brain, liver and kidney; anaemia, convulsion etc.
3.	Arsenic	Lung cancer, ulcer in gastro intestinal tract, mental depression, disturbance in peripheral blood circulation
4.	Cadmium	Bone deformation, growth retardation, testicular atrophy, injury of central nervous system, hypertension, anaemia etc.
5.	Copper	Hyper tension, sporadic fever, coma, uremia etc.
6.	Zinc	Vomiting, cramps, renal damage etc.
7.	Chromium (hexavalent)	Diseases of central nervous system, nephritis, gastrointestinal ulceration etc.
8.	Cobalt	Low blood pressure, bone deformities and paralysis etc.

### C. Effects of Soil Pollution on Human Health

Soil is polluted by dumping of wastes from domestic, municipal, industrial, commercial, agricultural, hospital, mineral and construction sources. Toxic and non- biodegradable pollutants from these sources join food- chains and accumulate in food sources like plants and animals. Pesticides from agricultural fields enter into plants and get accumulated inside leaves, flowers, stems, roots, fruits, vegetables and grains. From there they reach to the consumers of the first order i.e. herbivores. Since, man is the top consumer, most of the non- biodegradable substances like some pesticides get accumulated in fatty tissues of humans and animals, and cause different types of neurological and reproductive diseases. In an ecosystem in which a secondary consumer or other is on the top, all the poison gets accumulated and magnified in his body. It often kills the animal. **Allergies of respiratory tract, nausea, headache, fatigue, dizziness, kidney troubles, cancers, abortions, infant mortality etc. are some of the symptoms of pesticide poisoning.** Many cows die every year due to ingestion of plastics thrown here and there along with food items.

### D. Effects of Radiation Pollution on Human Health

The radioactive wastes are non- biodegradable substances that are mostly produced from laboratories, hospitals and atomic reactors etc. These substances produce highly energized particles that are very harmful to life. Radioactive emissions often cause seriously dangerous effects in human body when it is exposed to them. Atomic explosions emit such types of radiations that cause genetic disorders in men, animals and plants.

Radiations cause both **somatic** and **genetic** effects on and in human and animal bodies. The somatic effects include immediate effects like sickness and radiation syndrome as well as delayed effects like carcinogenesis, abortion, abnormal development of fetus and leukemia. The genetic effects of exposure to radiations on human bodies include **chromosomal** and **genetic mutations** that produce permanent abnormalities in their off springs.

## E. Effects of Noise Pollution on Human Health

Besides causing discomfort, noise can also produce some serious physiologica effects on human body like **high blood pressure**, **irregular heartbeat**, **deafness and mental disorders**. It interferes with general communications and disturbs in sleep and studies of students. It is very harmful for patients. These are the reasons why blowing of horns by vehicles has been banned in certain areas like military cantonments, schools and hospitals etc.

### 8.2.3. Effects of Pollution on Other Organisms

Except humans, other organisms in the environment include components of the biotic environment other than human beings. These are – Animals, Plants and Microorganisms.

#### A. Effects of Pollution on Animals

Effects of pollution on animals are more or less similar to the effects of pollution on human beings. However, being top consumers in most of the food chains, human beings are not directly exposed to pollutants, though they receive accumulated pollutants in greater concentrations and hence are prone to greater risks as compared to secondary consumers. Effects of pollution on animals are being summarized below.

1. The **pollution of air** causes different types of diseases of respiratory systems of animals. Numerous species of insects and birds are killed due to polluted air.

2. **High pitched sound** produced due to explosions, fires of bullets etc. kill a large number of birds and insects. Terrorist camps in forests frighten wild animals during fire testing and explosion practices.

High pitched sound is also produced by Supersonic planes. The effect produced in the atmosphere by the flight of a supersonic plane and heard by our ears is called as “**sonic boom**”. The term sonic boom is commonly used to refer to the shocks caused by the **supersonic** flight of an aircraft. Sonic booms generate enormous amounts of sound energy, sounding much like an **explosion**. **Thunder** is a type of natural sonic boom, created by the rapid heating and expansion of air in a **lightning** discharge.

Some of the physical factors causing or affecting the sonic boom are – composition of atmosphere, temperature variation, humidity, pollution, speed of wind, hard surfaces etc. The over pressure and impact of sonic boom can be reduced by Tree- belts, grassy fields and lots of foliage.

The acceptability of sonic booms has not been assessed so far. Until some standards are established, it is doubtful that the legislations will be enacted to remove the current prohibition on supersonic over flight.

3. **Millions of fish** are killed every year by a wide variety of different pollutants from municipal and industrial sources.

4. **Pesticides applied in agriculture** are lethal to numerous types of animals. The application of

Carboryl pesticide kills honey bees that are most important for the pollination of crop plants. This pesticide is lethal to fish and birds also. The Toxaphene, another pesticide, causes deformities in the backbones of fishes. The Dichloro Diphenyle Trichloro ethane (DDT) and its breakdown products tend to retard the reproductive capacities of birds and cause **thinning of their egg- cells**.

5. In the **marine environment**, some ornithologists estimate that up to 250,000 birds are killed each year by the effect of oil spilled on the sea- surface.

6. Water and mud contaminated with **pesticides** kill thousands of swallows due to **Pharyngitis** caused when their throats are exposed to pesticides when they go for collecting mud for building up of their nests.

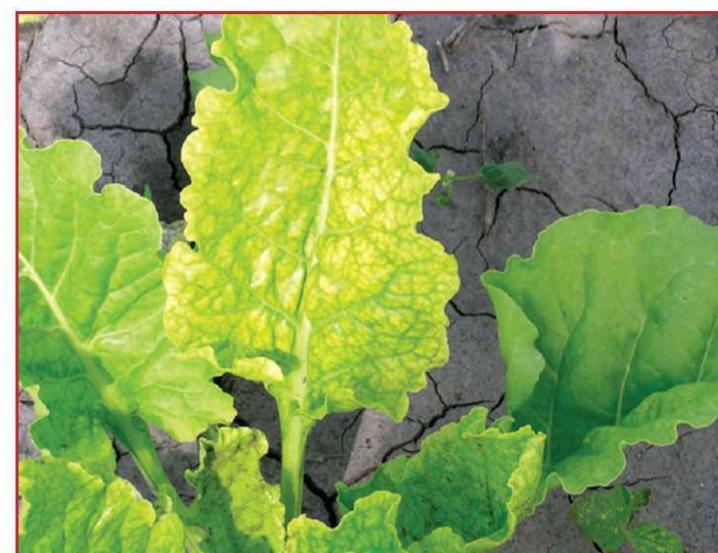
7. Hundreds of cows die every year due to ingestion of food containing polythene bags thrown along roadsides and in open grounds.

8. Large numbers of fish are killed in lakes and ponds due to Eutrophication as their waters get contaminated by plant- nutrients and sewage containing organic substances. The biological decomposition of these substances cause scarcity of oxygen which kills fish and amphibians.

## B. Effects of Pollution on Plants and Microorganisms

Most types of pollutions are harmful to plants and microorganisms as they are harmful to humans and animals. Some remarkable examples are being mentioned below.

1. The high concentrations of **sulphur dioxide** ( $\text{SO}_2$ ) produces **necrosis** (death of tissues), **blotching of broad leaved plants and grasses**, **brownish discolorations of tips of pine needles**, **chlorosis** (gradual yellowing) etc.



**Fig. 8.2. :** A. Blotching of leaves, B. Chlorosis.

2. **Hydrogen Sulphide** ( $\text{H}_2\text{S}$ ) in air causes leaf lesions or spots, defoliation and reduced growth.

3. High concentration (100 to 10,000 part per million) of **carbon monoxide** causes leaf – drop, reduction in leaf size, pre- mature ageing, inhibition of cellular respiration etc.

4. **Hydrogen fluoride** causes burning of tips of leaves, excessive dropping of blooms and fruits, development of seedless and small fruits etc.

5. Concentration of **Hydrogen chloride** in air is reported to be responsible for the abaxial glazing of leaves caused by collapse and plasmolysis of epidermal cells. Necrotic lesions are

produced due to high concentration of this gas in air.

6. Normal to high concentration of **hydrocarbons** like ethylene causes dry sepal disease of Orchids, decrease in the amounts of chlorophyll and carotenoids, shortening of internodes and lack of apical dominance.

7. **Ammonia, nitrogen oxides and fluorides** cause different types of harmful effects on leaves, stems and fruits of plants. Nitrogen oxides, ozone and PAN are reported to disturb metabolic processes of plants and cause deaths of tissues.(PAN = Perox Acyle Nitrates)

8. **The application of pesticides and fertilizers** kills a number of soil organisms, worms and insects. Many useful bacteria are killed in water due to contamination with pesticides. These bacteria are useful for decomposition of bio-degradable wastes in water leading to its purification.

9. **Dust and silica particles** from crushers, lime kilns, slate making units and quarries cause serious damages to plants. Particles released from cement manufacturing units are responsible for the premature fall of needles, formation of more stomata, reduction in the weight of seeds and increase in the number of infertile seeds.

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### EFFECT OF POLLUTION ON AGRICULTURE

Pollution in environment affects agriculture and horticulture also. The photochemical smog, a type of air pollution produces serious injuries to plants. It is due to photochemical smog that farmers in some parts of the world do not want to grow leafy plants like Lettuce, Swiss chord and Orchids. Sulphur dioxide emitted out from copper and lead smelters and hydrogen fluoride produced due to aluminium reduction and production of fertilizers, have severe effects on vegetables and crop-plants. Plants are more sensitive to pollutants and even low concentration of pollutants in air and water causes injury and growth retardation in them.

### 8.3. ABATEMENT OF POLLUTION

**Reducing the strength of pollutants so as to make them neutral or less harmful is called as abatement of pollution.** Certain principles, guidelines and control devices are necessary to be followed and adopted for the abatement of pollutions of all types. These principles and guidelines together with control measures are being given below.

#### 8.3.1. Principles and Guidelines for the Abatement of Pollution

**(a) Prevention of entry into the environment:** According to this principle pollutants are checked at the point of their origin and are not allowed to enter into the environment by the application of specific devices.

**(b) Isolation:** By isolation, we mean putting out or segregating pollutants at the point of their release or production. Such isolated pollutants are then dumped at specific locations as per scientific guidelines adopted from Pollution Control Agencies.

**(c) Conversion from highly toxic to lesser harmful product:** We can not stop industrial processes simply because they cause pollutions. However, we can reduce the toxicity or harmfulness of pollutants by applying bio-chemical technologies. A number of catalysts are introduced to reduce the toxicity of chemical pollutants produced during industrial processes.

**(d) Alternatives:** These are safer substances used on the place of substances that cause hazards. For example bio-pesticides like oil of Neem and garlic extract, are better alternatives to synthetic chemical pesticides.

**(e) Destruction:** The chemical pollutants which are proved to be toxic and are difficult to be substituted by safer ones, need to be blocked from further release and then destroyed in a safe and prescribed scientific manner. Advanced and Environment Friendly Incineration Technology and re-use for example re use of fly ash for making bricks.

**(f) Awareness:** Matters pertaining to good citizenship, environmental consciousness and preventive methods must be explained to the common man, so that he may try to perform his duties with a high degree of civic sense. These awareness programmes through various media may involve radios, TVs, seminars, demonstrations, documentary films, pamphlets, display of hoardings, banners and plays etc.

**(g) Public Participation:** The word ‘public participation’ means ‘sharing in common’ or ‘doing together’. In environmental context, it means, the involvement of the local public in solving their local environmental problems. It does not mean, people working under the planning and decisions of government agencies- it is rather bottom up approach. With joint efforts, people identify their problems, make plans to resolve them and then to implement them.

**(h) Environmental Education:** The environmental education has been made a compulsory subject for studies at schools, colleges and other institutions. This is the most effective tool for the abatement of pollution and conservation of environment at different levels.

**(i) Self Restraint – A Habit:** The greed of luxury and comfort initiates the production of newer and newer products. More and more products lead to more and more wastes which in turn pollute the environment more and more. That is why our ancient thinkers and philosophers preached on self restraint. Likewise, conservation should be made a habit.

**(j) Support to Professional Conservation Groups:** The state and central governments should provide subsidies for conservation of environment and pollution control works being carried out by professional groups.

**(k) Legislative and Tax Measures:** The existing laws for pollution control should be enforced properly so as to abate pollution. Industries doing recycling of wastes, regeneration of forest and production of pollution free technologies should receive tax-concession from the government.

Any big problem cannot be solved without planning and strong efforts. The pollution of environment is certainly a big problem. So planning for its abatement is very necessary. Heavy indoor pollution is caused through domestic cooking in rural areas. This pollution is mainly caused by burning wood and coal; and by using inefficient devices like rural furnaces (Angithis) and Smokey Chullhas. Use of **Smokeless chullhas** and burning **Bio-gas** (or Gobar Gas) can be two ways of reducing this type of pollution.

### 8.3.2. Practices of Abatement of Pollution

#### A. Abatement of Air Pollution

1. Large scale plantation in village commons, along rail tracks and along road-sides and compensatory forestation should be done so as to keep up the balance of oxygen and carbon dioxide gases in the atmosphere.



**Fig. 8.3.** Entry of cattle into water sources, like this pond, causes serious water pollution.

2. Burning of coal, petroleum and its products should be minimized to control emission of gases like CO<sub>2</sub>, SO<sub>2</sub>, H<sub>2</sub>S and NOx. Ecofriendly alternatives to fossil fuels like biogas, biodiesel, Solar power etc. should be developed & used to avoid air pollution.
3. Application of aerosol and CFCs should be substituted by the application of safe alternative.
4. Automobiles should be fitted with pollution control devices. Vehicles should be checked periodically for the control of pollutants.
5. Pollution control plants should be installed compulsorily in all the industries. Some emission control devices popularly used in industries and elsewhere for the control of particulates are: **Fabric Filters, Wet Scrubbers, Cyclone Collectors, and Electrostatic Precipitators**. We have already studied about these mechanical devices in the previous class.
6. Periodic monitoring and testing of industrial pollution should be insured by the agencies concerned.
7. People must be checked against burning of wastes including plastics and awareness should be generated in these regards.
8. A complete ban on shifting cultivation should be imposed in order to check air pollution.
9. Existing laws pertaining to pollution control should be enforced properly.

## B. Abatement of Water Pollution

1. Proper drains should be built in human settlements like mohallahs, villages and colonies. These drains should be routinely cleaned so as to ensure easy flow of water. No solid waste or plastic should be put into these drains.
2. Dumping of wastes near water sources and entry of cattle in these sources must be stopped to check the contamination of water.
3. Purification and treatment of industrial effluent must be ensured before allowing it to join local drains, water bodies, rivers or sea.
4. Disposal of dead bodies into waters of different rivers, or burning of dead bodies on the banks of rivers must be banned and continuous monitoring of such cases should be ensured by concerned government bodies or agencies.
5. Industries should not be established near human habitations, parks, hospitals, sanitaria etc.
6. Reduction in the input of wastes, proper disposal of wastes, checking organic substances against joining water bodies, treatment of sewage etc. practices must be taken care of at all levels.

We have already studied about the method of treatment of waste water. Water is a scarce resource. Hence, attempts should be made to re-use water after proper treatment and purification.

The waste water is treated by adopting following methods –

- (a) Collection and sedimentation of waste water,
- (b) Biological decomposition of sediments,
- (c) Decantation and filtration,
- (d) Chemical oxidation, chlorination and / or ozonization.

## **GANGA ACTION PLAN**

A comprehensive multicrore plan for cleaning Ganga, the Sacred River of India, was launched in 1986 by the Government of India. It was named as the Ganga Action Plan or GAP in abbreviated form. At the time of launching, the main objective of GAP was to improve the water quality of Ganga to acceptable standards by preventing the pollution load reaching the river. However, as decided in a meeting of the Monitoring Committee in June, 1987 under the Chairmanship of **Prof. M. G. K. Menon**, then Member, Planning Commission, the objective of GAP was recast as restoring the river water quality to the '**Bathing Class**' standard which is as follows –

**Table 8.3.**

Parameter	Quantity
Bio-Chemical Oxygen Demand (BOD)	3 mg/l maximum
Total Coliform	5 mg/l minimum
Dissolved Oxygen (DO)	10,000 per 100 ml
Faecal Coliform	25,00 per 100 ml

**The Principal aims of the GAP are –**

1. Improving the quality of the river-water by intercepting, diverting, and treating adequately.
2. Installing sewage treatment plants at its banks and releasing the water after proper treatment by the plants.
3. Encouraging pollution control, and waste management activities in cities located on its banks.
4. Installing electric crematoria and checking people against disposing dead bodies and their parts in the river.
5. Developing river fronts and making provisions of low cost sanitation facilities.

## **C. Abatement of Soil Pollution**

Soil is polluted through dumping of wastes, application of chemical fertilizers and synthetic pesticides and salinization through water logging. **Following efforts must be made to abate soil pollution –**

1. Solid wastes should be properly disposed by composting, land filling, thermal processes; and by re-cycling and re-use.

**Composting** is the process of degrading decomposable solid waste in a properly dug pit, called as compost pit. Composting process involves both the aerobic and anaerobic processes. In aerobic composting the biodegradable wastes are filled in the compost pit which is left open from one or more sides. On the other hand, in anaerobic composting the biodegradable wastes are allowed to degrade in sealed compost pits. The compost prepared through any one of these processes is very good manure for crops. It provides nutrients to the soil as well as improves its texture also.

**Land filling** is just the process of dumping wastes or other substances in low land areas and covering the same with soil. This is the age old practice of leveling low areas. But, in modern times waste materials are buried under soil after compacting them properly in a scientific manner. The provision of release of gases from the decomposing materials of the land fill is also made adequately. This type of advanced land filling is called as **sanitary land filling**.

In thermal process, the dried solid waste is safely burnt in closed compartments with proper provision of treatment of harmful gases, and utilization of heat energy evolved during the process. It is called as **INCINERATION**. Environmentalists do not favour this process of solid waste treatment in view of fear of air pollution, rather they advocate for Re-cycling and Re-use for the disposal of non-biodegradable substances.

In general terms, **Re-cycling** is the process of making useful things from discarded things. This style of waste management is very good as it reduces the pollution load of the environment. **Re- use** is simply the practice of using already used things after cleaning, disinfecting and repairing, what ever is important. Giving away old clothes and blankets to needy and poor instead of discarding away is considered to be a good practice of re-use.

2. Composts, green manure, wormy compost or natural manure should be added to soil so as to improve its fertility. The application of chemical fertilizers should be restricted for unavoidable conditions through proper assessment of the loss of nutrients in the soil.

Biodegradable solid waste, dung etc. can be used to prepare **Biogas**. Biogas is an ideal fuel with **methane** as its principal components. It is used for cooking and lighting houses.

3. The application of synthetic chemical pesticides should be substituted by the application of bio-pesticides.

4. Proper drainage of water from crop fields should be ensured to protect fields from water logging. This condition increases salt content in soil and makes it saline.

## D. Abatement of Radiation Pollution

The abatement of radiation pollution demands adequate knowledge, alertness and applications of advanced technologies. Some general measures to abate and control radiation pollution are being mentioned below—

1. There should be adequate provisions of proper handling and transport of radio- active wastes.

2. The atomic reactors should be built on the basis of the most advanced technologies so that their buildings must be absolutely safe for workers and the environment.

3. The transporters and handlers of the radio- active isotopes must be skilled and fully aware of the proper methods of the work.

4. The radio- active by-products of industries and power plants must be disposed properly.

5. The sampling, analysis and monitoring for radiation pollution should be done on routine basis.

6. All the safety measures and first aid devices as per recommendations of a team of high level experts must be made available round the clock.

## E. Abatement of Noise Pollution

According to a report of the **World Health Organization (WHO)** – ‘**of all environmental problems, noise is the easiest to control**’. But in the practical life it has become hardest to control because most of the people do not care for the conveniences of other people. Industries manufacture different types of horns that produce strange and high pitched sound and those horns are being fitted in

motor cycles and cars. It appears that such industries and users of such horns do not care for law or conveniences of other people.

Following are some of the tips for the Abatement of Noise Pollution-

1. The use of loudspeakers, amplifiers, pressure horns etc. should be restricted.

2. Strong awareness should be built by people and media about the bad impacts of noise pollution.

3. Every citizen must care for the conveniences of patients, students and other people and should keep his music systems for the use of his family only. He must produce sounds that are audible to him only and not to the public outside his home.

4. Designs and fabrication of silencers and their use in aircraft engines, automobiles and industrial machines are effective ways of controlling noise pollution through these sources.

5. The government must prescribe noise limits for vehicular traffic, declare silence zones and have control on sound pollution during public functions, fares, festivals etc.

6. Rows of trees and shrubs should be planted and vegetation buffer zones should be created in and around residential areas so as to reduce the effects of noise pollution.

7. Every city administration should prescribe a **city noise-control code**. The creation of noise should be prohibited. It should be punishable under law, effectively.

8

## TOWARDS A BETTER ENVIRONMENT...

Marine water pollution has become a major point of concern over the world today. Most of the important parts of the world have organized special pollution control departments to control pollution in the sea and along sea coasts. In India too, every major port has organized a special anti-pollution cell which is basically concerned with control of oil and other pollutants. There are coast guards who take care of pollution in the areas that are beyond the control of the port authorities. According to the International Marine Pollution Convention (MARPOL), ships and ports should have certain facilities for reducing pollution. Antipollution measures have been introduced in ports for checking sea and coast area pollution.

## IMPORTANT DEFINITIONS

**ABATEMENT**

: The practice of making something less harmful is known as abatement.

**EXPOSURE**

: The contact of a pollutant with a person is called as exposure.

**RISK**

: The harm or injury to a person by exposure to a particular pollutant is called as risk.

**NEUROLOGICAL DISORDER**

: Disorder related to nervous system of an organism is called as neurological disorder.

**LEUKAEMIA**

: A serious disease in which too many white blood cells are produced causing gradual weakness and eventual death, is called as leukaemia.

**RADIOACTIVE SUBSTANCE**

: A substance which emits out specific radiation is called as radio active substance.

**PHARYNGITIS**

: The infection or trouble of Pharynx (A chamber at the end of vocal chamber of alimentary canal), is called as Pharyngitis.

**FABRICATION**

: Making or producing: goods, equipments etc. from various different materials is called as fabrication.

**THERMAL POLLUTION**

: Harmful increase in water temperature in streams, rivers, lakes, oceans or coastal ocean water caused by either dumping hot water from factories and power plants or removing trees and vegetation that shade streams, permitting sunlight to raise the temperature of these waters is called as Thermal

<b>PATHOLOGICAL</b>	:	Pollution.
<b>SOMATIC EFFECTS</b>	:	Caused by or connected with disease or illness.
<b>HEAVY METALS</b>	:	Effects pertaining to physical make up of an organism.
<b>CARCINOGENIC</b>	:	Elements with high relative density ( 5 or more), often toxic to Humans and animals are called as heavy metals. Examples: lead, mercury, copper and cadmium etc.
	:	Any thing likely to cause cancer is called as carcinogenic.

## MODEL QUESTIONS AND EXERCISES

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. Mention any two global problems caused due to air pollution.
  2. Name any three natural phenomena that affect environment adversely.
  3. A gaseous pollutant in air causes leaf lesions, defoliation and reduced growth in plants on exposure in high concentration. Name the pollutant.
  4. What is the effect of water logging on soil?
  5. Name any two -
    - (a) Green House gases
    - (b) Pollutants causing acid rain
    - (c) Water borne diseases
  6. Which is main constituent of Biogas?
- (ICSE 2006)
- (ICSE 2007)

### II. SHORT ANSWER TYPE QUESTIONS

**(2 marks each)**

1. Distinguish between pollution and pollutant.
  2. ‘The pollution of anyone component of environment is sure to affect other components’ – How?
  3. Mention any two effects of Air Pollution on each of the following –
    - (a) Human Health
    - (b) Global Environment
  4. Name any two occupational Diseases. Explain reason of each one of these diseases.
  5. What is the effect of Noise Pollution on Human Health?
  6. What are the principles and guidelines for the abatement of pollution?
  7. Name any two devices that are used for the abatement of air pollution.
- (ICSE 2006)
8. State any two ecofriendly alternatives to fossil fuels.
- (ICSE 2010)
9. Mention two methods of disposing solid waste.
- (ICSE 2007)
10. Mention two objectives of Ganga Action Plan.
  11. Name the chemical compound that caused Mina-mata disease. which country was confronted by it?
- (ICSE 2006)
12. What is the radiation pollution? How can it be abated?
  13. State any two ways of reducing pollution from domestic cooking in rural areas.
- (ICSE 2010)

### III. DETAILED ANSWER TYPE QUESTIONS

**(4 to 6 marks each)**

1. What are the effects of pollution on human health?
2. What are the effects of pollution on
  - (a) Plants
  - (b) Animals
3. Describe the methods of the abatement of –
  - (a) Air Pollution

- (b) Water Pollution
  - (c) Soil Pollution
  - (d) Noise Pollution
  - (e) Radiation Pollution
4. What are physiological effects of noise pollution?
  5. Write a note on Land filling.

(ICSE 2008)

#### IV. OBJECTIVE TYPE QUESTIONS

##### A. Multiple Choice Type Questions

**Tick (✓) the correct option**

1. Melting of glaciers is associated with-
  - (a) global warming
  - (b) ozone depletion
  - (c) acid rain
  - (d) desertification
2. Unhealthy practices of soil management have enhanced-
  - (a) soil erosion
  - (b) afforestation
  - (c) soil pollution
  - (d) both (a) and (c)
3. A gas causing acid rain is-
  - (a) nitrogen oxides
  - (b) ozone
  - (c) methane
  - (d) bio- gas
4. Vehicular Noise pollution is controlled by-
  - (a) removing horns
  - (b) using air conditioners inside vehicles
  - (c) pressure horns
  - (d) silencers
5. Ozone is depleted by-
  - (a) chlorofluorocarbons (CFCs)
  - (b) pesticides
  - (c) oxygen
  - (d) sulphuric Acid

##### B. Fill in the blanks

1. The application of ..... kills honey bees that are most important for the pollination of crop plants.
2. ..... is caused in water bodies due to their enrichment with nutrients including phosphates and nitrates .
3. ..... causes burning of tips of leaves, excessive dropping of blooms and fruits, development of seedless and small fruits etc.
4. The radioactive wastes are ..... substances.
5. Fabric filters, wet scrubbers and electrostatic precipitators are mechanical devices to control ...emissions.

##### C. True / False

Write T against the statement which is True and F against the statement which is False.

1. The components of nature tend to recover general natural losses on their own.
2. The depletion of the ozone layer is causing the melting of glaciers.
3. The harm or injury to a person by exposure to a particular pollutant is called as cancer.
4. The nitrogen oxides contribute to acid rain.
5. The risk associated with smoking of cigarette by a person is called as involuntary risk.
6. The exposure of seeds to ammonia causes reduction in the rate of their germination.
7. The exposure of sulphur dioxide to a person may cause a disease of respiratory tract.
8. The Black Lung disease is also called as Silicosis.

## I. VERY SHORT ANSWER TYPE QUESTIONS

1. Global Warming, Ozone Layer Depletion.
2. Change in Atmospheric Temperature, Climatic Variation
3. Hydrogen Sulphide,
4. Salinization,
5. (a) Carbon dioxide and Methane, (b) Nitrogen Oxides and Sulphur Dioxide, (c) Cholera and Diarrhoea
6. Methane

## IV. OBJECTIVE TYPE QUESTIONS

### A. Multiple Choice Type Questions

- 1.(a), 2.(c), 3.(a), 4. (d), 5.(a)

### B. Fill in the blanks

1. Carbonyl pesticide, 2. Eutrophication, 3. Hydrogen fluoride, 4. Non- biodegradable, 5. Particulate.

### C. True / False

1. T, 2. F, 3. F, 4. T, 5. F, 6. T, 7. T, 8. T.

## PROJECTS & ACTIVITIES

### Act for Environment

#### 8.1. OBSERVATION

Observe cases of voluntary and involuntary types of excess risk in your society continuously for a week. Prepare a report of your observation.

#### 8.2. PROJECT WORK

Prepare a Project on the Environmental Management of your school campus. Observe what activities of students affect it adversely. Add your suggestions.

#### 8.3. SURVEY

Identify cases of Air Pollution and Water Pollution in your area. Make an assessment of the impacts of these pollutions on the community health. Prepare a report indicating all the sources of pollution, and send it to the Member Secretary, Pollution Control Board of your State.

# **3**

# **ISSUES OF ENVIRONMENT**



**9. Decline in Productivity and Effects on Economy**

**10. Resettlement and Rehabilitation of People**

**11. Energy Crisis-Urban and Rural Sectors**

**12. Global Issues of Environment**

**13. Disasters: Types, Management and Mitigation**

# Decline in Productivity and Effects on Economy

## FACTS & CONCEPTS



- Introduction
- Productivity : What does it mean?
- Forest Productivity
  - Decline in Forest Productivity and Effects on Economy
  - Causes of Decline in Forest Productivity
  - Efforts to Recover the Loss of Forest Productivity and to Improve the Economy
- Agricultural Productivity
  - Decline in Agricultural Productivity

- u Causes of Decline in Agricultural Productivity
- u Effects of Decline in Agricultural Productivity
- u Efforts to Recover the Loss of Agricultural Productivity and to Improve the Economy
  
- u Marine Productivity
  - u Decline in Marine Productivity and Effects on Economy
  - u Causes of Decline in Marine Productivity
  - u Efforts to Recover the Loss to Marine Productivity.

## 9.1. INTRODUCTION

Natural Resources – both Physical and Biological, make up the economic strength of a nation. But human beings are destroying these resources without any care and responsibility. It has been during the last few decades that peoples and their governments started thinking about the loss of natural resources in economic terms. In fact, all the forests, crops, marine and all the other resources form economic backbone of our country. These resources supply raw materials to many of our important industries and build up our economic strength. But, the utilization of these resources in most of the cases is being done on an unsustainable basis. As such, our resource bases are being depleted causing serious losses to their productivities. This condition may invite serious crises in the natural environment and the depleting resource bases may prove challenges to life on this planet. In this chapter, we are going to study about the loss of the productivity of our forests, agricultural and marine ecosystems and its effects on economy.

## 9.2. PRODUCTIVITY: WHAT DOES IT MEAN?

In Economics, the productivity is the rate at which goods or commodities are produced. But in the context of environment, **the rate of production or the amount of organic matter accumulated in the living systems in the unit period of time is called as productivity**. In more simple terms, **the production of biomass per unit area in a unit period of time in an ecosystem** (forest, agriculture or marine ecosystem etc.) **is called as productivity of that ecosystem**.

**The productivity of an ecosystem has been classified as:** Primary Productivity, Secondary Productivity and Net Productivity.

In fact, it is through the biological process that the living organisms (say- green plants, other autotrophs and chemosynthetic bacteria) synthesize energy-rich organic materials in the environment – through photosynthesis. It is called as Primary Production. **The rate at which the energy is converted by photosynthesis and chemosynthetic autotrophs to organic substances is called as Primary Productivity.** The Primary Productivity has been classified into: Gross Primary productivity and Net Primary Productivity.

**The total (gross) photosynthesis or total assimilation is called as Gross Primary Productivity. The rate of storage of organic matter in plant tissues in excess of respiratory utilization by plants during the period of measurement is called as Net Primary Productivity.** Some of the primary production is consumed by herbivores and is transformed into other forms. **The rate of storage of energy at consumer level or the rate, at which food is assimilated by consumers, is called as secondary productivity.**

A certain amount of organic material is used to sustain the lives of producers. What ever remains after these processes is called as **Net Production**. The growth and productivity of an ecosystem

depends upon certain factors like soil fertility, consumption by herbivores, climatic fluctuations and human interferences.

### 9.3. FOREST PRODUCTIVITY

The total amount of organic matter produced per unit area of forest per unit time is called as the forest productivity. In a stable forest ecosystem there is neither an accumulation nor a diminution in the total amount of organic matter present. The productivity of a forest is judged in terms of various types of economically valuable products derived from it.

#### enviro\_Facts : 9.1.

Forests are sources of various economically valued products. They provide important services to environment and human beings. Some most important examples are being mentioned here.

1. Forests provide timber and significant revenue is derived from harvesting and processing of timber by private and government sectors.
2. Forests provide over 13 million tonnes of fuel wood per year in India alone.
3. Forests provide medicines, gums, resins, alkaloids leaves worth crores of rupees every year.



**Fig. 9.1.** Timber : A Forest Product.

4. Forests provide other commodities of great economic value like lakh and silk.
5. Forests provide shelter to numerous species of birds, mammals, reptiles, amphibians, molluscs, insects and rodents etc.
6. Forests provide job opportunities for about 50 million people in the developing countries.
7. According to recent calculations natural forests store about 430 billion metric tonnes of carbon, which is more than the carbon released by the burning of fossil fuels over the next 70 years or so.
8. Reports suggest that one hectare of mangrove forest offers more than US \$ 1,000 to a country.

#### 9.3.1. Decline in Forest Productivity and Effects on Economy

The increasing human population has put tremendous pressure on land for housing, agriculture, farming, pasture development, grazing by cattle and the production of various types of consumer

goods through industrialization. For this land has to be acquired by claiming wetlands, mangroves and by large scale deforestation. In Indonesia; about 68000 sq km of land have been allocated for new plantations for the production of palm oil. Here are some more examples of decline in forest productivity due to different reasons.

1. The total forest area in the world has been estimated to be around 3,869 million hectares. Out of this area about 95% is covered with natural forest and 5% is covered with regenerated forest. The natural forests are being lost or being converted to other uses of land at an alarming rates. For example, about 16.1 million hectares of natural forests were lost during 1990 – 2000. The annual forest loss at the Pan-tropical level has been estimated to be 9.2 million hectares.



**Fig. 9.2.** Great amount of money is spent each year on rescue and relief of people endangered by floods.

2. According to the Food and Agricultural Organisation, the global loss of forests during the period 1990–2000 has been around 9.4 million hectares per year.

3. The destruction of forests and grasslands is causing extinction of more than 12% of bird species, 25% of mammal species and about 33% of amphibian species.

4. In spite of increasing awareness about deforestation on global scale during recent years, the total area under forests is declining continuously.

5. About 850 million hectares of forest land is degraded in Asia and Pacific accounting for 24% of the region's land. It was during 1981 – 1990 that deforestation in Asia and Pacific regions increased from 3.9 million hectares per year against 3.9 million hectares per year during 1981 – 1990. On the global level, the annual forest loss runs at about 12 million hectares per year, mostly in developing countries.

6. The period between 1976–1990, has been the period of **Plantation Forestry**. During this period, dense forest cover was destroyed from 46 to 36 million hectares which reduced the livelihood options for forest dependent poor people especially tribal people.

The land denuded of forests, is taken away with the rain water to cause the siltation of rivers which finally leads to frequent floods. Floods claim large number of lives of humans and cattle every year. Great properties are ruined by devastating floods and great amounts of money are spent on rescue and rehabilitation of people. Thus, the decline in the forest productivity causes great losses to economy.

### **9.3.2. Causes of Decline in Forest Productivity**

The world average of per person forest cover is estimated to be one hectare whereas in India; it is just 0.10 hectare or so. Forests of India are being destroyed at the rate of 12.5 million hectares per year. If this trend continues, a day may come when we may have to face acute environmental crises on all fronts. We have already studied about all possible reasons of the depletion of the forest cover, and that need not be repeated here in detail. However to recall, some important reasons behind the depletion of the forest cover are – the **explosion of human population, overgrazing by cattle like sheep and goats, mining activities and heavy industrialisation, deforestation along hill slopes and the construction of roads along hillsides**. Since forests contribute a lot to the national and local economy up to remarkable extent, loss of forest economy is a serious loss to the national economy.

### **9.3.3. Efforts to Recover the Loss of Forest Productivity and to Improve the Economy**

There is an increasing awareness regarding the impact of the loss of the Forest Productivity on economy across the world. People are now relying on plantation for the production of industrial wood. Nearly half of the plantation in the world is not more than 15 years old. Asia has become the world leader in terms of plantation as more than 62% of all the forest plantation done by the year 2000 across the globe, has been done in this region alone. Ideally, about 83% of the land area should be under forest, but due to growing demand for agricultural land and rapid urbanization, both the area under forest and productivity of forests have decreased considerably. This is the reason why Governments and people are putting their efforts for raising Forests Productivity.

Some very important signs of **human efforts for raising forest productivity** are –

1. The Private Sector Investment in plantation in developing countries has gone up during recent years.
2. The foreign investment in plantation sector has increased considerably.
3. Communities and small landowners are producing trees for selling to private companies and generating income though it is doing a very little good to environment.
4. The timber harvesting has been banned by many countries in order to conserve their forest resources or to check the economic losses due to natural calamities like land slides or floods.
5. Some countries have put restrictions on the export of wood so as to address the problems of national environment and markets.
6. The *World Trade Organisation (WTO)* Committee on trade and environment and the Intergovernmental Forum on Forests are considering issues pertaining forest trade.

## **EFFECTS OF DECLINE IN FORESTS PRODUCTIVITY**

The **decline in Forest Productivity has serious effects** on the whole environment. It reduces the income of those who depend on forests, and makes their lives miserable. As forests act as **sinks of carbon dioxide**, a gas contributing into global warming, decline in forest productivity raises the intensity of this global terror. **Roots of forest trees hold soil water and act as sponges**, but in case of their depletion, manifold effects are observed- for example- reduction in humus content, soil moisture, and general fertility of the soil. As the national economy too, has to depend heavily on the forest productivity, loss in forest productivity is sure to put down the national economy. In absence of trees soil becomes prone to serious erosions leading to siltation of water bodies- thus causing water crisis and flash floods. The soil under these conditions remains prone to desertification.

## 9.4. AGRICULTURAL PRODUCTIVITY

The rate of production of agricultural goods in a unit period of time is called as Agricultural Productivity.

In more simple terms, the production of flowers, fruits, vegetables, legumes, nuts, millets, tubers, corms, roots, leaves, herbs and other agricultural products in unit period of time(say one season or one year), is called as Agricultural Productivity.

Food is the most important agricultural product. But many other products like natural fibres, flowers, forage (like alfalfa, clover grasses etc.), and many other products are also obtained from agriculture. About 85 major crops are grown in the world. Some important crops are: cereal grains, (e.g. barley, maize, oat etc. millets, rye, sorghum and wheat), roots(sweet potato, cassava etc.), pulses, oil bearing crops, nuts, sugar bearing crops, cocoa beans, coffee, tea etc. Cotton, flax, hemp, jute, sisal etc. produce plant fibres. Some farms provide raw materials for industry: like fibre, natural rubber, castor oil, linseed oil, tobacco etc. These agricultural products support greater part of the world economy. But human activities leading to soil degradation, pollution, encroachment on agricultural lands, wetlands, mangroves etc. have posed seriously bad impacts on agricultural production and economics of the world.

Today, a variety of crops are grown through mixed farming methods. These crops are produced for commercial purposes. Farmers in Europe and Mid- Western United States do mixed farming for great productivity. This type of farming is less risky than specialized farming. Thus market price for a particular product may decline sharply. On a mixed farm, losses from one product may often be covered by profits from the other product.

### 9.4.1. Decline in Agricultural Productivity

Two –third of the world's agricultural land has been degraded. About 1.2 billion poorest people of the world inhabit those lands. They work hard. Still the agricultural productivity is very low in those areas.

The **declining land productivity** in many cases has forced people to encroach on forests, grasslands and wetlands. These conditions cause further degradation of environment and decline in agricultural productivity.

**Climatic variations** and human activities are causing droughts, land degradation and desertification. As per reports of **United Nations Convention to Combat Desertification (UNCCD) - 2000a**, about 3600 million hectare or 70% of the world's dry land are degraded. Africa, Asia and small island states are facing serious economic losses due to land degradation caused by declining productivity of land due to climate change.

Agricultural productivity declines considerably due to **floods and the climatic change**. The degradation of land, Siltation of rivers, pollution of soil from acid rains and industrial wastes are some of the issues that are associated with urbanisation and industrialization that are strong causes of **land degradation** and decline in agricultural productivity. As per estimates of **Food and Agricultural Organisation (FAO)** - 1996, about 1.96 million hectare of land has been degraded by industry and urbanisation. **Urbanisation** has also caused damages to urban agriculture on public and private lands. For example about 30% of the **Russian Federation's** food is produced on 3 per cent of land in sub urban areas. The United States lost 400 000 hectare of farm land and China has lost up to 5 million hectares of farm land due to urbanisation. All these conditions have put tremendous impact on

agriculture and decline in economy.

Most of the **biodiversity loss** has occurred during 20<sup>th</sup> century. According to FAO's reports, out of traditionally cultivated 7000 species for food, only 120 are being cultivated today. All these declines in agricultural productivity reflect human activities pertaining to carelessness and exploitation.

#### **9.4.2. Causes of Decline in Agricultural Productivity**

Following are the causes of the decline in Agricultural Productivity –

1. With the explosion in human population the agricultural land has gradually been converted into residential and industrial areas.
2. The need of production of more and more food forced people to go for commercial and extensive agriculture. These practices caused serious depletion of nutrients causing loss in the agricultural productivity.
3. The agricultural production was to be boosted up by the application of synthetic chemical fertilizers and crops were protected from pests and diseases by the applications of pesticides and fungicides. All these synthetic chemicals caused permanent losses in the further productivity of agriculture by causing degradation of lands.
4. Vast areas of productive land are destroyed by heavy mining and quarrying.
5. Frequent floods due to siltation of rivers caused by soil erosion often leads to damage of the top soil at certain places causing serious soil degradation leading further to serious losses of agricultural productivity.
6. Irratic rainfall induced by human activities causes frequent drought conditions that further leads to causing crop failures and damages to the agricultural productivity.
7. The current practice of planting commercial varieties of trees on agricultural land instead of growing food crops is leading to serious losses to agricultural productivity.

#### **9.4.3. Effects of Decline in Agricultural Productivity**

**1. The decline in Agricultural Productivity is causing hunger in major parts of the world.** The World Food Summit- 1998 set the goal of reducing the number of hungry people up to half. In spite of great improvements in the food production about half million people are still starving across the world. Thus, it has become evident that the Agricultural Productivity has become a driving force for economic and social developments. According to the **International Atomic Agency**- ‘**When agriculture fails sources of income are lost. Social ties are disrupted and as a result, societies become more mobile.**’

**2. The decline in the productivity of the land under poor farmers created regional disparities.** The **Green Revolution** was launched to enhance food production but only the rich farmers could derive benefits out of it. The poor could not afford heavy prices of synthetic fertilizers and pesticides. Thus they remained hungry and economically backward in comparison to the rich. On the other hand, application of synthetic fertilizers and poisonous pesticides degraded the productivity of soil seriously. Thus the land even under the rich farmers no longer remained productive. These conditions are causing seriously bad impacts on the agricultural production during current times leading to a setback to the national economy.

**3. The agricultural growth created a gap between the rich and the poor states** in the post green revolution period after 1980 – 1981.

4. The agriculture growth slowed by 2 per cent a year in the 9<sup>th</sup> Five Year Plan and the overall income growth was only 5.5 per cent where as the target was 8 per cent.

5. The decline in agricultural productivity is causing **distress among farmers**. They used to take loans from local money lenders & banks to purchase more & more agrochemicals to boost up the production. Unfortunately natural calamities ruin the crop & the already degraded land too, could not support the production. As such farmers fell into a DEBT TRAP and committed suicide when their all credit sources. The Debt-Trap is a situation where you add on a new debt to pay an existing debt. When a farmer is over leveraged all the credit sources are exhausted and he arrives at a situation of DEBT TRAP.

6. Poor maintenance of irrigation system causes **loss of water through wastage and seepage**. The scarcity of water affects crop production adversely.

7. Uncontrolled exploitation of ground water has caused **serious depletion of water table** in many parts of the country. It is leading to a **water crisis** and the **failure of crops**. Even after the exploitation of all the irrigation potential, up to 60% of India's cultivable area is assessed to depend on dry land farming.



A



**B**

**Fig. 9.3.** Water crisis (A) Children collecting water from a 7 feet deep pit in Rajkot distt. of Gujarat (India) (B) Queue for water.

8. The decline in agricultural productivity has no longer left the agriculture profitable activity far general farmers. Hence, **large scale migration of people** from rural areas towards cities is increasing day by day. It is further causing urban congestions, expansion of slums and encroachments on government lands.

#### **9.4.4. Efforts to Recover the loss of Agricultural Productivity and to Improve the Economy**

The loss of Agricultural Economy can be recovered so as to improve the economy through following measures :

- (i) Improvement of Land by the application of organic fertilizers, by plantation and by control on overgrazing.
- (ii) Lesser dependence on agro-chemicals
- (iii) Adoption of methods of crop-rotation, mixed-cropping etc.,
- (iv) Adoption of proper methods of irrigation. etc.
- (v) Application of Green Manure.

## **9.5. MARINE PRODUCTIVITY**

**The Marine Productivity is the production of organic matter fixed or changed into stable compounds by photosynthetic organisms especially phytoplankton and algae in a unit period of time.**

The oceans are major sources of food, minerals, medicines and numerous types of precious things. Certain regions of a particular ocean remain zones of a very high productivity where as some regions are zones of very low productivity. Early records of ocean productivity show that the global oceanic production of organic matter fixed from nutrients amount to about 130 billion metric tonnes. Current assessments show that oceans produce 82 million metric tonnes of fish and about 500 000

metric tonnes of sea weeds. Sea weeds provide us valuable food and medicines. *Cladophora fascicularia*, *Porphyra indica*, *Codium tomentosum*, *Hydroclathrus*, *Chaetomorpha lenoides* and *Caulerpa sertularioides* are edible algae. Some algae yield important chemicals like Agar, Algein, and Carrageenan etc. Some important algal products and their algal sources are being mentioned in the table below-

**Table 9.1. Some important substances derived from Marine Algae.**

Algal Product	Algal Source
Agar	<i>Gracilaria edulis</i> , <i>Sarconema furcellatum</i> , <i>Gellidiella acerosa</i> , <i>Gracilaria cortica</i> , <i>G. cylindrica</i> , <i>Gelidium pusillum</i> .
Algein	<i>Sargassam duplicatum</i> , <i>S. tenerium</i> , <i>S. myriocystum</i> , <i>Turbinaria conoides</i> , <i>T. ornata</i> , <i>S. wightii</i> .
Carrageenan	<i>Hypnea valentiae</i> , <i>Laurencia papillosa</i> , <i>Acanthophora sp.</i>
Algae in research	<i>Doliolaria</i> , <i>Pentacula</i> , <i>Sea cucumber</i> etc. Agar powder is used in Preparing potato dextrose agar nutrient medium for cultural Studies of fungi etc.



A



B



C

**Fig. 9.4.** Some important marine algae : (a) *Gracilaria edulis* (b) *Sargassum duplicatum* ( c ) *Hypnea valentae*.

On the basis of the sustainable yield maximum harvestable substances from oceans amount to 100 million metric tonnes per year. 25 per cent of the world's annual output of oil is produced by offshore wells. Some of the major minerals obtained from the sea water are magnesium, bromine, sodium chloride and several metals including about 10 billions of gold. Manganese nodules, found on the sea floor contain many different minerals in different amounts. About 17% of the petroleum of the world is derived from offshore oil and gas wells. Sulphur is also found on sea floors.

Ocean is also an alternate source of energy like Thermal Energy obtained through a process known as **Oceanic Thermal Energy Conversion (OTEC)**. The sea water is also being converted for drinking and related purposes through desalination.

### 9.5.1. Decline in Marine Productivity and Effects on Economy

Rapid and **unwise exploitation of oceanic resources** compounded with **sea- water pollution, dumping of wastes and oil spills** has reached to a very dangerous level which has caused considerable decline in the productivity of marine resources which has further led to serious losses to economies.

According to a FAO- report, about 60 to 70 per cent of the **world's fish stock** requires urgent protection. The global sustainable yield of the marine fisheries is just 6296 million tonnes per year. About one – third of the world's marine fish production is dumped into the sea mostly in injured or dead condition.

Sea –water contains a **large number of water borne pathogens**. Most of the cities in the developing world do not have efficient **sewage treatment facilities** and discharge their contaminated water into the sea. Bathing in such water poses significant risk and causes remarkable economic loss as mentioned below-

## **DISEASES RELATED TO MARINE CONTAMINATION**

**Oceans and human health are linked together inextricably.** Though human beings are studying marine environment for centuries it is only recently that they have started to study the impact of marine contamination on human beings. Since human beings are exposed to marine contamination through **bathing, water sports, and eating sea-food etc.**, a number of infectious and non-infectious diseases used to attack them through these routes. **Some serious diseases caused in human beings due to marine contamination are mentioned below –**

1. Bathing and swimming at marine coastal beaches cause **enteric and respiratory diseases** if sea-water is contaminated by domestic waste water containing fecal matter. The **World Health Organization** (WHO) has reported that about 150 million clinical cases of mild gastroenteritis and upper respiratory diseases are caused every year in human beings by taking baths in the contaminated marine water.

2. A number of **infectious diseases** attack to people consuming sea-food. These infectious diseases are **Infectious Hepatitis-A (HAV), Reproductive Failure, Viral Hemorrhagic Septicemia** etc. There are about 2.5 million clinical cases of Infectious Hepatitis globally with some 25,000 fatalities, and 25,000 cases of long term disabilities from liver damage caused by eating contaminated shellfish (Food and Agricultural Organization=FAO- 1999).

3. Eating of **sea –food contaminated by toxins from algal bloom** cause poisoning like **Amnesic Shellfish Poisoning(ASP), Paralytic Shellfish Poisoning (PSP), Ciguatera Poisoning, Neurotoxin Shellfish Poisoning(NSP), Diarrheic Shellfish Poisoning(DSP)** etc. Some of the most reported cases are **Paralysis, Neurological Toxicity, and Human Neurobrucellosis etc.**

4. **Intestinal Nematodes, reproductive disorders, kidney failure, and Skin Diseases etc.**

### **9.5.2. Causes of Decline in the Marine Productivity**

The marine productivity is declining due to over exploitation of marine resources and the degradation of the marine environment. **Trawler fishing** and **whaling** are two principal exploitation activities causing decline in the marine productivity. The ocean bottom is scraped by trawler nets that destroy even coral reefs which are habitats of numerous types of fish and other organisms. The global fishing industry had total sales of \$ 125 billion in 1995. The fishing fleet of the world doubled in size during 1970 – 1990. By 1998, the fishing capacity of the world industrial fleet rose by 22 per cent since 1991. All these activities are causing seriously bad impacts on the economies of Nations.

## **POLLUTION OF MARINE WATER**

The pollution of marine water is another strong factor which causes serious decline in marine productivity leading to heavy losses to economy. The pollution of the Marine Waters is basically

caused by following agents –

**(i) Oil discharge:** The discharge from oil exploration units, leakage from oil tankers, oil spills, and sea accidents etc. cause serious marine pollution. It causes deaths of marine birds and other animals and other animals as well.

## enviro\_Facts : 9.2

### OFFSHORE DRILLING

The act of extracting underground resources that lie underwater near the shoreline is called as offshore drilling. The term offshore drilling is used to describe oil extraction off the coasts of continents, though the term can also apply to drilling in lakes and inland seas.



**Fig. 9.5.** Offshore oil Platform

The first offshore drilling was done at the end of the 19<sup>th</sup> century in Baku in the Biki- Eibat oil field; and in 1896 at Summerland field on the coast of California.

The exploration offshore oil and gas is more challenging than land based exploration because –

1. It requires man-power to keep above sea-level;
2. An offshore oil platform is maintained together with shops and sleeping quarters for sheltering human population in the sea;
3. A helicopter- transport service is to be managed round the clock for transporting man power on shift- basis from the coastal area to the sea point and back.

**Effects of Offshore Drilling on environment –**

1. There remains continuous risk from oil spills from tankers that transport oil from pipelines; and from leaks and accidents on the platform;
2. Water, oil and drilling fluid mix with the marine water and cause severe marine pollution. The produced water(the water which comes out of the earth at the time of drilling) contains heavy metals;
3. Oil platforms present problems in the sea.

**(ii) Algal bloom or the red – tide:** The algal bloom in sea water is caused by nutrition-enrichment of the sea water which is also called as Eutrophication. This condition creates the formation of toxic algal bloom which causes depletion of oxygen in marine water in a very large area. This area becomes death zone where no animal can survive.

**(iii) Bacteria:** The discharge of sewage in sea water generates and brings numerous species of pathogenic bacteria. These bacteria infect sea animals and stick to sea food causing diseases like cholera, hepatitis-A etc. in consumers.

**(iv) Acid Precipitation:** The precipitation of different acids occurs in sea water due to contamination by industrial discharge. This condition causes deaths of fish and other aquatic animals and contributes in the decline of productivity.

**(v) Toxic Discharge:** Several industries discharge Mercury Chlordane, dioxins etc. directly into sea water. Different toxic pesticides join marine ecosystems through rivers and streams. These poisonous substances kill marine animals of coastal and estuarine regions.

**(vi) Introduction of Exotic species:** Different types of species of marine animals and plants are being shipped and transported all over the world where they do not have their natural enemies. This introduction of marine species causes devastating effects on the economy and marine biodiversity. The effects of invasion of jelly fish on the Black Sea is one of various examples of the effects of introduction of exotic species documented so far.

**(vii) Global Climatic and Atmospheric Changes:** Changes in the global climate and atmosphere are affecting the flow of the ocean currents besides causing damages to marine flora and fauna. It has been predicted that the global warming may cause storms and other natural disturbances. The bleaching of coral reefs on global scale is occurring due to the global warming. It was during the year 2000 that mass bleaching of coral reefs was observed. The concentration of CO<sub>2</sub> has been reported to increase in the sea water due to air pollution. It is feared that this condition may impair the deposition of lime stone skeletons of coral reefs.

**(viii) Physical Alterations:** Port dredging, landfill, coastal solid waste dumps, coastal constructions, road buildings, cutting of coastal forests, beach and reef mining, trampling anchors and pollution due to tourism and recreation are some activities that are causing physical alterations to the marine environment. The mangroves have great economic values estimated by IUCN (1996) at around US \$ 10,000 / ha/ year but more than half of the **mangrove forests** have been lost over the past century. According to an estimate about 58 per cent of the world's coral reefs have been threatened with the direct physical destruction.



**Fig. 9.6.** Pollution of sea coast due to tourist activities.

### 9.5.3. Efforts to Recover the Loss to Marine Productivity and its Impact on Economy

There are various general and global measures to recover the loss to marine productivity and its impact on economy. Some of those efforts have been listed below –

#### A. General Measures

1. Treatment of the industrial effluents before allowing them to mix in the sea water.
2. Large scale tree plantation in the catchments areas of rivers and ban on overgrazing.
3. Treatment of sewage before allowing it to join streams and rivers.
4. Control on cultivation along the banks of rivers.
5. Control on the emissions of the heat absorbing gases to prevent the global warming.

#### B. Global Measures

Various efforts have been made to check marine pollution and to recover the lost health of our marine environment on international scale, from time to time. Some remarkable international efforts in direction are mentioned below.

1. The Stockholm Conference on Marine Pollution-1972.
2. The International Agreements to control marine pollutions and enhance marine productivity.
3. The London Protocol -1996.
4. Basel Convention on the control of the Transboundary Movement of Hazardous Waste and their disposal-1972.
5. The Global Programme of Action for the protection of the marine environment from land – based Activities- 1995.
6. Agreement on the conservation and management of migratory fish stock and formulation of code of conduct for responsible fisheries- 2001.

## THE LONDON DUMPING CONVENTION

Seas and oceans are being used as open dumping areas since long. But dumping of litter in the sea can cause huge problems. Degradation of dumped items can take different periods, and some items are hard to degrade through natural process. The dumped materials cause serious marine pollution. Some materials are routinely dumped into sea water, and they are even more dangerous for marine animals and corals. Some of such materials are matter from vessels, aircraft, and platforms of offshore drillings.

In view of reducing marine dumping, a dumping convention of 15 nations of the world was organized in London on November 13, 1972. It was called as the London Dumping Convention. The London Dumping Convention was called for by the **United Nations Conference on the Human Environment (June 1972, Stockholm)**; the treaty was drafted at the **Intergovernmental Conference on the Convention on the Dumping of Wastes at Sea (November 13, 1972, London)** and it was **opened for signature on December 29, 1972. It entered into force on August 30, 1975 when 15 nations ratified** International Administration of the Convention functions through Consultative Meetings held at **International Maritime Organization (IMO)** headquarters in London.

The **Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972**, commonly called the “**London Convention**” or “**LC '72**” and also abbreviated as **Marine Dumping**, is an agreement to control pollution of the sea by dumping and to encourage regional agreements supplementary to the Convention. It covers the deliberate **disposal** at sea of **wastes** or other matter from vessels, aircraft, and platforms. It does not cover discharges from land-based sources such as pipes and outfalls, wastes generated incidental to normal operation of vessels, or placement of materials for purposes other than mere disposal, providing such disposal is not contrary to aims of the Convention. As of 2005, there were 81 Parties to the Convention.

The **main objective** of the London Convention is –

To prevent indiscriminate disposal at sea of wastes that could be liable for creating hazards to human health; Harming living resources and marine life; Damaging amenities; or interfering with other legitimate uses of the sea.

The 1972 Convention extends its scope over “all marine waters other than the internal waters” of the States and prohibits the dumping of certain hazardous materials. It further requires a prior special permit for the dumping of a number of other identified materials and a prior general permit for other wastes or matter.

## IMPORTANT DEFINITIONS

<b>PRODUCTIVITY</b>	:	The production of biomass per unit area in a unit period of time in an ecosystem is called as productivity.
<b>PRIMARY PRODUCTIVITY</b>	:	The rate at which the energy is converted by photosynthesis or chemosynthesis to organic substances is called as Primary Productivity.
<b>GROSS PRIMARY PRODUCTIVITY</b>	:	The rate of storage of organic matter in plant tissues in excess of respiratory utilization by plants during the period of measurement is called as Net Primary productivity.
<b>FOREST PRODUCTIVITY</b>	:	The total amount of organic matter produced per unit area of forest per unit of time is called as Forest Productivity.

## MODEL QUESTIONS AND EXERCISES

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. Mention any two factors causing decline in forest productivity.
2. How much of the agricultural land of the world has been degraded?
3. How much people have directly been affected by desertification?
4. Mention any one root cause of floods.
5. How much of the world's coral reef have been threatened by direct physical destruction?

### II. SHORT ANSWER TYPE QUESTIONS

**(2 marks each)**

1. What is the productivity of an ecosystem?
2. Distinguish between Gross Primary Productivity and Net Productivity.
3. Mention some of the major causes of decline in the forest productivity.
4. What is the impact of decline in agricultural productivity on the economy of a nation? Explain any two impacts.
5. What do you mean by the Marine Productivity? Mention any three causes for the decline in the marine productivity.

6. Name any two offshore oil fields in India.
7. How are the Global climatic changes affecting the marine productivity?
8. What is debt trap?

(ICSE 2005)

### III. DETAILED ANSWER TYPE QUESTIONS

(4 to 6 marks each)

1. What is Productivity? What is the impact of the decline in the productivity of the forest and marine ecosystems on the economy?
2. What are the principal causes of the decline in the agricultural productivity? What is the impact of its decline on economy? How can it be recovered?
3. What is meant by offshore Drilling? Mention Environmental Effects of offshore Drilling.
4. Describe – London Dumping Convention.
5. Describe the International Efforts to recover the loss of Marine Productivity.

(ICSE 2008)

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice Type Questions

Tick (✓) the correct option

1. Living organisms synthesize energy rich organic materials from energy poor inorganic materials in the environment through the process of –
  - (a) photosynthesis
  - (b) respiration
  - (c) growth
  - (d) decomposition
2. The substance synthesized by a plant during the process of photosynthesis is called as –
  - (a) primary production
  - (b) secondary production
  - (c) net production
  - (d) final production
3. Total assimilation of organic substances in a plant is called as -
  - (a) gross primary productivity
  - (b) secondary productivity
  - (c) net productivity
  - (d) net primary productivity
4. Many of our resource bases are being depleted fast due to their utilization on –
  - (a) sustainable basis
  - (b) unsustainable basis
  - (c) regular basis
  - (d) uneconomic basis
5. It has been predicted that global warming may cause -
  - (a) storms and other natural disturbances
  - (b) cutting of coastal forests
  - (c) marine pollution
  - (d) eutrophication

#### B. Fill in the blanks

1. The decline in agricultural productivity is causing ..... in many parts of the world.
2. A number of farmers in India want to leave farming because they think it no longer a ..... business.
3. Uncontrolled exploitation of ground water has caused serious depletion of .....
4. About 56 per cent of soil degradation is caused due to soil erosion through .....
5. Precipitation of different acids in sea water occurs due to its contamination with ..... discharge.

#### C. True / False

Write T against the statement which is True and F against the statement which is False.

1. Some of the primary production is consumed by herbivores and is converted into other forms.
2. The rate of storage of organic matter in plant tissues minus respiratory utilization of organic matter by plants equals to primary

- productivity.
3. The productivity of a forest ecosystem is the total amount of organic matter produced per unit area of forest per unit time.
  4. Only two third of the world's land is fertile.
  5. The mass bleaching of coral reefs was observed during the year 2000 due to the global warming.

## ANSWERS

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. Cutting of trees & overgrazing, 2. two- third, 3. 250 million, 4. sedimentation, 5. 58%

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice Type Questions

1. (a), 2. (a), 3. (a), 4. (b), 5. (a)

#### B. Fill in the blanks

1. hunger, 2. profitable, 3. water table, 4. water, 5. industrial.

#### C. True / False

1. T, 2. F, 3.F, 4. F, 5. T.

## PROJECTS & ACTIVITIES

### Act for Environment

#### 9.1. PROJECT

Do a project on the impact of application of synthetic fertilizers on the productivity of agriculture. Adopt all the appropriate methods of survey and data collection for a particular crop grown by a farmer in a nearby village. Write the Project Report.

#### 9.2. OBSERVATION

Observe cases of improving productivity of agriculture by any three farmers in a village nearby your home. Write the activity report.

#### 9.3. SURVEY

Do a survey of any three fish farms. Enquire from the farm manager about measures he adopts for improving the productivity of his fish farm. Also, find out about the potential dangers that may hamper the productivity.

#### 9.4. DISCUSSION

Through the eco- club of your school, organise a group discussion on – What is better for increasing long term agricultural productivity: the application of synthetic fertilizers or the application of manures.

# 10

## CHAPTER

# Resettlement and Rehabilitation of People

## FACTS & CONCEPTS



- Introduction
- Displacement, Resettlement and Rehabilitation
  - Issues Involved in Displacement and Resettlement
  - Resettlement and Development
- Causes of Displacement of People
- Impact of Displacement on People
- Strategies for Rehabilitation of Displaced People in India
- International Efforts for R & R

### 10.1. INTRODUCTION

Groups of people have moved from place to place throughout the human history. The act of coming to live in a foreign country by any group of people is called as **Immigration**. On the other hand, the act of leaving a country, habitat or the resource base by any group of people is called as

## **Emigration.**

History reveals that large numbers of people have fled from their homelands because of different types of disasters such as epidemics, hunger or war. On the contrary, tourism, recreation, surveys and other study objectives, spread of religion etc. have also been some specific reasons behind the movements of different groups of people. But, here in this lesson, we are basically concerned to factors and conditions that disrupt livelihood of people, deprive them of their natural resources and enforce them to leave their habitat for resettlement and rehabilitation. Let us try to understand these terms first.

## **10.2. DISPLACEMENT, RESETTLEMENT AND REHABILITATION**

**The act of compulsory acquisition of land for different purposes and forcing people to give up their homes, resource bases, assets and means of livelihood is called as displacement.** Large scale displacement of people occurs due to Mega River Valley Projects, establishment of big industries, mining activities, development of canal systems, railway constructions and Natural Disasters.

**Displaced people have to settle on a suitable place which may serve as a favourable place for their living and development. They settle on a new place usually with the intention of making permanent new settlement. This is called as resettlement.**

In many cases migrants of some areas use to occupy government places without any provision from the government side. This leads to the problem of encroachment and development of slums in the later course. The government favoured resettlement is observed in cases of displacement due to mega projects. For the resettlement of displaced people due to a project, the declaration of an area under Para 5.12 of the **National Policy on Resettlement and Rehabilitation -2003**, Government of India, by the appropriate Government acquired or proposed to be acquired for resettlement and rehabilitation of project affected families is called as a **Resettlement Zone**.

### **10.2.1. Issues Involved in Displacement and Resettlement**

Human Rights, governance and accountability, participation and self determination in development, complexities of resettlement goals, options and strategies, relevant policy and legal instrument- are some important issues that are involved in displacement and resettlement.

### **10.2.2. Resettlement and Development**

Forced displacement of people has its deleterious and traumatic consequences. It is a distressful and potentially destructive experience. Hence, it requires affirmative actions for the mitigation of deleterious and traumatic effects.

According to the **World Commission on Dams- Report, March 16, 2000**; resettlement must be planned and implemented as a developmental project over a minimum of two generations and include not only protective measures but also the provisions of new rights, resources and strategies. Through resettlement, the project authority or the administrator tries to restore the *status quo ante* and makes available the material assets to project affected families. But these things do not go to fulfil the requirement. The resettlement of people should also incorporate the improvement in the living standard besides restoration of pre- relocation of living.

**The result of resettlement conceived as development of project affected people besides**

**their relocation and development of incomes, is called as Rehabilitation.**

In other words, the arrangement for resettlement of people in distress due to displacement and provisions of housing, employment, recreation, education, medical aid etc. to the displaced people is called as rehabilitation. The rehabilitation is rather a vocational process of preparing people with physical, sensory, emotional development, employment and helping them cope effectively with their environment and to function as independently as possible.

According to the report of **The World Commission on Dams** (March16, 2000), the rehabilitation should also incorporate following elements –

- (a) Enhancement of capabilities of people,
- (b) Expansion of social opportunities by addressing the social and personal constraints that restrict people's choices,
- (c) Landlessness should be converted to land- based settlement,
- (d) Joblessness should be substituted with employment,
- (e) Provisions of safe nutrition,
- (f) Construction of houses,
- (g) Improvements in health and wellbeing,
- (h) Community reconstructions and social inclusions.

The **United Nations Relief and Rehabilitation Administration** started was on July 1, 1947. Among services supplied by the UNRRA, the maintenance of refugee camps, vocational training, orientation for settlement and an extensive tracing service to find lost relatives come on the priority basis. The Resettlement and Rehabilitation (R &R) of people affected due to natural calamities involve services like medical, Psychological, preparation for work etc.

### 10.3. CAUSES OF DISPLACEMENT OF PEOPLE



**Fig. 10.1.** Scene of a devastating cyclone.

The displacement of people from their habitat is caused due to several factors. These factors are kept under two major categories- **Natural causes and Man-made causes.**

The **Natural causes of displacement of people** comprise volcanic eruptions, floods, earthquakes, cyclones, tsunamis, etc. Each one of these causes is seriously dangerous, as each one of these cause large scale devastation of life and property.

The **Man-made causes of displacement of people** are listed below –

- ◆ Construction of mega-dams under River Valley Projects for irrigation and power generation.
- ◆ Activities related to mining projects that involve large scale cutting of forests and clearance of land which finally result into large scale displacement of people.
- ◆ Reservation of large areas of land as National Parks, Biosphere Reserves, Sanctuaries etc. lead to forced migration of people.
- ◆ Scarcity of resources and adverse conditions in the home environment enforce people to migrate to resource rich and favourable environment.
- ◆ Construction of roads, rail tracks, flyovers etc. and establishment of industries cause compulsory displacement of people with little or no compensation.

There are still a number of man-made causes of migration and displacement of people from their original habitats to some new habitats. Scarcity of food and other resources due to explosion of population, defeat in war (as during the World War II, in 1945), desires for material gains (as during 13<sup>th</sup> century invasion by Turkish tribes on wealthy cities of Western Asia), search for religious and political freedom, change in climate, search for warmer or colder regions are some of the other reasons that stimulate people for movement to other habitats.

#### 10.4. IMPACT OF DISPLACEMENT ON PEOPLE

The displacement of people from their habitats causes various types of risks on the parts of the affected people. It causes the risks of landlessness, joblessness, homelessness, marginalization, increased morbidity and mortality, food insecurity, loss of access to common property resources and services, and social disturbances.

Besides the above, **some of the major impacts of displacement are listed below–**



**Fig. 10.2.** Refuge camp of tribal people who often have to face multiple displacement.

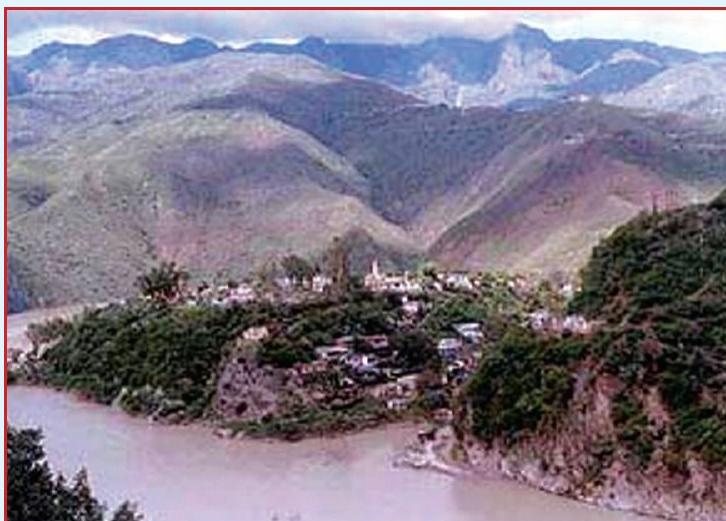
1. After displacement, the resettlement programmes usually loose momentum once the people are shifted out of the particular place. According to the **World Commission on Dams, the focus on resettlement programmes remains always to simply get people to move 'out of the way' to the resettlement sites as quickly and smoothly as possible.** The displaced and resettled people are usually forgotten once their physical relocation is

complete.

2. It has been observed that indigenous tribal people are subjected to multiple displacements as their lands are not considered to be legal. These people often do not get any compensation for their lands and other properties.
3. The basic amenities and essential infrastructure such as schooling, health facilities, credit, agriculture, employment, etc. often remain incomplete at resettlement sites. These conditions cause long lasting suffering to people.
4. Forced displacement and relocation destroys production processes of various social organisations. It breaks the network of relationships and allocation of resources as well as individual and community rights.
5. **The people of displacement areas become poorer even before their real displacement** as they have to break their occupational and financial schemes they use to run for years.
6. Displaced people often do not receive full compensation. They are very frequently cheated by corrupt agents and office staff.
7. In cases of natural calamities and in other cases too, the displaced people are temporarily shifted to refugee camps. In some cases these people become permanent refugees and the **refugee camps** become their permanent homes that are later managed and repaired by themselves.
8. In some cases lands of poor farmers and tribal people are forcefully acquired for private mining and industrial purposes. Such cases have been observed *in Maharashtra and Orissa where people were forcibly displaced for grabbing their lands for mining and other industrial purposes.*

### enviro\_Facts : 10

The construction of mega dams and other such projects create large scale devastation and destruction of resource bases of local people. One painful example is the submergence of the Traditional Tehri town set up in 1815 by Sudershan Shah due to the construction of asia's highest Tehri Dam (height 260 meters) on Bhagirathi River. On the construction of this dam the Gandhian styled activist, has said,"This is a dam built with our tears." The traumatic conditions of displaced people, inadequate rehabilitation etc. are giving birth to a number of social organisations and movements in the affected areas. Some of the social organisations of India fighting for the rehabilitation of displaced people and for the amendments in the Land Acquisition Act- 1984, are – Tehri Bandh Virodhi Sangharsh Samiti (TBVSS), Visthapit Mukti Morcha, Jamshed Pur; Indian Social Institute, Delhi; Samaj Parivartan Samuday, Karnataka; Shramjivi Sangathan, Maharashtra; and Narmada Bachao Andolan(NBA), led by Gandhian styled leader Medha Patkar) etc.



**Fig. 10.3.** Submergence of the Tehri town.

## 10.5. STRATEGIES FOR REHABILITATION OF DISPLACED PEOPLE IN INDIA

### A National Policy on Resettlement and Rehabilitation for Project Affected Families (PFAs)

- **2003(NPRR-2003)**, was published in the Gazette of India, Extra Ordinary, Part-I, Section-1, No.-46, on 17<sup>th</sup> February 2004. This policy aimed at laying down basic norms and packages for the resettlement and rehabilitation of PAFs. The Policy has been subjected to revision and improvements from time to time. Accordingly, the **Draft National Development, Displacement and Rehabilitation Policy** was released during **January, 2006**. Some of the principal objectives and provisions are being listed below –

- (i) To minimize displacement and to identify non- displacing or least displacing alternatives,
- (ii) To plan the resettlement and rehabilitation of project affected families including special needs of tribals and vulnerable sections,
- (iii) To provide better standards of living to PAFs,
- (iv) To facilitate harmonious relationships between the requiring body and PAFs through mutual co-operations.

Every displaced population has to receive adequate compensation according to the **Land Acquisition Act -1994**. In addition to the legally due compensation, every displaced community should get **rehabilitation package** as per the Act. Some important features of the rehabilitation package are listed below –

1. In all irrigation projects, it is mandatory that all the displaced people who primarily depended on agriculture are settled within the command area of an irrigation project. It is the responsibility of the state to provide land to the Project Affected Populations (PAPs).
2. The unskilled and semiskilled persons out of the project affected population should be given direct jobs in the project.
3. The government must undertake a special **Employment Guarantee Programme** for a minimum period of five years.
4. The resettlement sites must be granted the status of special Panchayat. The allocation of **Jawahar Rojgar Yojna (JRY)**, **Indira Aavasiya Yojna (IAY)** etc. must be suitably enhanced to cover the needs of the people.
5. All the displaced families should be provided the homesteads and dwelling units within 50 sq meters in urban and between 100 sq meters to 250 sq meters in rural areas.
6. The project should bear all the cost of transportation or trans-shipment of a family along with its domestic animals, moveable properties, moveable building materials and other belongings from the place of displacement to the place of resettlement.
7. The cost of providing agricultural land, homestead land, constructed houses, shops, working sheds etc. should be realised from the amount of compensation awarded to the families receiving the aforesaid packages under different conditions.
8. The resettlement and rehabilitation(RR) authorities shall provide at project cost the necessary training to develop entrepreneurship and assist the adult members of the displaced families to take up economically viable self employment projects.
9. All the families who have not been provided agricultural land or a regular job in the project

shall be entitled to rehabilitation grant equivalent to 750 days minimum agricultural wages.

10. Tribals should be resettled close to their habitats so as to ensure continuation of their traditional rights on minor forest produce and common property resources.

11. Twenty six basic amenities and infrastructural facilities must be provided for en-masse resettlement. These amenities are- **roads, safe drinking water, plantation, educational facilities, community hall, irrigation facilities** etc. These facilities are to be ensured for resettlement and rehabilitation at the project cost.

Besides the above, there are still a number of facilities that are to be provided to project affected families at the cost of the project. Some of those additional provisions are- preferential rights of allotment of shares of project particularly of companies, and double benefits in case of multiple displacements.

It has been observed that people from rural areas use to migrate to cities in search of jobs to earn money. This type of migration can be reduced by implementing Swarn Jayanti Swa-Rojgar Yojna, rural-development and improving sustainable agriculture.

## 10.6. INTERNATIONAL EFFORTS FOR R & R

A number of international institutions or agencies like the **World Bank, United Nations Development Programme(UNDP), Exim Bank of United States and Jexim Bank of Japan** etc. are major financers of building of mega projects(including dams), and resettlement and rehabilitation programmes. Of these institutions the World Bank Group is a big funder of dams in the world. As per estimates it has funded about US\$58 billion dollars as loans for construction of dams and rehabilitation works. The **International Finance Corporation**, a member of the World Bank is the largest loan provider and equity financer for private sector projects. The World Bank draws operational directives pertaining to baseline surveys, compensations, relocations, income generations etc. Among other operational policies of the bank, policies related to protection of environment and development of indigenous people are of special importance. It is one of the leading institutions in evolving policies to mitigate the impacts of displacement.

10

## TOWARDS A BETTER ENVIRONMENT...

Mega Dams have been reported to cause earthquakes besides causing other forms of destruction in the affected areas. As such the construction of Sardar Sarovar Dam and Indira Sagar Dam entails serious seismic and ecological risks. Experts are of the opinion that the vicinity of the location of the Sardar Sarovar dam contains a Seismically Active Centre at the focal depth of 3km. Two faults namely BisarPur and Ambadongar also lie across the area upstream from the reservoir.

In Narmada Valley, two villages namely Vadgam (Gujrat) and Manibeli (Maharashtra) were among the first villages that were submerged in July 1993 due to the construction of Sardar Sarovar Dam. After the submergence of these villages, the World Bank had issued a document entitled 'Next Step' on September 11,1993 and had demanded that the submergence should have started one year after the resettlement of villages. It had threatened to cut development loans unless construction of the dam was slowed down to synchronise resettlement and rehabilitation(WWF-Publication- 1995). Now that the height of the dam is going to increase from existing 110 meters to 121 meters,, and the rehabilitation process is found inadequate the volunteers of Narmada Bachao Andolan are still fighting under the Gandhian styled activist Medha Patkar.

### Counter Urbanization

The movement of people out of cities, to the surrounding areas is called as counter urbanization. This process has started in more economically developed countries since 1950.

Counter urbanization is achieved in following ways-

1. Growth of economy leading to increase in public and private transport systems
2. Increasing pollution, crime and congestion in urban areas
3. Search of open, less expensive, and natural spaces
4. Growth of means of communication technology and other facilities in surrounding areas of cities

## IMPORTANT DEFINITIONS

<b>DISPLACEMENT</b>	:	The act of compulsory acquisition of land for different purposes and forcing people to give up their homes, resource bases, assets and means of livelihood is called as displacement.
<b>RESETTLEMENT</b>	:	The accumulation of people on a suitable place that may favour their living and development, with an intention of making permanent new settlement, is called as resettlement.
<b>REHABILITATION</b>	:	The vocational process of preparing people with physical, sensory, emotional development, employment and helping them cope effectively with their environment and to function as independently as possible is called as rehabilitation.
<b>PROJECT</b>	:	According to the National Policy on Resettlement and Rehabilitation for Project Affected Families – 2003, Project means a project displacing 500 families or more en masse in plain areas and 250 families or more en masse in hilly areas or other areas mentioned in schedule V and schedule VI of the constitution of India. In general, a project is a planned piece of work designed to produce something new. Examples, a research project, a building project etc.
<b>PROJECT AFFECTED FAMILY</b>	:	A family whose place of residence or other properties or resource of livelihood are substantially affected by the process of acquisition of land for the project.
<b>RESETTLEMENT</b>	:	An officer not below the rank of a district collector, appointed in respect of a project through notification, by the government, for resettlement and rehabilitation of PAFs.
<b>REQUIRING BODY</b>	:	A body, company, corporate institution or any other organisation for which land is to be acquired.

## MODEL QUESTIONS AND EXERCISES

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. State any one aspect of development that should also be incorporated in a rehabilitation programme of project affected families.
2. Mention any one man made cause of displacement of people.
3. Where is the Tehri Dam located in India ?
4. On which river are the Sardar Sarovar and the Indira Sagar dams being built?
5. What is the name of the environmental activist who is leading to the Narmada Bachao Andolan?
6. When was the National Policy on Resettlement and Rehabilitation published in the Gazette of India?
7. How many people, according to the World Commission on Dams(report of March- 2000) have been displaced in the world due to reservoirs created by mega dams?
8. State any two ways of reducing migration from rural to urban areas.

(ICSE 2010)

### II. SHORT ANSWER TYPE QUESTIONS

(2 marks each)

1. What is displacement?
2. Define Resettlement.
3. What do you mean by rehabilitation?
4. Mention any four elements that should be incorporated in a rehabilitation programme.
5. What elements should a rehabilitation programme incorporate as per the recommendations of the World Commission on Dams?

6. Mention any three impacts of displacement of people.
7. What are the principal objectives of the National Policy on Resettlement and Rehabilitation of project affected people – 2003, in India?

### III. DETAILED ANSWER TYPE QUESTIONS

(4 to 6 marks each)

1. What do you mean by resettlement and rehabilitation? Mention some of the important measures to be taken up during the rehabilitation of the people distressed by the construction of a big dam somewhere in your country.
2. Developmental activities like construction of Dams and Mining lead to displacement of people. Explain any three problems faced by these displaced people.

(ICSE 2007)

3. What are different causes of displacement of people?
4. Describe strategies for the rehabilitation of the people displaced due to projects in India.
5. What are the impacts of displacement of people from their habitats due to a developmental project?
6. According to the Land Acquisition Act -1894, every displaced community should get rehabilitation package. Mention principal features of the rehabilitation package for displaced people.
7. What is counter-urbanisation? State any four ways of achieving counter urbanisation

(ICSE 2010)

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice Type Questions

**Tick (✓) the correct option**

1. The act of coming to live in a foreign country by any group of people is called as -
  - (a) displacement
  - (b) arrival
  - (c) immigration
  - (d) emigration
2. When groups of people leave their country, habitat or resource base, it is called as –
  - (a) emigration
  - (b) departure
  - (c) displacement
  - (d) immigration
3. The act of compulsory acquisition of land and forcing people to leave their homes is called as –
  - (a) resettlement
  - (b) rehabilitation
  - (c) displacement
  - (d) migration
4. The United States started resettlement and rehabilitation on –
  - (a) July 1, 1947
  - (b) January 28, 1974
  - (c) July 28, 1947
  - (d) August 15, 1949
5. The displacement of people on mass scale is basically concerned with –
  - (a) mega projects
  - (b) canals
  - (c) landslides
  - (d) road bridges

#### B. Fill in the Blanks

1. Rehabilitation is rather a ..... process.
2. Forced displacement of people has its ..... and ..... consequences.
3. Resettlement must be planned and implemented as a ..... project.
4. People of displacement areas become poorer even before their real .....
5. The Narmada Bachao Andolan is being led by Gandhian styled leader named .....

#### C. True / False

Write T against the statement which is True and F against the statement which is False.

1. History reveals that a large number of people fled from their home land due to soil erosion, in different parts of the world.
2. The displaced people have to settle on a suitable place.
3. Floods and cyclones sometimes act as natural causes of displacement.
4. Many displaced people often do not get adequate compensation due to legal obstacles.
5. Tribal people displaced due to projects must always be rehabilitated closest to cities.

## ANSWERS

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. education, 2. construction of mega- dams, 3. on Bhagirathi River, a main tributary of Ganges, in outer Himalayas(U.P.), 4. Sardar Sarovar and Indira Sagar, 5. Medha Patkar, 6. on 17<sup>th</sup> of February 2004, 7. 60 million.

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice Type Questions

- 1.(c), 2. (a), 3.(c), 4. (a), 5. (a)

#### B. Fill in the Blanks

1. vocational, 2. deleterious, traumatic, 3. development, 4. displacement, 5. Medha Patkar.

#### C. True / False

1. F, 2. T, 3. T, 4. T, 5. F.

## PROJECTS & ACTIVITIES

### Act for Environment

#### 10.1. OBSERVATION

Find out, if any type of developmental project is being implemented in your area. Observe cases of displacement, if any, due to the project. If you observe displacement, find out about the rehabilitation measures, being taken up. If no displacement has occurred due to it, find out about all possible impacts of the project on the local environment. Prepare a report.

#### 10.2. DISCUSSION

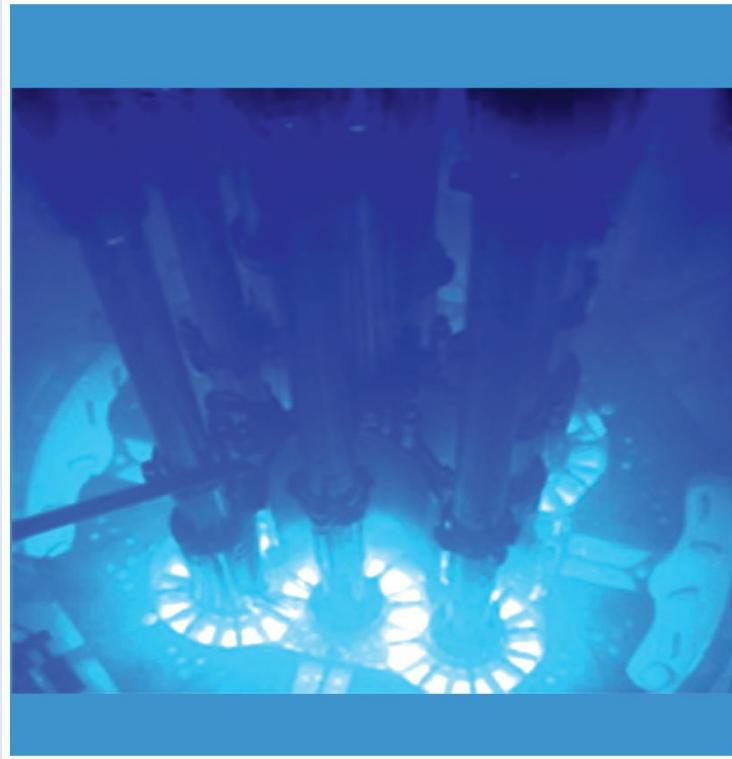
Organise a discussion / debate on ‘Impacts of the construction of mega dams’ through the Eco- club of your school.

#### 10.3. COLLECTION / COMPIRATION / COST-BENEFIT ANALYSIS

Collect information in the forms of texts and photographs about the construction of the Sardar Sarovar and the Indira Sagar dams on the Narmada River from news papers and magazines. Read carefully and write the whole story in your own words. Also add your own opinion regarding benefits or harmful impacts (whatever you think) of these dams on people and environment. If you have been successful in collecting complete information, write down a cost - benefit analysis of the construction of these dams.

# Energy Crisis-Urban and Rural Sectors

## FACTS & CONCEPTS



- Introduction
- What is Energy Crisis?
- Effects of Energy Crisis on Economy
- Energy Crisis in Rural and Urban Sectors
  - Energy Crisis in Rural Sector
  - Energy Crisis in Urban Sector
- National and Global Scenes of Energy Consumption
  - The National Scene of Energy Consumption
  - The Global Scene of Energy Consumption
- How to Solve the Problem of the Energy Crisis?
  - Development of Energy Efficient Technology
  - Conservation of Energy and Reducing Wastage
  - Development and Uses of Alternate Sources of Energy
  - Proper Urban Planning

## 11.1. INTRODUCTION

Energy is the basis of life processes on this planet. It is the basis of today's civilization. In the previous class, we have studied about energy, its different sources and its utilization. We have studied that energy is the primary input in any system including industrial operations. We have also studied that the consumption of energy has become synonymous with the socio-economic development of countries. Some countries like United States etc. are developed countries. They utilize more energy. Other countries like India etc. are developing countries. These countries utilize less energy as compared to developed countries. The United States, though its population is less than 5% of the world's population, utilizes 25% of oil, 26% of gas and 26% of coal of the world. Developing countries too, are trying to consume more and more energy for their development. Conventional Sources of energy like fossil fuels are limited in stock but the growing population puts additional pressure on the demand of energy. The technologies for deriving energy from non-conventional sources of energy like sun, wind, water etc. are yet to be developed properly. Under these conditions the whole world is facing an acute shortage of energy. This condition is called as energy crisis. In this lesson, we have to study about Energy Crisis in urban and rural sectors and about all possible measures of solving the energy crisis.

## 11.2. WHAT IS THE ENERGY CRISIS?

The dictionary meaning of the word 'crisis' is – a time of great difficulty, danger or uncertainty, when problems must be solved and important decisions must be taken so as to neutralize or minimize impacts. In the context of environment, **the energy crisis is a time of acute shortage of energy resources creating a situation of great difficulties, danger or uncertainty before the world. The crisis of energy occurs due to a great shortfall in the supply of energy resources like gasoline (petrol), diesel, natural gas, kerosene, electricity and traditional sources.** The crisis of energy causes rise in the cost of both the production and transportation leading to general rise in the prices. These problems are to be solved and important decisions are to be taken to face the conditions and to protect the balance of the economy.

## 11.3. EFFECTS OF ENERGY CRISIS ON ECONOMY

The prices of energy resources are governed by the principle of **Supply and Demand**. Any change in the supply or in the demand can cause sudden change in the price of the energy resource concerned.



**Fig. 11.1.** A long line of people with LPG- cylinders, waiting for their turn in front of counter of a gas agency.

The energy crisis is directly related to the market economy. This is due to the fact that prices of energy resources are directly governed by the principle of supply and demand. When there is a short supply of any resource, its demand in the market is bound to increase automatically. Some of you might have seen long lines of people carrying **LPG (Liquified Petroleum Gas)** cylinders in front of the counter of a gas agency (Fig. 11.1.). This condition results into a competition among consumers which encourages the market to raise the price of the resource concerned. This condition causes an energy crisis at a particular time. In other words, the crisis of energy occurs when markets fail to adjust prices in response to shortages of energy resources. Some economists are of the opinion that the energy crisis that occurred during 1973 was worsened by improper price control system.

## 11.4. ENERGY CRISIS IN RURAL AND URBAN SECTORS

Though the pattern of consumption of energy is different in rural and urban sectors, both the sectors are facing the crisis of energy. Let us discuss crises in these two sectors separately.

### 11.4.1. Energy Crisis in Rural Sector

The rural people need energy for many different purposes most of which are mentioned below-

- (i) Cooking of food
- (ii) Lighting of homes and surrounding,



**Fig. 11.2.** A Combine machine used in agriculture needs energy for its operations.

- (iii) Running of agricultural machines or appliances like tractors, threshers, harvesters, winnowing fans, combines, engine operated ploughs, harrows, seeders, transplanters etc. ([Fig. 11.2.](#)),
- (iv) Running of irrigation pump sets and motors of tube wells,
- (v) Running of fans, televisions, computers etc. in some electrified villages,
- (vi) Lighting Anganwadi Kendras, village council's houses, village Panchayat houses and community halls (where diesel generators/ electricity is available).

Besides these, rural people need muscle power of humans for working in fields, bullocks for ploughing fields and some other animals for carrying goods. Rural people mostly depend on traditional sources of energy like their own muscle power, animal energy, animal dung, fuel wood and crop residues. **Animal dung, fuel wood and crop residues account for 35% to 40% of the total consumption of energy in India.** But, with increasing population and development of rural areas these traditional sources are being largely replaced by modern fuels like coal, diesel, and petroleum. All of these are fossil fuels and these fuels cause considerable level of pollution. Appliances used in agriculture consume diesels and electricity up to considerable extent. Kerosene is used for lighting houses. **With rising prices of crude oil, and depletion of indigenous trees, villages are facing acute crisis of energy today.** Rising prices of coal, replacement of cattle by machines and consumption of high priced diesel have put the rural economy into a critical stage. Even the kerosene oil meant for lighting the homes of the rural poor has become costlier, though it is under public distribution system.

**Wood has been a major source of energy in the rural sector.** Earlier, it was easily available because vast tracts of forests existed in many parts of the world and the amount of wood needed for household purposes was relatively low. As the wood began to be used for producing charcoal for industrial uses, rural people started clearing forests and selling wood for income generation. Illegal timber- trade also started in most parts of the world ([Fig. 11.3.](#)). Thus rural sector was caught into an acute crisis of energy. About two billion people of the rural world don't have access to adequate, affordable and convenient sources of energy. Millions of rural ladies in the world walk up to many kilometers for collection of wood for cooking purposes ([Fig. 11.4.](#)).



**Fig. 11.3.** Illegal Timber Trade goes on in most parts of the world.



**Fig. 11.4.** Millions of rural ladies in the world walk up to many kilometers for collection of wood for cooking purpose.

#### 11.4.2. Energy Crisis in Urban Sector

The Urban Sectors consume more energy than rural sectors. This is due to following reasons-

- I. Urban Sectors have many **industries, workshops, shops and shopping complexes, hospitals, government and public institutions** etc. Most of these work day and night. Thus, they consume greater parts of energy. Both the light and heavy machines in industries need energy for their working.

Most of the machines are run on electricity. But the generation of electricity consumes coal which is a fossil fuel.

Great amounts of coal and coke are consumed in metallurgical operations. Machines that don't run on electricity require diesel, petrol or gas that too is fossil fuel. We have limited supply of fossil

fuels; still their consumption is increasing at a fast rate. Here are some projections-

- (a) The **annual consumption of fossil fuels** in 1999 has been 324 quadrillion British Thermal Units (Btu).
  - (b) The **global consumption of oil** is projected to rise from 78 million barrels per day in 2015 and 119 million barrels per day in 2025.
  - (c) According to the report of the **United Nations Environmental Programme** (UNEP) -1998, the richest 20% of the world's population accounts for the consumption of 85% of the total energy produced in the world. Thus, unequal sharing of energy too, is leading our cities towards energy crisis.
- II.** Urban sectors have different types of **networks of transport systems**. Besides these, most of the people move in their own vehicles and ignore public transport system. According to the report of UNDP, UNEP and World Bank (1998), about 16 million vehicles have come onto the world's roads annually. The passenger cars account for 15% of the total global energy. Transport and industry are major consumers of oil in the world. **The transportation sector accounts for about 60 % of the projected increase in the use of oil from 2002 to 2025.** All the rest volume of oil is expected to be consumed by industries.

Under above conditions, the consumption of fossil fuels is increasing day by day. We know that we have limited stock of fossil fuels. On the other hand, prices of crude oil and other fuels are rising at a very fast rate due to increasing rates of their consumption. With the slow down of fuel supply and rise in demand, urban sectors are bound to face energy crisis.

- III. The flow of traffic towards cities** is increasing which is leading to the growth of urban population and urban congestion. Every house needs energy for regular domestic activities like cooking and running various types of home appliances.

The authorities concerned with the control of traffic in metropolitan cities apply different rules and ways for controlling traffic. Strict parking prohibitions, creation of traffic lanes along roads, encouraging public transporation, and use of traffic signals are some of the important ways of controlling traffic in these cities.

## enviro\_Facts : 11

### HISTORICAL ACCOUNT OF ENERGY CRISIS

The Historical Accounts reveal that the world has been facing Energy Crisis since 1993. A brief historical account of the same is being given below –

Year	Details
1993	In response to western support of Israel during Yom Kippur War, many oil producing states of Arab imposed oil export embargo, creating oil- crisis.
1979	Energy – crisis due to Iranian Revolution.
1990	Energy – crisis due to spike in the price of oil because of the Gulf War.
2000	Energy – crisis due to UK fuel protest because of rise in the price of crude oil and high taxation on road fuel.
2004 -2006	Energy crisis due to increase in the oil price, tight supply margins in the face of the increasing demand.

## 11.5. NATIONAL AND GLOBAL SCENES OF ENERGY CONSUMPTION

### **11.5.1. The National Scene of Energy Consumption**

In India, we have traditional sources of energy like animal waste, fuel wood and crop residues, fossil resources like coal, oil and natural resources and secondary sources like hydroelectric and nuclear sources. Of the total primary energy, 60% is contributed by commercial fuels. 69% of the electricity is produced from coal, 25% is produced by hydel power. Diesel and natural gas contribute up to 4% whereas 2% is contributed from nuclear power. Energy from non- conventional sources like solar, biomass, wind and tidal energy account for only one percent.

It was during past two decades that demand of energy in India went up steeply. It was caused due to growth in industrial and transport sectors, population growth, urban congestion, rise in household uses of energy, more access to consumer products and increase in the use of energy in agriculture. Rapid industrialization, urbanization, mechanization and changing life styles of people are also causing continuous increase in the energy requirements in India.

In an important address on 26<sup>th</sup> June 2006, at Tata Energy Research Institute, New Delhi (India), President Dr. A.P.J.Abdul Kalam asked the energy sector to raise the existing power generation capacity of 130,000 MW to 400,000 MW by 2030 to achieve Energy Independence. According to the President, India can achieve Energy Independence through three different sources- hydel capacity, nuclear power and non- conventional sources like solar energy, thermal power, bio- mass energy etc.

**The power generation targets according to the Scientist President of India, Dr. A.P.J. Abdul Kalam, are detailed below-**

<b>(A). The Existing Capacity of Power Generation</b>	1 30000 MW
<b>(B). Targets to be achieved up to 2030</b>	
(i) Nuclear Power	50 000 MW
(ii) Hydel Capacity	50 000 MW
(iii) Large Scale Solar Energy Farms	55 000 MW
(iv) Conventional Thermal Plants & through renewable sources- like wind power, bio-mass, and municipal waste and solar- thermal power	1 15000 MW
<b>TOTAL (A+B)</b>	<b>400,000 MW</b>

### **11.5.2. The Global Scene of Energy Consumption**

Some energy experts of the world are of the opinion that the world is progressing towards a Global Energy Crisis due to the scarcity of oil. They recommend that the world should reduce its dependence on fossil fuels. There is a vast gap between the energy consumption by developed and the developing nations. The Nations of the Organization of Economic Co- operation and Development (OECD) consume 8053 Kilowatt-hours (kWh) of energy on per capita basis. It is about 100 times greater than per capita energy consumption in least developed nations. According to the reports of United Nations Development Programme-2000, per capita consumption energy in least developed nations is only 83 kilo Watt hour.

The rate of total energy consumption between 1972 and 1999 remained 2%. It decreased from 2.8% in 1970s and again 2.1 % in 1990s. According to the report of UNDP-2000, it was due to the global financial crisis over past 30 years that the global per capita consumption of energy grew by about 70% during 1972 – 1999.

## **11.6. HOW TO SOLVE THE PROBLEM OF ENERGY CRISIS?**

The problem of energy crisis can be solved by conservation of energy and by developing its non-conventional sources. It is the practice of increasing the efficiency of the use of energy in order to achieve higher useful output for the same energy consumption. The conservation of energy increases national and personal security, financial capital, human comfort and environmental value. The problem of crisis of energy can be solved through following methods-

### **11.6.1. Development of Energy Efficient Technology**

It has often been observed that much of our fossil fuels and other fuels are wasted due to improper combustion. The development and application of advanced technologies for proper combustion can lead to production of more energy and improvements in energy production. Now, scientists and engineers are working to develop more efficient methods of deriving maximum energy out of fuels. They are designing more efficient transportation systems so as to reduce the loss of energy as fuel in transport.

All the production and processing of goods including mining, construction, manufacturing, farming etc. are concerned with the industrial sector. Increasing cost of energy resources during past thirty years have forced the industry sector to make substantial improvements in their technologies. As a result, the total use of energy in the industrial sector has declined during the last decade. Responsible and profit conscious industries put greater emphasis on modification of products and manufacturing process in order to save energy. The industrial sector can make following improvements in order to save energy–

- (a) Judicious lighting,
- (b) Recovery of waste and recycling
- (c) Technological innovations like re-designing products and process to embody technology of greater efficiency.

### **11.6.2. Conservation of Energy and Reducing Wastage**

The practice of increasing the efficiency of use of energy in order to achieve higher useful output for the same energy consumption is called as energy conservation.



**Fig.11.5.** Fluorescent lights consume less energy.

The energy conservation helps in increasing national security, personal security, financial capital, human comfort and environmental values. That is why; we celebrate the **National Energy Conservation Day** on 14<sup>th</sup> December, every year. Here are some examples of the methods of energy conservation.

- (i) Better insulation of buildings,
- (ii) Recovery of waste heat produced during many industrial processes and its better use.
- (iii) Encourage travel by bus and train rather than by private cars.
- (iv) Encouraging the use of fluorescent lights because these lights produce three times more light per unit of electricity than other lights do ([Fig.11.5.](#)).
- (v) Lowering of thermostats in winter and raising them during summer.
- (vi) Turning off unnecessary lights.
- (vii) Recycling of paper and metals.

### **11.6.3. Development and Uses of Alternate Sources of Energy**

In view of the global energy crisis, scientists the world over are inclined in the research of alternate sources of energy such as fuel- cells technology, hydrogen fuel, bio-diesel, bio-methanol, karrick process, solar energy, tidal energy, hydroelectricity, nuclear power and energy from Bio-mass (like Bio- gas etc.). Bio-gas, Social Forestry, Solar Energy etc. can be some most useful renewable sources of energy in Rural Areas.

### **11.6.4. Proper Urban Planning**

Many of our Indian cities are facing congestion due to heavy flow of labour force from rural areas. On the other hand, the growth of human population is another factor responsible for causing this problem. Great volumes of fuels are wasted due to frequent traffic jams and very slow movements of vehicles. In modern conditions an approach of New Urbanism and Transit- oriented development of cities has become most important.

**Secondary City :** Many cities typically develop at the intersections of major highways and in other important areas near cities. Such cities often feature amenities that serve large sub-urban populations. Such cities are called secondary cities. A secondary city can be defined as- “sizeable commercial centres offering a mix of employment, shopping and entertainment, and serving primarily a sub-urban area”. Examples : Greater Mumbai, Hyderabad, Pune, Chennai, (India), Edison’s Township, Plan, Tysors (USA) etc.

There are various other solutions also to the problem of the energy crisis. **In order to solve this problem in rural areas, following steps can be taken up-**

- (a) Policy makers should offer priority on rural energy and rural developments.
- (b) The rural people should be put at the focus of planning and implementation and the development of rural energy must be decentralised.
- (c) The development of rural energy must be integrated with different aspects of rural development.

## **NUCLEAR ENERGY**

The sun and stars are seemingly inexhaustible sources of energy. That energy is the result of nuclear reactions, in which matter is converted to energy. We have been able to harness that mechanism and regularly use it to generate power. Presently, nuclear energy provides for approximately 16% of the world’s electricity. Unlike the stars, the nuclear reactors that we have today work on the principle of nuclear fission. Scientists are working like madmen to make fusion reactors which have the potential of providing more energy with fewer disadvantages than fission reactors.

### **ADVANTAGES OF NUCLEAR ENERGY**

1. The Earth has limited supplies of coal and oil. Nuclear power plants could still produce electricity after coal and oil become scarce.
2. Nuclear power plants need less fuel than ones which burn fossil fuels.
3. Coal and oil burning plants pollute the air. Well-operated nuclear power plants do not release contaminants into the environment.

### **DISADVANTAGES OF NUCLEAR ENERGY**

1. A nuclear accident may go out of control leading to a nuclear explosion and the emission of great amounts of radiation.
2. Radiations due to a nuclear accident may produce seriously dangerous effects for many years.
3. Nuclear reactors also have waste disposal problems. Reactors produce nuclear waste products which emit dangerous radiation. Because they could kill people who touch them, they cannot be thrown away like ordinary garbage. Currently, many nuclear wastes are stored in special cooling pools at the nuclear reactors.
4. Nuclear reactors only last for about forty to fifty years.

**11**

## **TOWARDS A BETTER ENVIRONMENT...**

Specialists in the field of energy conservation are of the opinion that we do not realise the importance of renewable energy and bio-fuels in full spirit. They forward some suggestions to protect the country from energy crisis, some of those suggestions are mentioned below.

It should be made mandatory for housing societies, government buildings and industrial houses to use solar energy for lighting and heating systems. It may be helpful in reducing the consumption of energy derived from conventional sources.

Governments provide subsidies on kerosene oil which is supplied through public distribution system. Instead of subsidising kerosene, governments may subsidise applications of solar energy so as to reduce the consumption of the kerosene oil, a fossil fuel.

Attractive incentives can be offered to both the industrial houses and individuals to encourage the supply of electricity generated through wind power plants and other renewable sources.

Cost effective products should be developed by encouraging Research and Development (R&D). So far we have been able to harness only 45, 000MW of wind power. A big push to this sector can be given through proper Research and Development and also through offering tax- incentives.

## IMPORTANT DEFINITIONS

<b>ENERGY CRISIS</b>	:	The energy crisis is a time of acute shortage of energy resources creating a situation of great difficulties, danger or uncertainty before the world.
<b>FOSSIL FUEL</b>	:	Dead remains of plants and animals buried deep underground and obtained through mining for the use as fuel to produce energy. Examples: petroleum, natural gas, coal etc.
<b>BTU</b>	:	British thermal unit . The amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit (this unit of energy has currently been replaced by the S. I. Unit, the joule or J).
<b>URBAN PLANNING</b>	:	Making plans for proper building up of a city.
<b>ENERGY CONSERVATION</b>	:	The practice of increasing the efficiency of use of energy in order to achieve higher useful output for the same energy consumption is called as energy conservation.
<b>BIO- FUELS</b>	:	Sources of biological origin that produce energy on combustion. Examples: crop residues.

## MODEL QUESTIONS AND EXERCISES

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. Name any two traditional sources of energy.
2. Name the principle that governs prices of energy resources.
3. What is the major source of energy in the rural sector?
4. What will be the global consumption of oil in 2015 according to current projections?
5. How much increase in the use of oil has been projected to occur from 2002 to 2025 in transportation sector?
6. It was during last two decades that demand of energy in India went up steeply. What were the causes of increase in the demand of energy during that period?
7. Write full form of LPG. State one disadvantage of using it as a fuel.

(ICSE 2006)

8. When is the Energy Conservation Day celebrated in India?

(2 marks each)

1. What is the energy crisis? Why does it occur?
2. What is the effect of energy crisis on Economy?
3. Why has the rural sector been caught into an acute crisis of energy?
4. What are important causes of energy crisis in the urban sector?
5. How does urban planning affect energy consumption?
6. Name any two prospective sites of tidal energy in India.

(ICSE 2005)

7. Suggest two renewable energy sources for meeting the energy demand in Rural Areas.

(ICSE 2007)

8. Define Secondary City. Give any one example.

(ICSE 2010)

### III. DETAILED ANSWER TYPE QUESTIONS

(4 to 6 marks each)

1. What do you mean by energy crisis? Describe energy crisis in rural sectors.
2. How is the urban sector facing an energy crisis? Suggest some important measures to solve the problem of energy crisis.
3. Why do urban sectors consume more energy than rural sectors?
4. Discuss the national scene of Energy consumption in India.
5. "The world is progressing towards a "Global Energy Crisis"— Comment.
6. State two advantages and two disadvantages of nuclear energy.

(ICSE 2010)

7. Explain any four ways of controlling the problem of road traffic in metropolitan cities.

(ICSE 2010)

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice Type Questions

**Tick (✓) the correct option**

1. Acute scarcity of energy sources is called as -
  - (a) energy conservation
  - (b) energy crisis
  - (c) energy crisis
  - (d) acid rain
2. The whole world is facing an acute scarcity of –
  - (a) food
  - (b) water
  - (c) energy
  - (d) wood
3. Prices of energy resources are controlled by the Economic Principle of –
  - (a) supply
  - (b) demand
  - (c) supply and demand
  - (d) consumption
4. The lobby of OPEC countries comprise –
  - (a) UAE, Saudi Arabia, U.S., Norway, Kuwait
  - (b) UAE, Saudi Arabia, Venezuela, Norway, Kuwait
  - (c) Saudi Arabia, UAE, Japan, India, China
  - (d) China, UAE, Israel, Kuwait, Venezuela
5. The total consumption of energy in India accounted by animal dung, fuel wood, and crop residues is –
  - (a) 35 – 40 %
  - (b) 40 – 60 %
  - (c) 10 – 30 %
  - (d) 35 – 55 %

#### B. Fill in the blanks

1. Sun, wind, water, etc. are ... ... sources of energy.
2. Prices of energy resources are directly governed by the principle of supply and ... ....
3. The richest 20% of the world's population accounts for the consumption of ... ... per cent of the total energy produced in the world.
4. Animal waste, fuel wood, and crop residues are ... sources of energy.
5. The insulation of buildings is also a way of ... conservation.

#### C. True / False

Write T against the statement which is True and F against the statement which is False.

1. Travel by bus and by train is wastage of energy.
2. Recycling of paper and metals is a way of energy conservation.
3. Urban planning has nothing to do with energy conservation.
4. Policy makers should offer priority on rural energy and rural development.

## I. VERY SHORT ANSWER TYPE QUESTIONS

1. animal dung, 2.supply and demand, 3.wood, 4. 78 million barrels, 5.60% 6. Oil crisis, Gulf war, oil price hike; 7. Liquified petroleum gas, disadvantages – Limited supply 8. 14<sup>th</sup> December

## IV. OBJECTIVE TYPE QUESTIONS

### A. Multiple Choice Type Questions

- 1.(b), 2. (c), 3. (c), 4. (b), 5. (a).

### B. Fill in the blanks

1. Non-conventional, 2.Demand, 3.85, 4.traditional / biological 5.Energy.

### C. True/False

1. F, 2.T, 3.F, 4.T,

## PROJECTS & ACTIVITIES

### Act for Environment

#### 11.1. PROJECT

Prepare a project on “Traditional Sources of Energy- Status and Conservation”. Write the Project Report properly in your project book.

#### 11.2. SURVEY

Do a survey of Energy Consumption in any 10 houses in your locality. Record, data pertaining to the consumption of different sources of energy, separately. Write a survey report suggesting measures to reduce energy consumption in your locality.

# Global Issues of Environment

## FACTS & CONCEPTS



- Introduction
- Green House Effect
  - Green House Effect: How does it Occur?
  - Green House Gases
  - Importance of Green House Effect
  - Green House Effect and Global Warming

- u Global Warming and Climate Change
- u Impact of Global Warming
- u Prevention and Control of Global Warming
- u Global Efforts
- u Acid Rain
  - u How is Acid Rain caused?
  - u Acid Deposition
  - u Impact of Acid Rain
  - u Prevention and Control of Acid Rain
- u Depletion of Ozone Layer
  - u What is Ozone? How is it Formed?
  - u Importance of Ozone Layer
  - u Ultraviolet Radiations and their Harmful Effects
  - u Ozone Depleting Substances (ODS)
  - u How is the Ozone Layer Depleted?
  - u Prevention and Control of Ozone Depletion
  - u Global Efforts

## 12.1. INTRODUCTION

Our environment today is facing a number of problems. All those problems are causing dangers to take shape against the existence of the whole biosphere of this planet. But, who is behind all those problems? The answer is – M A N.

All those problems have become great topics for discussion, planning and implementation at all levels. **An important topic that people discuss or argue about is called as an issue.** We have different types of environmental issues at local, regional, national and global levels. Here in this chapter, we are going to discuss about some global issues like Green House Effect and Global Warming, Climate Change, Acid Rain and Depletion of Ozone Layer. These are global issues caused due to human activities in their own countries but these issues relate to the fate of the whole planet.

Here we must not forget that the root-cause behind all these issues is exponential growth of human population. Until and unless the explosive growth of human population is kept in control through proper strategies, all of our efforts for tackling global issues will fall flat. Proper Family Planning and adopting birth control measures are essential strategies for effective control of growth of Human Population.

## 12.2. GREEN HOUSE EFFECT

**The warming effect produced inside a green house by its glass panels, is called as Green House Effect.** A green house is a specialized house constructed at horticulture stations for keeping plants that survive better in warm surrounding.

### 12.2.1. Green House Effect: How Does it Occur?



**Fig. 12.1.** A Green House.

The walls or panels of a green house are made of specialized glass that allows short wave solar radiations to go inside but does not allow long wave infrared heat energy of the glass house to pass out. In fact, some of the solar radiations that are absorbed inside the green house get transformed into heat energy in the form of long wave infrared radiations that can not go out of the glass panels of the green house. Thus, temperature inside the green house rises as compared to the temperature outside. The term- Green House Effect was coined by J. Fourier in 1827.

### 12.2.2. Green House Gases (GHGs)

Gases that help in causing green house effect are called as green house gases (GHGs). These gases either occur naturally or are produced on earth due to human activities of burning fossil fuel and bio-mass. One of the most abundant naturally occurring green house gases is the water vapour. Other green house gases are carbon dioxide, methane, Nitrous oxide, Trifluoromethyl sulphur pentafluoride and hydrochlorofluorocarbons. It is since 1700s, that a substantial increase in the concentration of green house gases has occurred in the atmosphere.

**1. Water Vapour:** It accounts for about 60 to 70 percent of the natural green house effect. Its level in the atmosphere rises with the increasing global warming adding up further to the green house effect.

**2. Carbon dioxide:** In the modern age of industrialization and increasing automobile exhausts the concentration of carbon dioxide is increasing faster than the earth's natural capacity of assimilation. It has been assessed that the level of CO<sub>2</sub> in the atmosphere has risen by more than 30 percent since 1750. Currently, the CO<sub>2</sub> concentration in the atmosphere is about 370 parts per million (ppm). *It accounts for more than 60 percent of the additional green house effect.*

**3. Methane:** This gas is produced through various sources like decomposing organic substances, coal mining, production and transport of other fossil fuels etc. Its concentration in the atmosphere has become more than double since 1750. Scientists are of the opinion that it is an extremely effective heat trapping gas. *One molecule of methane is 20 times more efficient in terms of trapping infrared radiation than a molecule of carbon dioxide.*

**4. Nitrous Oxide:** This gas is released into the atmosphere by burning of fossil fuels, automobile exhaust, decomposition of nitrogenous fertilizers in the soil etc. Its level in the

atmosphere has risen by 17 percent since 1750. This gas has a capacity of trapping heat 300 times more effectively than carbon dioxide. *It can stay in the atmosphere for about 100 years.*

**5. Fluorinated Compounds:** Compounds comprising CFCs (chlorofluoro-carbons), HCFCs (hydrochlorofluorocarbons) and HFCs (hydrofluorocarbons) are man-made compounds called as fluorinated compounds. These compounds are used in a variety of manufacturing processes. Each molecule of these synthetic compounds is many thousand times more effective in trapping infrared radiations than a single molecule of carbon dioxide. CFCs were first synthesized in 1928. Since then these were widely used in the manufacture of aerosol sprays, blowing agents for foams, packing materials, as solvents and as refrigerants. *By 1992 an amendment in the Montreal Protocol was made to ban these compounds worldwide. However, the HFCs compounds do not contain chlorine and stay in the atmosphere only for a short time. Hence, these are regarded as safe for various applications.*

**6. Trifluoromethyl sulphur pentafluoride:** *This compound was not reported before 2000. Each molecule of this industrially produced compound can trap heat more effectively than all the other gases known to cause green house effect.*

### 12.2.3. Importance of Green House Effect

Our Earth is subjected to green house effect which is very important for creating a climate favourable to the sustenance of most forms of life on it. In this context, the green house effect can be defined as –

**The effect of warming and insulation of the earth caused due to some heat trapping gases accumulated in the atmosphere after their emission from the earth surface, is called as green house effect.**

The natural green house effect is in fact, a process of thermal blanketing of the earth which maintains its temperature around 33 Celsius degrees which helps in the sustenance of life on it. Without the green house effect, the climate of the earth is reported to become too cold for most of the life to survive. Then, the temperature may fall much below the required level essential for the existence of life. Hence green house effect is an important natural process which is essential for the survival of life on this planet.

### 12.2.4. Green House Effect and Global Warming

Human activities of pollution are modifying the natural process of green house effect. The advent of the Industrial Revolution in the 1700s boosted up the activities of burning of fossil fuels like coal, oil and natural gas which released lots of heat absorbing gases into the atmosphere. **Clearing of land for agriculture or for urban settlements wiped out the forests & vegetation that acted as ecological sink for some of those gases like carbon dioxide.**



**Fig. 12.2.** Global Warming.

These heat absorbing gases accumulate in high concentrations in the upper atmosphere around the earth extending up to 100 km above its surface and act as **glass panels** of a **green house**. They allow much of the **short wave solar radiation** to reach to the earth surface but stop much of the **long wave infrared rays** against escaping out as heat. They absorb these infrared radiations and then re-radiate most of them back to the earth surface. Thus, the temperature of the atmosphere rises gradually causing an **unnatural heating effect** which is called as the Global Warming. *The Global Warming is the enhanced green house effect due to greater accumulation of GHGs in the upper atmosphere.*

The warming of the earth's atmosphere attributed to a build up of green house gases in high concentration in the atmosphere is called as the Global Warming. It is a term which is used to refer to the observed increase in the average temperature of the earth's atmosphere and oceans in recent decades. *Scientific discoveries reveal that the world experienced warmest atmosphere during last 50 years out of the period of 100 years. The global mean temperature increased by about 0.5 to 1 degree Celsius, within a period of last 100 years.*

### 12.2.5. Global Warming and Climate Change

*The regular pattern of weather conditions of a particular place is called as climate of that place. This regular pattern of weather conditions is considerably disturbed by fluctuations in temperature. The disturbance in the pattern of weather conditions at a particular place may rightly be called as Climate Change.*

*The Global Warming itself is not the Climate Change as the effects of global warming may not be uniformly negative. But, it is the abnormal rise in global temperature that is causing changes in the global climate. Most of the causes of climate change are man-made. Principal man-made causes of climate change are (a) Industrial Activites (b) Jhum cultivation, (c) burning of crop-residues in fields (d) deforestation, and (e) Vehicular Pollution. Let us see, how abnormal changes in temperature may lead to climate change.*

Temperature has significant role in the regulation of **water cycle** in the environment. Hence, rise in global temperature can change the pattern of water cycle. On the other hand, increased temperature can cause most of the ice to melt down. The increased evaporation of water due to high temperature may alter the pattern of cloud formation and rains at different places. The physical features of the

earth also play important roles in causing temperature variations that finally result into variations in air pressures. These variations cause disastrous conditions like **storms, cyclones, tornadoes** and **hurricanes** etc.

International agencies studying the climate change have projected the globally averaged temperature to increase by 1.4 to 5.8 degrees Celsius over the period 1990 to 2100. The **Intergovernmental Panel on Climate Change** (IPCC) does important climatic researches and surveys on periodic basis. It has hundreds of scientists from many different countries who study and analyse the meteorological changes and provide a collective pictures of global warming and other changes in the climate systems. The **Third Assessment Report of IPCC** was released in **January 2001**.

According to the reports of **Asia-Least Cost Green House Gas Abatement Strategy (ALGAS) Project**, the energy sector is the largest contributor of GHG (55%) in India. The ALGAS Project in India is funded by the **Asian Development Bank, Global Environmental Facility (GEF)** and **United Nations Environmental Programme (UNEP)**.

#### **12.2.6. Impact of Global Warming**

The Global Warming or the **climate change** has various types of impacts on the whole earth and its systems.

**Some of the major impacts of Global Warming (or the climate change) are mentioned below.**

1. Global Warming may cause frequent **natural disasters** like cyclones, storms and hurricanes, floods and droughts. It may also cause cloud bursts, avalanches, landslides, mud- flows and earthquakes.



**Fig. 12.3.** Melting of ice at Antarctica.

2. Global Warming is causing **melting of ice and glaciers** which is leading to a rise in sea-level. As a result, the creeping up of oceans swallow low lying islands and coastal areas.

**The rising sea level** is causing loss of land, loss of property and loss of lives. It may also cause

large scale displacement of people which may further create a problem of rehabilitation.

3. It is damaging forests, agriculture and water supplies.
4. It is damaging various ecosystems like mangrove-swamps, coral reefs and coastal lagoons etc. due to various reasons like reduction in pH of oceanic water and increasing deposits of acids.

5. Some populations of migratory birds have been declining because of unfavorable variations in climatic conditions. On the other hand the migration time of spring butterflies in Britain has become earlier than it was 30 years ago. **It has been observed that the behaviors of some bird species have changed due to climatic variations in the Indian state of Orissa.** Some birds like Black Headed Oriole and Open Billed Stork have changed their times of migration whereas some birds like Bronze Winged Jacuana and Indian Small Skylark have changed their nesting behaviors.

### **The Change in Climate, in the long run could affect agriculture in a number of ways –**

1. It may cause reduction in productivity both in terms of quality and quantity
2. Climate change may lead to changes in the water-use Pattern that may finally lead to failure of crops.
3. Climate change may enforce organisms to become more competitive and adoptive. It may adversely affect the agriculture.
4. Frequent changes in seasons and alterations in weather pattern may ruin the crop leading the world towards hunger and poverty.

### **enviro\_Facts : 12**

- A. As per land records of 1930, a cluster of seven villages named as '**Satabhaya**' (seven brothers) was spread in an area of 320 sq km near **Paradip of Orissa** state of India. By 2000, five out of seven villages were gradually swallowed by the sea and the area of 320 sq km was reduced to mere 155 sq km. Similarly, a large number of other villages located near the **sea coast in Orissa** have so far been swallowed in by the sea and the people residing in those villages have been migrated elsewhere. The reason ? ... yes, the global warming.
- B. It has been reported that melting of glaciers has contributed as much as 30 percent of change in sea level in the 20<sup>th</sup> century. The **Gangotri glacier** has shrunk more than 850 meters from 1996 to 1999. Melting of ice at **Antarctica** has caused **growth of grass** for the first time there.
- C. The total surface of glaciers worldwide has decreased by 50 percent since the end of the 19<sup>th</sup> century. According to a report, the snow cap that covered the top of **Mount Kilimanjaro** for last 11000 years since the last ice age was almost disappeared upto March 2005.
- D. The change in climate due to rise in global temperature is causing migration of species of wild animals towards poles and high altitudes. Since those areas are already inhabited by animals of different species, the migrated species receive the status of **Refugee Species**.

### **12.2.7. Prevention And Control of Global Warming or Climate Change**

Since all these and a lot of other miseries are feared to encircle us in near future due to climate change, let us come closure to formulate some strategy to make a carbon neutral world, yes a world without any change in the global climate. For this the United Nations Environment Programme has directed (2008) us through following words -

Carbon-neutral, yes – that sounds familiar. But climate Change, it is strange? The answer is simple: it is not just carbon dioxide, CO<sub>2</sub> that is driving climate change, even if it makes up almost 80 per cent of the climate gases (including contributions from changes in land use) emitted by human activities. Carbon dioxide is the most abundant greenhouse gas we are adding to the atmosphere, but it is not the only one. The international climate change treaty, the Kyoto Protocol, limits the emissions of six main GHGs produced by human activities. These gases are carbon dioxide (CO<sub>2</sub>), methane

(CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydro fluorocarbons (HFC), per fluorocarbons (PFC), and sulphur hexafluoride (SF<sub>6</sub>).

### Measures and instruments to arrest the Climate Change

The measures to control or mitigate the global climate change can be divided into two categories - the Technological Changes; and the Behavioural Changes. Following are some tips to reduce the climate change-

1. Controlling global emissions through various measures like local control, tax measures or carbon credit system to reduce carbon emission from commercial and residential building.
2. Control of emission through motor vehicles.
3. Control on air conditioning refrigerant leaks.
4. Use of alternatives to diesel, natural gas, and propane.
5. Fuel taxes for GHG emission.
6. Changes in urban and transport infrastructures to reduce the need for motorized transport and shift demand to less energy intensive transport models.
7. Traditional approaches to reduce unwanted emissions need to be supplemented with market mechanisms, voluntary agreements, tax policy and other non-traditional approaches.
8. Regeneration of forests, agroforestry.
9. Solid waste and waste disposal measures.
10. Economic instruments like subsidies, taxes, and tradable permits/ quotas as well as joint implementations.
11. Regulatory mechanisms.

#### 12.2.8. Global Efforts

Periodic Surveys, researches and assessments have proved that the global warming causing changes in the world climates is increasing day by day. It is currently recognized as an important global issue. Representatives from over 160 countries have met regularly to discuss ways to reduce GHG emission. In 1997 a conference was organized in **Kyôto**, Japan, in which world nations signed an agreement called as **Kyôto Protocol**. According to the Protocol, the industrialized nations were required to cut their GHG emissions to an average of 5 percent below 1990 levels, by 2012. Russia's cabinet approved the treaty in 2004 and paved the way to start it with effect from 2005. The protocol has been ratified by more than 126 countries. But Australia and U.S. did not support the protocol.

In early December 2005, representatives from 90 countries met in **Montreal**; Canada, to discuss ways on cutting down the use of fossil fuels so as to ensure less emission of carbon dioxide. According to the **Montreal bulletins**, the CO<sub>2</sub> level in the atmosphere is now higher within past 650,000 years. Unfortunately the two biggest CO<sub>2</sub> emitters of the world – Australia and United States refused to cut down their emissions.

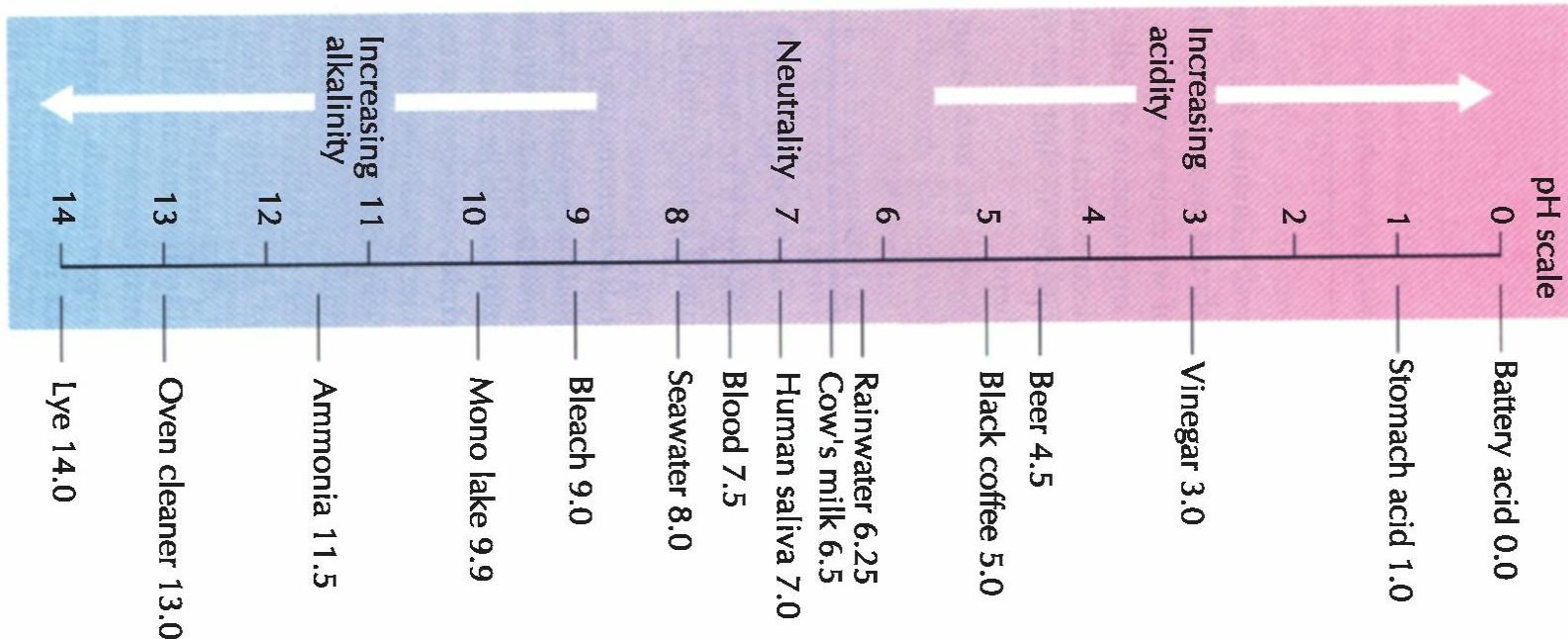
### 12.3. ACID RAIN

Falling down of acids from atmosphere to the earth in different forms is called as acid rain. In other words, we can say that-

**The process by which acids with pH normally below 5.6 are removed from the atmosphere**

## in rain, snow, hail or sleet is called as acid rain.

The quantity of acid in a liquid, like water is measured by a scale called as pH scale. In fact, the acid content of a solution is based on the concentration of Hydrogen Ions and it is expressed as pH. The acidity of rain samples is usually measured by pH- scale. As the number on a pH- scale goes down, it indicates more and more acidic nature of the sample of the rain water. Zero number indicates maximum acidity, seven (7) number indicates neutrality where as fourteen (14) number indicates maximum alkalinity. You might have studied about pH in your Chemistry classes.



**Fig. 12.4.** pH- scale showing increasing acidity and alkalinity.

### 12.3.1. How is the Acid Rain Caused?

Acid is a substance chemically characterized by the ability to form a salt on reacting with a base. It turns blue colour of litmus into red and can burn or cause injury to animal skin and plant leaves that come into its contact.

In the modern industrialized world furnaces, engines and machines burn lots of fossil fuels regularly. Burning of fossil fuels emits gaseous pollutants like **oxides of sulphur and nitrogen** etc. Forest fires also cause the release of **acidic fumes and vapours** that go up into the atmosphere. These substances are regarded as serious air pollutants. These pollutants are transported in the atmosphere over distances of hundreds and thousands of kilometers. In their journey through sky, these pollutants eventually **combine with water vapour** to form acids like **Sulphuric Acid ( $H_2SO_4$ )** and **Nitric Acid ( $HNO_3$ )**. These acids are washed down during rains to reach to the earth surface. Such a rain is called as acid rain.

There are other pollutants as well that help in the process of acid rain. These pollutants are **Hydrocarbons, soot** and **metallic ions of manganese, iron, nickel and copper** etc. that may often remain inside water vapour. These particles have been reported to **catalyze the process of acid formation**.

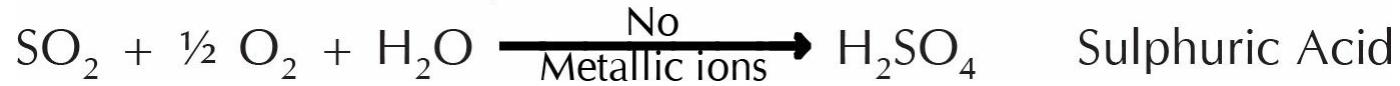
Sulphur dioxide and Hydrogen Sulphide may form **Sulphuric acid** where as Nitrogen oxide may form **Nitric acid** when combined with water. Similarly, other acids like **Hydrochloric acid, Carbonic acid** and **Phosphoric acid** may also be formed in the atmosphere as secondary pollutants and may be

washed down to earth along with rain water, snow, hail or sleet.

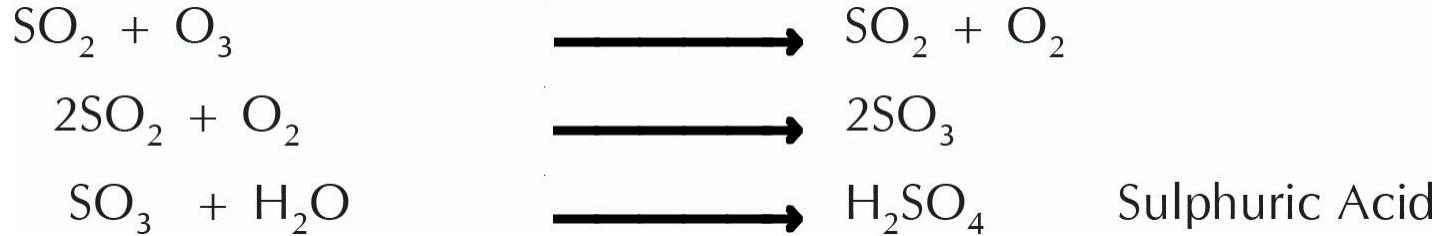
Chemical Reactions pertaining to the formation of acid during the process of acid deposition/acid rain are given as follows.

### A. In Atmosphere [reactions with Sulphur dioxide]

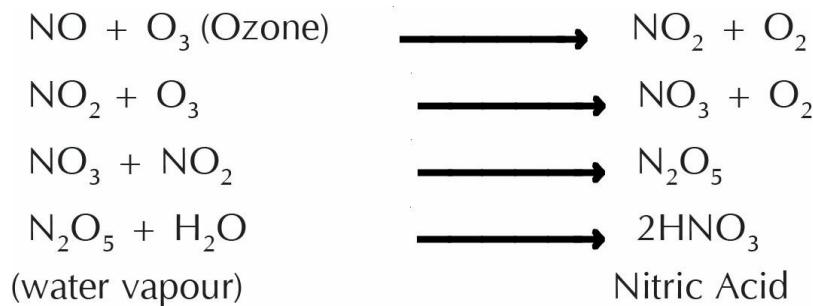
- (i) When  $\text{SO}_2$  reacts with Oxygen and water vapour



- (ii) When  $\text{SO}_2$  reacts with stratospheric Ozone



### B. In Atmosphere [reactions with NOx]



In another case



### 12.3.2. Acid Deposition

When acid forming primary pollutants like  $\text{SO}_2$ ,  $\text{H}_2\text{S}$  and  $\text{NO}_x$  move through atmosphere, they encounter a number of solid particles and water vapour moving in air. Some of those pollutants combine with water vapour to form secondary pollutants like acids of sulphur and nitrogen that fall down as acid rain. This is called as **wet deposition** of acids. When acid forming pollutants are absorbed by solid particles like fly ash etc. already present as pollutants in the atmosphere, this process is called as **dry deposition** of acids. In fact, dry deposition refers to acidic gases absorbed by particles that move through wind here and there. The acids absorbed by solid particles in air are also washed down to earth during rains; otherwise they remain in the atmosphere for longer periods. In this way the concentration of acids in rain water is increased. These processes i.e. wet and dry deposition of acids in the environment are together called as **Acid Deposition** in the Environment. The acid rain is only a part of acid deposition.

### 12.3.3. Impact of Acid Rain

The acid rain affects living and non-living components of environment. In July 1982, Stockholm—the venue of UN—conference on acid rain, suffered heavy acid showers for about a week. In India too, acid rains have been reported since last twenty years in areas where thermal power plants are located and also around Delhi, the capital of India.

Some of the remarkable impacts of acid rain are mentioned below-

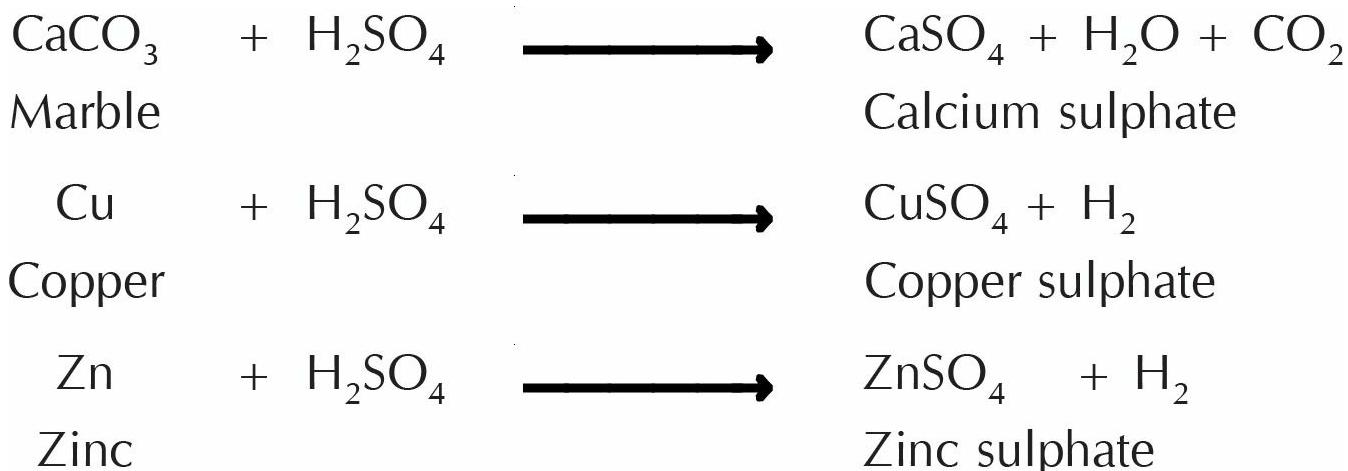
**A. Impacts on Human Health:** Acids of rain water join food-chains and water cycles and reach to human body systems. There they cause various types of health problems like neurological and digestive disorders, problems of eyes, throat and respiratory tract. Acid rain causes varieties of safety hazards like reduced visibility due to smog etc.

**B. Impact on Flora and Fauna:** Acid rain has seriously adverse impacts on aquatic as well as terrestrial flora and fauna. It kills fishes in lakes and ponds. Sweden and U.S.A. have 15000 and 100 fishless lakes respectively due to acid rains. About 237 lakes in Adirondack have highly acidic water with pH below 5. Numerous species of microorganisms are also killed due to acid rains. About 10 percent of forests have been destroyed and 18 million acres of vegetation are under serious threat due to acid rains in West Germany.

Acid of acid rains reaches to wild animals through water cycle and food-chains and cause serious health problems often leading to death. Acidic water containing traces of toxic metals destroys root systems of plants.

Since acid rain is a transboundary problem, both Norway and Sweden experience up to 90 percent acid rain due to air pollution in United Kingdom. Acid deposition in soil damages trees like Pine, Cedar, Ashes, Birch, and Spruce etc. About 5000 sq km of Cedar trees in Japan have already been damaged by acid rains. The populations of phytoplanktons, snails, insects etc. are eliminated due to acid rains.

**C. Impact of Acid Rain on Monuments:** Acid is corrosive by nature. Hence, water containing acids will also be naturally corrosive. Even dry acids deposited in air causes damage to limestone, marble and metals. Acid rain causes heavy damage to monuments and other buildings containing limestone, marble and metals as acids quickly react with these substances. Some chemical reactions of Sulphuric acid with different substances are given below.



The damage caused to rocks and marble by acid rain is called as **marble-leprosy** or **stone-leprosy**. In India acid rain was reported to cause damage to the walls of **Taj Mahal** in Agra.

Recently, the issues of pollution harming the marble surface of the **Taj Mahal** have arisen. In

Agra, today, pollution levels are high. Although the Taj is cleaned approximately every one to two years with a resin compound, the marble is beginning to be discolored with a yellow hue from pollution. There is more than one cause contributing to the pollution around the Taj Mahal. There are factories in Agra that emit dangerous sulfur and smoke. Exhaust from vehicles also harms the Taj. Both the Government and non-government bodies are trying to make Agra a pollution-free city but their objectives include reducing lead and sulfur emissions, and they are initiating sales of low-lead or lead-free gasoline in the area. Such ideas are admirable but are arguably not addressing the real problems. To generate power and avoid blackouts in cities like Agra, pollution is being generated at an unlawful scale.

Steps are being taken to reduce the pollution levels around the Taj. Several strategies are now in place to help protect the Taj Mahal. For example, all nearby transport must run only on electric battery power and may not come within a third of a mile (500 meters) of the monument. Investment in urban infrastructure has been used to reduce both water and air pollution.

In 2005, a new air monitoring system was adopted at the Taj Mahal to continuously measure air quality. Importantly, this new system will enable those protecting the building to better understand local wind patterns, the precise pollution load of the air, and the direction the wind is coming from. But because wind can carry pollution from great distances, there is still the challenging political and legal question of how particular industries can be held accountable.

Local and regional governments in India have tried in their own way to watch over the Taj Mahal. So too, has the national government's Ministry of Petroleum and National Gas, via the introduction of a 10-point plan to clean up Agra's air.

Acid rain has caused serious damages to different things and statues in the world like monuments and statues in Italy and Greece etc. **St. Paul's Cathedral in Bristol** is being corroded by acid rains. The British environment experiences acidic snow fall. Much of the snow that falls there contains acids due to which the snow does not melt easily.

#### **12.3.4. Prevention and Control of Acid Rain**

Acid rain can be prevented by controlling air pollution especially from industrial sources. For this, industrial units should install such technological equipments or devices that may control emissions at the source of their origin. Scrubbers, filters and electrostatic precipitators are some devices that help in controlling as well as removing air pollutants. Acidic water should be neutralized chemically so as to reduce its toxicity. The existing level of air pollutants especially CO<sub>2</sub>, SO<sub>2</sub>, NO, NO<sub>2</sub>, N<sub>2</sub>O etc. should gradually be removed out of atmosphere through specific technology. Vehicles should also be fitted with pollution control devices. They must be checked regularly for their exhausts.



**Fig. 12.5.** St. Paul's Cathedral in Bristol is subjected to regular corrosion by acid rains.

## 12.4. DEPLETION OF OZONE LAYER

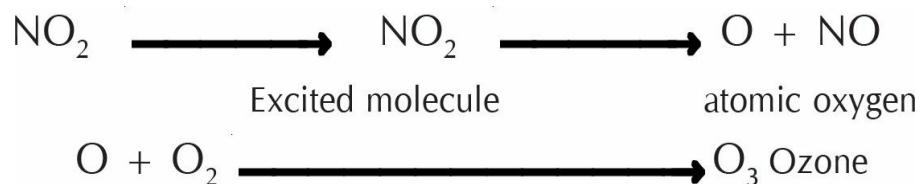
The depletion of ozone layer is one of the Global Issues of environment related to atmosphere and air pollution. But, what is ozone? How is it formed? What are its functions? ...etc., are many questions that we need be answer here. Let us take up these questions one by one.

### 12.4.1. What is Ozone? How is it Formed?

Ozone is one of the three allotropes of oxygen, an element in gaseous form. It is triatomic and less stable than oxygen. Its chemical formula is  $O_3$ .

Ozone in the stratosphere is very important to life. It is formed by the action of the ultraviolet light from the sun on molecules of oxygen. However, it is mainly produced from oxygen containing molecules such as  $SO_2$ ,  $NO_2$ , aldehyde etc. also when these molecules are exposed to ultraviolet radiations. Here is an example of the chemical reaction that takes place during the formation of ozone from  $NO_2$ .

Ultraviolet radiation



A large number of ozone molecules assemble around the earth to form the Ozone Layer which extends from 12 to 45 km above the earth surface. On an average it is about 230 **Dobson units** (DU) in thickness. DU is the unit which measures thickness of the ozone layer. It equals to 0.01 mm. One Dobson unit is the number of molecules of ozone that would be needed to create a layer of pure ozone 0.01 mm thick at a temperature of zero degrees Celsius at pressure of 1 Atmosphere.  $1DU = 2.69 \times 10^{16}$  ozone molecules.

## 12.4.2. Importance of Ozone layer

Ozone absorbs ultraviolet radiations so that much of it is never allowed to reach to the earth surface. The protective umbrella of ozone layer in the stratosphere protects the earth from harmful ultraviolet radiations. Ozone plays an important role in the biology and climatology on the earth's environment. It filters out all the radiations that remain below 3000Å. Radiations below this wavelength are biologically harmful. Hence any depletion of ozone layer is sure to exert catastrophic impacts on life in the biosphere.

## 12.4.3. Ultraviolet Radiations and their Harmful Impacts

There are three types of ultraviolet radiations in the sunlight- ultraviolet-A, ultraviolet-B and ultraviolet-C radiations. The UV-A is a low energy radiation with wavelengths 400 to 315 nm (1nm= 10Å). It is not harmful to life. UV- B radiations that comprise 1- 5 percent of the total radiation, is a short wave radiation (315 to 280 nm) with high energy. It is harmful to life. The UV- C radiation is a radiation of shortest wavelength (280 to 100 nm) with highest quantum of energy. It has great power to damage life but the ozone layer does not allow it at all to pass through and to reach to the earth.

### **HARMFUL IMPACTS OF ULTRAVIOLET RADIATIONS-**

- (1) UV radiation causes sun- eye- diseases (cataract), skin diseases, skin cancer and damage to immune system in our body.
- (2) It damages plants and causes reduction in crop productivity.
- (3) It damages embryos of fish, shrimps, crabs and amphibians. The population of salamanders is reducing due to UV-radiations reaching to the earth.
- (4) UV- radiations damage fabrics, pipes, paints, and other non-living materials on this earth.
- (5) It contributes in the Global Warming. If the ozone depletion continues, the temperature around the world may rise even up to 5.5 Celsius degrees.

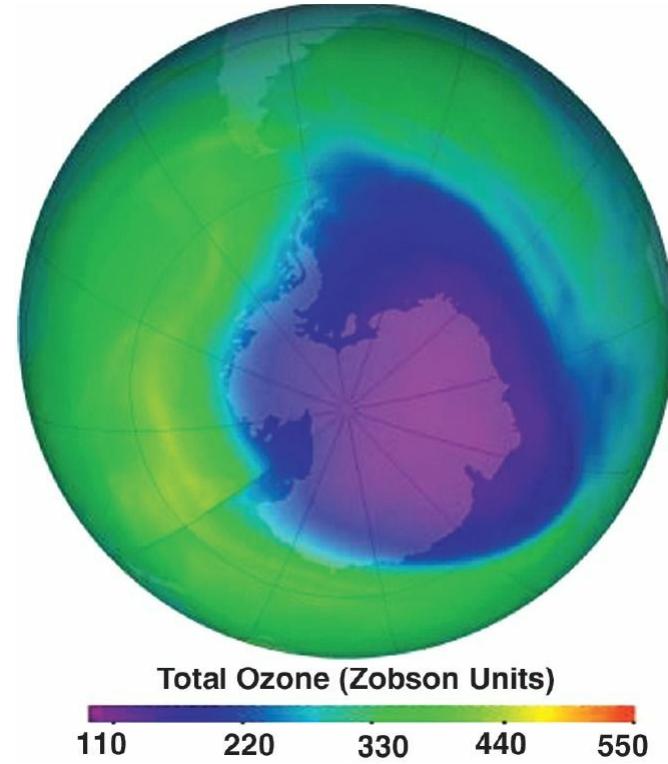
## 12.4.4. Substances that cause depletion of Ozone Layer

**Chlorofluorocarbons, methane, nitrous oxides ( $N_2O$ ), carbon tetrachloride ( $CCl_4$ ), methyl bromide** (a soil fumigant and insecticide), **aircraft emissions, n- propyl bromide** and **Halon- 1202** are major agents that cause depletion of ozone layer. Hence, these are called as **Ozone Depleting Substances (ODS)**.

Chlorofluorocarbons are a group of **aliphatic organic compounds**. These are a family of synthetic chemicals that are mostly the compounds of chlorine, fluorine and carbon. These are stable, nonflammable, non-corrosive chemicals with a peculiar trade name **Freon**. This trade name has been registered by the **E.I. du Pont de Nemours & Company**. Being relatively non- toxic chemicals, these are easy and inexpensive to produce. *These were first developed in 1930s but found widespread use only in the years following World War II.* During 1970s CFCs were linked to destruction of ozone layer due to which its manufacture has been banned in most of the countries of the world. Some important members of CFCgroup are *dichlorodifluoromethane* (Freon-12), *trichlorofluoromethane* (Freon- 11), *chlorodifluoromethane* (Freon- 22), *dichlorotetrafluoroethane* (Freon- 114) and *trichlorotrifluoroethane* (Freon- 113). On earth these chemicals are used extensively as aerosol-spray propellants, refrigerants, solvents and foam blowing agents.

#### 12.4.5. How is the Ozone Layer Depleted?

Chlorofluorocarbons or Freons get accumulated in greater amounts at high altitudes and gradually reach to the stratosphere. Under the influence of intense short wave ultraviolet radiations they release chlorine atoms. A single chlorine atom can react with more than, 100,000 molecules of ozone and can convert them into oxygen. Other ozone depleting substances like methane, nitrous oxide, methyl bromide etc. too, pass through a series of reactions under the influence of UV-radiations of sunlight and catalysts found in the air and help in the depletion of ozone layer.



**Fig. 12.6.** The Ozone Hole over Antarctic, October 21, 2006 (Source : NASA news)

**Ozone Hole:** The hole in the context of ozone depletion relates to thinning of the ozone layer in a certain area. The satellite measurements done in September 2000 revealed that the thinning of ozone layer in Antarctic had reached a record 28.3 million sq km which was about one million sq km greater than the record of 1998. As per the latest record of October 21, 2006, the area of ozone hole was 29 million square kilometers ([Fig. 12.6](#)). The blue and purple colours are where there is the least ozone and the greens, yellows and reds are where there is more ozone (NASA, Paul Newman, Image and Records; Satellite Aura). Thinning of ozone in such a big area is rightly termed as ozone hole. The ozone hole in the Northern Latitudes has also been recorded. The ozone hole over Antarctica may expose not only the Antarctica but also a large area of the pacific and Atlantic oceans and South America as well.

#### 12.4.6. Prevention and Control of Ozone Depletion

Banning the production and use of ozone depleting substances is one important way of preventing further depletion of the ozone layer in the stratosphere. On the other hand, alternatives to these chemical compounds should also be searched out so as to replace these chemicals. *Scientists of the University of California, U.S.A. devised a possible way of plugging the ozone hole by injecting alkanes or propanes into the atmosphere of Antarctica. The alkanes have the affinity of reacting*

with ozone destroying chlorine atoms. According to the scientists, about 50,000 tonnes of alkane or propane would have to be blown to check the ozone loss. These chemicals could be released from an altitude of about 15 km by a group of hundreds of large aircrafts.

#### 12.4.7. Global Efforts

Since ozone depletion is a Global Environmental Problem, it requires strong global efforts and co-operations for its solution. The International Community is taking up strong efforts as a result of which global consumption of ozone depleting substances has decreased markedly.

Following the UNEP's **Governing Council's meeting** to co- ordinate activities on protecting ozone layer in 1975, United States, Canada, Norway and Sweden banned the use of CFCs. The production capacity of the European Union (E U) was frozen allowing limited uses of aerosols. In March 1985, 28 countries of the world agreed on **Vienna Convention** for the protection of the ozone layer. In September 1987, different countries of the world adopted **Montreal Protocol** on substances that deplete ozone layer. By December 2001, 182 countries ratified the Vienna Convention and 181 the Montreal Protocol. By 2000, 96 chemicals were subject to control under the Montreal Protocol.

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## TOWARDS A BETTER ENVIRONMENT...

Indian government is contributing its best in arresting Global Warming under United Nations Framework Convention on Climate Change by adopting Clean Development Mechanism (CDM) Project of the Kyôto Protocol- 1997 to check the GHGs emission. The country has worked on the project for past two years and has emerged as a pioneer in the reduction of GHGs. Thus India has become able to generate Rs.10, 000 crores from the mechanism through Carbon Credit System. Carbon Credits are measured in units of Certified Emission Reductions (CERs). By adopting cleaner and environment friendly technologies industrial units can gain these credits. Rs. 17,000 crores have been invested by India in the project of the Clean Development Mechanism. Still there are 300 projects which are to be completed by 2012.

## IMPORTANT DEFINITIONS

<b>ISSUE</b>	: An important topic that people discuss or argue about, is called as an issue.
<b>GREEN HOUSE EFFECT</b>	: The warming effect produced inside a green house by its glass panels is called as green house effect.
<b>GLOBAL WARMING</b>	: The enhanced green house effect due to greater accumulation of green house gases is known as Global Warming.
<b>CLIMATE</b>	: The regular pattern of weather conditions of a particular area is called as climate.
<b>CLIMATE CHANGE</b>	: Change in the regular pattern of weather conditions (due to global warming) is called as climate change.
<b>IPCC</b>	: Inter governmental Panel for Climate Change.
<b>ALGAS</b>	: Asia-Least Cost Green house Gas Abatement Strategy.
<b>GEF</b>	: Global Environment Facility.
<b>ACID RAIN</b>	: The process by which acids from pH normally below 5.6 are removed from the atmosphere through rain, snow, hail or sleet is called as acid rain.
<b>ACID DEPOSITION</b>	: Accumulation of acids in dry or wet forms or in both the forms, in the environment, is called as acid deposition.
<b>FLORA AND FAUNA</b>	: All the plants of an area are collectively called as flora of that area. In the same way, all the animals of an area are collectively called as fauna of that area.

OZONE	:	One of the three allotropes of oxygen, an element in gaseous form, is called ozone.
NANOMETER (NM)	:	Nanometer, unit of measurement of length, ( $1 \text{ nanometre} = 10^{-9} \text{ m}$ )
Å	:	Angstrom unit, used to measure wavelengths of electromagnetic radiations, a unit of length which is equal to $10^{-10}$ meter.
CFCS	:	Chlorofluorocarbons, a group of aliphatic organic compounds synthesized artificially for industrial uses like manufacture of aerosol, refrigerants, solvents and foam blowing agents etc. are called as CFCs.
FREON	:	It is the trade name of a group of Chlorofluoromethanes or chlorofluorocarbons.
OZONE HOLE	:	An area in the ozone layer which has become very thin due to reactions of ozone and ozone depleting substances.

## MODEL QUESTIONS AND EXERCISES

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. Mention names of any two green house gases.
2. What has been the reason behind widespread retreat of mountain glaciers in non-polar regions during 20<sup>th</sup> century?
3. How much of the green house gases are contributed by the energy sector in India to the Global Warming?
4. Write names of countries that did not support the proposal of cutting down of CO<sub>2</sub> emission in a meeting of the world nations organized at Montreal, Canada in early December of 2005?
5. In which year did the Stockholm- the venue of UN- Conference on Acid Rain suffered continuous showers of acid rain for about a week?
6. What is stone- leprosy?
7. Which Ultraviolet radiation is completely absorbed by the ozone layer?

### II. SHORT ANSWER TYPE QUESTIONS

[2 Marks Each]

1. Suggest any two strategies to control population growth in India? (ICSE 2010)
2. What is the Green House Effect? How is it useful for the existence of life on the earth?
3. What is the Global Warming? How is it connected to the Green House Effect?
4. How is the Global Warming associated with the Climate Change? Mention any one example.
5. Mention two man-made causes of climate change. (ICSE 2008)
6. Mention any two cases showing Climate Change as per the third assessment Report of Intergovernmental Panel on Climate Change (IPCC) - 2001. Add your own explanation to each case.
7. What is Acid Rain? Mention factors responsible for causing Acid Rain.
8. What is ozone? Explain the process of depletion of ozone layer. (ICSE 2007)
9. What are harmful effects of Ultraviolet Radiations?

### III. DETAILED ANSWER TYPE QUESTIONS

(4 to 6 Marks Each)

1. Define Green House Effect. State four consequences of this phenomenon in the environment. (ICSE 2007)
2. What is Global Warming? Describe its impacts. How is the global warming, related to the Climate Change?
3. The depletion of ozone layer is one of the man's major environmental concern. In this context discuss the cause of its depletion with reference to chlorofluorocarbons with reasonable details. (ICSE 2005)
4. Briefly explain Global Warming. (ICSE 2007)
5. Mention six ways in which global warming could eventually effect agriculture. (ICSE 2005)

6. What is Acid Rain? How is it caused? Mention any three impacts of acid rain including the impact on monuments.
  7. How does the Ozone Layer protect life on this planet? How is it depleted? Suggest any two measures for the control of depletion of the Ozone Layer.
  8. Describe global efforts for the prevention and control of the Global Warming and the Depletion of the Ozone Layer.
  9. Acid Rain has been found to be extremely dangerous. Mention any four effects of the acid rain.
- (ICSE 2006)
10. Explain briefly the formation of acid rain.
- (ICSE 2008)
11. Suggest four measures to control climate change.
- (ICSE 2006)
12. What are the steps that have been taken to save Taj Mahal from the effects of Acid Rain?
- (ICSE 2006)
13. Mention six ways in which Global Warming could eventually affect agriculture.
- (ICSE 2005)

#### **IV. OBJECTIVE TYPE QUESTIONS**

##### **A. Multiple Choice Type Questions**

**Tick (✓) the correct option**

1. Green House Effect, Acid Rain, and Depletion of Ozone Layer are –
  - (a) local Issues
  - (b) national Issues
  - (c) regional Issues
  - (d) international Issues
2. Green House Effect is –
  - (a) a natural and essential effect
  - (b) an un-natural and harmful effect
  - (c) an effect produced by green plants
  - (d) an effect produced in a house painted in green
3. A heat trapping compound not discovered before 2000 is –
  - (a) carbon dioxide
  - (b) chlorofluorocarbon
  - (c) trifluoromethylsulphurpenta fluoride
  - (d) freon-114
4. The regular pattern of weather conditions of a particular area is called as –
  - (a) global Warming
  - (b) climate
  - (c) green House Effect
  - (d) climate Change
5. Global Warming is caused due to –
  - (a) heating effects of solar radiations
  - (b) enhanced Green House Effect
  - (c) acid Rain
  - (d) melting of ice

##### **B. Fill in the blanks**

1. Water vapour accounts for ..... to ..... percent of the natural Green House Effect.
2. Vegetation acts as a natural ..... for some of the gaseous pollutants like carbon dioxide.
3. Global Warming causes changes in .....
4. Five, out of the seven villages of SATABHAYA village- cluster that have been swallowed by the rising sea belonged to ..... State, of India.
5. Species migrated due to changes in climate receive the status of .....

##### **C. True / False**

Write T against the statement which is True and F against the statement which is False-

1. Decreasing number on pH scale shows decreasing acidity.
2. The number for neutral pH is 7.
3. Both dry and wet deposition of acids may cause damage to our monuments.

4. Stone – leprosy is a disease which affects stone – cutters.
5. Global Warming is caused due to acid rains.

## ANSWERS

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. Carbon dioxide, methane, 2. global warming, 3.55 %, 4. Australia and United States, 5. 1982, 6. damage ( weathering) caused to stones and marble due to acid rain, 7. UV-C

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice Type Questions

1. (d), 2.(a), 3.(c), 4. (b), 5. (b),

#### B. Fill in the blanks

1. 60, 70, 2. sink, 3. climate, 4. Orissa, 5. refugee species

#### C. True / False

1. F, 2.T, 3. T, 4. F, 5. F.

## PROJECTS & ACTIVITIES

### Act for Environment

#### 12.1. PROJECT

Prepare a project on ‘Global Warming- Causes and Effects’. Incorporate latest data and photographs and write the project properly.

#### 12.2. SURVEY

Do a survey of any ten houses of your locality and find out how many types of ozone depleting substances (ODS) are used in each house. Write a survey report with your suggestions at the end.

#### 12.3. DISCUSSION

Organize a discussion on ‘Acid Rain’.

# Disasters : Types, Management and Mitigation

## FACTS & CONCEPTS



- Introduction : Disaster-What Does it Mean?
- Components of a Disaster
- Classification of Disasters
- Disaster Management and Mitigation Strategies
  - Meaning of Management and Mitigation of Disasters
  - Strategies for Management and Mitigation of Disasters
- Management and Mitigation of Disasters
  - Management and Mitigation of Natural Disasters
  - Management and Mitigation of Man-made Disasters
- Governments' Role in Disaster Management and Mitigation

**An unexpected event that kills a lot of people or animals and causes a lot of damage may be called as a disaster.** The term DISASTER has been derived from DISASTRE- a French word, which means ‘an evil star’. In general, a disaster is a set of terrible and unexpected events that occur due to natural or human- induced reasons and cause severe losses to life, property and environment up to such an extent that the affected society becomes unable to cope up with its own resources.

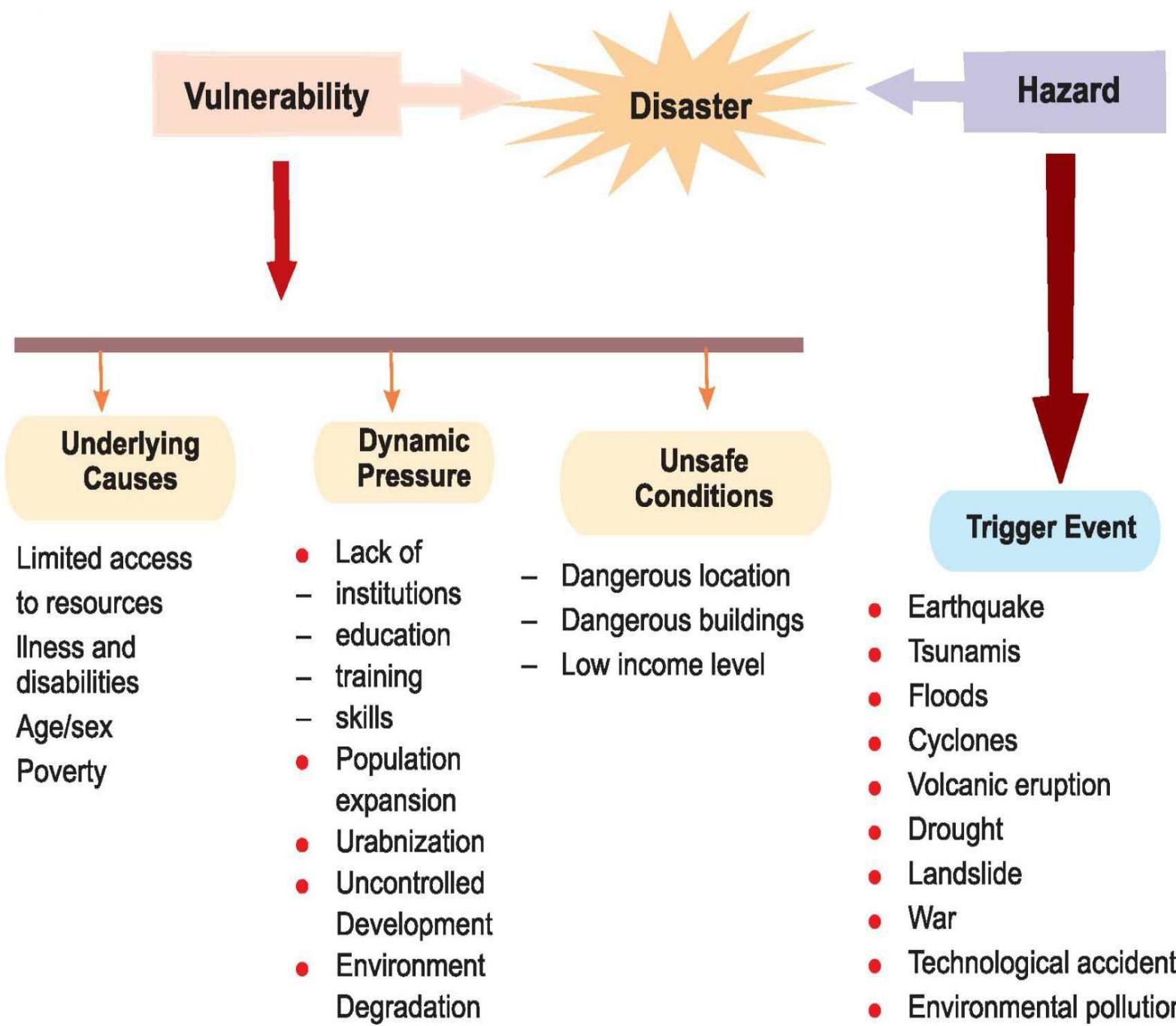
## 13.2. COMPONENTS OF A DISASTER

A Disaster has two components – **Vulnerability** and **Hazard**. When vulnerability meets a hazard, the disaster is bound to occur. Let us discuss these two terms first.

**The extent to which anything is likely to be damaged or disrupted by the impact of a particular hazard is called as vulnerability.** The word *anything* in this context relates to a community, structure, service or geographical area. But, what is a hazard?

**Any dangerous condition or event that threatens or has the potential for causing damage to life, property or environment is called as hazard.** Both the vulnerability and hazard together cause a disaster. Here is an example. A house made of mud walls is more vulnerable to some type of hazard than a house made of concrete walls. Any hazard like heavy rain accompanied by speedy wind may damage the house causing losses to life and property. This is what we call a disaster. Here is another example. A human habitation close to a sea coast has high vulnerability of being swallowed by rising sea waves- the hazard. The condition of drowning of the human habitation, deaths of inhabitants and loss of property, is a disaster.

Let us make a comparison between hazard and disaster. A hazard is just a threat which may or may not cause a disaster. A disaster is the event caused by a hazard. A cyclone is a hazard and it can not be called a disaster if it does not do any harm to anyone. It turns into a disaster when it affects populated areas and causes losses to life and property.



**Fig. 13.1.** Flow Chart- Vulnerability and Hazard meet together to cause Disaster.

The measure of the expected losses (like deaths, injuries, property losses etc.) that are caused by a hazard of some particular magnitude over any specific time in a given area is called as risk. Let us take a third example which incorporates all the three – vulnerability, hazard and risk. A bird's nest having three or four young ones has a high degree of vulnerability if it is located close to a high voltage electric wire passing through the same area. To and fro movement of the high voltage electric wire may be a hazard for the family of the particular bird. One day in a storm, the vulnerability meets to the hazard and the disaster occurs. It is the disaster for the male bird that has lost his wife and children during the electric shock. For other birds, it may just be an accident. The total of losses including the loss of life and the property (the nest) is the total risk involved in the disaster.

**Causes of vulnerability:** There are three major causes of vulnerability- 1. **Underlying causes**, 2. **Dynamic pressure** and 3. **Unsafe conditions**.

The dynamic causes include limited access to resources, illness and disability, age and sex and

poverty etc. The Dynamic pressure include- lack of institution, education and training, skills; expansion of population, urbanization, uncontrolled developments and environmental degradation etc. The Unsafe conditions may be – earthquake, tsunami, floods, cyclones, volcanic eruptions, droughts, landslides, war, technological accidents and environmental pollutions etc. The following flow chart explains these reasons more properly.

### 13.3. CLASSIFICATION OF DISASTERS

We know that there are two types of disasters: (1) Natural and (2) Man made or Human Induced Disasters.

#### 13.3.1. Natural Disasters

Disasters that occur due to abrupt changes in the earth systems and weather conditions are called as natural disasters. These disasters have further been classified into – **Planetary** and **Extra-Planetary** Disasters.

(a) **Planetary Disasters:** Disasters that occur on land and in atmosphere due to changes in earth systems or the geological conditions and atmosphere are called as Planetary Disasters. These disasters have further been classified into – **Terrestrial** and **Atmospheric disasters**.

Disasters that remain confined to land and bottoms of oceans are called as **terrestrial disasters**. Volcanic eruptions, earthquakes, tsunamis, landslides and mine disasters are some examples of terrestrial disasters. Atmospheric disasters are caused due to atmospheric events. Tropical cyclones, droughts, floods etc. are some examples of **atmospheric disasters**.

(b) **Extra- Planetary Disasters:** Disasters occurring due to collisions between the earth and space bodies or due to physical forces between them are called as extra-planetary disasters. High tide waves, hurricanes, landslides, movements of rocks, changes in sea level, biological extinctions etc. are examples of extra- planetary disasters.

#### 13.3.2. Man-made Disasters

Disasters that are caused due to human intervention in the natural processes or due to his activities related to development and war are called as man- made disasters. Occurrence of epidemics, nuclear hazards, industrial accidents, biological war fares, bioterrorism etc. are man-made or human induced disasters. In modern age, so many of the natural disasters like earthquakes etc. have become man- made disasters due to human activities of building mega dams and large scale developmental projects.

### 13.4. DISASTER MANAGEMENT AND MITIGATION STRATEGIES

We know that disasters whether natural or man- made, are very dangerous and destructive. We just can not do anything to stop a disaster, if both of the vulnerability and the hazard are existent. We can only try our best to protect men, women, children and cattle etc. that are in distress and help them by offering life sustaining things they need. We can prepare our people, cattle and property in advance to escape any disaster if it occurs in future. We can only manage or mitigate a disaster.

### **13.4.1. Meaning of Management and Mitigation of Disasters**

In general sense of the word, the act or skill of dealing with people or situation in a successful way is called as management. In case of a disaster, formulation of strategies, taking actions and adopting processes to prevent, minimize or control the adverse impacts of a disaster at all the stages (before, during and after) of its occurrence, is called as disaster management.

According to the National Disaster Management Division, Ministry of Home Affairs, Government of India-

Disaster Management can be defined as '**the body of policy and administrative decisions and operational activities which pertain to the various stages of a disaster at all levels**'.

Policies and measures designed and adopted to minimize impacts of a disaster, whether natural or man- induced, is called as disaster mitigation. For a successful mitigation of a disaster, it is important for the people to understand causes, seriousness, impacts and need of relief measures. Mitigation relates to the reduction of the effects of hazards and conditions vulnerable to it. Hence, mitigation activities are focused on both the hazard and elements exposed to the threats of the hazard concerned. The mitigation strategies are so devised that they can modify the occurrence of a particular hazard. Here is an example – the proper management of water, reduction of impacts and strengthening of the structures so as to reduce damage, can be the mitigation strategies for a drought prone area. Mitigation also relates to physical, economic and social vulnerability to a particular hazard and underlying causes of the vulnerability.

### **13.4.2. Strategies for the Management and Mitigation of Disasters**

The disaster management strategies can be divided into three parts-

- A. Pre- disaster Management Strategies or Preparedness
- B. Disaster Occurrence Management Strategies
- C. Post Disaster Management Strategies

#### **A. Pre- disaster Management Strategies or Disaster Preparedness**

We can neither prevent nor avoid a disaster. However, we can reduce the extent of a disaster by making advanced preparations. This incorporates four components- Awareness, Planning, Monitoring and Development of Early Warning System. In fact, preparedness is a protective process. It includes such measures which enable governments, communities and individuals to respond rapidly to the disaster situations so as to cope with them effectively.

**1. Awareness:** Making people aware of vulnerability, hazard and extent of risk of a hazard can enable them to protect themselves and their properties up to considerable extent. This can be done by either of the following measures- information, education and communication (IEC). **How can disaster awareness help the people?** Well, this can help the people in following ways-

- (i) It will ensure unity, co- operation and participation to fight against a particular disaster. This is due to awareness that people may remain ready to co-operate to agencies that come forward to help them.
- (ii) Through awareness, people become able to protect themselves on their own against a disaster.
- (iii) Disaster awareness develops a sense of service among people and they remain ready to

help their fellow citizens caught in the hazard.

- (iv) This enables people, to know legal aspects of disaster control, management and mitigation.

**2. Planning:** It is the most important component of disaster preparedness. Planning is necessary for getting success in every sphere of life. As for a disaster, vulnerability, extent of risk, preventive measures, safety measures, recovery options etc. are planned in advance so as to avert disaster risk and carry on rescue operations.

**3. Monitoring:** Proper care and knowledge of changing conditions and operations done during awareness building and planning is necessary. All the programmes and plans under preparation need to be monitored carefully so as to avoid any possible mistake.

**4. Early Warning System:** Early Warning Systems are developed in disaster –prone areas to inform public to take up necessary actions soon after a hazard is suspected. For this, warning stations are established near sea coasts, river banks, in industries etc. Warning related to abrupt weather fluctuations are regularly transmitted to people through communication channels. India has established various disaster warning stations in different parts of the country. As much as 250 cyclone- warning Dissemination Centers have been established along eastern and western sea- coasts that send early warning through communication satellites. In modern times, remote sensing satellites are effectively employed for monitoring as well as for sending data and photographs of weather conditions. Special automatic aircrafts are also being employed for collecting informations about the changing weather.

Preparedness also includes maintenance of inventories, training of personnel, search and rescue measures, and evacuation plans. The preparedness planning needs to be supported by appropriate legislation with clear allocation of responsibilities and budgetary provisions.

## B. Disaster Occurrence Management Strategies

At the time when a hazard strikes, the service groups, government agencies or social organizations should take up all possible rescue measures to protect people and their properties. At that time, activities are taken to ensure that needs and provisions of victims are met properly and their suffering is minimized. These strategies are called as Emergency Response Strategies.

## C. Post Disaster Management Strategies

These strategies include- Damage Assessment, Relief Measurement and Rehabilitation. Strategies adopted at this stage are called as Response and Recovery Strategies. Under these strategies, activities are taken to achieve early recovery and removal of earlier vulnerable conditions. An assessment of damage is done through surveys and baseline data collection etc. The relief and Rehabilitation measures are done on the basis of these activities. Other activities covered under these strategies are-

- (i) Empowerment of women,
- (ii) Coping with post disaster situations, restoration of livelihood with overall purpose of sustainable environment, and
- (iii) A coherent mechanism should be designed for meeting the needs of children following disasters. The rehabilitation of children should be priority, but in some cases their future outside the village might be preferable.

## 13.5. MANAGEMENT AND MITIGATION OF DISASTERS

Since the disasters are both natural and Man-made, somewhat separate strategies are applied for their management. Here are those strategies.

### 13.5.1. Management and Mitigation of Natural Disasters



**Fig.13.2.** Devastations caused by an Earthquake.

**A. EARTHQUAKES:** Sudden release of stresses built up in the earth's crust cause shaking of the earth- surface. It is called as earthquake. The intensity of an earthquake is measured on Richter scale, which was devised in 1935 by **Charles Richter of California Institute of Technology**, U.S.A. An earthquake measuring more than 5 on Richter scale (usually 7 and above) causes great damage. The place of origin of an earthquake is called as its focus or the hypocenter where as the point on the earth surface vertically above the Focus is called as Epicenter. Earthquakes cause physical, biological, economic and environmental damages.

**Management and Mitigation (Control Measures)** – These strategies comprise main and community based activities mentioned below-



**Fig.13.3.** Retrofitting of school buildings is very important for Quake-proofing.

- ◆ Contractors and developers of building constructions must follow norms fixed for buildings. Building constructions should not be done on soft soils.
- ◆ Buildings should not be constructed in vulnerable areas and those that have already been built in such areas should be strengthened properly.
- ◆ Use of standard quality building materials and following Indian Standards Codes for building constructions should be kept on priority.
- ◆ Human habitations at high risk zones should be shifted elsewhere.
- ◆ People should be made aware of dos and don'ts about earthquakes and important lifeline buildings should be strengthened to accommodate people after the earth quake. Hospitals and Fire services should be upgraded.
- ◆ Community should be prepared and educated for mitigating impacts of earthquakes.
- ◆ Community based Earthquake Risk Management Projects should be developed. Retrofitting of school buildings and other important buildings, purchase of Emergency Response Equipments etc. should be the principal activities of such projects.

**B. CYCLONES:** Cyclones are extremely disastrous hazards that originate in seawater. These are usually followed by wind of very high speed. These are atmospheric disasters occurring in tropical and coastal regions in Bangla Desh and India. Cyclones of eastern U.S.A. and Caribbean region are called as hurricanes and the same in the North Pacific Oceans are called typhoons. Local storms are called tornados. Cyclones usually extend vertically up to 12 to 14 km and horizontally up to 150 to 1000 km.

**Management and Mitigation-** Disasters due to cyclones can be prevented by adopting safety

measures and by constructing barriers. Some important measures for mitigation of cyclones are mentioned below-

- ◆ Plantation of green belts along the coastal line in a scientific interweaving pattern can reduce the hazard due to a cyclone.
- ◆ Wide buffer zones of forests should be managed properly along the coastal line so that cyclone may not run freely to penetrate inland.
- ◆ Meteorological records of wind speed and directions should be kept properly so as to predict for future cyclones and to make advanced preparations. In this regard hazard mapping is very important.
- ◆ Policies should be made to regulate land use and enforcement of building codes. Vulnerable areas should be reserved for parks, grazing grounds or play grounds.
- ◆ Buildings in coastal areas should have high engineering inputs. Traditional homes should be improved by building in disaster resistant features so that they can withstand cyclones with moderate speed.
- ◆ Building meant for storing food supply should be protected against winds and water.
- ◆ Arrangement of early warning systems, construction of concrete walls along coast line, organization of action groups and rescue squads etc. are some other important measures to mitigate cyclones.

## enviro\_Facts : 13

### UPWELLING OF PERUVIAN OCEAN CURRENT AND EL-NINO

There is an ocean current that flows along the Peruvian Coast. It is called as **Humboldt** Current, after the Prussian Explorer **Alexander von Humboldt**. This ocean current serves as a classical example of an eastern boundary current and features a typically wide and slow equator ward transport of cold water along the coast of South America.

The Peruvian Current is the largest **upwelling** system among the eastern boundary currents. What do you mean by upwelling? *Upwelling is a process in which cold nutrient-rich water rises to the surface from the ocean depths.*

The North- western alignment of the Andes Mountain along the **Peruvian Coast** forces the south –east Trade Winds to blow northwards. This condition causes an offshore flow in the surface layers of the marine water. This makes it one of the most productive upwelling systems in the world causing cold nutrient rich water to appear along the coast. It supports an extra- ordinary abundance of marine life. The Peruvian Ocean Current System accounts for approximately 18 to 20 percent of the tidal fish catch worldwide. The weakening of the Peruvian Current System allows the counter current to move southwards. It disrupts the coastal upwelling which normally occurs along the coast and creating a condition known as **El-Nino**. El- Niño is the warming of sea surface temperatures in the equatorial pacific ocean which influences atmospheric circulation, and consequently rainfall and temperature in specific areas around the world.

**El-Niño** is the Spanish word which means Christ Child. It indicates the appearance of a warm ocean current of the South American Coast around the Christmas. Approximately 14 El-Niño events affected the world between 1950 and 2003. On the reverse side, is **La-Nina** which is the cooling of sea surface temperatures in the equatorial Pacific Ocean, and which influences the atmospheric circulation, and consequently the rainfall and temperature in specific areas around the world. It is the opposite of El-Nino.

**C. DROUGHTS:** Failure of rains cause prolonged periods of dryness which results into crop-failures. This condition is called as drought. Drought causes deaths of humans and cattle as they cannot withstand dry weather. Drought enforces many populations to migrate elsewhere which creates further problems of rehabilitation.

**Management and Mitigation-** Drought can be managed and mitigated in following ways-



**Fig 13.4.** Landslides may kill many thousands of people.

- ◆ Management of watersheds, water- harvesting structures and other measures should be undertaken to ensure water supplies in the area.
- ◆ Drought resistant crops or crops demanding less water should be cultivated in drought prone areas to ensure food supply.
- ◆ Afforestation and other forestry measures should be undertaken so as to retain humidity in the atmosphere and promote precipitation.
- ◆ Cutting of trees and clearing of forests should be banned.
- ◆ Roof top water harvesting should be adopted by every house so as to retain water for different uses.

**D. LANDSLIDES:** The downhill movement of large amounts of soil, mud, rocks debris is called as landslide. It causes flooding of rivers due to deposit of silt and aggravates floods. Landslides cause maximum fatalities depending on the place and time of occurrence. Landslides may kill many thousands of people. The landslide in Peru in 1970 killed 18000 people.

**Management and Mitigation –** The management and Mitigation of disasters due to landslides can be done by adopting following measures-

- ◆ Clearing of forests on hill slopes must be stopped.
- ◆ Proper monitoring and warning systems should be developed in landslide prone areas so as to facilitate the activities of evacuation before the disaster.
- ◆ Search and rescue operations should be done by special rescue squads.
- ◆ The assessment of damage, financial assistance to the affected people and rehabilitation should be done in time.
- ◆ Retaining walls should be built to stop land from slipping.
- ◆ The surface drainage control works should be implemented to control the movement of soil accompanied by infiltration of rain water and spring flows.
- ◆ Increasing vegetation cover, building engineering structures and insurance of people are other measures to mitigate the disasters due to landslides.

**E. TSUNAMIS:** Tsunamis are towering walls of marine water having great powers of destruction. These are usually caused due to undersea earthquakes or undersea volcanic eruptions. Tsunami is a Japanese word which means harbor waves. These may also be caused by undersea landslides and force of an asteroid crashing into ocean.



**Fig. 13.5.** Tsunamis are towering walls of marine water with great power of destruction.

**Management and Mitigation –** The management and mitigation of tsunami hazards need specific preparedness measures like hazard mapping, arrangement of early warning systems and community participation. **Main tsunami mitigation strategies should include** site planning, land management and evacuation of public living in coastal areas. Residents of coastal areas should shift their houses far beyond the coast line and they should construct houses on high ground levels. Water breakers should be constructed to reduce the velocity of waves. For construction, water resistant and corrosion resistant materials should be used. Community halls should be constructed at higher locations that may act as shelters during the disasters. Sea walls should be constructed to stop the gushing water.

**F. FLOODS:** Floods cause great losses to life and property every year. Occurrence of floods is a cumulative condition which appears as accumulation of huge volumes of water in a vast area.

**Management and Mitigation –** Following are the measures usually adopted for the management of disasters due to floods-

- ◆ Arrangement of proper warning systems to relocate people,
- ◆ Construction of embankments to restrict water against entering into human habitations,
- ◆ Ban on cutting of trees on hill slopes and on other areas as well and checking soil erosion so as to avoid the Siltation of rivers,
- ◆ Proper rescue and relief operations,
- ◆ Mass scale tree plantation in flood prone areas.

### 13.5.2. Management and Mitigation of Man –made Disasters

Man –made disasters can be managed and mitigated through following general measures-

- (i) The spread of epidemics can be managed by keeping healthy living conditions, proper storage of food materials, proper storage of water, proper disposal of wastes, checking pollutions of resources at all levels,

- (ii) Nuclear hazards can be prevented by proper handling and disposal of nuclear wastes,
- (iii) Traffic accidents can be avoided by obeying traffic rules,
- (iv) Biological, chemical and industrial disasters can be prevented by strict legislations, increasing moral values in societies, upgrading medical facilities, building up public awareness, proper education etc.

## 13.6. GOVERNMENTS' ROLES IN DISASTER MANAGEMENT AND MITIGATION

Though the institutional and policy mechanisms for carrying out response, relief and rehabilitation have been established in India, since Independence, the **Ministry of Home Affairs** (The Government of India) created a **National Disaster Management Division** (NDM) on June 2002 and restructured various Disaster Management Committees on State, District and Block levels.

1. The central government has taken up various steps to strengthen Management and mitigation instruments in the country. In case of major disasters, the Central Government is inclined to provide financial and logistic supports and to co-ordinate the efforts of all the central ministries, departments and organizations. The apex body is the **Cabinet Committee on National Calamities** (NCMC).
2. The NCMC gives directions to the **Crisis Management Groups**. The Chairman of the Crisis Management Group is the Central Relief Commissioner, Ministry of Home Affairs. This group reviews contingency plans formulated by various ministries, departments or organizations and measures required for dealing with a natural disaster and co-ordinates functions of Central Ministries and State Governments in relation to disaster preparedness and relief.
3. The government of India has proposed the organization of a **National Emergency Management Authority** on the national and state levels. States have been directed to set up Disaster Management Authorities under the Chief Minister with ministers of different departments as members.
4. The Central Government has directed state governments to reorganize the **Department of Disaster Management** and to form four Functional Groups and to assign those groups their functions as below-

Hazard Mitigation	- Functional Group one
Preparedness and Capacity Building	- Functional Group Two
Relief and Response	- Functional Group Three
Administration and Finance	- Functional Group Four

5. At district level the District Magistrate is the Chief Coordinator of all activities related to prevention, mitigation and preparedness . The District Committee is being reconstituted as Disaster Management Committee and Disaster Management Teams are to be constituted to work under it.
6. Different institutes have been established in different parts of India to impart training for the development of skilled citizens for a better management and mitigation of disasters. Names of some important institutes are mentioned below.

- (a) Centre for Disaster Management, Mussoorie,
- (b) National Institute of Disaster Management, New Delhi,
- (c) National Fire Service College, Nagpur,

Students like you, and your friends too, can play significant roles in Disaster Management. But, how? Here are some important tips –

1. Students can help in the preparedness and response to a disaster,
2. Students can make the people aware regarding pre- and post disaster situations and can communicate through ham-radio,
3. Students can build awareness among the public about different types of natural and man-made disasters and about how to deal with these disasters,
4. Students can help in relief work by collecting relief funds,
5. Students can help in rehabilitation of the Disaster- victims.

## **CHERNOBYL DISASTER**

The Chernobyl nuclear power plant in the Ukraine exploded on April 26; 1986. The effects of the explosion were felt for thousands of kilometers. The plant is located 14.5 kilometers northwest of Chernobyl. A number of things caused the disaster at Chernobyl. First, the plant was not properly designed, and could only be run with very specific instructions. Second, the operators of the plant failed to properly follow instructions, and some scientists conducted a highly risky experiment that led to the explosion. The scientists decided to conduct the experiment, and had to remove safety and cooling equipment in order to do so. Eventually, pressure on the reactor's roof blew it away. Everything inside, including molten uranium, burning graphite, and radioactive ashes were emitted into the atmosphere.

This was not a nuclear explosion. There was no chain reaction or explosion like that in an atomic bomb. However, the amount of radioactive material released was ten times that caused by the US atomic bombing of Hiroshima. Radioactive fallout spread throughout Europe. It hit Poland, Germany, Belgium, France, and Holland, and then shifted towards the Balkans and Italy.

It is hard to predict just how many people were affected by the Chernobyl explosion. A British report estimated that the radioactivity will give 2300 people cancer, though others think the number is much higher. It was an important lesson for us that maximum care, skill and safety measures are essential while working with nuclear plants and devices.

**13**

## **TOWARDS A BETTER ENVIRONMENT...**

The Government of India has given special emphasis on the management and mitigation of disasters in the country. Accordingly, a number of special attempts have been taken in different sectors.

In the field of education the government has directed to Central Board of Secondary Education (CBSE), other Boards and National Council of Educational Research & Training (NCERT), New Delhi to include Disaster Management in the curriculum. In Tenth Five Year Plan, the Planning Commission of India has given Stress on Disaster Management and Mitigation while dealing with developmental aspects .This subject has been included in the training programmes of police and para military forces also. The government has also organized a special task force named National Emergency Response Force for rescue and mitigation operations. A component of Disaster Management has been included in the training programmes of Indian Civil Services also.

A Disaster Risk Management Programme has been started with the assistance of United Nations Development Programme. The programme covers 169 districts of 17 hazard prone states of India. The Government has also joined hands with a number of International agencies for co-operations in the field of Training and Capacity building for Disaster Management and Mitigation. Asia Disaster Reduction Centre (ADRC) Japan, Indo-Swiss Agreement for co-operation and Asian Disaster Management Centre are

## IMPORTANT DEFINITIONS

<b>DISASTER</b>	:	A set of terrible and unexpected events that occur due to natural or human induced reasons and cause severe losses to life, property and environment up to such an extent that the affected society becomes unable to cope up with resources of its own, is called as a disaster.
<b>VULNERABILITY</b>	:	The extent to which anything is likely to be damaged or disrupted by the impact of a particular type of hazard is called as vulnerability.
<b>HAZARD</b>	:	Any dangerous condition or event that threatens or has the potential for causing damage to life, property or environment is called as a hazard.
<b>RISK</b>	:	The measure of expected losses that are to be caused by a hazard of some particular magnitude over any specific time in a given area is called as risk.
<b>DISASTER MANAGEMENT</b>	:	The body of policy and administrative decisions and operational activities which pertains to various stages of a disaster at all levels is called as disaster management.
<b>MITIGATION</b>	:	All the measures taken to reduce both the hazard itself and the vulnerable conditions to it in order to reduce the scale of a future disaster is called as disaster.
<b>PREPAREDNESS</b>	:	The protective process which comprises measures that enable governments, communities and individuals to respond rapidly to a disaster to cope it effectively is called as preparedness.
<b>HAZARD MAPPING</b>	:	The activity of illustrating areas vulnerable to hazard in a given time is called as hazard mapping. A hazard map is prepared with designated areas expected to be damaged by a hazard.
<b>EPICENTER</b>	:	The point on the earth surface vertically above the focus of an earthquake is called as epicenter.
<b>TSUNAMI</b>	:	Towering walls of marine water caused due to geological activities in the bottom of a sea or due to the force of an asteroid crashing into ocean is called as tsunami. Tsunami waves have great powers of destruction.

## MODEL QUESTIONS AND EXERCISES

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. Make a mention of any one dangerous location which is vulnerable to a cyclonic hazard.
2. Who is the head of a National Crisis Management Committee (NCMC) at Central Level?
3. Name anyone human induced disaster.
4. What is done to reduce the velocity of sea-water in coastal areas?
5. How can you avoid Traffic Accidents ?
6. Name the Warm ocean current that flows along Peruvian coast. What effect does it have in this area?
7. What is the meaning of ‘Tsunami’?

(ICSE 2005)

### II. SHORT ANSWER TYPE QUESTIONS

[2 Marks Each]

1. Define-
  - (a) Vulnerability
  - (b) Hazard
  - (c) Risk
2. What is a disaster?
3. Define Disaster management and Disaster Mitigation.

4. What is preparedness? What are different components of pre disaster Management strategies?
5. How can the following factors cause vulnerability? Think and answer
  - (a) Age & Sex
  - (b) Poverty
  - (c) Unsafe locations
6. What is Risk? Give an example.
7. What is a post disaster management strategy ? What are its components ?

### III. DETAILED ANSWER TYPE QUESTIONS

**(4 to 6 Marks Each)**

1. "When vulnerability meets a hazard, the disaster is sure to occur"? Explain with any two examples.
2. What are various pre and post Disaster Management strategies? Describe giving appropriate examples
3. What is the role of government in mitigating disasters in India?
4. What is disaster management? Discuss the role students can play in disaster management.

(ICSE 2007)

5. Suggest Four control measures for an earthquake.

(ICSE 2008)

6. The chernobyl disaster was an important lesson for us. Write briefly on this disaster.

(ICSE 2010)

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice type Questions

**Tick (✓) the correct option**

1. A disaster is-
  - (a) a periodic event
  - (b) an unprecedeted event
  - (c) an atmospheric event
  - (d) a social event
2. Vulnerability and Hazard meet to cause-
  - (a) preparedness
  - (b) risk
  - (c) tsunami
  - (d) disaster
3. Disasters that remain confined conferred to land and bottom of oceans are called as-
  - (a) atmospheric Disasters
  - (b) terrestrial Disasters
  - (c) land- oceanic Disasters
  - (d) man-made Disasters
4. Policies and measures designed and adopted to minimize impacts of disaster whether natural or man-induced is called-
  - (a) politics
  - (b) disaster-policy
  - (c) impact of a disaster
  - (d) disaster minimization.
5. The downhill movement of large amounts of soil, mud and debris is called as-
  - (a) soil erosion
  - (b) landslide
  - (c) soil movement
  - (d) hazard

#### B. Fill in the blanks

1. When vulnerability meets a Hazard the ..... is bound to occur.
2. Poverty is an important factor which causes .....
3. Children and women remain more vulnerable to .....
4. A bird's nest on the branch of a tree near a high voltage electric wire passing close to it is in a .....location which increases its.....to the hazard of electric shock.
5. Sudden release of stress built up in the earth's crust causing shaking of earth's surface is called .....

### C. True / False

Write T against the statement which is True and F against the statement which is False-

1. Retrofitting of school buildings located in risk zones is necessary for protection against earthquakes.
2. Forestry measures like afforestation and Social Forestry have nothing to do with drought conditions.
3. Tropical storms of eastern U.S.A. and Caribbean region are called Hurricanes.
4. Landslides always occur in the plains of Uttar Pradesh.
5. Traffic accidents can be avoided by keeping away from the traffic.

## ANSWERS

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. housing close to coast line, 2. Cabinet Secretary, 3.epidemic, 4.construction of water breakers, 5. by obeying traffic rules,
6. Humboldt current, It produces upwelling effect along the peruvian coast. 7. "Harbor wave"

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice Type Questions

1. (b), 2.(d), 3.(b), 4. (d), 5. (b),

#### B. Fill in the blanks

1. disaster, 2. vulnerability, 3. hazards, 4. dangerous, vulnerability, 5.earthquake.

#### C. True / False

1. T, 2.F, 3.T, 4.F, 5. F.

## PROJECTS & ACTIVITIES

### Act for Environment

#### 13.1. COLLECTION/ COMPIRATION

Collect data and other informations about any two different cases of disaster that occurred during last ten years in India.

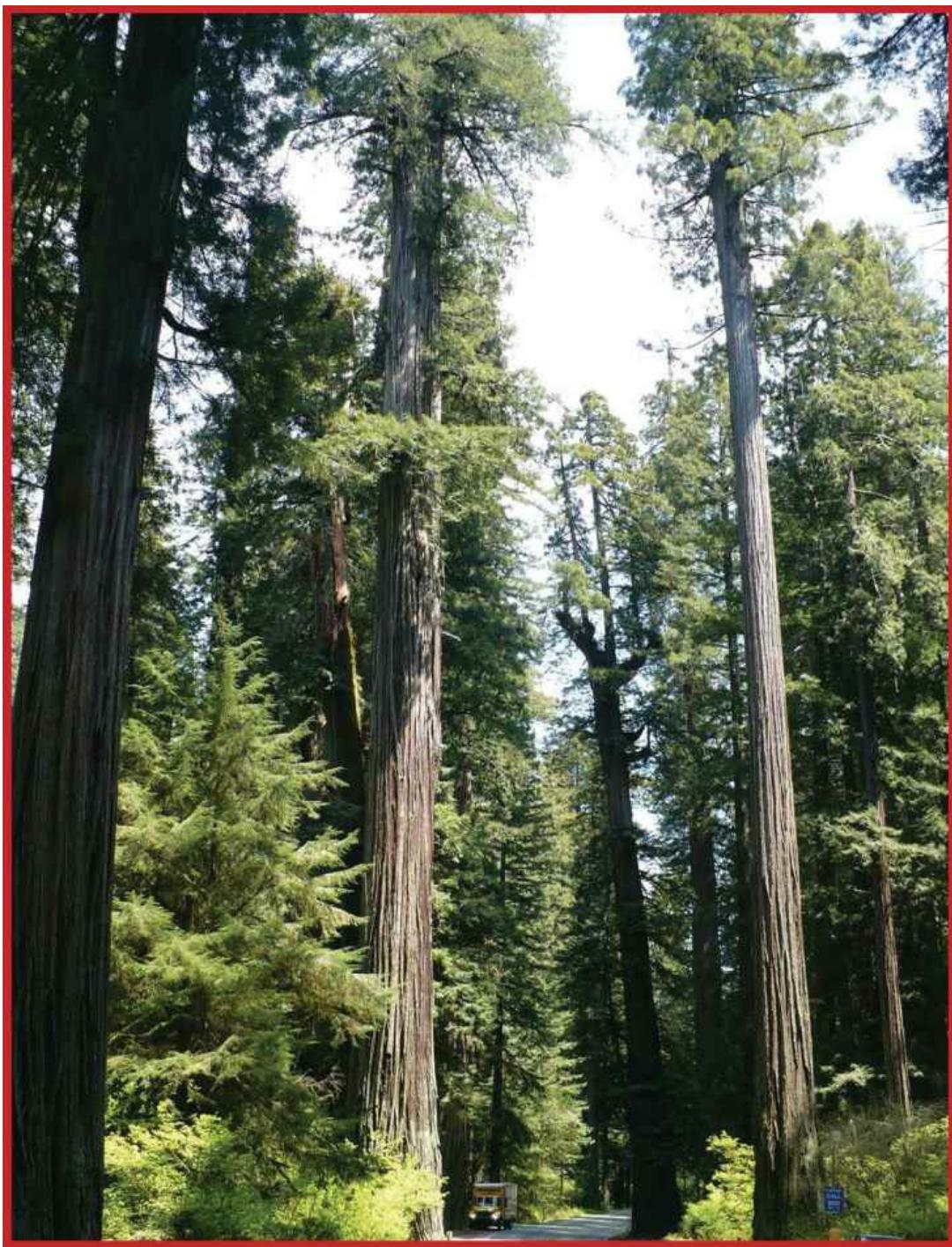
#### 13.2. POSTER PREPARATION

Prepare a colorful poster showing pre-disaster management / activities undertaken during a disaster and post Disaster Management activities on any one type of Natural Disaster.

# 4

# STRIVING FOR A

# BETTER ENVIRONMENT



**14. Sustainable Environment**

**15. Consumer Education**

**16. Ecological Restoration and Conservation**

# Sustainable Environment

## FACTS & CONCEPTS



- Introduction : International Co-operation
- Concept of Sustainability and Sustainable Environment
- Use of Efficient and Eco-Friendly Technologies
  - Emerging Eco-Friendly Technologies
  - Available Eco-Friendly Technologies
- Sustainable Use of Resources
- Adoption of Indigenous Practices-Sacred Groves
  - Some Examples of Indigenous Practices
  - Sacred Groves

## 14.1. INTRODUCTION : INTERNATIONAL CO-OPERATION

The **World Commission on Environment and Development** (WECD) reported in 1987 – ‘*the present decade (1980s) has been marked by a retreat from social concerns. Scientists bring to our attention urgent but complex problems bearing on our survival: a warming globe, threats to the earth’s ozone layer, deserts consuming agricultural land. We respond by demanding more details, and by assigning the problems to institutions ill equipped to cope with them.*’

The decade of 1980s observed a number of new discoveries like-

- (i) Measurement of the size of ozone hole by British Researchers in 1985,
- (ii) The U.S. Government’s Report entitled **Global-2000**, recognized that species extinction was threatening biodiversity,
- (iii) Adoption of **World Charter for Nature** by the **General Assembly of United Nations** (1982), made clear that environment and development were interdependent, and
- (iv) The realization of intrinsic values of Species and Ecosystems through the World Charter for Nature (1982).

In spite of these developments the decade of 1980s experienced severe industrial accidents that left permanent marks on environment and human health. Some examples are mentioned below-

- A. The leakage of the **Methyl Iso Cynate** (MIC) in 1984 from one of the Union Carbide’s plants located in Bhopal, India, killed 3000 people and injured 2000.
- B. Up to one million people died of hunger in **Ethiopia** during 1984-85.
- C. The world’s worst nuclear accident occurred when a reactor at the **Chernobyl Nuclear Power Plant**, exploded in the **Ukrainian Republic of Soviet Union on Saturday, April 26, 1986**.
- D. The spill of 50 million Litres of oil from **Exxon Valdez** super tanker into Alaska’s Prince William in 1989 reflected that even the remotest areas on the globe are unsafe due to human activities.

A **World Industry Conference** was organized in 1984 by United Nations in **Canada**. It was the first attempt to provide a code of conduct for sound management in the business sector. As a result of this the concept of **Sustainable Development** and **Eco-friendly Technology** or **Eco-efficiency** was introduced in the area of development. **Some of the major objectives of eco-efficiency are** (1) Judicious use of fossil fuels, (2) Reduction of pollution load, (3) Maximum production (4) Reduction of man-power-wastage; and (5) Sustainable Development.

To make the environment sustainable, a number of measures are necessary to be taken up by the people and government across the globe. Some of these measures are- **use of efficient and eco-friendly technologies, sustainable use of resources and adoption of indigenous practices** like keeping of **sacred groves**. Here in this chapter, we are going to discuss these tough issues in most simple ways.

## 14.2. CONCEPT OF SUSTAINABILITY AND SUSTAINABLE ENVIRONMENT

It is being felt that the process of modern development is defective one. It is creating various

types of stresses on the environment due to which a number of local, regional and global problems have emerged out that challenge the existence of human beings and other organisms on this planet.

Some of the environmental problems that have been created due to stress caused on environment by modern developments are being listed below-

- (1) Destruction of forests.
- (2) Falling underground water table.
- (3) Rise in global temperature and climate change.
- (4) Extinction of animal and plant species.
- (5) Large scale migration of people.
- (6) Great financial inequality.
- (7) Reduction in the means of livelihood for the poor.
- (8) Scarcity of food.
- (9) Increasing number of disasters.

Besides above mentioned problems, the process of modern development is creating gender inequality and imbalances in sex-ratio. In view of these problems it is thought that the current process of development cannot go for long. This means it is **unsustainable**.

Keeping in mind the unsustainable nature of modern development, scientists and environmentalists the world over, have thought out a new model of development called as **sustainable development**.

*Such a new model of development which benefits every individual, safeguards environmental rights of every citizen and which may keep the natural environment in a perfectly balanced state is called as sustainable development.*

### **Sustainable Development has following basic objectives-**

- (i) Respect and care for living beings.
- (ii) Improvement in the quality of human life.
- (iii) Establishing equity in the distribution and sharing of resources.
- (iv) Planning and implementing projects on Gender Equality.
- (v) Minimizing the depletion of resources.
- (vi) Changing attitudes for Environmental conservation.
- (vii) Caring and sharing of the natural resources.

## **14.3. USE OF EFFICIENT AND ECO-FRIENDLY TECHNOLOGIES**

The word efficient technology in the present context means such a technology which derives maximum through the utilization of minimum resource with negligible quantity of wastage. Old machines often consume lots of fuels and generate lots of wastes without liberation of sufficient energy. Thus we cannot afford to waste our resource by making use of old and inefficient technology.

An ecofriendly technology is one that can be employed for the developmental works without causing any harm to any part of the natural environment. Rather, such a technology supports the balance of environment alongwith doing the needful.

**The selection of an appropriate technology for a particular purpose depends on following important factors-**

- (i) The cost of technology should be low.

- (ii) It should be selected keeping in view the demand of electricity on local level.
- (iii) It should be supported by government.
- (iv) It should be based on locally available resources.

#### 14.3.1. Available Eco-Friendly Technologies

Some of the significant ecofriendly technologies used in modern times are discussed below-

**A. Wind Power:** India has a Wind Energy Potential of 45,000 MW. The capital cost of a single wind power plant ranges from Rs. 4.0 to 4.5 Crore/MW and the cost of power generation through wind power plant is expected to decline in the cost of a power plant as- Improvements in Technology, Increase in the size of turbine & optimal planning and site selection. 80% of the power generated through wind systems is of captive in nature.

**B. Small Hydro- Power:** The total installed capacity of small hydro-power is 63 MW. However there is a drastic increase to 226 MW within a period of only ten years. These small hydro-power stations are located in hilly areas and canal drops. Most of these plants are connected to grid. Some of the small hydro-plants in India are run by Non-Government Organizations or by local communities.

**C. Biomass Power:** Primary power generation technologies applied in the generation of Biomass Power are – **gasification, co-generation and Direct Combustion**. So far, about a total of 34 units aggregating to upto 210 MW capacity co-generation plants have been commissioned whereas 26 units aggregating to 237 MW capacity is under implementation. Of the total energy supplied world wide the biomass power generation is about 14% out of this, 38% is consumed in developing countries comprising rural and traditional sectors. Major applications of biomass power are – **direct or indirect heating, pumping water for irrigation, power generation, rural electrification and industrial uses**.

**D. Energy from Wastes:** The basic concept behind generating energy from wastes is the reduction of wastes. The technologies so far available for the recovery of energy from wastes, are- **Anaerobic Digestion, Bio-methanation, landfill gas recovery, incineration and intensification or pelletization**. Other ecofriendly technologies for deriving energy from wastes are **pyrolysis, gasification, alcohol fermentation, slurry carb process and plasma**.

**E. Solar Energy Technologies:** Solar Water Heating, Solar Cookers, Solar Air Heating, Solar thermal heating, Solar thermal building design are some important non-grid solar thermal technologies applied in India and other countries.

**F. Hybrid and Stand-alone System:** **Combination of two different energy technologies is called as Hybrid System.** Under this scheme solar photovoltaic system and wind electric generators can be combined to produce energy. During cloudy days wind electric generation is useful for optimum supply whereas during low wind conditions solar photovoltaic system can be used effectively. Wind water pumps, wind battery chargers and chemical storage comprise stand-alone Wind technologies.

**G. Rural Energy Technologies:** Some technologies mostly used in rural areas are being introduced below-

**(I) Biogas:** Biogas generation is the most important, clean and eco-friendly technology for rural areas. The biogas plant installation potential of India is 12 million plants out of which 3.1 million plants have so far been installed different parts of the country. Two types of Biogas plants are most commonly used in the country and they are of fixed drum and

floating drum types. Equipments like stoves, burners, lamps etc. are available indigenously.

- (II) **Improved Chulhas or the Energy Efficient Wood Stoves:** Wood-stoves are scientifically designed wood burning devices designed for optimal regulation of heat flow as well as better fuel utilization. These wood stoves, conserve fuel wood, reduce air pollution, help in checking tree fellings, reduce health hazards, save cooking time, provide employment opportunities to rural poor and upgrade the environment.

#### 14.3.2. Emerging Eco-friendly Technologies

- A. Fuel Cells:** Fuel cells are suited for decentralized power generation due to their modular nature. Hydrogen or any other inflammable gas is used as primary fuel in these fuel cells. India is focusing on the development of such an ecofriendly technology that can be applied for generating electricity alongwith the protection of water & heat. The application of fuel cells include – production of electricity, water and heat; Industrial and residential uses, surface transportation electrification in remote areas and power supplies for personal computers, health clinics etc.



**Fig. 14.1.** A Fuel Cell.

- B. Hydrogen Energy:** Hydrogen is a clean fuel and good source of energy. It is a possible substitute to fossil fuels and can be used as fuel for vehicular transport. A hydrogen fuel cell vehicle may be able to travel for 5,000 km between refuelling shops. Hydrogen is used in rocket and spacecraft propulsion also.

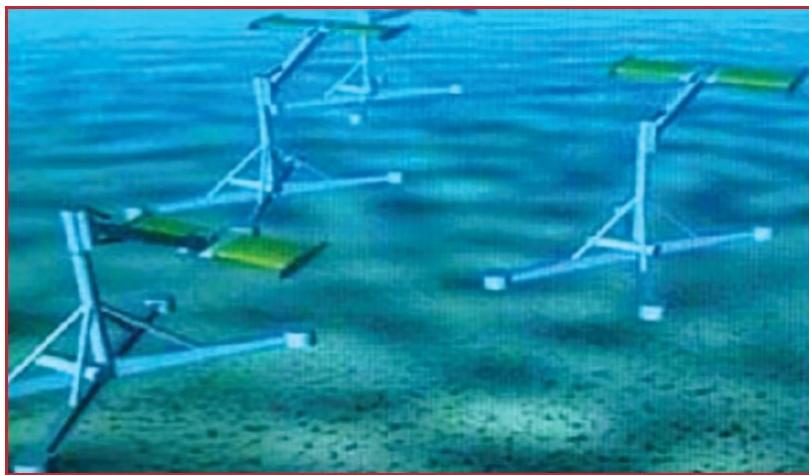
Scientists are on their ways of developing Carbon nano- fibre technology (CNF). It has a capacity to store upto 70% of hydrogen by weight.

- C. Geothermal energy:** It is the heat of the earth which is enormously available. It is clean, reliable and home-grown. The energy of the earth can be converted into heat and electricity. There are more than 300 potential sites for geothermal energy in India out of which Tattapani Geothermal fields, Chattisgarh and Puga Geothermal fields and Ladakh (J & K) have been earmarked for tapping.



**Fig.14.2.** A Geothermal Energy Station.

**D. Tidal Energy:** Tides, ocean thermal energy, ocean waves and ocean currents are different forms of energy. Scientists have identified many areas of tidal energy that include Gulf of kachchh and Gulf of Cambay in Gujarat, Durgaduani creek and a delta of Ganga in Sundarban area in West Bengal.



**Fig.14.3.** A Tidal Energy Generation System.

**E. Alternate Fuel for Surface Transport:** This technology is still in the research phase. Material technology development, performance improvement, cost reduction, eco-friendly electric and alternate energy or hydrogen energy vehicles and Advanced high density batteries for electric vehicles are examples of some areas of development of this technology.

#### 14.4. SUSTAINABLE USE OF RESOURCES

An approach to economic planning that attempts to foster economic growth while preserving the quality of the environment for future generations, is called as sustainable development.

The quality of the environment for future generations can only be maintained by sustainable use of resources provided by nature. But what is the meaning of sustainable use of resources? Well, in simple ways; the judicious use of resources so that the natural process of regeneration of those resources are not hampered or altered, and every one of the present and future generations may have his proper share of resources, is called as sustainable use of resources.

**The practice of sustainable use of resources should incorporate following components-** (i)

Search for alternate source of energy, (ii) Development of Renewable Resources, (iii) Judicious use of Natural Resources, (iv) Adoption of environment friendly technologies, (v) Participation of public in decision making processes, (vi) Keeping up the balance in nature.

**Example:** If we cut some extra branches of a tree for keeping it up in a proper shape and use the cut out parts as fuel wood we make use of the tree in a sustainable way. But if we cut a tree through its main stem and use it for fuel wood we kill the tree forever. This is destruction of a resource which is the tree in this case. The same example may be applied for other resources also.

**Renewable resources of nature** like vegetation can be renewed through proper use. **Non-renewable resources** cannot be renewed in our life time. Since we are going on overusing and wasting our non-renewable resources we are sure to be captured by a crisis one day. We are already facing crisis of resources in many sectors like the energy sector. To overcome the scarcity of energy we have to develop alternate sources. Side by side we should adopt the practice of recycling and reuse of existing resources. All the renewable resources too need to be used judiciously so as to keep up the running of the regeneration capacity of nature.

## enviro\_Facts: 14

The General Assembly of United Nations Environment Programme (UNEP-1988) established a World Commission on Environment & Development in 1988. This commission is also known as the Brundtland Commission, which was formed to hold hearings across the globe and produce a formal report of its findings. The commission completed its findings as a report entitled "Our Common Future". The sustainable Development in the report has been defined as-

*Development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED 1987). Some International Conferences like the *Earth Summit* (1992) continuously focussed attention on Environmental Issues. It produced a declaration of principles called as *Rio - declaration* on Environment and Development which was a plan for the sustainable development of the Resources of the Earth into the 21<sup>st</sup> century. That is why it was called as *Agenda-21*. The Agenda-21 also included guidelines for management, conservation and sustainable development of forests. The subsequent conferences of United Nations continued to incorporate sustainable development with social issues in their programmes.

## 14.5. ADOPTION OF INDIGENOUS PRACTICES; SACRED GROVES

The word indigenous means: belonging to a particular place; or nature. Indigenous Practices means practices developed and properly applied by native people of a particular area.

The ideas that have been worked upon by our local people can help us to meet the future challenges and to achieve a sustainable development. Adoption of such practices, therefore, assumes ample importance. Many types of indigenous practices have been popular in our traditional societies in the areas of agriculture and food, health and hygiene, energy and materials. Now we should find, test and popularise, if found worth, our indigenous practices. While popularising such practices our approach need not necessarily be traditional only but it may also include current practices of development and contributions of institutions of our country.

### 14.5.1. Some Examples of Indigenous Practices

A lot of indigenous practices are popularly known and applied in Indian Societies in the fields of agriculture, health and hygiene, energy, materials( metals & metallurgy, timber and wood, use of glass, ceramics and refractory, soil, stone, textile and fabrics etc. ). Some of these indigenous practices are mentioned below-

(i) Traditional water management systems like-

- Digging of ponds and check dams (in Bihar, Jharkhand, Uttar Pradesh, Madhya Pradesh, Punjab, West Bengal and many other states.) and collecting rain water for domestic purposes.
- Digging of Erys (small ponds with earthen embankments from three sides in Tamil Nadu), Chunwas (small water ponds) in low land areas of Jharkhand, Kunds (in Rajasthan) etc.

(ii) Summer season cultivation of fields in plains of India.

(iii) Applications of Manual Irrigation Systems.

(iv) Planting Twigs in fields, as Singing Posts for birds.

(v) Planting scare-crows in fields and beating drums in fields at nights to protect crops from cattle.

(vi) Use of Neem leaves and lime for safe storage of grains.

(vii) Worshipping different animals and protecting them as vahanas of Gods and Goddesses.

(viii) Regarding some grasses like durva (or *Doob* = *Cyanodon dactylon*) as Sacred.

(ix) Protecting Neem trees as habitat of Sheetala Mata (a form of Goddess Durga) and worshipping Banyan and Peepal trees.

(x) Protection of trees of Karam and Sal by people of Jharkhand.

(xi) Worshipping of Sun on the occasion of ‘Surya Shashti’; cleaning of traditional ponds for the holy bath of the worshipper and cleaning of surroundings during a festival by the people of Jharkhand & Bihar.

(xii) Keeping, protecting and worshipping Sacred Groves by the people of different Indian States. **Example :** Management of orans or sacred Groves of Khejri by Bisnol Tribes of Indian State of Rajasthan.



**Fig.14.4.** Worshiping the Sun God on the occasion of Surya Shashti is a traditional practice of Nature Worship specially in Bihar and Jharkhand (the two Indian States).

## 14.5.2. Sacred Groves

### A. What are Sacred Groves?

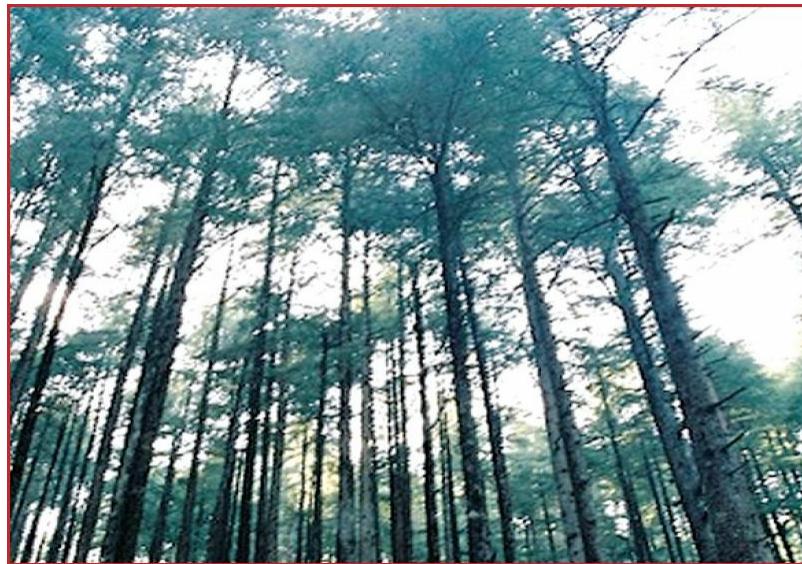
The word sacred means: considered to be holy or ‘connected with a god’ and the word ‘Grove’ means: a small area of land with trees of particular types grown on it. Thus by combining these two words the final dictionary meaning of the couple of words Sacred Groves is: “A small area of land with particular types of trees grown on it and that are considered to be holy by the local human community”.

In other words Sacred Groves can be defined as below-

**An area with particular types of trees dedicated to local deities or ancestral spirits that are protected by local communities through social traditions and taboos incorporating spiritual and ecological values are called as sacred groves.**

### B. Sacred Groves of India

The presence of sacred groves of India has been documented since the early 1800s. Sacred Groves of India comprise trees like Deodara (*Cedrus deodara*), considered to be the “abode of Gods”, Sal (*Shorea robusta*), Rudraksha (*Elacocarpus species*), Bel (*Aegle marmelos*), and Ashok (*Saraca asoca*), and kadam (*Anthocephalus kadamba*), Pipal (*Ficus religiosa*), Neem (*Azadirachta indica*), Banyan tree (*Ficus benghalensis*: native to India), Mango tree (*Mangifera indica*) and bushes like, Basil (*Ocimum basilicum & Ocimum minimum*; (native to India and Iran) and grass like Doob or Durva (*Cynodon dactylon*) etc.



**Fig.14.5.** Sacred Grove.

In India most of the sacred groves are planted around artificially dug sacred ponds. This condition creates a system of pool and sacred grove. Many of the sacred trees are associated with individual deities for example Pipal is associated with Lord Vishnu; Bel with Shiva; and Rudraksha with an incarnation of Shiva, Lord Rudra. Small temples are also constructed at the pool-grove areas.

### C. Sacred Groves Outside India

Many sacred groves are found scattered in isolated pockets in Britain, Europe, Asia and Africa. In Britain dead bodies are buried in the grounds of sacred groves and the practice is called as “Green Burials”. This practice is also adopted by United States. There are about 130 forested burial grounds

in Britain.

## D. Importance of Sacred Groves

- (i) Sacred Groves provide shelter to thousands of species of other plants and animals.
- (ii) Sacred groves have great powers to heal body and spirit.
- (iii) Sacred Groves are important reservoirs of biodiversity.
- (iv) These are last refuge for endemic and endangered plant and animal species.
- (v) These are storehouses of Medicinal plants valuable to village communities as well as modern pharmacopoeia.
- (vi) Sacred Groves contain relatives of crop species that can help to improve cultivated varieties.
- (vii) Sacred Groves help in keeping the water cycle in local areas.
- (viii) These improve soil stability, prevent top-soil erosion and provide irrigation for agriculture in drier climates.

14

## TOWARDS A BETTER ENVIRONMENT...

In 1999 the Indira Gandhi Rashtriya Manav Sangrahalaya (The National Museum of Mankind) established a museum for sacred groves with the goal of raising awareness of the importance of sacred groves. In Bhopal a campus of 200 acres is dedicated to sacred groves of different parts of India. Festivals and rituals associated with each type of sacred grove are also celebrated by communities there. In Goa a sacred grove restoration project has also been undertaken by the Society for Ecological Restoration- India. The bio-diversity of sacred groves is being documented and catalogued through many national and regional projects in India so as to prevent outsiders from patenting local species and traditional knowledge. A web-interfaced multimedia database is also being prepared by HCL centre for biodiversity informatics to document the biodiversity status of sacred groves in India.

## IMPORTANT DEFINITIONS

<b>MIC</b>	:	Methyl Iso Cynate, a gas, leakage of which from Union Carbide factory in 1984 killed about 3000 people and injured about 2000 in Bhopal, India.
<b>WORLD INDUSTRY CONFERENCE</b>	:	The conference organised by United Nations in Canada in 1984 after a series of industrial accidents in different parts of the world. The conference was organised to provide a code of conduct for sound management in the business sector.
<b>SUSTAINABLE DEVELOPMENT</b>	:	A new model of development which benefits every individual, safeguards environmental rights of every citizen and which may keep the natural environment in a perfectly balanced state is called as sustainable development.
<b>ECO-FRIENDLY TECHNOLOGIES</b>	:	Technologies that can be employed for the developmental works without causing any harm to any part of the natural environment, are called as Eco-friendly Technologies.
<b>INDIGENOUS PRACTICES</b>	:	Practices that are developed and properly applied by native people of a particular area are called as indigenous practices.
<b>SACRED GROVES</b>	:	Area with particular types of trees dedicated to local deities or ancestral spirits that are protected by local communities through social traditions and taboos incorporating spiritual and ecological values are called as sacred groves.

## MODEL QUESTIONS AND EXERCISES

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. Where did the spill from the super tanker Exxon Valdez occurred into Alaska's Prince Williams?
  2. Name any one Eco-friendly Technology.
  3. Mention two objectives of Eco-Efficiency.
- (ICSE 2008)
4. 'Many indigenous technologies are popular in our traditional societies in the areas of water conservation' - Name any one of such technologies.
  5. What do you mean by a Sacred Grove?
  6. Which Sacred Grove is considered to be the abode of Gods?

### II. SHORT ANSWER TYPE QUESTIONS

[2 Marks Each]

1. What is sustainable development? What are its objectives?
- (ICSE 2007)
2. Define Sustainable Development.
- (ICSE 2010)
3. What do you mean by Eco-friendly Technology?
  4. What do you mean by the efficient use of Resources?
  5. Name any three of the emerging Eco-friendly technologies. Describe any one of them.
  6. Define Sacred Grove. Mention names of any two states where sacred groves are found.
- (ICSE 2007)
7. What is an indigenous technology? Give one example.
  8. Mention any four significant features of Sacred Groves.

### III. DETAILED ANSWER TYPE QUESTIONS

(4 to 6 Marks Each)

1. Describe any three ways by which international co-operation can help in achieving a sustainable future.
- (ICSE 2010)
2. What is Sustainable Environment? How do Eco-friendly Technologies and indigenous practices help in maintaining sustainability of environment?
  3. What are Sacred Groves? Mention some of the Sacred Groves of India. How are the Sacred Groves important?

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice Type Questions

**Tick (✓) the correct option**

1. The World Commission on Environment and Development which was formed in 1983, is also known as –
  - (a) The Brundtland Commission
  - (b) World Meteorological Organisation
  - (c) The World Commission on Floods
  - (d) World Industry Conference
2. The United Nations adopted the World Charter for Nature in the year-
  - (a) 1989
  - (b) 1982
  - (c) 1999
  - (d) 1987
3. The first International attempt by United Nations to provide a code of conduct for the sound management in the business sector was made in Canada in 1984. It was called as-
  - (a) World Trade Organisation
  - (b) World Industry Conference
  - (c) World Commission on Environment and Development

- (d) World Charter for Nature
4. One of the conditions for eco-friendly technology is –
- its cost should be low
  - it can be applied by all nations
  - it can be applied in rural areas only
  - it should be available to all sections of society
5. Bisnoi Tribes of the Indian State of Rajasthan manage Orans which means –
- sacred groves of mango
  - sacred groves of Khejri
  - sacred groves of Neem
  - sacred groves of Sal

#### **B. Fill in the Blanks**

- Up to one million people died of hunger in Ethiopia during the year ... that coincides with the Chernobyl Nuclear Disaster in Ukrainian Republic of Soviet Union.
- The process of modern development is creating economic .....
- An ..... Technology can be employed for developmental works without causing any harm to any part of the natural environment.
- 80% of the power generated through wind systems is ..... in nature.
- CNF in the field of technological developments stands for .....

#### **C. True / False Questions**

Write T against the statement which is True and F against the statement which is False-

- The Hybrid and Stand-alone System of Technology is the combination of two energy technologies.
- The Biogas installation potential of India is 500 million plants.
- The practice of sustainable development involves participation of public in decision making process.
- Erys in Tamil Nadu are small ponds with earthen embankments from two sides.
- Rudraksha is considered to be an incarnation of Shiva, Lord Rudra.

## ANSWERS

#### **I. VERY SHORT ANSWER TYPE QUESTIONS**

- 1985, 2.Biogas generation, 3. Judicious use of fossil fuels and maximum production, 4. Construction of ponds, 5. A small area of land with trees of religious significance, 6. Deodara.

#### **IV. OBJECTIVE TYPE QUESTIONS**

##### **A. Multiple Choice Type Questions**

- (a), 2.(b), 3.(b), 4.(a), 5.(b)

##### **B. Fill in the Blanks**

- 1984, 2.inequalities, 3.eco- friendly, 4.captive, 5. Carbon nano-fibre Technology

##### **C. True/ False**

- T, 2. F, 3. T, 4. F, 5. T

## PROJECTS & ACTIVITIES

### Act for Environment

#### **14.1. SURVEY**

Do a survey of indigenous technologies applied in your area. Find out the ways through which these technologies are better in comparison to modern technologies applied for the similar purposes. Write a survey report.

#### **14.2. PROJECT**

Do a project on the topic: Listing of locally available medicinal plants and their importance to society. Write the Project – report.

# Consumer Education

## FACTS & CONCEPTS



- ◆ Introduction : Who is a Consumer?
- ◆ Consumer Education
- ◆ Consumer Rights
- ◆ Legislations for the Protection of Consumers
  - ◆ Provisions Made by United Nations
  - ◆ Legislative Provisions Made by Government of India
- ◆ Making Correct Choices While Buying
  - ◆ General Observations by Consumers
  - ◆ Looking for Standards, Seals and Marks
- ◆ Food Adulteration

### 15.1. INTRODUCTION : WHO IS A CONSUMER?

A person, who consumes or uses different types of goods and services, is called as consumer. Goods that a consumer buys, may include consumable goods like rice, salt, sugar, vegetables etc. or Durable Consumer Goods like television, bicycle, scooter etc. Services that a

**consumer may buy include electric power, telephone, transport services, theatre etc.** Anyone who obtains goods or services for resale or for any commercial purpose (except self employment) or one who obtains any service free of charge or under a contract of personal service is not called a consumer.

## 15.2. CONSUMER EDUCATION

A process of teaching, training and learning to improve knowledge and develop skills among consumers, is called as Consumer Education. The Consumer Education relates to imparting knowledge to and developing skills in consumers regarding consumer rights, consumer laws, product quality-standards, health aspects of various products, availabilities of various public and private services, units and measurements, redressal of consumer problems and making correct choices while buying different commodities etc.

The Consumer Education covers following areas-

- Health, Nutrition, food-borne diseases and food- adulteration,
- Product hazards like hazards due to storage and consumption of a particular product,
- Product labelling - pasting labels on the packaging of products regarding their composition status, weight, ecological impacts, purity standards, colour, preservatives used, date of manufacture and expiry, address of producer/ manufacturer, matters pertaining to registration, trade marks, marks of standards etc.
- Protective Laws – Laws framed by the government to protect rights of consumers and seeking redressal, how and whom to approach for redressal etc.
- Information regarding weight, measure, packaging, price quality and availability of basic needs etc.
- Environment, different types of pollutions, sustainable consumption etc.

## 15.3. CONSUMER RIGHTS

1. Right to SAFETY against hazardous goods and services
2. Right to be INFORMED about the quality, quantity, purity and standard price
3. Right to CHOOSE from a variety at competitive prices
4. Right to be HEARD
5. Right to seek REDRESSAL.
6. Right to CONSUMER EDUCATION

The above consumer rights are being explained below-

### 1. RIGHT TO SAFETY AGAINST HAZARDOUS GOODS AND SERVICES

This right protects consumers against hazardous products and services. The product offered for sale should not pose undue risk or physical harm to consumers or their family members. Impure food, defectively manufactured automobiles and tyres, drugs having harmful side effects and unsafe appliances can cause harm, risk or injury to consumers. Consumers should observe marks of quality standards before buying products.

### 2. RIGHT TO BE INFORMED

Consumers have rights to know about the quality, quantity, purity, potency, standard, price etc.

about the product they go for buying. They have rights to know everything regarding the product like composition, preservatives used, colouring agents mixed in the product, date of manufacture & expiry date and also about nature of the product like vegetarian or non-vegetarian etc.

### **3. RIGHT TO CHOOSE**

Consumers have been given a right to buy things of their choice and likings. They can compare varieties and prices of products and can purchase items to the best of their satisfaction.

### **4. RIGHT TO BE HEARD**

Consumers have been given the rights to file complaint in case of any cheating or defect in the purchased product. They have right to seek a refund, replacement or remedy or they can file a case in the consumer court or consumer forum.

### **5. RIGHT TO SEEK REDRESSAL**

Consumers have right to get protected from unfair trade practices by filing complaints in consumer forum or court. Many consumer organizations have been formed to protect consumers and get their problems properly redressed.

### **6. RIGHT TO CONSUMER EDUCATION**

Every consumer has the right of keeping knowledge and skills regarding purchase, use and effects of products. He has a right to get educated about various products, markets and related things so as to protect him against any possible exploitation.

## **15.4. LEGISLATIONS FOR THE PROTECTION OF CONSUMERS**

Various Legislative Provisions for the protection of consumers have been made on International and National levels.

### **15.4.1. Provisions Made by United Nations**

The General Assembly of United Nations adopted following guidelines for consumers on April 9.1985-

- (i) Protection of consumers.
- (ii) High levels of Ethical conducts of producers/distributors of goods and services.
- (iii) Develop market conditions providing consumers greater choices at lower prices. These guidelines were expanded on July 26, 1999 to include sustainable consumption.

### **15.4.2. Legislative Provisions Made by the Government of India**

**1. Legislative provisions made before independence:** These are – Indian Penal Code, Indian Contract Act, Drugs and Cosmetics Act, Agricultural Produce (Grading and Marketing) Act. These legislations did not contain Rights of consumers nor remedial measures in favour of consumers.

**2. Consumer Protection Act 1986:** This act of government of India makes following provisions for consumers-

- (i) Exclusive courts for consumer disputes in all districts, states and national capital.
- (ii) Specification of six consumer rights (mentioned above).
- (iii) Consumer protection councils from national to state and district level.
- (iv) This act covers private, public and co-operative sectors.

Besides the above, a number of laws have been passed by the government of India over the years to protect interest of consumers. Those laws are- Agricultural Products(Grading and Marketing ) Act-1937; Industries(Development and Regulation) Act-1951; Prevention of Food Adulteration Act-1954; Essential Commodities Act-1955; The Standards of Weights and Measures Act-1951; Monopolies and Restrictive Trade Practices (MRTP) Act-1969 (Replaced by Competition Act-2002); Prevention of Black Marketing and Maintenance of Essential Supplies Act-1980; and Bureau of Indian Standards Act-1986.

## 15.5. MAKING CORRECT CHOICES WHILE BUYING

A buyer is a person, a private business firm or a government office that chooses goods and services and spends money to obtain them either for own use or for sale. A buyer may not be a consumer in all the cases. Any one who uses or consumes a product is called as consumer. We buy commodities to meet our requirement, to raise our standards of living, to use quality products, to respond to changes in trade and fashions, to fulfil our social requirements, to maintain durable goods in working conditions or to run a business.

### 15.5.1. General Observations by Consumers:

Consumer must check following things before buying anything-

**1. Verification Certificate:** All shops using weights and measures must display an ILM (Inspector of Legal Metrology) verification certificate. A weighting balance must be made of metal and it should also have a straight pointer. Every weight has to be stamped on the reverse with last two digits of the year and the unit number of the inspector. A consumer must refuse non-standard weight like stones, iron pieces etc. and if the lead filling on the reverse is not there.

#### 2. Balance and Weights:

- (i) Any balance and scale if it is made of wood with strings to suspend the pans is illegal.
- (ii) The consumer must verify the verification scale on a plate fixed to an electric weighting instrument
- (iii) Weight of the tray is not included with the material to be brought.

#### 3. Buying Clothes, Alcohol and Sweets

- (i) A consumer must check the measuring rod while buying cloth. He must see that it is made of steel and it has ILM's seal at either end.
- (ii) Packed readymade garments should have sizes mentioned only in cms. and not the XXL, XL, L, M, S etc.
- (iii) For dispensing alcohol the peg measure must be of glass or silver plated brass can. Volume of standard peg is 60 ml.
- (iv) Sweets having sugar syrup must be sold by weight & not by numbers.

- (v) Weighting scales at ration shops and jewellery shop must be close to the consumer.
- (vi) Jewellery shops must use Class I or Class II balances protected from any disturbance.
- (vii) Consumers must insist on HALLMARK gold ornaments having BIS logo and marked fitness.

**4. Buying Packaged Commodity:** While packaged commodities a consumers must see that package carries –

- Name and address of manufacturer and packer.
- Net quantity of the package when packed.
- Number of items contained in the package when it is to be sold by number.
- Month and year of manufacturing, expiry date and “best before” (the date)
- If it is imported the package must bear the name and address of the importer alongwith valid registration number.
- Consumer must know that no pre-packed commodity can be sold above the declared MRP (Maximum Retail Price) in shops, hotels, restaurants and bars (including bottled water, soft & hard drinks).

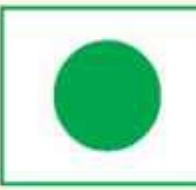
**5. Buying LPG:** While buying LPG the consumer must check the weight with the spring balance which must be available with the distributor. The net quantity is 14.2 Kg and the wt. of the empty cylinder is 15 to 17 kg.

**6. Buying Petroleum, Oil, and Lubricants (P.O.L.):** Consumers should keep in mind that fuel stations must display conspicuously a verified 5 litre can by which you can measure the quantity of the actual supply. To check the accuracy of the dispensing unit every fuel station must have a Totaliser. The fuel station must have Anti- adulteration cell to check any complain regarding spurious oils.

**7. Kerosene Oil:** The consumer, while buying Kerosene oil, should check ILM's verification on the measure and the bottom that should have no cut mark or dent or re- welding mark. He should ensure that the measure is filled to the top hole and it is not containing sponge or wax.

### **15.5.2. Looking for Standards, Seals and Marks:**

A consumer must observe the following marks of standards while buying commodities-

S. No.	DESCRIPTION	MARK
1.	For Baby Food, Mineral Water, electrical and cooking gas appliances, Pressure Cookers, cement, steel etc. – consumers should look for: <b>ISI</b> mark. The <b>ISI</b> mark guarantees quality, testing standards of product, and in-process checks. The ISI license is guaranteed by the Bureau of India Standards of product ( <b>BIS</b> ) for one year only.	
2.	For Gold: consumers should look for - <b>HALLMARK</b> . It is the license granted to manufacture on meeting IS-1417 for purity. Jewellery is Hallmarked from a <b>BIS</b> recognised <b>Assaying &amp; Hallmarking Centre</b> (A&HC). There are five compulsory symbols in a Hallmark & they are- BIS logo, fitness in millesimal number, Assaying & Hallmarking Center's mark , year of marking ( like 'A'- 2000) and logo of BIS certified jeweler. Hallmarking was started in April 2005.	
3.	For packages of Processed Food or Agricultural Products like Jams, Jelly, Sauce, Fruit Juice, Pickles etc. : consumers should look for – <b>FPO</b> mark.	
4.	For Pouches/Containers for purchase of Pulses, Flour, Edible Oil, Ghee, Rice, Wheat, Butter, Honey, Spices etc. (Agricultural produce): consumers should look for - <b>AGMARK</b> .	
5.	For an <b>Environmentally Safe Product</b> : consumers should look for <b>ECOMARK 1991</b> .Consumers should always prefer products showing the logo of ECOMARK.	
6.	Standards of Weights and Measures Act & Rules have Weighting Balance, Measuring Rod and Calibrated Container, which are tools for Consumer Protection.	
7.	Every package of <b>Non-Vegetarian Food</b> must bear the following symbol on the Principal Display Panel just close in proximity to the name or brand name of food, namely: <b>RED colour</b> .Adopted by Government of India from codex alimentarius.	
8.	Every package of <b>Vegetarian Food</b> must bear the following symbol in green colour on the Principal Display Panel just in proximity to name or brand name of the Food, namely:— <b>Green Colour</b> . Adopted by Government of India from codex alimentarius.	
9.	<b>WOOL MARK</b> , a certification mark, prescribed by International Wool Secretariat, appears on Pure & Quality Wool/Woollen Garments.	

The specific objectives of the ECO MARK Scheme are as follows :

- ◆ To provide an incentive for manufacturers and importers to reduce adverse environmental impact of products.
- ◆ To reward genuine initiatives by companies to reduce adverse environmental impact of their products.
- ◆ To assist consumers to become environmentally responsible in their daily lives by providing information to take account of environmental factors in their purchase decisions.
- ◆ To encourage citizens to purchase products which have less harmful environmental impacts.
- ◆ Ultimately to improve the quality of the environment and to encourage the sustainable management of resources.

Besides the above, MFPO-73 and Euro II are other two important standards that also need to be mentioned here—

**MFPO-73** : Consumers should check **MFPO-73** (Meat Food Product Order-1973) mark on canned meat & fish.

**Euro II** : Government of India has adopted the Standards of Emissions prescribed by the European Union, known as **Euro II** norm. A similar emission norm, which is applied to Indian cars, is **Bharat II**. These days it is compulsory for Indian cars to comply with these norms.

Consumers may also try to observe any mark of **Codex Alimentarius Commission** for International Products. The Codex Alimentarius is jointly governed by Food & Agriculture Organisation (**FAO**) and World Health Organisation (**WHO**). It formulates standards for food items for sale in International Markets.

## 15.6. FOOD ADULTERATION

**Mixing of undesirable cheap and often harmful substances in edible materials is called as Food Adulteration.**

Some greedy traders use to mix unwanted substances into our food items so as to cheat the public and earn more money. This practice of mixing of unwanted substances in food items is harmful and sometimes fatal to consumers.

In 2000, some greedy traders mixed the oil of *Argemone mexicana* seeds in the mustard oil to earn more money and sold it to consumers. The consumption of Argemone oil mixed with mustard oil caused Dropsy in consumers and killed hundreds of them. Dropsy is a serious disease which occurs due to consumption of Argemone oil. Here is a table which details some of the edible items and adulterants usually mixed into them.

S. No.	Edible Substances	Adulterants
1.	Pulses	Pulses of <i>Lathyrus sativus</i> (Grass Pea), metanil yellow colour
2.	Turmeric Powder	Lead chromate
3.	Coriander Powder	Powder of dried dung of Cow or Horse, starch etc.
4.	Black Pepper	Dried seeds of Papaya
5.	Red Chilli Powder	Brick-powder, powder of wood
6.	Spices(powder)	Powder of dried dung, wood powder etc.
7.	Edible Oil	Cheap Oils, Oil of Argemone seeds etc.
8.	Milk	Fat, starch, water etc.
9.	Honey	Sugar syrup
10.	Rice	Pebbles, husk etc.

Food Adulteration is a punishable crime under **Prevention of Food Adulteration (PFA) Act 1954** (amended in 1964, 1976 and 1986). It has been enacted to ensure the availability of pure and standard food to consumers and to protect them from deceptive trade practices.

The prevention of food Adulteration Act prohibits manufacture; sale and distribution of adulterated foods and foods contaminated with toxicants and misbranded foods-

#### **Food is deemed to be adulterated if-**

- (a) The article sold by a vendor is not of the nature, substance or quality demanded by the purchaser and it is represented to be.
- (b) It contains any other substance or is processed as to affect its original nature and cause harm to consumers.
- (c) Any inferior or cheaper substance have been substituted wholly or in part of the article.
- (d) It is prepared, packed or kept under insanitary conditions.
- (e) Consists of any filthy, putrid, disgusting, rotten, decomposed or diseased animal or vegetable substance or is insect infested or otherwise unfit for human consumption.
- (f) It contains any poisonous or other ingredients injurious to health.
- (g) It contains any colouring material other than prescribed and in amounts not within the prescribed limit.

## TOWARDS A BETTER ENVIRONMENT...

Plastics are used in major consumer products manufacturing sectors. Plastic industry is closely linked to the growth of automobiles, electronics, telecommunications, textile industry, medicine and food- processing industries. Most of the plastics contain a binding element called as Phthalate. This chemical remains present in paints, inks and adhesives also. Phthalates are released into the atmosphere during the life of an article or from plastic waste in landfill sites and from industrial sites also. From there, they join water and enter into the bodies of fish and other animals. Thus these pollutants join local food-chains and enter into the bodies of human beings. These chemicals remain present in food packaging materials such as cellophane, aluminium foils, laminate packaging, and ink used to print on plastic paper for food wrapping. Phthalates may be categorised into Butyl benzyl phthalate (BBP) and Di-n-butyl

phthalate (DBP). High level of DBP is found in sandwiches packed in nitro-cellulose coated papers. These are also found in inks used for printing wrappers for cakes, yogurts and cheese etc.

These chemicals are reported to increase cell division in mammals. When entered into bodies through food-chains, these chemicals cause abnormal reproductive cycles connected with simultaneous abortions and low estrogen levels. Hence, it is very important for consumer organisations and governments to take steps in this direction in effective ways.

## IMPORTANT DEFINITIONS

<b>CONSUMER</b>	:	Any person who buys any goods or hires any service is called as a consumer.
<b>CONSUMER EDUCATION</b>	:	A process of teaching, training and learning to improve knowledge and develop skills among consumers is called as consumer- education.
<b>FOOD ADULTERATION</b>	:	Mixing of undesirable cheap and often harmful substances in edible materials is called as Food Adulteration.
<b>MFPO</b>	:	Meat Fish Product Order
<b>DROPSY</b>	:	A disease caused due to the consumption of mustard oil contaminated with the oil of seeds of <i>Argemone</i> plant.

## MODEL QUESTIONS AND EXERCISES

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. Which certificate is to be displayed compulsorily by all shops?
2. What should a consumer check on measuring rod?
3. For what type of products the Codex Alimentarius must be checked by consumers?
4. For what does BIS stand for?
5. Which adulterant is usually mixed in black pepper?

### II. SHORT ANSWER TYPE QUESTIONS

(2 Marks Each)

1. Define a consumer.
2. What is the difference between a buyer and a consumer?
3. What are rights of consumers?
4. What legislative provisions have been made by government of India for the protection of its consumers?
5. What should a consumer look for in following cases?
  - (i) While buying clothes.
  - (ii) While buying sweets.
6. What is food adulteration?
7. Mention main four points of the Consumer Protection Act- 1986.
8. What care should be taken by a consumer while buying a packaged commodity?

### III. DETAILED ANSWER TYPE QUESTIONS

(4 to 6 Marks Each)

1. What are the correct choices that are to be made by a consumer while buying?
2. What are Acts and Laws? Mention laws related to pollution control and protection of wildlife in India.
3. What are Consumer Rights? Mention legislative provisions made by UN and GOI for the protection of consumers.
4. What is Food-Adulteration? Give two examples.

(ICSE 2007)

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice Type Questions

Tick (✓) the correct option

- Which one of the following is not recognised as a consumer right?
  - right to safety
  - right to be heard
  - right to punish a dishonest trader
  - right to be heard
- A consumer must refuse to buy a substance from a trader—
  - if it is not handed over in a plastic carry bag
  - if it is weighed by a non-standard weight like stone
  - if the trader does not salute the consumer
  - if sweets, having syrup are sold by weight
- The volume of standard peg is-
  - 60 ml.
  - 10 ml
  - 1 litre
  - ½ kg
- The consumer protection Act was passed in-
  - 1986
  - 1999
  - 2005
  - 1857
- The General Assembly of United Nations adopted guidelines for consumers on-
  - April 1, 1985
  - April 9, 1985
  - April 3, 1985
  - April 11, 2005

#### **B. Fill in the blanks**

- Protection of .....has been provided by provisions made by United Nations.
- Consumer protection Act covers private, public and .....sectors.
- Lead Chromate is commonly mixed by dishonest traders in .....
- Consumption of oil of Argemone seeds in Mustard oil causes a disease known as.....
- Dishonest traders cheat consumers by mixing .....in food items.

#### **C. True / False**

Write T against the statement which is true and F against the statement which is false-

- A person who buys and sells any goods is called as consumer.
- Right to safety has been granted under consumer rights.
- Indian Penal Code was made before Independence.
- There are exclusive courts for consumers in every state capital only.
- The net quantity of LPG in a full sized cylinder should be 14.2 kg.

#### **D. Matching Test**

Match the words under column A with those of column B

<b>Column A</b>	<b>Column B</b>
1. FPO	A. Muffler
2. Wool Mark	B. Jelly
3. ISI	C. Flour
4. Agmark	D. Pressure cooker

## ANSWERS

#### **I. VERY SHORT ANSWER TYPE QUESTIONS**

- Verification Certificate,
- That it is made of steel & it has ILM's seal at either end,
- International Products,
- Bureau of Indian Standards,
- Papaya seeds .

#### **IV. OBJECTIVE TYPE QUESTIONS**

##### **A. Multiple Choice Type Questions**

- (a), 2.(b), 3.(a), 4.(a), 5.(b).

##### **B. Fill in the blanks**

1. Consumer, 2.private, 3.turmeric, 4. Dropsy, 5. unwanted and cheap substances

**C. True / False**

1. F, 2.T, 3.T, 4.F, 5. T.

**D. Matching Test**

1. B, 2.A, 3.D, 4. C

## PROJECTS & ACTIVITIES

### Act for Environment

#### 15.1. PROJECT

##### **Test of the mixing of vegetable oil in Ghee/Butter.**

(i) Melt the sample of ghee or butter in a test tube and add some hydrochloric acid into it. Now add a bit of sugar. Shake the test tube for sometime and keep it on the stand for five minutes. If yellow colour appears on the upper level of the liquid in the test tube, it confirms the presence of vegetable oil in ghee/butter. Write the test-report.

#### 15.2. PROJECT/EXPERIMENT

##### Test the mixing of Argemone seeds into Mustard Oil.

- (i) Take a 5ml sample of mustard oil in a test tube. Now add a few drops of Nitric Acid ( $\text{HNO}_3$ ) to it.
- (ii) Shake the test tube carefully.
- (iii) If the colour of the liquid in the test tube turns red or brown the presence of oil of Argemone seeds is confirmed  
Write the experiment properly.

#### 15.3. PROJECT/EXPERIMENT

##### Test of Metanil yellow mixed in Pulses

- (i) Take a sample of pulses in a beaker and add some water to it.
- (ii) Now add a few drops of hydrochloric acid to it.
- (iii) If the colour changes to pink the mixing of metanil yellow in pulses is confirmed.

#### 15.4. SURVEY

Make a survey of any five General Stores in your area and observe the standard marks that are printed on packaged commodities being sold there. Prepare a complete report about total number of items observed, total number of items having proper labels and marks and total number of items without such certifications.

#### 15.5. COLLECTION/ COMPIRATION

Collect information published in newspapers and magazines from time to time regarding (i) Protection of Consumer Interest (ii) Redressal of Consumer Problems.

# 16

## CHAPTER

# Ecological Restoration and Conservation

## FACTS & CONCEPTS



- ◆ Introduction : Ecological Restoration and Conservation
- ◆ Community Participation
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## 16.1. INTRODUCTION : ECOLOGICAL RESTORATION AND CONSERVATION

The word ‘ecological’ is derived from ‘Ecology’ which is *the study of inter relationships between organisms and their natural environment*. Thus the word ‘ecological’ means ‘connected with ecology’. In the present context the word relates to the *components of the natural environment and the linkages between organisms and their natural surroundings*. Along this line of thought, the topic ‘ecological restoration and conservation’ means the ‘**restoration and conservation of natural environment, its components and the interrelationship between organisms and their natural environment**’.

Now it is clear that Ecological Restoration means ‘Environmental Restoration’. But What is Environmental Restoration? **An intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity and sustainability is called as Ecological Restoration.**

The practice of restoration includes: **control of soil erosion, reforestation and improvement of range and habitat**. Over the last two decades, the study of Restoration Ecology has become an independent scientific discipline.

With the phenomenal growth in human population, natural resources are being exploited and spoilt all over the world. While number of people is raising geometrically, the degradation of natural ecosystems, deterioration of fertile soil and pollution of environment threaten the survival of organisms on this planet. It is thought that if current practices of overexploitation of natural environment continue, it will be difficult for the natural environment to support life that depends on its components. Under these conditions, humans are bound to *learn all those methods and practices that may help them care, protect and promote the components of natural environment, recover its lost health and re-establish its various components*. This is what we call as **Ecological Conservation**.

Ecological Conservation, in the modern scientific usage implies a **sound management of biosphere within given social and economic constraints, acknowledging the naturally dynamic character of biological systems**. The term like ecological conservation also implies the maintenance of biospheric functions like **bio-geo-chemical cycles** without which the basic resources for life would be lost. The conservation of biological resources cannot succeed without simultaneous conservation of abiotic resources.

## 16.2. COMMUNITY PARTICIPATION

In Ecology, a community is *the group of populations of different organisms found living together in a particular environment*. Accordingly, the biotic components of an ecosystem are together called as the *biotic community*. Here in the present context, community has been taken as a

more general term which means *group of human beings living together in a particular area*.

In the context of ecological restoration and conservation, *the involvement of local communities in the process of decision making, planning and working for the restoration and conservation of a particular natural resource in their own area is called as community participation for ecological restoration and conservation*.



**Fig. 16.1.** A Scene of Community Participation.

According to the United Nations (1981), **the creation of opportunities to enable all members of a community to actively contribute to and influence the process of development and to share equitably in the fruits of development is called as community participation.**

### **16.2.1. Community Participation in Ecological Restoration**

The community participation can make important contributions in Ecological Restoration in following areas-

#### **A. Control of Soil Erosion**

The erosion of soil is a major ecological problem which occurs at global level due to human activities of clearing vegetation and allowing their cattle to overgraze on lands. There are many other causes of soil erosion but all those causes can be removed through the efforts of local communities. Some of the **restorative measures** of land degraded due to soil erosion are mentioned below-

- (i) Communities should protect soil from the battering effects of rain drops by keeping control on overgrazing, by dense plantation of trees, by afforestation, reforestation, social forestry and compensatory plantation.
- (ii) Communities can participate in the activities pertaining to slowing down the water from concentrating and moving down the slope in a narrow path by plugging gullies and making check dams.
- (iii) Community should reduce the wind velocity near ground by growing vegetation cover or by ridging the land.

- (iv) Strips of stubble or other vegetation cover can be grown to stop moving particles of soil.
- (v) Communities should adopt the method of strip cropping on hill slopes.
- (vi) Banks of rivers should not be utilized for cultivation of crops.
- (vii) Levelling of derelict land and mined areas and utilizing those areas for horticulture, agriculture or Pisciculture.

The **National Wasteland Development Board** (NWDB) is conducting projects for the development of waste land through community participation. Its aims are –

- (i) Stopping the soil erosion and desertification,
- (ii) Making sustainable use of waste land,
- (iii) Increasing biomass and making arrangements for fuel wood and fodder, and
- (iv) Keeping up the balance of nature.

## B. Reforestation and Afforestation

**Planting trees in the denuded forest area is called as reforestation, whereas the activity of growing artificial forest on a waste land or non- agricultural land is called as Afforestation.** For both of these activities, the community may grow a nursery of useful plants and plant the saplings in village common lands during proper seasons. A number of trees in a forest area die due to diseases. Community can plant a new tree near the place of a dead tree. This activity is called as **Compensatory Plantation**. Communities can take care of forests by forming **Forest Protection Organisations** and **Forest Protection Squads**. Such cases can be seen in the tribal areas of Jharkhand and in some other states of India.

The Government of India is conducting a number of rural development projects through the participation of Panchayati Raj Institutions (PRIs). Some of these projects may be **Hariyali, Watershed Development** etc. The Government of India has launched an ambitious Afforestation Programme under **National Afforestation and Eco- development Programme** (NAEB) with peoples' participation for the sustainable management of country's forests. Under this programme, an amount of Rs. 1264.44 Crore have been earmarked during the **Tenth Five Year Plan** which is to create community assets for meeting the requirements of fuel wood, fodder and small timber besides generating gainful employment.

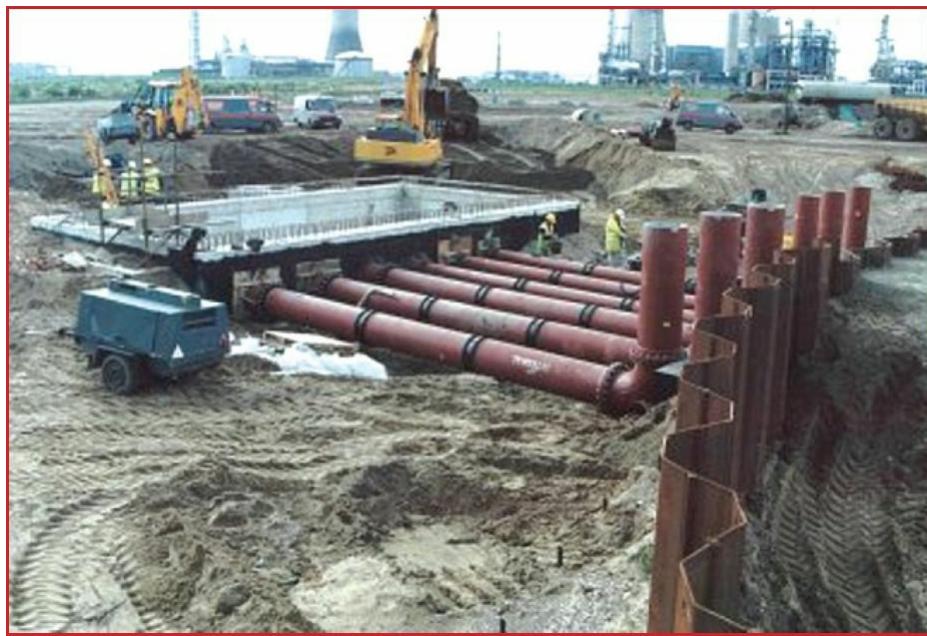
## C. Improvement of Range and Habitats

**The extensive open grazing land for human use and for semi-domestic grazing animals is called as range.** A Habitat is a place which favours living, feeding and development of organisms. Vegetation, ponds, lakes, crop-fields, gardens, grasslands etc. are some habitats. There are so many other types of habitats also. Ranges and habitats can be managed through community participation for its own benefits and for keeping a balanced environment.

### 16.2.2. Community Participation in Ecological Conservation

Communities can play important roles in the conservation of environment and keeping the balance of nature. Here are some examples-

## A. Energy Conservation and Generation



**Fig. 16.2.** An Energy Park.

Communities can play important roles in the conservation of energy through many different ways that are mentioned as follows.

(i) A community can solve local energy problems by generation of bio-gas by making use of animal dung and biodegradable waste generated in domestic and agriculture sectors.

(ii) The community can develop Community Energy Parks through government assistance. Thus, it can generate bio-mass energy, wind energy, solar energy and micro-hydropower energy at local level and can replace conventional energy. About 200 E parks were set up upto 31<sup>st</sup> March 2004 by government assistance.

(iii) Community can develop alternate energy at village level by participating in **Integrated Rural Energy Programme (IREP)**. Under this programme a community can meet its energy needs through a blend of conventional and non-conventional energy sources.

(iv) Communities can take up projects on Biomass gasifier programme, small hydropower programme, energy from wastes programme etc.

(v) Communities can solve the problem of energy by growing Bio diesel plants like *Jatropha*, *Pongamia* etc. and selling their oil for easy mix into diesel. The govt of India supports such projects.

## B. Water Conservation

Water-crisis and drought have become major environmental issues in many parts of India. Communities can conserve water through the adoption of indigenous practices of water harvesting. However, communities can conserve water through water-recharge techniques, water shed development, Roof-top water harvesting and allowing easy percolation of rainwater into ground.

## C. Waste Disposal

The problem of waste creates a number of secondary problems like insanitary conditions, spread of diseases and pollutants of land, air and water. No municipality/municipal corporation is efficient enough to solve the problem of waste until citizens have proper civic sense and participate

in waste disposal system. A number of NGOs are doing commendable jobs in the disposal of waste and development of vermi-compost etc in different parts of the world.

## D. Awareness Building

Communities can build awareness among the public to conserve environment and its resources so as to keep up the balance of nature. Several non-government organizations in the society and Eco-Clubs in schools are spreading awareness regarding various environmental issues at local and regional levels. These organizations and clubs can undertake so many types of activities to develop solutions to major environmental problems at local level. Celebration of different days may be an added opportunity in spreading awareness regarding the conservation of nature among the public. Development of resource material on EE and use of traditional and modern media of communication need to be strengthened. At district level Environmental Information Centres should be setup to generate knowledge regarding traditional and indigenous system of management practices.

## 16.3. PROTECTION OF WILDLIFE

All the organisms existing in the wild may truly be called as Wildlife. In this sense the world wildlife relates to all the plants, animals and micro-organisms of the natural environment. In specific cases wildlife relates to wild animals only. Wildlife form important links in the transfer of food and energy .Hence, protection of wildlife is very important to maintain the ecological balance in the nature and also to preserve the **gene pool**. **The total number of genes or the amount of genetic information that is possessed by all the reproductive members of a population of sexually reproducing organisms is called as the Gene Pool.**

We have already studied that conservation and protection of wildlife is done in two ways –Ex-situ and In-situ .Ex-situ conservation is the conservation outside the original habitat of organisms whereas In-situ conservation means conservation in the original surrounding. The protection and conservation of wildlife in National Parks, Sanctuaries, Nature Reserves, Cultural landscapes and Biosphere Reserves is called as In-situ protection and conservation. Development of wildlife populations in genetic resource centres, Zoos, botanical gardens, culture collections etc. is called as Ex-situ conservation.

### 16.3.1. Measures for the Protection of Wild Animals

- (i) Laws made to impose ban on poaching or capturing of wild animals should be enforced strictly.
- (ii) Indiscriminate killing of birds and animals should not be allowed to anyone even if these organisms are found in abundance.
- (iii) Natural habitats of wildlife should be preserved under law.
- (iv) Periodic surveys and counting of wildlife (birds, animals, plants).
- (v) Felling of trees for trade or other purposes must be controlled under law.
- (v) If cutting of trees comes to be unavoidable, equal no of saplings should be planted in the same area to compensate the loss.

### 16.3.2. Endangered, Threatened and Rare Species

It is due to human activities of hunting, poaching, habitat destruction etc. that species of wild animals are vanishing fast. Some of them are facing threat of their extinction (endangered species), whereas, some are already threatened. Some of the species have remained very less in number (rare species). According to the Red List of IUCN some endangered species of wild animals are- Swamp deer (*Cervus duvauceli*), Assam Rabbit (*Caprolagus hispidus*), Asian Elephant (*Elephas maximus*), Lion tailed Macaque (*Macaca silensis*), Tiger (*Panthera tigris*), Great Indian Rhinoceros (*Rhinoceros unicornis*) etc.

## 16.4. STOPPING CRUELTY TO ANIMALS

Love and care of animals is deeply rooted in Indian culture. Hindus worship different animals as *vahanas* (live means of transport) of many Gods & Goddesses. The concept of protection and compassion towards animals, alongwith other components of nature, has deeply been enshrined in the Indian Constitution. **Article 51-A (g) of Indian constitution reads –**

**It shall be the fundamental duty of every citizen of India to protect and improve the Natural Environment including forests, lakes, rivers and wildlife, and to have compassion for all living creatures.**

In spite of all the ethical and constitutional bindings many people have cruel behaviour towards animals. Cruelty can be defined as: *an abnormal behaviour of some human beings that causes pains and suffering to others. In our day to day life we come across a number of different incidents and observe that some normal people have cruel behaviour towards animals.* Cruelty to animals is seen in many forms. Here are some examples-

- (i) Causing pain and suffering to animals by overloading, kicking and beating,
- (ii) Employing a sick animal for hard works and beating him on poor performance,
- (iii) Keeping animals in cages in uncomfortable conditions,
- (iv) Killing an animal or cutting parts of its body for trade,
- (v) Abandoning or killing a milch animal when it becomes unproductive,
- (vi) Castrating, dogs, without giving anaesthesia,
- (vii) Training and exhibition of animals,
- (viii) Packing of poultry in suffocating conditions and their transport to distant places under the same conditions, and hanging poultry upside down.
- (ix) Killing of stray dogs in view of avoiding accidents on roads and checking rabies, a viral disease which often spreads due to the bite of dogs and some other animals.



**Fig. 16.3.** Hanging poultry upside down is an act of cruelty.

## enviro\_Facts : 16

Nowadays there are many non-governmental organizations that oppose cruelty to animals. **People for the Ethical Treatment of animals (PETA) & People for Animals (PFA)** are two such organizations. These organizations work for the welfare of animals. Animal lovers across the world are of the opinion that animals too have rights to live and develop peacefully like human beings. In India Legal protection is offered to animals through the **Prevention of Cruelty to Animals (PCA) Act- 1960** (59 of 1960) which was enacted in December 1960 with the objective of preventing infliction of unnecessary pain and suffering to animals. In exercise of powers conferred by this Act, the central Govt made the Prevention of Cruelty to Animals (Establishment and Regulation of Societies for Prevention of Cruelty to Animals) Rules, 2001. Accordingly, **Societies for Prevention of Cruelty to Animals (SPCAs)** have been organized on state and district level across the country. The **Animal Welfare Board of India**, at **Chennai**, conducts and co-ordinates various activities pertaining to rescue, rehabilitation, care and welfare of animals. We should take care of animals and encourage others to do the same.

### **The Prevention of Cruelty to Animals (PCA) Act- 1960 contains following Rules-**

- Performing Animals Rules – 1973 and Performing Animals (registration) Rules-1972.
- Transport of Animals Rules-1978 and 2001.
- Prevention of Cruelty (slaughter house) Rules-2000.
- Prevention of Cruelty to Animals (establishment and regulation of society for prevention of cruelty to animals) Rules-2001.
- Breeding of and Experiments on Animals (control and supervision) Rules-1998 as amended in February 2001.

## 16.5. ENFORCEMENT OF ACTS, LAWS AND POLICIES

*The statement of instructions regarding law that has been passed by the parliament is called as an **act**. The whole system of rules that everyone in a country or society must obey is called as **Law**. The statement of what you are advised to do in a particular situation or an official decision about something is called as **Rule**. On the other hand a course or a programme of action adopted by an individual, group or government or the sets of principles on which they are based is called as **Policy**.*

**Some environmental policies of government of India are – National Forest Policy (1988,**

2005-06), Policy Statement for Abatement of Pollution 1992, National Conservation Strategy and Policy Statement on Environment and Development 1992.

### **16.5.1. Enforcement of Legal Control for Ecological Restoration and Conservation**

Acts & Laws pertaining to the protection of the natural environment and its resources have been framed and enforced from time to time as per the need. The disposals of litigations pertaining to environment are done by **Green Benches** in different High Courts of Indian states especially the State of West Bengal & Tamil Nadu. The whole process of legislation in the field of environment in India can be broadly presented in three important phases –

#### **Phase I: Legislation for protection of specific animals or their groups**

1. Madras Wild Elephant Preservation Act 1873
2. All India Elephant Preservation act 1879
3. Wild Birds and Animals Preservation Act 1912
4. Bengal Rhinoceros Protection Act 1954
5. Assam Rhinoceros Protection Act 1954
6. Indian Wildlife (Protection) Act 1972 & Rules 1973 (ammended in 1983, 1986 & 1991)

#### **Phase II: Legislation for the Protection of Wildlife and their Natural Habitats**

1. Bengal Smoke Nuisance Act 1905
2. Indian Ports Act 1907
3. Motor Vehicles Act 1938
4. Maharashtra Prevention of Water Pollution Act, 1953
5. Orissa River Pollution Act 1954
6. Gujarat Smoke Nuisance Act 1963
7. The Forest (Conservation) Act 1980 and Rules 1981
8. The Water (Prevention & Control of Pollution) Act 1974, Cess Rules 1978 (ammended 1988).
9. Motor Vehicles Act 1930 (ammended 1988)
10. Environmental Protection Act 1986

#### **Phase III: Legislations for the protection of Rights of people to a healthy environment**

1. The Water (Prevention & Control of Pollution) Cess Act 1977 (ammended 1991), Cess Rules 1978
2. The Public Liability Insurance Act 1991, Rules and Amendment 1992.
3. The National Environment Tribunal Act 1995
4. The National Environment Appellate Authority Act 1997

### **16.5.2. Institutional Structure for Monitoring Control and Abatement of Pollutants in India**

The ministry of Environment & Forests in India was formed in 1985. This Ministry formulates plans and strategies and enforces laws for Ecological Restoration and Conservation across the country. The Indian Govt. has set up **Central Pollution Control Board**, and its different state wings to assess, monitor and control various types of pollutions. **The central M/O E & F has constituted different authorities besides CPCB for various environmental purposes-**

1. National Environmental Appellate Authority -1977: This authority has been created to hear appeals with respect to restricted areas in which classes of industries etc. are carried out or prescribed subjects to certain safeguards and Environmental Protection Act-1986 and National Environmental Appellate Authority Act-1997.
2. Environmental Pollution (Prevention & Control) Authority (For National Capital of Delhi).
3. Loss of Ecology (Prevention and Payment of Compensation) Authority (for Tamil Nadu).
4. Dahanu Taluka Environment (protection) Authority.
5. The Central Ground Water Authority.

The Central Pollution Control Board is responsible for the enforcement of following Acts &

Rules-

#### **Acts-**

1. Water (Prevention and Control of Pollution) Cess Act 1977
2. Air (Prevention and Control of Pollution) Act 1981
3. Environmental (Protection) Act 1986

#### **Rules-**

4. Hazardous Waste (Management & Handling) Rules 1989
5. Manufacture, storage and import of Hazardous Chemicals Rules 1989
6. Coastal Regulation Zone- Rules 1991
7. Public Liability Insurance Rules 1991
8. Bio-medical waste (Management & Handling) Rules 1998
9. Plastic Waste Rules 1999
10. Municipal Solid Waste (management and Handling) Rules 2000

## 16.6. SOME SUCCESS STORIES

### **16.6.1. Use of CNG**

CNG or the Compressed Natural Gas is better than other fuels like petrol & diesel. This gas is being successfully used in cars & buses in many Indian cities due to a number of advantages that are mentioned below-

- (i) It is cheap and can be used conveniently.
- (ii) It can not be adulterated and has a higher octane value which increases the efficiency of vehicles.
- (iii) It causes less pollution than other fuels. It does not emit carbon monoxide and Nitrogen oxide, and does not produce high pitched noise pollution.

The application of CNG was started on experimental basis in Delhi, the National capital of India to run school buses and taxis. Later some other vehicles also started the application of CNG. Now the application of CNG has also been started in some other cities of India. Outside India, CNG is used as transport fuel in U.S., U.K., Canada and France etc.

### **16.6.2. Chipko-Movement**

This is the success story of Peoples' movement for the protection of trees that started in 1970s in Garhwal, Himalayas. The movement was led by Sarvodaya workers Shri Chandi Prasad Bhatta and

Smt. Sarla Devi of Dashauli Gram Swaraj Sangh (DGSS) and by Smt. Gaura Devi of Mahila Mandal. Earlier, the Uttarakhand Rajya Sammelan had organised a meeting in which leaders had stressed on exploitation of natural resources from hills and growing problem of unemployment. Sarvodaya workers organized general public meetings and demanded the replacement of contractor system with forest labour co-operatives and setting up of small scale industries. In 1973 the govt. amended to sell ash trees of the area and allotted cutting of trees to a timber company. The local people took oath of protecting trees even at the cost of their lives.

Gradually when the movement spread to all the villages of Tehri Garhwal and Kumayun, Sarvodaya workers started a door to door campaign. Sarvodaya worker Sundarlal Bahuguna sat on a hunger strike and his wife Vimla started mobilizing ladies to join the movement. Some people call Mr. Sundarlal Bahuguna as the father of Chipko movement. In 1983, on April 29th, school children in USA also observed 'CHIPKO'-Day by hugging a big tree in the Unique Square Park. Adults also followed up those children. In Karnataka, the people of Balegadde village protested against the cutting of Teak-trees in 1983. They invited Sunderlal Bahuguna and carried on a CHIPKO. This movement was called as APPIKO.

### **16.6.3. Silent Valley Movement**

The silent valley is located in the Palghat district of Kerela(India). In 1929 British people had identified the valley as a prospective Dam site. The state govt. of Kerela had decided to launch the silent valley project on the Kandhi Puzha River in view of generating 240 MW of electric power and irrigating 10,000 ha of crop land. A section of elites felt concerned about the ecological damage to be caused due to the project. A local NGO – Kerala Shastra Sahitya Parishad (KSSP), deputed a multidisciplinary team to conduct a socio-economic survey which declared that the project if implemented could submerge about 850 ha of virgin tropical evergreen forest, replete with valuable endemic trees and animal species including endangered animals like Nilgiri Tahr, Langur, Macaque, and Malabar Squirrel. Later, this survey report was also confirmed by Botanical and Zoological Surveys of India. A Nationwide campaign was started by WWF, Bombay Natural History Society and students and scientists of different states. Lastly, the IUCN General Assembly requested the Kerela govt. to call off the project. In August 1980 a joint committee chaired by Prof. M.G.K. Menon was formed to investigate the extent of ecological damages due to the project. The joint committee submitted its report in December 1982. Following the findings of the report the project was scrapped and in 1983 the valley was declared a National Park. The Silent Valley forests are locally called as SAIRANDHRIVANAM. Many scholars say that Forest of this valley are last representatives of virgin Tropical Evergreen forests of India.



#### **16.6.4. Water Harvesting**

The collection, storage and use of rainwater is called as rain-water harvesting. This is a traditional practice of water conservation and water-recharge in India. Some important buildings in India like the Rashtrapati Bhawan, Jawaharlal Nehru University building etc. has started harvesting of rainwater and recharge of ground water which has led to an increase of ground water level to about one metre.

1. Jhabua district of the Indian state of Madhya Pradesh has started the construction of check dams, community lift irrigation and water storage tanks. These practices have increased the agricultural productivity of the area.
2. Drying up of wells and rising up of ground water level have been recorded in Rajkot district of the Indian state of Gujarat where people have started rainwater harvesting and recharging of groundwater. The similar success has also been achieved by the people of Amaravati district of Maharashtra (India).
3. Hundreds of villages in Alwar district of Rajasthan (India), have built several thousand small check dams during last 15 years. Those dams have recharged wells and underground aquifers & have even brought drying rivers back to life.
4. Ralegaon- Siddhi & Manegaon in Maharashtra (India) have irrigated water scarcity & have gained fame for their work.
5. Businessmen of Bombay are funding the construction of water harvesting structures in Saurashtra. The Aga Khan Rural Support Programme has helped villages (Devagarh near Junagarh) to drought proof the area.

#### **16.6.5. Sukhomajri**

**Sukhomajri** is a village located in the foothills of **Shivaliks** that stretch from Nepal to the border of Pakistan. Like many Shivalik villages in Haryana Sukhomajri is a settlement of Gujjar, a community of glaziers subsisting on pastoralism and rain fed agriculture along hill slopes. The area was trapped in a serious environmental crisis comprising soil erosion, siltation of all the water bodies, and total crop failures. The people of Sukhomajri had no way except facing the problem.

#### **THE BACKGROUND OF THE PROBLEM**

Till the mid-19th century, Shivalik hills were covered by thick forests and Bhabhar grass (*Eulaliopsis binata*). But the land use policy of the British encouraged the people from the foothills to bring the forest land under grazing and cultivation. The British Government too undertook large scale deforestation to supply timber for railways; and Bhabhar grass to paper mills. These activities compounded to cause serious soil erosion that resulted into siltation of water bodies in the area, like the famous artificial Sukhana Lake. Gradually all the water bodies dried up resulting into the failure of crops and water crisis. Thus agriculture became less dependable. Consequently, the people were forced to keep a large number of sheep, goats, and cows to meet the demand of food. But once the cattle were allowed to graze freely and indiscriminate cutting of trees continued; the hill slopes became bare completely. The **Punjab Land Preservation Act** was passed in 1902 to prevent land erosion through excessive grazing. But it could not get social support and hence became ineffective.

## **ROLE OF COMMUNITY IN ECOLOGICAL RESTORATION**

The Central Soil and Water Conservation Research and Training Institute (CSWCRTI), Chandigarh conducted a survey of the Environmental Crisis of the area in 1975, and found that the sedimentation from the Shivalik hills was caused at the annual rate of 600 tonnes / ha.

Some social workers started educating the villagers of Sukhomajri. They told about the value of vegetation and techniques of soil conservation. The awakening thus created by social workers led to the formation of a village Society named as ‘Water Users Association’ in 1979. This society later emerged as “Hill Resource Management Society” (HRMS) in 1980. The society developed a concept of **Social Fencing of Shivalik Hills which comprised following components –**

1. Building of earthen dams across natural gullies to store the rain water for irrigation,
2. Protecting the vegetation on hill slopes,
3. Reducing grazing by cattle,
4. Maintenance of dams and distribution of stored water on payment basis,
5. Replacement of goats and sheep by milk yielding cows and buffaloes,
6. Plantation along hill slopes.

In 1986, when the **Haryana Forest Department** acknowledged the role of the village community in protecting forests, it decided to handover the contracts for cutting Bhabhar grass and also the fodder grass to villagers. The earning from the Bhabhar leases have been major incentive for the **Participatory Forest Management System**. On the basis of these facts it can be said that Sukhomajri is a successful model of Community Participation for Ecological Restoration.

### **16.6.6. Warlis**

**Warlis** are tribal people inhabiting north-western coast of Maharashtra state of India. According to some environmentalists – the Warli tribe basically belongs to the foothills of Sahyadris. It is found inhabiting Thane districts, and can be seen living in small clusters of huts known as Padas. The Padas are houses that have single doors and no windows.

Today the Warli tribe is internationally known for its wall paintings and fables. In a book entitled the Painted World of the Warlis (authored by Yashodhara Dalmia) it has been mentioned that the tradition of Warli tribe is as old as 2500 or 3000 B.C. The Warli Paintings were traditionally done by women alone until the late 1960. But in the 1970’s a man named Jivya Soma Mashe started Warli painting as routine practice and gained national as well as international fame for the traditional artwork.

A WARLI PAINTING is usually a combination of circle, triangle, and square. The circle represents the sun or the moon; the triangle represents trees or mountains; and square represents sacred enclosures or a piece of land. Human or animal bodies are painted by joining triangles at their tips. This shows the balance of the universe.



A



B

**Fig.16.5.** Warli Paintings: A. A Typical Warli Painting, B. Warli Circle

**Warlis are worshippers of Mother Nature.** Their **religious philosophy** reveals that destruction and death faced by human beings is because of disrespect they have shown to the Mother Earth. They worship the **Goddess of Creative Energy**- the Corn Goddess, and the Goddess of Trees and Plants; to appease the Mother Nature.

Warlis have a deep sense of respect and care to the Wildlife. They worship **Vaghadeo** or Vyaghra as a supreme God. They consider the tiger as symbol of life and regeneration, and offer a part of their harvest to it. “The Tiger is regarded as the harbinger of fertility and Warli couples dress in the colour of the tiger- yellow and red shawls- when visiting the temple of Palghata, the Goddess of Marriage. **According to one of several Warli Fables-** if the Goddess were pleased, she would bless the couple a child; or else the shawls would transform into tigers and consume the pair. Warli paintings depict the tiger as a part of their daily life, often walking through or sitting in the village. **Here is another Warli Fable for you -**

*“In ancient time when the man decided to start agriculture by gradually shifting from hunting*

and food-gathering, he approached different creatures for a grain of paddy to plant, but in vain. The rat came to his rescue and gave him a seed from its own savings. The man then cultivated paddy and made good harvests. In reciprocation to the help of rat the man promised him a fixed quota of paddy from paddy field each time it harvests. So, when the rat takes some paddy from the field, in the understanding of this community, it does not amount to stealing but it is the fulfillment of the promise made by the man to repay the debt it owed to rat from ancient time.” The moral of the story: the human being should not only think about its own living but also for all the other living creatures, and they have to live in harmony with each other.

### 16.6.7. Beej Bachao Andolan

“**Beej Bachao**” has been an **Andolan** initiated in the late 1980s by farmers and Social Activists to promote **conservation and use of indigenous seeds in Tehri district** of the newly constituted state **Uttaranchal** in India. The Beej Bachao Andolan, which means- “**Save the Seeds Movement**” is not only a crusade to conserve traditional seeds but also to promote agricultural biodiversity, sustainable agriculture, and local traditions.

- ❖ Beej Bachao Andolan is a peoples’ campaign;
- ❖ It is flourishing without any financial assistance from the government;
- ❖ It focuses on traditional farming and emphasizes on avoidance of hybrid seeds, synthetic pesticides, and chemical fertilizers as against the tradition established during the Green Revolution;
- ❖ This revolution was started as an Awareness Campaign in 1989 for farmers to discontinue growing cash crops, and to promote indigenous practices;
- ❖ About 200 varieties of Kidney Beans, 100 varieties of Paddy, 7 varieties of wheat have been collected and stored so far by Andolan workers;
- ❖ The collection of seeds by the Andolan workers is being done in view of –
  - ❖ Preparing a comprehensive chart of High Yielding Varieties of seeds and traditional seeds to show a comparative account to farmers and to remove their confusion,
  - ❖ Doing a village wise documentation of seeds and maintaining a seed- bank.

The Andolan received Rs. 1.5 lakh as a token appreciation from the Booker-Prize Winner Arundhati Roy in 2002. The Andolan Workers are planning to establish a farm in Tehri to grow traditional crops.

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## TOWARDS A BETTER ENVIRONMENT...

In modern times community participation in Ecological Restoration and conservation is considered to be essential and important. The role of community in Ecological Restoration and Conservation was greatly emphasized in the Earth Summit which was held at Rio de Janeiro, the capital of Brazil from June 3,1992 to June 14, 1992. The summit is officially known as United Nations Conference on Environment & Development (UNCED). It was attended by 115 heads of states and 1000 delegates to mark the 20th century of Stockholm Conference. The delegates were expected to sign a pledge called as the “Earth’s pledge”. The Rio- centre has a giant board bearing the pledge with thousands of signatures. The pledge reads-

Recognizing that people’s actions towards nature and each other are the source of growing damage to the environment and the resources needed to meet human needs and to ensure survival and development-

“I pledge to act the best of my ability to help make the earth a source of hospitable home for present and future generations.”

# IMPORTANT DEFINITIONS

<b>ECOLOGY</b>	:	The study of interrelationship between organisms and their environment is called as Ecology.
<b>ECOLOGICAL RESTORATION</b>	:	An intensive activity that initiates the recovery of an ecosystem, with respect to its health, integrity and sustainability is called as Ecological Restoration.
<b>ECOLOGICAL CONSERVATION</b>	:	The wise use and care of resources of nature, maintenance of their qualities and sound management of interrelationships among its different components is called as Ecological Restoration.
<b>COMMUNITY</b>	:	Group of populations of different organisms found living together in a particular area is called as community.
<b>COMMUNITY PARTICIPATION</b>	:	The creation of opportunities to enable all members of a community to actively contribute to and to influence the process of development and to share equitably in the fruits of development is called as community participation.
<b>RANGE</b>	:	Extensive open grazing land for human use and for semi domestic grazing animals is called as range.
<b>HABITAT</b>	:	A place which favours living, feeding, breeding and development of organisms is called as a habitat.
<b>CRUELTY</b>	:	Abnormal behaviour of some human beings that causes pain and sufferings to others is called as cruelty.
<b>ACTS</b>	:	The statement of instructions regarding law that has been passed by the parliament is called as an Act.
<b>LAWS</b>	:	The whole system of rules that everyone in a country or society must obey is called as Law.
<b>POLICY</b>	:	A course or programme of action adopted by an individual, group or government or the sets of principles on which they are based on is called as a Policy.

## MODEL QUESTIONS AND EXERCISES

### I. VERY SHORT ANSWER TYPE QUESTIONS

- When was the Prevention of Cruelty to Animals Act passed?
- Name any activity of Water Conservation that can be done by Community Participation?
- Which article of the Indian Constitution directs the citizens of India to have compassion for all the living creatures?
- When was the Ministry of Environment & Forests formed in India?
- What is the expanded form of SPCA?

### II. SHORT ANSWER TYPE QUESTIONS

(2 Marks Each)

- Define Ecological Restoration and Conservation.
- What do you mean by community participation? Give any two examples?
- How can wildlife be protected? What is the need of protection of wildlife?
- Define cruelty. Why is the cruelty to animals considered a bad practice?
- How can community take part in awareness - building?
- Mention any four legislative provisions for the protection of rights of people to a healthy environment. (ICSE 2008)
- What is Silent Valley Movement? (ICSE 2007)
- What is the aim of Silent Valley Movement? (ICSE 2008)
- What was the Chipko movement? (ICSE 2007)
- Write Full form of CNG. State one advantage of using it as a fuel. (ICSE 2007)

### III. DETAILED ANSWER TYPE QUESTIONS

(4 to 6 Marks Each)

1. What do you mean by Ecological Restoration and Conservation? How can a community participate in the process of Ecological Restoration?
  2. What are Acts and Laws? Mention laws related to pollution control and protection of wildlife in India.
  3. What is community participation? Explain the role of community participation in the conservation of environment? Mention any two success stories of community participation in India.
  4. Community participation can help immensely in the restoration and conservation of Environment. Discuss with suitable examples.
- (ICSE 2007)
5. Sukhomajri is a successful model of community participation for Ecological Restoration. Give a brief background of the problems faced by the people of Sukhomajri and steps taken by the community for Ecological Restoration.
- (ICSE 2008)
6. What is the relevance of the practice of Warli tribe in today's world?
- (ICSE 2008)
7. What was Beej Bachao Andolan? Explain.
- (ICSE 2008)
8. The Warlis are known to transmit their philosophy of life through their fables : Describe briefly any two of Warli Fables.
- (ICSE Specimen Question)

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice Type Questions

**Tick (✓) the correct option**

1. Control of soil erosion, reforestation and improvement of range and habitat relate to –
  - (a) ecological Conservation
  - (b) ecological Degradation
  - (c) ecological Restoration
  - (d) ecological Control
2. Number of people is rising-
  - (a) geometrically
  - (b) arithmetically
  - (c) algebraically
  - (d) statistically
3. Planting trees in denuded forest areas is called-
  - (a) afforestation
  - (b) deforestation
  - (c) reforestation
  - (d) plantation
4. Government of India is conducting a number of Rural Development projects through the participation of –
  - (a) panchayati Raj Institutions
  - (b) schools
  - (c) universities
  - (d) institutions
5. IREP stands for-
  - (a) Internal Rural Environment Programme
  - (b) International Report of Environment Programmes
  - (c) Integrated Rural Employment Programme
  - (d) Integrated Rural Energy Programme

#### B. Fill in the blanks

1. The problem of wastes creates a number of ..... problems.
2. Causing pain and sufferings to animals is called as .....
3. Animal Welfare Board of India is located in ..... city of India.
4. The CHIPKO movement is related to the protection of.....
5. Silent Valley Movement was started in .....state of India.

### C. True / False

Write T against the statement which is true and F against the statement which is false-

1. Ecology is the study of relationship between plants and animals.
2. Group of human beings living in a particular area is called as ecosystem.
3. The National Wasteland Development Board is conducting many projects through community participation.
4. Biogas can be produced by using animal dung.
5. The National Environmental Appellate Authority Act was passed in 1977.

## ANSWERS

### I. VERY SHORT ANSWER TYPE QUESTIONS

1. Construction of check dams, 2. in 1980, 3. Article 51-A(g), 4. 1985, 5. Society for prevention of Cruelty to Animals.

### IV. OBJECTIVE TYPE QUESTIONS

#### A. Multiple Choice Type Questions

1. (c), 2.(a), 3.(c), 4.(a), 5.(d).

#### B. Fill in the blanks

1. Secondary, 2. Cruelty, 3. Chennai, 4. Forest, 5. Karnataka

#### C. True / False

1. F, 2.F, 3.T, 4.T, 5. T.

## PROJECTS & ACTIVITIES

### Act for Environment

#### 16.1. PROJECT

Prepare a project on the Role of Community Participation in controlling soil-erosion in your area.

#### 16.2. SURVEY

- (i) Make a survey of cases of cruelty to animals in your neighbourhood. Suggest politely to the people doing cruel practices that they should have sympathy to innocent animals.
- (ii) Make a survey of pet animals in your residential area. Find out if all of them are registered. Observe if they are cared properly. Also note down the food constituents given to each animal and the time of their vaccination. Write a report.

#### 16.3. SEMINAR

Organise a seminar through Eco –club of your school on “Water Harvesting”. Write the proceedings of the seminar.



**EE–Activity by Students**

**Special Section**

**PROJECTS & ACTIVITIES IN ENVIRONMENTAL EDUCATION**

# **PROJECTS AND ACTIVITIES IN ENVIRONMENTAL EDUCATION**

## **A. - CARRYING OUT AN EE- PROJECT & METHODOLOGY OF WRITING A PROJECT REPORT**

### **What is an EE- Project?**

The scientific study of an Environmental Problem carried out with the objective of developing a suitable strategy of finding out a solution, is called an EE- Project.

**Carrying out of an EE-project incorporates following elements—**

1. Identifying and defining an environmental problem existing at local level,
2. Making hypothesis
3. Observation,
4. Collection of data through survey or experiment or through both,
5. Analysis of data,
6. Drawing inference(s),
7. Solution of the problem, and
8. Taking feedback and follow up .

**By carrying out an EE- Project, a student can generate new knowledge like a scientist.**

This new knowledge can be utilised in making easy the life of future generation by solving a particular environmental problem. So, an EE- Project should always be based on a planned and systematic approach.

### **Steps of doing an EE- Project**

An EE- Project should incorporate the following steps -

1. Students should form different groups of like minded boys or girls to carry out a particular project. The whole class may act as a group for carrying out a big project as per the decision of the teacher.
2. A list of some important environmental problems that exist in the nearby areas should be prepared through surveys and observations. Then, one most important and challenging problem should be selected out of many problems written in the list. The carrying out a project demands resources like man power, time, apparatuses and equipments, money etc. So, one should go for a project which demands resources within the capacity of the students.
3. Make a survey of the geographical area of the study and try to draw a working map of this area.
4. Collect as much references like books, articles, and news paper cuttings etc. that are related to the project and study those references carefully. Arrange a discussion under the guidance and supervision of your teacher and make a plan of action.
5. Conduct a survey or do an experiment as per the demand of the project and try to solve the problem up to the all possible extent. Sometimes it is very difficult to solve the problem if it is a big one. Hence it is suggested that you select a small but important problem.

6. Ensure participation of some local responsible persons in your project and do communicate your findings to local communication media from time to time or at one time after you receive the results in case the project consumes a short time.
7. Take feed back sometimes after the completion of the project.

## Nature of the project to be undertaken at this stage

Various types of environmental problems may exist in your surroundings. Some of them need researches of very high level. So many equipments and a good laboratory are needed for carrying out such projects. You need to do small projects that may consume short time and very less money. You may develop your own short cut methods for experimentation instead of going for a technology of a high order. Try to develop an appropriate technology on your own, as far as it is possible. That is how you can become a good scientist in future to solve problems of the ailing humanity.

## Types of EE- Projects

Generally three types of projects can be undertaken at the secondary level- (i) survey based projects, (ii) experiment based projects, (iii) survey cum experiment based projects. The survey based projects are of two types – (a) the projects to be done through a pre designed questionnaire, and (b) projects based on factual data obtained through surveys. Surveys are important but these alone can not help you to solve the problem. Others are experiment based project. In these projects experiments are carried out either in field conditions or in a laboratory. For this, students will have to follow the pre established processes of scientific studies like- observations, questioning, formation of hypothesis, testing, data collection, data analysis and drawing of inference(s) etc.

## Solving a problem

After drawing an inference, the student has to go for solving the problem. If the problem is solved once, it should be tried many times to confirm the actual process of solving the problem and the result so obtained.

The steps of carrying out an EE –project, as given above may not always be the same and modifications may surely be made if the guide teacher and the student think so.

## Writing an EE- Project Report

EE-Projects should be written preferably on A4 size paper sheets (21 cmx31 cm) or in a project book as per the direction of the teacher concerned. An abstract in about 500 words should also be prepared. The project report should be written on one side of the paper. Following should be the structure of a project report-

1. The **cover page** should contain the title of the project, written nicely on the top of the page and name(s) of worker(s) should be written nicely in the lower part of the page. This page should also contain space for signatures of the guide teacher and attestation by the Principal.
2. The cover page of the project report should be followed by the **abstract** i.e. the summary of the project report.
3. The abstract page should be followed by a brief justification of **why the project has been undertaken?** or the **Need of the Project.**

4. The need statement should be followed by the **Plan of work** undertaken by the student.
5. The plan of work should be followed by **Materials and Methods**. This should incorporate the list of materials and equipments used along with a mention of methods of research applied for carrying out the project (i.e. survey, experimentation and so on).
6. The above should follow the **Result, Analysis of data, Inference, Solution of the problem, Acknowledgements and References**.

The student-in charge of the project must acknowledge the co-operations of individuals, institution(s) or organisation(s). This is the chapter in which thanks for help, co-operation, guidelines, directions, encouragements etc. are to be recorded. In some cases teachers and other learned people suggest to place this page in the beginning. It is okay. Only the important guidelines are being mentioned here. However, only the standard format of writing a project is to be followed in every case.

The reference section occupies its position in the end. It is in this chapter that all the study materials and sources of knowledge are written in alphabetical order with names of author, title of the work, page numbers, volume number, date/year, place of publication, name of publication etc. In some projects the above format can be changed as per the requirement and nature of the project.

## Aids to the Project Report

Posters, transparencies, overhead projectors, slide-projectors, computer etc. may be some aids for the demonstration of the project. The posters prepared for projects should be 55cmx 70cm in measurement. These posters should correlate to the different steps of the project. Posters must be scientific rather than being merely the pieces of art.

## B- DOING AN EE- ACTIVITY AND METHODOLOGY OF WRITING AN ACTIVITY REPORT

### What is an EE- Activity?

A situation in which something is happening or anything is being done, is called as an activity. An activity is a single unit of work. It may be a minor part of a project. Naturally, a project is a set of many different activities.

An EE-Activity is a situation in which something related to environment is being done with a certain goal. The goal of an EE-Activity may either be learning and understanding of a natural phenomenon, process, mechanism etc. or protection and preservation of any part of environment.



An Overhead Projector.



A Slide Projector.

## Types of EE-Activities

At this stage EE- Activities may be of various types like surveys, visits, field-trips, debates, discussions, poster preparation, plantation, audit of energy consumption, study of a particular environmental aspect, drawing, collage making, compilation, demonstration, flow charting and writing of slogans, scripts etc.

## Writing an Activity Report

Writing of an activity report involves the following steps-

1. **Basic Concepts:** It is the idea or principle connected to the activity, for example-the basic concept behind an activity related to an Ecological Pyramid may be “the importance of different Tropic Levels in contributing to Ecological Stability”.
2. **Background:** It may be the background knowledge about the activity to be undertaken.
3. **Objective:** It is the basic aim of the activity.
4. **Mode:** It may be participatory or individualistic. In case of participatory, the mode will be the Group Work.
5. **Materials and Equipments:** This relates to the materials and equipments needed for the use in a particular EE- Activity.
6. **Time Required:** It is the total time expected for the completion of the activity.
7. **Methodology:** It includes the methods of doing the activity.
8. **Observation:** It is the change which has occurred due to the activity performed through above method.
9. **Recapitulation:** Each activity performed by the student is needed to be revised and improved. So a recapitulatory exercise is done in order to test the authenticity of the

activity done earlier and to make corrections.