
UNIT – 1

ENVIRONMENT

Environment

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- 1.2 Objectives
- 1.3 Concept of Environment
 - 1.3.1 Definition of Environment
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1.1 INTRODUCTION



The term environment means the surroundings or conditions in which a person, animal, or plant lives or operates. Environment includes both living and non-living components. The living component is biological or biotic and the non-living component is physical or abiotic. Environment refers to the sum total of conditions which surround man at the given point in 'space and time'. It is a general term that refers to the external conditions in which organism lives. Organisms and environment forms an interrelated, interdependent and interacting system. Environmental issues affect, and are affected by, all our activities to varying degrees. Knowledge about the environment is indispensable which is not an end, but rather beginning.

1.2 OBJECTIVES

At the end of this unit, you will be able to:

- Define the concept of environment, environmental science and ecology
- Identify the historical development of the branch ecology
- Establish the relationship between ecology and economic development
- Understand the socio-economic concept of degradation of environment
- List out the major branches of ecology

1.3 DEFINITION OF ENVIRONMENT

Environment

Our environment is very important to us because it is where we live and share resources with other species. The word 'Environment' comes from a French word 'Enviro' or 'Environer' meaning around, to surround. Some of the definitions for the term 'environment' are given below:

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- "Environment is the sum of all social, economical, biological, physical and chemical factors which constitute the surroundings of man, who is both maker and molder of his environment".

- T.D. Elliot

- "Environment is the field of effective stimulation and interaction for any unit of living matter".

- E.J. Ross

- "Environment is an external force which influence us"

- "Environment is anything immediately surrounding our object and exerting a direct influence on it".

- P. Gisbert

- "Environment is external conditions influencing development or growth of people, animals or plant",

- The term environment is used to describe, in the aggregate all the external forces, influences and conditions which affect the life, nature, behaviour and the growth, development and maturity of living organisms".

- Doughless and Holland

- "Environment is the physical and biotic habitat that surround us".

Hence the environment includes the physical factors like soil, temperature, energy, water, atmosphere, fire, gravity, topography etc. and the biological factors like plants and animals including human beings. And there is an effective stimulation and interaction between these two factors of the environment.

1.3.1 CLASSIFICATION OF ENVIRONMENT

In general, environment may be divided into two types which are as follows:

- Natural environment
- Man-made environment

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Natural Environment

The natural environment has many components like air, water, soil, energy, gravitation, radiation, flora and fauna, etc. These components are interacting with each other. There exists a reciprocal relationship among various components of the natural environment. The physical components of the natural environment are called abiotic (air, water, soil, etc.) and biological components are called biotic (plant and animals).

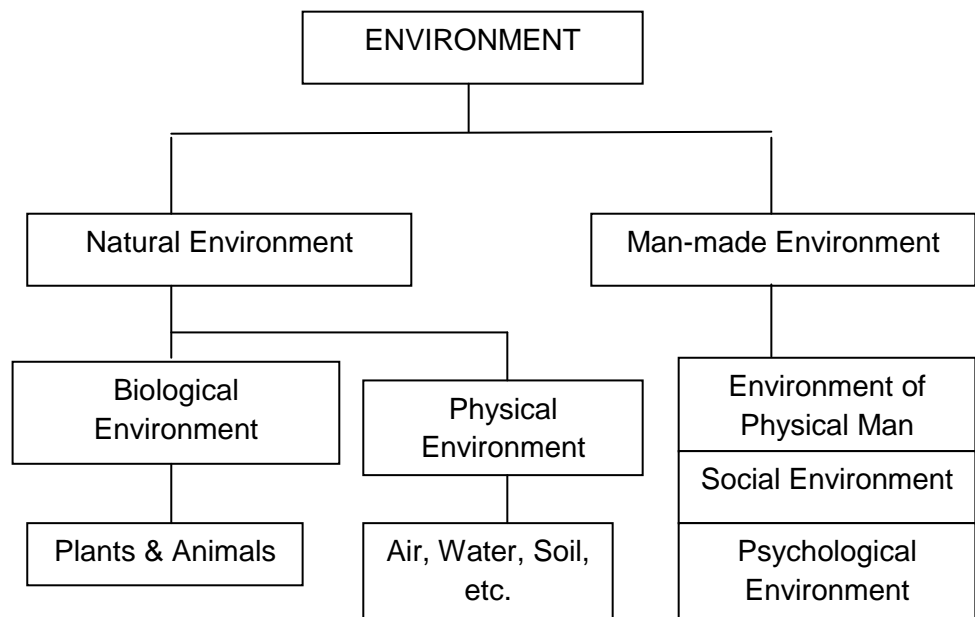


Fig 1.1: Types of Environment

Man - Made Environment

Of all organisms, man is most skilled and utilized. Human activities are now so pervasive and profound in their consequences that they too affect the earth on a global scale in complex, interactive and accelerating ways. Human beings have the capacity to alter the environment which leads to severe impact on the earth system. The following are few indicators of above effect which are listed out by Benny Joseph (2005).

- Almost half of the earth's land surface has been transformed by direct human action, with significant consequences on bio-diversity, nutrient cycling, soil structure and climate.
- More than half of all the accessible freshwater on earth is used directly by mankind and underground water resources are being depleted rapidly in many areas.
- The concentrations of several climatically important greenhouse gases, in addition to carbon dioxide and methane, have subsequently increased in the atmosphere.
- In a few generations mankind is in the process of exhausting fossil fuel reserves that were generated over several hundred million years.
- Coastal and marine habitats are being dramatically altered.

Man influences and interacts with the environment by many ways. These may be physical, social, economical etc. The 'physical man' is one among biological community and thus requires basic elements of physical environment viz. habitat (Space), air, water and food like any other biological organism and releases wastes into the eco-system. The 'social man' establishes social institutions, forms social organizations, formulates laws, policies etc. 'Economic man' devices and utilizes resources from physical and biotic environments using his skills and technologies.

Physical Environment

The physical environment includes land, air, water, plants and animals, buildings and other infrastructure, and all of the natural resources that provide our basic needs and opportunities for social and economic development.

A clean, healthy environment is important for people's physical and emotional wellbeing. At a fundamental level, factors such as clean air and good quality drinking water are vital for people's physical health. Other environmental factors such as noise pollution can cause both physical harm and psychological stress.

The physical environment is the physical and chemical make-up of an ecosystem. It includes the climate, rainfall, winds, soil, obtainable nutrients, etc., within the ecosystem. The physical environment affects the organisms that live in particular ecosystems.

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Certain items are necessary for each species' survival. These items can be obtained from one's ecosystem. For humans, we need to ingest specific vitamins and amino acids that our bodies cannot make. We also need some sunlight in order for our bodies to make vitamin D. And, we need to be in a warm enough climate to be able to maintain our body temperatures. Other species have other needs. But for us, we are somewhat limited by our needs. If you consider our temperature requirements, it makes sense that humans don't live at the north or south poles; we are somewhat limited by our temperature requirements for where we can live.

The physical environment affects organisms. For example, different organisms are found in a desert than in a rainforest. And we don't find cactus on mountaintops around here, either.

The physical environment is an important determinant of health influencing the prospects of health in many ways. Air quality affects people's health and especially that of people with respiratory disease. Infectious disease may be transmitted through water. Quality of housing affects many aspects of people's health. The attractiveness of the environment influences people's readiness to be physically active and to socialise with their neighbours. Toxic materials in the environment can cause disease and interfere with development. Road design and transport systems affect the risk of accidents. Access to green space is good for mental health.

Biological Environment

Biological environment is the environment where life forms can exist. It is a medium where live our organism cells. Every type of living organism needs certain environmental conditions. "Friendly" bacteria, such as *acidophilus* and *bifidus* also live in our organism. They play a big role in a digestion process. Besides, they are especially important in the synthesis of B vitamin, which is considered to be a huge disease resistant organ. Pathogenic microorganisms such as viruses, disease-causing bacteria, fungi and parasites feel more comfortable in a changed biological environment, the one which is more acidic. If harmful bacteria take the upper hand in a human body, a person falls ill. An infant is born with a neutral environment, as a rule. Infant's organism has more negatively charged hydrogen ions (H⁻), which neutralize harmful radicals, and organize a normal biological reaction process. Mother's milk provides a baby with antibodies and good bacteria, which strengthen his immune system.

Then, what is the thing which changes our environment? Firstly, it is malnutrition, polluted environment and stress. Human's biological pH acidifies, and his organism turns into a much more favourable

environment for bad bacteria. Secondly, acid environment gives a start to the formation of harmful radicals, which, in its turn, promotes solar radiation, exercise stress, active and passive smoking, stress, and air pollution. It also affects antibiotics and food products, which contain a lot of animal fat or chemicals.

Environment

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Social Environment

The social environment often refers to the immediate physical and social setting in which people live or in which something happens or develops. It includes the culture that the individual was educated or lives in, and the people and institutions with whom they interact frequently.

The interaction may be in person or through communication media, even anonymous or one-way, and may not imply equality of social status. Hence, the social environment is a broader concept than that of social class or social circle. Generally people with the same social environment often develop a sense of social solidarity; they often tend to trust and help one another, and to congregate in social groups. They will often think in similar styles and patterns even when their conclusions differ with each other. The social environment includes the groups to which we belong, the neighborhoods in which we live, the organization of our workplaces, and the policies we create to order our lives. There have been recent reports in the literature that the social environment is associated with disease and mortality risks, independent of individual risk factors. These findings suggest that the social environment influences disease pathways (Yen and Shime, 1999).

Psychological Environment

Environmental psychology is an interdisciplinary field focused on the interplay between individuals and their surroundings. The field defines the term environment broadly, encompassing natural environments, social settings, built environments, learning environments, and informational environments.

The term psychosocial refers to the close connection between psychosocial aspects of our experiences (e.g. our thoughts, emotions, and behavior) and our wider social experience (e.g. our relationships, tradition and culture). Learners and teachers are psychologically affected by the surrounding social conditions that may disrupt or enhance the quality and effectiveness of learning. The question is how to endure every learner an environment that is physically safe, emotionally secure and psychologically enabling. A focus on well-being of the learner,

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including attention to different groups according to such factors as their gender, physical ability and socio-economic status, will help address disparities that stem from home and community background, creating a more level playing field (UNESCO).



Fig 1.2 Psychological Environment
ACTIVITY

List out the influences of Environment by Human beings in your area

Write an account on Social Environment of your Area

1.3.2 COMPONENTS OF ENVIRONMENT

There are four major. Environmental components which are as follows:

- i. Atmosphere (the gaseous mandle)
- ii. Hydrosphere (water)
- iii. Lithosphere (Solid components)
- iv. Biosphere (Part of Earth or Living Organism)

The atmosphere may be considered as a transport component that moves substances from atmospheric sources to receptors. The hydrosphere which includes all liquid components namely the water in oceans, lakes, rivers and on land. Lithosphere comprises the solid components, the rocky substances of the continents. Biosphere can be defined as the part of the earth in which the ecosystem exists. The part of the earth containing living organism is known as 'biosphere'. These components are shown in the figure No. 1.3.

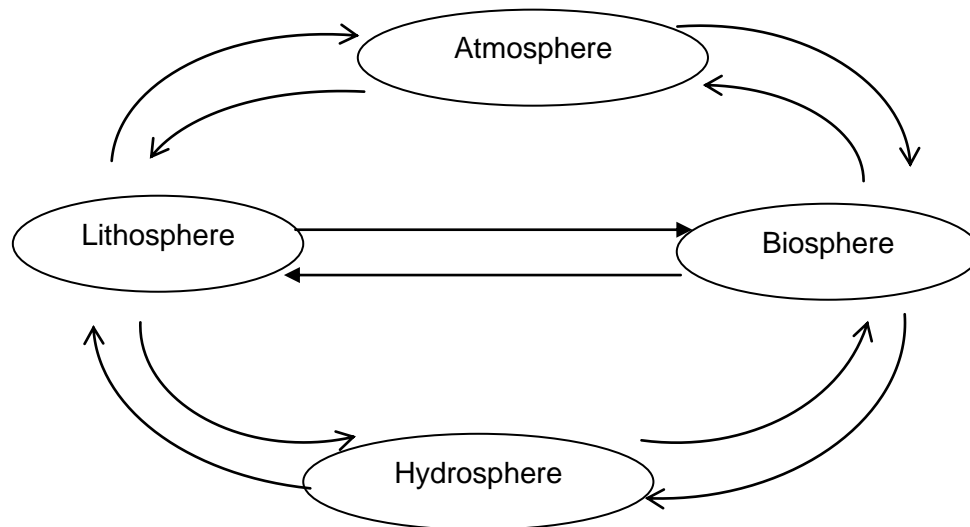


Fig. 1.3: Components of Environment

1.4 HEREDITY AND ENVIRONMENT

All traits depend both on genetic and environmental factors. Heredity and environment **interact** to produce their effects. This means that the way genes act depends on the environment in which they act. In the same way, the effects of environment depend on the genes with which they work. For example, people vary in height. Although height is highly heritable, environmental variables can have a large impact. For example, Japanese-Americans are on the average taller and heavier than their second cousins who grew up in Japan, reflecting the effect of environmental variables, especially dietary differences.

Man's behaviour is influenced by two forces: heredity and environment. The biological or psychological characteristics which are transmitted by the parents to their off-springs are known by the name of heredity. Heredity is, in other words, a biological process of transmission of certain traits of behaviour of the parents to their children, by means of the fertilized egg. Heredity traits are innate; they are present at birth.

The human individual is the progeny of two parent cells that come together when a male sperm fertilizes a female egg. In the nuclei of these parent cells are certain hair like substances called 'chromosomes'. The chromosomes contain chemical substances called genes. These basic

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substances, chromosomes and genes determine characteristics of the individual. And this is what constitutes heredity.

The essential characteristics inherited by all human beings are physical structure, reflexes, innate drives, intelligence, and temperament. There are some biologists who claim that the difference in the traits or qualities of individuals or groups are due to the difference in their heredity. They are duly supported by some psychologists and sociologists in their assertion, that like begets like.

But there are others who explain that the variations of human beings and the societies are due to differences in environment. Thus a great controversy has been going on since long about the relative importance of heredity and environment in determining the behaviour of individuals and groups.

Though arguments have been advanced by the supporters of both heredity and environment, no exact conclusions with regard to the relative importance of the two factors have been drawn, nor is it possible either to determine the relative values of both.

Modern biology has long insisted that we are what our parents and grandparents have made us, that heredity counts far more than social opportunity. Not only it is impossible for a man to change his skin, but he cannot change his outlook, his mode of thinking or behaviour because these too are hereditary. Others, on the other hand, belittle the importance of heredity. Hence it is concluded that both heredity and environment plays an important role in the development of personality of a man.

Heredity + Environment = Human Being.

Check Your Progress –I

Note: a) Space is given below for your answer

b) Compare your answer with these given at the end of this unit

1. The dictionary meaning of the word 'Environment' is

2. What are the two major types of environment?

a)

b).....

3. Which of the following is not influenced by human activities?

a) Depletion of ground water

b) Destruction of forest

c) Exhausting fossil fuel

d) None of the above

1.5 ECOLOGY

Ecology is a field science which deals with the ways how the living things relate to each another as well as to their environment. Experts on Ecology are called Ecologist. Ecologist brings the information and skills in different field of sciences such as in Biology, Chemistry, Physics and others related branches.

The word ecology has been derived from the Greek words 'Oikos' meaning habitation or home and logos meaning discourse or study. Hence it is a study of habitations of organisms. The term was introduced by Reiter in 1868, but it was properly defined by Ernst Haeckel in 1869. Ecology or environment biology deals with the inter-relationship of organisms with their physical and biotic environments.

1.5.1 DEFINITIONS OF ECOLOGY

The various definitions of ecology are given below:

Ecology has been defined as 'the scientific natural history', 'the study of biotic communities', or 'the science of communities and populations'.

"Ecology is the study of animals and plants in their relations to each other and to their environment".

"Ecology is the science of all the relations of all the organisms to all their environment" (Traylor, 1936).

"Ecology is the scientific study of the relationship of living organisms with each other and with their environment". (Southwide, 1976).

"Ecology is the study of interrelations of plants and animals with their environment which includes the influences of other plants and animals as well as those of the physical features" (G.L. Clarke, 1954).

Ernst Haeckel has given the following definition. "It is the relation of animal to its organic (living) as well as its inorganic (non living) environment, particularly its friendly or hostile relations to those animals or plants with which it comes in contact".

"Ecology is the scientific study of the structure and functions of nature", (Odum, 1963).

All the above definitions are emphasizing the interrelationship of living organisms and environment. Ecology is therefore, could be viewed as the interaction between biotic and abiotic factors.

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1.5.2 HISTORY OF ECOLOGY

The beginning of ecology may be traced back to the prehistoric man, who had collected environmental informations for hunting food, fishing and trapping animals and in finding the edible vegetation. In 18th Century, an early attempt to the systematic knowledge about the interrelationship of organisms and their environment was made by Buffon (1707 - 1788). He emphasized that plants and animals develop adaptations in response to their environment, and called it environmental induction. In 19th century, Hjumbolt (1807) discussed the geographical distribution of animals and plants in relation to climate. August Grisebach (1838), a German botanist also made initial contributions to ecology. Darwin (1859), while working of his theory of evaluation recognized the importance of competition and predation among individuals. In 1869, Ernst Haeckel proposed the term, ecological for the relationship of organisms to their organic and inorganic environments.

Friestley and Schfele described the interdependence of animals and plants. Considerable work has been done in the field of ecology in early 20th century, but the term ecology has reached every man's mind in last two decades. Clements (1905) and Warming (1909) have contributed immensely to the field of ecology. Adams (1906 and 1909) has described many animal communities of Northern Michigan and Isle Royale. V.E. Shelford (1912, 13 and 29) has offered examples of ecological succession, animal communities and discussed the effect of environmental factors. He also added recent knowledge and methods in the field of physiological ecology. The concept of biotic principles was introduced by L.R.Dice (1943) and (F.F .Clements, 1939).

The ecological society of America was founded in 1915 and the British Ecological Society in 1913. The international society for tropical ecology was organized in 1960. The Indian society has established several regional and soil conservation research stations with an integrated programme of research on soil science, agronomy, forestry and engineering at Jodhpur, Otacamund, Kota, Dehradun and Chandigarh. Since ecology is a young science, it should be emphasized that its concepts and techniques have not become standardized and that there is lot of opportunity for new investigations.

1.5.3 ECOLOGY AND ECONOMIC DEVELOPMENT

Ecology and economy must be considered as mutually complementary to each other. Man is a creature of nature, being just one species among the millions inhabiting the planet. But being the cleverest of all species, he has long established his dominance as the skilled exploiter of nature and its resources. Human civilizations ranging from those of the primitive tribal hunter to those of the present day astronaut

have always depended on nature and natural resources. The needs of the tribal civilizations were austere and, therefore, exploitation was minimal. With the development of the agrarian civilizations, the needs increased. Lands cleared for agricultural operations, plenty of water for irrigation, habitations for people to live together to meet the man-power needs, etc., became a necessity. With the advent of the industrial Civilization the needs increased by leaps and bounds and consequently the exploitation of natural resources increased to levels which nature cannot sustain. The trend continues, endangering not only natural environment, but posing serious threat to the welfare of future generations.

In the modern age, the environment has to bear the brunt of urbanization and industrialization, apart from the problems of population growth. An industrial economy can thrive and prosper only through mass production of goods. This can be sustained only by increased energy needs, increased utilization of natural resources as raw materials and increased consumption of the goods produced.

Fossil fuels like coal and oil are fast depleting due to excessive utilization for generation of electricity, industrial purposes and vehicular transport. The use of fresh water has increased several fold with the introduction of modern amenities in the bathrooms and domestic appliances like washing machines, dish washers and so on in the houses, the increase in irrigation needs of modern agricultural practices and large-scale industrial needs for manufacturing and allied purposes. Exploitation and utilization of natural resources like mineral deposits, forest vegetation etc. as raw materials by the industry, are causing irreparable damage to the environment. To add to the depletion of resources, environmental pollution caused by domestic wastes, agrochemical residues and industrial pollutants poses serious hazards.

1.5.4 BRANCHES OF ECOLOGY

The following are the branches of Ecology:

Applied Ecology

The practice of employing ecological principles and understanding to solve real world problems (includes agro ecology and conservation biology);

Biogeochemistry

It is a study of effect of biota on global chemistry, and the cycles of matter and energy that transport the Earth's chemical components in time and space.

Biogeography

It is the study of the geographic distributions of species

Chemical ecology

It deals with the ecological role of biological chemicals used in a wide range of areas including defence against predators and attraction of mates

Conservation ecology,

It deals with how to reduce the risk of species extinction

Ecophysiology

Ecophysiology studies the interaction of physiological traits with the abiotic environment

Ecotoxicology

Ecotoxicology deals with the ecological role of toxic chemicals (often pollutants, but also naturally occurring compounds);

Evolutionary Ecology or Eco Evolution

It deals with evolutionary changes in the context of the populations and communities in which the organisms exist;

Fire Ecology

Fire Ecology deals with the role of fire in the environment of plants and animals and its effect on ecological communities;

Functional Ecology

It is a study of the roles, or functions, that certain species (or groups thereof) play in an ecosystem.

Global Ecology

Global Ecology examines ecological phenomena at the largest possible scale, addressing macro ecological questions.

Ecophysiology

It studies the interactions between discrete elements of a landscape;

Macro Ecology

It is the study of large scale phenomena in our Ecosystem.

Micro Ecology

It deals with the study of small scale phenomena of an Eco system.

Marine ecology

It deals with the marine environment

Aquatic Ecology

It deals with the aquatic environment which includes both the fresh water and marine water.

Microbial Ecology

It deals with the ecology of micro-organisms

Paleoecology

It seeks to understand the relationships between species in fossil assemblages

Quantitative Ecology

It deals with the development of mathematical and statistical tools to interpret and analyze ecological data.

Restoration Ecology

Restoration Ecology attempts to understand the ecological basis needed to restore impaired or damaged ecosystems.

1.5.6 ECOSYSTEM

An **Ecosystem** is a community of living organisms (plants, animals and microbes) in conjunction with the nonliving components of their environment (things like air, water and mineral soil), interacting as a system. An ecosystem includes all of the living things (plants, animals and organisms) in a given area, interacting with each other, and also with their non-living environments (weather, earth, sun, soil, climate, atmosphere)

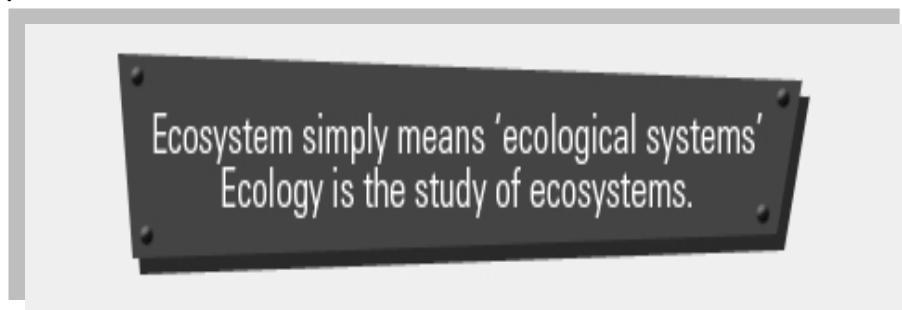


Fig No 1.4 Ecosystem

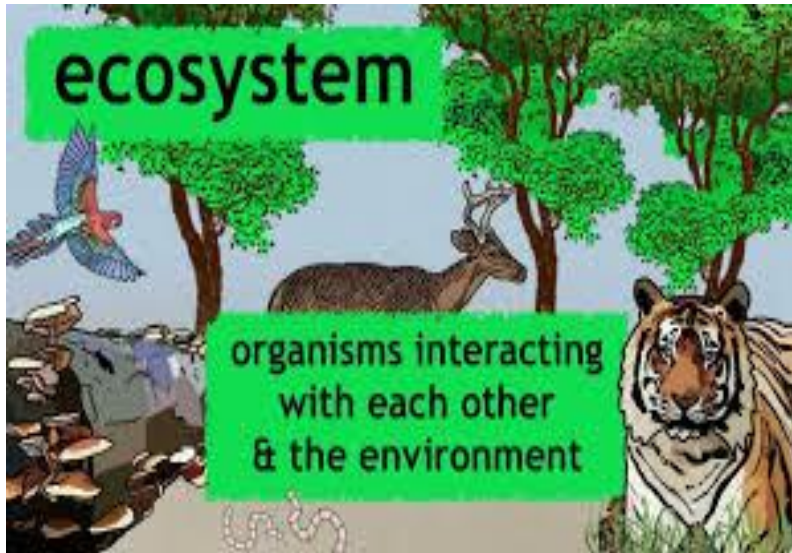
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An ecosystem consists of the biological community that occurs in some locale, and the physical and chemical factors that make up its non-living or abiotic environment. There are many examples of ecosystems -- a pond, a forest, an estuary, a grassland. The boundaries are not fixed in any objective way, although sometimes they seem obvious, as with the shoreline of a small pond. Usually the boundaries of an ecosystem are chosen for practical reasons having to do with the goals of the particular study.

The study of ecosystems mainly consists of the study of certain processes that link the living, or biotic, components to the non-living, or abiotic, components. Energy transformations and biogeochemical cycling are the main processes that comprise the field of ecosystem ecology. As we learned earlier, ecology generally is defined as the interactions of organisms with one another and with the environment in which they occur. We can study ecology at the level of the individual, the population, the community, and the ecosystem.

Studies of individuals are concerned mostly about physiology, reproduction, development or behavior, and studies of populations usually focus on the habitat and resource needs of individual species, their group behaviors, population growth, and what limits their abundance or causes extinction. Studies of communities examine how populations of many species interact with one another, such as predators and their prey, or competitors that share common needs or resources.

In ecosystem ecology we put all of this together and, insofar as we can, we try to understand how the system operates as a whole. This means that, rather than worrying mainly about particular species, we try to focus on major functional aspects of the system. These functional aspects include such things as the amount of energy that is produced by photosynthesis, how energy or materials flow along the many steps in a food chain, or what controls the rate of decomposition of materials or the rate at which nutrients are recycled in the system.



Environment

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Fig no 1.5 Diagrammatic illustration for ecosystem

1.5.7 COMPONENTS OF ECOSYSTEM

Two main components exist in an ecosystem: abiotic and biotic. The abiotic components of any ecosystem are the properties of the environment; the biotic components are the life forms that occupy a given ecosystem.

Abiotic Components

Abiotic components of an ecosystem consist of the nonorganic aspects of the environment that determine what life forms can thrive. Examples of abiotic components are temperature, average humidity, topography and natural disturbances. Temperature varies by latitude; locations near the equator are warmer than are locations near the poles or the temperate zones. Humidity influences the amount of water and moisture in the air and soil, which, in turn, affect rainfall. Topography is the layout of the land in terms of elevation. For example, according to the University of Wisconsin, land located in the rain shadow of a mountain will receive less precipitation. Natural disturbances include tsunamis, lightning storms, hurricanes and forest fires.

Biotic Components

The biotic components of an ecosystem are the life forms that inhabit it. The life forms of an ecosystem aid in the transfer and cycle of energy. They are grouped in terms of the means they use to get energy. Producers such as plants produce their own energy without consuming other life forms; plants gain their energy from conducting photosynthesis

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via sunlight. Consumers exist on the next level of the food chain. There are three main types of consumers: herbivores, carnivores and omnivores. Herbivores feed on plants, carnivores get their food by eating other carnivores or herbivores, and omnivores can digest both plant and animal tissue.

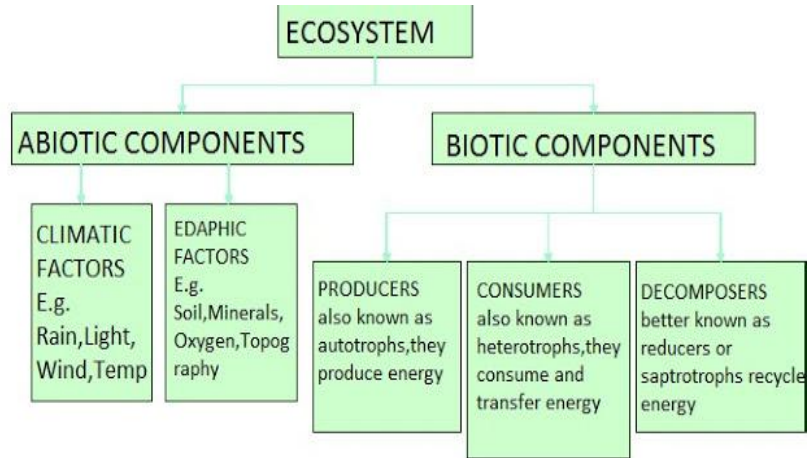


Fig No1.6 Components of Ecosystem

Activity

How would you make your students recognize the importance of ecology?

Check Your Progress – 2

Note: a) Space is given below for your answer

b) Compare your answer with those given at the end of this unit

4. The word ecology is introduced by
5. In every year almost square kms of new deserts are formed.
6. The ecological society was founded in the year
7. In the year 1960, the International society for ecology was Organized

Check Your Progress – 3

Note: a) Space is given below for your answer

b) Compare your answer with those given at the end of this unit

8. Environmental Education should be in nature.

9. Write True or False

a. Environmental Education should be a continuous life long process

b. Environmental Education should be taught directly

10. Which field of knowledge is required for the topic control devices of water pollution?

1.6 EVALUATION

- Define the term environment
- Briefly explain the meaning of the discipline "Environmental Science".
- Explain the historical development of the subject 'ecology'
- Establish the relationship between ecology and economic development
- Discuss the factors that lead to the degradation of environment
- Explain the impacts of socio-economic degradation of environment.
- Define the term ecology.
- Describe the nature and scope of environmental education.
- List out the major constraints for the implementation of environmental education at school level.

1.7 LET US SUM UP

In this unit you have studied in detail about the basic concepts, definitions of environment. You have identified the historical development of the subject ecology. Moreover you have learnt about the socio-economic impact of degradation of environment. It is your bounden duty to identify the suitable areas in your subject to integrate the

concept of environmental education by which you are developing environmental awareness among the learners.

1.8 UNIT - END ACTIVITIES

- Describe the way in which you can develop a favourable attitude among your learners towards environment
- List out the co-curricular activities for environmental education.

1.9 POINTS FOR DISCUSSION

"Knowledge about environment is not an end, but rather a beginning" - Discuss.

1.10 ANSWERS TO CHECK YOUR PROGRESS

1. Surrounding
2. Natural, Man made
3. d
4. Reiter
5. 61000
6. 1915
7. Tropical
8. Inter disciplinary
9. a) True b) False
10. Physics, Chemistry, Engineering

1.11 SUGGESTED READINGS

- Nagarajan. K and Sivakumar. P, "Environmental Education", Ram Publishers, Chennai - 93.
- Veer BalaRalogi and Jayaraj, "Animal Ecology and Distribution of Animals", Kadar Nath Ram Nath, New Delhi.

UNIT – 2 ENVIRONMENTAL EDUCATION

*Environmental
Education*

STRUCTURES

Notes

- 2.1 Introduction
- 2.2 Objectives
- 2.3 Definition of environment education
- 2.4 Characteristic features of environmental education
- 2.5 Objectives of environmental education
- 2.6 Need for environmental education
- 2.7 Scope of environmental education
- 2.8 Environmental science and environment education
- 2.9 Evaluation
- 2.10 Let us sum up
- 2.11 Unit – end activities
- 2.12 Points for discussion
- 2.13 Suggested readings



LIVE & LEARN

Environmental Education

2.1 INTRODUCTION

Environmental Education (EE) is a process in which the learners gain awareness of their environment and acquire knowledge, skills, values, experiences. It is a complex process, covering not just events, but a strong underlying approach to society building as a whole. EE provides learners with the awareness needed to build partnerships, understand NGO activities, develop participatory approaches to urban planning, and ensure future markets for eco-business.

Environmental education is a learning process that increases people's knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action (UNESCO, Tbilisi Declaration, 1978).

Environmental education enhances critical thinking, problem-solving, and effective decision-making skills, and teaches individuals to weigh various sides of an environmental issue to make informed and responsible decisions. Environmental education does not advocate a particular viewpoint or course of action. In this unit, we will discuss about definition, objectives, scope, and need of Environmental Education. Furthermore we will describe both Environmental Science and Environmental Education.

2.2 OBJECTIVES

At the end of this unit, you will be able to:

- Define the term environmental education, environmental science and ecology

- Identify the characteristic features of environmental education
- Establish the relationship between environment and education
- Understand environmental education curriculum
- List out the need and scope of environmental education.

2.3 DEFINITION OF ENVIRONMENTAL EDUCATION

Some of the definitions for the term 'environmental education' are given below:

- Environmental education is a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions.

Environmental education does not advocate a particular viewpoint or course of action. Rather, environmental education teaches individuals how to weigh various sides of an issue through critical thinking and it enhances their own problem-solving and decision-making skills (**American Environmental Protection Agency, 2014**).

- Environmental Education (EE) properly understood, should constitute a comprehensive lifelong education, one responsive to changes in a rapidly changing world. It should prepare the individual for life, through an understanding of the major problems of the contemporary world, and the provision of skills and attributes needed to play a productive role towards improving life and protecting the environment with due regard given to ethical values (**UNESCO, 1977**).
- Environmental education may best be defined as a process directed at creating awareness and understanding about environmental issues that leads to responsible individual and group actions. Successful environmental education focuses on processes that promote critical thinking, problem solving, and effective decision-making skills. Environmental education utilizes processes that involve students in observing, measuring, classifying, experimenting, and other data gathering techniques. These processes assist students in discussing, inferring, predicting, and interpreting data about environmental issues.

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Hence the environmental education includes Awareness and sensitivity to the environment and environmental challenges, Knowledge and understanding of the environment and environmental challenges, Attitudes of concern for the environment and motivation to improve or maintain environmental quality, Skills to identify and help resolve environmental challenges and Participation in activities that lead to the resolution of environmental challenges.

2.4 CHARACTERISTIC FEATURES OF ENVIRONMENTAL EDUCATION

The following are the Environmental Education Characteristics;

- Environmental Education relates to an environmental topic or issue.
- It makes use of the outdoors as a learning environment whenever possible and appropriate.
- It is a lifelong learning process.
- It is interdisciplinary and draws upon many fields of study and learning.
- It is relevant to the needs, interests, and motivations of the learner.
- It is based on accurate and factual information.
- It presents information in a balanced and unbiased manner.
- It inspires critical thinking and decision-making. It motivates people to take responsible action. It improves learner achievement and outcomes.
- It explores the complex relationships that exist between humans, the built environment, and natural systems.
- It presents factual, accurate, and balanced content, presenting all sides of a topic and encouraging students to examine their own opinions and attitudes;
- It teaches students more about "how to think" and less of "what to think".
- It includes hands-on, minds-on investigations that engage students and feature student-centered learning through real-world applications.

- It recognizes that different learning styles exist among students of all ages and strive to develop both critical and creative thinking skills in all students.
- Environmental Education is an interdisciplinary, synthesizing knowledge and experiences across disciplines and in all grade levels; It allows students to learn from previous knowledge which would then support further learning.
- Environmental Education is localized and as well as "globalized," focusing on community, backyard and schoolyard interests as well as on national and international interests.

ACTIVITY

List out the influences of Environmental Education

Write an account on functions Environmental Organizations of your Area

2.5 OBJECTIVES OF ENVIRONMENTAL EDUCATION

The objectives of environmental education are broad in sense of nature. The primary aim of environmental education is to impart knowledge about the principles required for the conservation and utilization of natural resources for the existence of mankind. Environmental education gives required knowledge and experience realizing the value of such important views. The role of environmental education is important in the realization of the necessity of maintaining a friendly and well balanced relationship between man and nature.

Various Objectives of Environmental Education as defined at the International Seminar on Environmental Education, Belgrade, (1975) are as follows;

Awareness

Assist individuals and groups in society to acquire a greater sensitivity and awareness of the environment in general and of its problems.

Knowledge

Assist individuals and groups in society to acquire a basic comprehension of the environment in its totality and of its problems. Also, to understand the presence and role of humans in this, which involves a critical responsibility.

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Attitudes

Assist individuals and groups in society to acquire social values and a deep interest in the environment that may drive them to actively participate in its protection and improvement.

Skills

Assist individuals and groups in society to acquire the skills needed to solve environmental problems.

Capacity to evaluate

Participation

Assist individuals and groups in society to develop their sense of responsibility and take note of the urgent need to pay attention to environmental problems; to ensure that they adopt adequate measures in this respect.

Other general Objectives are listed here under;

- To develop the sense of awareness among the students about environment and its various problems.
- To help the students in realizing the inter-relationship between man and environment.
- To help the students in acquiring basic knowledge about environment.
- To inform the students about the social norms that provides unity with environmental characteristics.
- To create positive attitude about environment among the student.

2.6 NEED FOR ENVIRONMENTAL EDUCATION

Environment is degrading at a much faster pace than our imagination. Mostly this is due to the various activities caused by human activities. The damage is both at global and regional level. Depletion of ozone layer and increase in the emission of greenhouse gas are the best examples of the damage at global level whereas groundwater pollution, soil erosion are some of the best examples at regional consequences of human activities and their impact on environment.

Therefore whatsoever wrong has been done by the people must be rectified by the people only. To protect and manage environment it is imperative to have a sound environmental education. It is a way to teach people and societies on how to use the present and future resources optimally. Environmental education seeks to influence and change this attitude towards the environment and, ultimately, instil a stronger sense of responsibility for safeguarding the environment. Unlike the commonly

held understanding that the ‘environment’ only constitutes what we fondly refer to as ‘Mother Nature’, it also encompasses social, political and economic influences. The admittedly ambitious aim of bringing about change to safeguard the environment can only be achieved if different players within society actually come to understand why they should take on such responsibility.

According to Prof Paul Pace following are the need for Environmental Education;

Environmental education involves an intricate process where stakeholders may start off as being passive observers of what is going on within their surrounding environment, but are transformed into taking responsibility and action for its protection. For this to happen, one must be able to see the link between the issue at hand and oneself – this is why the education is an indispensable tool for environmental protection. It is a cognitive process that involves a delicate mixture of a number components, including information, emotion, empathy and the ability, and courage, to apply critical thinking.

Information and data alone is not enough to spur a person or an organisation into action. An emotional reaction alone is not enough to be able to identify the best solution to a problem. The inability to question claims, information or commonly held beliefs will never lead to innovative solutions. Fear will cripple people, preventing them from taking action.

It is only through taking a holistic approach to environmental education that one can be assisted in developing the critical thinking skills that will enable them to overcome these obstacles and to understand, interpret and apply knowledge. Yet, while the need for environmental education has been recognised the world over, it is often only paid ‘lip service’, with the inclusion of environmental issues in the curriculum, which is not supported by the required institutional changes.

However, this educational process need not take place within the confines of the classroom. There are in fact three main sectors involved – formal educational institutions such as the University, primary and secondary schools and MCAST; non-formal institutions such as non-governmental organisations; and informal institutions, such as the media.

Indeed, education is a powerful tool and each and every one of these educational for a must bear responsibility for the role they play in forming opinions and facilitating, or hindering, the individual’s understanding of environmental issues. This responsibility is not

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insignificant, yet it is often overlooked, and it is time that this state of affairs is changed to ensure that the potential to bring about positive change becomes a tangible reality.

2.7 SCOPE OF ENVIRONMENTAL EDUCATION

Scope of Environmental Education includes different aspects and components in the environment. Among them, the biological, physical, social and cultural aspects are important. Scope also refers to the breadth of the curriculum, the content, learning experience, and activities to be included in the curriculum.

The scope of environmental education can be divided into biological, physical and sociological aspects. They are described below: (Ebenezar Esau, 2018)

Biological aspect: Biological aspects are one of the most important aspects of environmental education. Human being, animals, birds, insects, microorganism, plants are some of the examples of biological aspects.

Physical aspect: It can be further divided into natural aspects and human- made aspects. Air, water, land, climate etc are included in natural physical aspects. Likewise, Human made physical aspects cover all human made things such as roads, buildings, bridges, houses etc.

Socio- cultural aspect: Socio- cultural aspects are man-made social practices, rules and laws, and other religious places etc. Human beings have created them with their effort.

Check Your Progress –I

Note: a) Space is given below for your answer

b) Discuss your answer with our faculty members

1. The meaning of the word 'Environmental Education' is
2. Environmental Education is a ----- Process
3. Which of the following is the Global Level effect of human activities?
 - a) Pollution of ground water
 - b) Destruction of Ozone Layer
 - c) Sewage Problem
 - d) All of the above

ACTIVITY

How would you make your students recognize the importance of environmental Education?

Compare the EE curriculum of CBSE pattern and the pattern prescribed by Government of Tamil Nadu.

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Check Your Progress – 2

Note: a) Space is given below for your answer

b) Discuss your answer with our faculty members

4. The First Consultation on the academic aspects of Environmental Education (EE) in schools was organised by NCERT on _____ in New Delhi.
5. NCERT has published in collaboration with the CEE a book titled _____ in the year 1960.
6. Salim Ali Centre for Ornithology and Natural History (SACON), is located at _____.
7. In Ahmedabad _____ Institution was established in connection with environment.

2.8 ENVIRONMENTAL SCIENCE AND ENVIRONMENTAL EDUCATION

Environmental science is the study of the effects of natural and unnatural processes, and of interactions of the physical components of the planet on the environment. It is an interdisciplinary academic field that integrates physical, biological and information sciences to the study of the environment, and the solution of environmental problems. Environmental science is focused on the study of the relationships of the natural world and the relationships between organisms and their environments. An example of environmental science is the study of the natural world and how it relates to recycling and mulching. The field of environmental science has three general goals, which are i) to learn how the natural world works, ii) to understand how we as humans interact with the environment, and also iii) to determine how we affect the environment.

Based on the above description we can understand that Environmental science is the study of patterns and processes in the

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natural world and their modification by human activity. To understand current problems, we need to consider physical, biological and chemical processes that are often the basis of those problems. Study of Environmental Science provides learners with an understanding of earth's living and physical environment, processes that operate within the environment, and as well as the nature and mitigation of human being impact on the environment.

Environmental Education as “a lifelong learning process that leads to an informed and involved citizenry having the creative problem-solving skills, scientific and social literacy, ethical awareness and sensitivity for the relationship between humans and the environment, and commitment to engage in responsible individual and cooperative actions. (Wisconsin Environmental Education Board). Environmental education is a process that allows individuals to explore environmental issues, engage in problem solving, and take action to improve the environment. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed and responsible decisions. An International workshop on Environmental Education Belgrade charter emphasised the goal of environmental education is to develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively towards solutions of current problems and the prevention of new ones.

Environmental Education refers to organized efforts to teach how natural environments function, and particularly, how human beings can manage behavior and ecosystems to live sustainably. It is a multi-disciplinary field integrating disciplines such as biology, chemistry, physics, ecology, earth science, atmospheric science, mathematics, and geography. The United Nations Educational, Scientific and Cultural Organisation (UNESCO) states that Environmental Education is vital in imparting an inherent respect for nature amongst society and in enhancing public environmental awareness. It emphasizes the role of EE in safeguarding future global developments of societal quality of life, through the protection of the environment, eradication of poverty, minimization of inequalities and insurance of sustainable development (UNESCO, 2014a).

Environmental Education has four main components which are as follows:

i) Awareness: Raising awareness of the need for environmental conservation is the first step in any programme.

ii) Knowledge: Developing a deeper understanding of the principles and complex issues involved.

iii) Values and ethics: Building personal and societal commitment to conservation.

iv) Action: Facilitating changes in behaviour and action that promote sustainable development as a new mode of living.

Hence, based on the above description it has been concluded that the Environmental Science is an interdisciplinary academic field that integrates physical, biological and information sciences to the study of the environment, and the solution of environmental problems. Whereas the Environmental Education refers to organized efforts to teach how natural environments function, and particularly, how human beings can manage behavior and ecosystems to live sustainably. Both Environmental Science and Environmental Education are multi-disciplinary fields integrating disciplines such as biology, chemistry, physics, ecology, earth science, atmospheric science, mathematics, and geography.

2.9 EVALUATION

- Define the term Environmental Education.
- Briefly explain the meaning of the discipline "Environmental Science".
- Explain the need and importance of the subject EE.
- Establish the relationship between environment and education
- Discuss the various characteristics features of EE

2.10 LET US SUM UP

Thus, 'Environmental education should simultaneously attempt to create awareness, transmit information, teach knowledge, develop habits and skills, promote values, provide criteria and standards and present guidelines for problem-solving and decision-making. It therefore aims at both cognitive and affective behavior modification. This is an action-orientated, project-centred and participatory process leading to self-confidence, positive attitudes and personal commitment for environmental protection. Furthermore, the process should be implemented through an interdisciplinary approach'. Whilst this

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interdisciplinary approach links closely with many aspects of geography and natural science, it should lead on to participation in practical environmental education activities orientated towards a solution of the problems facing the global environment. Environmental education is a process which helps to develop the skills and attitudes needed to understand the relationships between human beings, their-cultures, and the biophysical world. All programmes of environmental education will therefore include the acquisition of knowledge and understanding and the development of skills. However they should also encourage curiosity, foster awareness and lead to an informed concern which will eventually be expressed in terms of positive action.

2.11 UNIT - END ACTIVITIES

- Describe the way in which you can develop a favourable attitude among your learners towards environmental education
- List out the practical activities for environmental education based on your local needs.

2.12 POINTS FOR DISCUSSION

"Environmental Education may be introduced as a separate subject or maybe integrated with already existing subjects" - Discuss.

2.13 SUGGESTED READINGS

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UNIT – 3 ENVIRONMENTAL AWARENESS

STRUCTURES

- 3.1 Introduction
- 3.2 Objectives
- 3.3 Environmental awareness
 - 3.3.1 National environmental awareness campaign (NEAC)
 - 3.3.2 Environmental education, awareness and training (EEAT)
 - 3.2.3 Main issues in creating environmental awareness in schools
- 3.4 Environmental education for teacher education programme
 - 3.4.1 EE in pre-service teacher education at primary level
 - 3.3.1 EE in pre-service teacher education at secondary level
 - EE in in-service training
 - 3.3.2 Teacher education for EE: concerns and issues
- 3.5 Environmental education in school curriculum
- 3.6 Evaluation
- 3.7 Let us sum up
- 3.8 Unit – end activities
- 3.9 Points for discussion
- 3.10 Suggested readings

3.1 INTRODUCTION

Environmental awareness means being aware of the natural environment and making choices that benefit rather than hurt the earth we all live on. For instance, in the Chipko and Appiko movements where tribals, and mainly women, hugged their trees to prevent them being

felled. The tribal has now realised that government claims of development only mean money and advantage to some people in a far-off city. They no longer want cash compensation for being displaced by dams and mines —they want land for land. Environment activism has already stopped two dams —Silent Valley in Kerala and Bedthi in Karnataka. Strong protests have also led to litigation against lime-stone mining in lush Dehradun. The report’s ultimate message is in its shared statement of concern: “Nature can never be managed well unless the people closest to it are involved in its management.” There is still time to act, however gloomy the scenario may look. Otherwise there is worse to come. In this unit we will discuss about the Environmental Awareness and Environmental Education for the Teacher Education programme.

3.2 OBJECTIVES

At the end of this unit, you will be able to: Define the term environmental awareness

- Identify the features of National Environmental Awareness Campaign (NEAC)
- Establish the relationship between environmental Education and Environmental Science
- Understand Environmental Education for Teacher Education programmes
- List out the need for Environmental Education in School Curriculum

3.2 ENVIRONMENTAL AWARENESS

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The Earth is in serious trouble, and save environmental slogans are just starts at spreading awareness, which will spark the changes our planet so desperately needs. The speed of global warming is increasing, and Arctic ice is melting. Scientists are realizing the danger at hand and are stepping forward to make changes.

The most well-known protect the environment slogan is “Reduce, Reuse, Recycle,” or the three R’s. This slogan is well known for its symbolic of three arrows in the shape of a triangle.

Reduce. Simply limit your consumption. Choose products that don’t have a lot of excess packaging. Turn off the lights and water when not in use and we should not buying things that we don’t need.

Reuse. Rather than purchasing a new item, try to find something that can be reused for the purpose at hand. Before throwing an item in the trash, consider whether that item can be reused for another purpose.

Recycle. Use your community’s recycling program and look for other ways to recycle. You can collect the empty juice pouches milk pocket and other polythene product and send them for recycle and also earn money.

Environmental awareness is an integral part of Teaching. By teaching our friends and family that the physical environment is fragile and indispensable we can begin fixing the problems that threaten it.

3.2.1 National Environmental Awareness Campaign (NEAC)

In India the National Environmental Awareness Campaign,(NEAC) was launched in mid 1986 with the objective of creating environmental awareness at the national level. In this campaign,

nominal financial assistance is provided to NGOs, schools, colleges, universities, research institutes, women and youth organisations, army units, government departments etc. from all over the country for conducting awareness raising and action oriented activities. Thirty four Regional Resource Agencies (RRAs) appointed by the Ministry are involved in conducting, supervising and monitoring the NEAC activities. During NEAC 2013-2014, 11754 Organisations participated from across the country.

"Combating Desertification Land Degradation and Drought" is main focus area of National Environmental Awareness Campaign (NEAC) 2014-2015.

3.2.2 Environmental Education, Awareness and Training (EEAT)

The 'Environmental Education, Awareness and Training (EEAT)' is a flagship scheme of the Ministry of environment, forest and climatic change for enhancing the understanding of people at all levels about the relationship between human beings and the environment and to develop capabilities/skills to improve and protect the environment. This scheme was launched in 1983-84 with the basic objective to promote environmental awareness among all sections of the society and to mobilize people's participation for preservation and conservation of environment.

EEAT Scheme has the following objectives:

- a. To promote environmental awareness among all sections of the society;
- b. To spread environment education, especially in the non-formal system among different sections of the society;
- c. To facilitate development of education/training materials and aids in the formal education sector;
- d. To promote environment education through existing educational/scientific/research institutions;
- e. To ensure training and manpower development for environment education, awareness and training;
- f. To encourage non-governmental organizations, mass media and other concerned organizations for promoting awareness about environmental issues among the people at all levels;

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- g. To use different media including films, audio, visual and print,, theatre, drama, advertisements, hoarding, posters, seminars, workshops, competitions, meetings etc. for spreading messages concerning environment and awareness; and
- h. To mobilize people's participation for preservation and conservation of environment.

Centers of Excellence

The Ministry started the scheme in 1983 to strengthen awareness, research and training in priority areas of Environmental science and management. Nine Centres of Excellence have been set up so far by the Ministry with a view to **strengthening awareness**; research and training in priority area of environmental science and management are as under:

- **Centre for Environment Education (CEE)**, Ahmedabad
- **CPR Environmental Education Centre (CPREEC)**, Chennai
- **Centre for Ecological Sciences (CES)** Bangaluru
- **Centre of Mining Environment (CME)** Dhanbad
- **Salim Ali Centre for Omithology and Natural History (SACON)**, Coimbatore
- **Centre for Environment Management of Degraded Ecosystem (CEMDE)**, Delhi
- **Centre of Excellence in Environmental Economics at Madras School of Economics**, Chennai.
- **Foundation for Revitalization of Local Health Traditions (FRLHT)**, Bangaluru.
- **The Tropical Botanic Garden and Research Institute (TBGRI)**, Thiruvananthapuram.

3.2.3 Main Issues in Creating Environmental Awareness in Schools

In Schools there are many issues aroused when developing Environmental awareness which are as follows;

- Most of the schools are result oriented rather than Knowledge oriented
- Availability of skill full teachers to promote Environmental awareness is another constrain.
- Enrolling the students into the awareness program can be difficult.

- Many schools span multiple buildings and multiple administrators and creating a consistent message of awareness is challenging.
- As budgets are often decided a year or more in advance, schools find it difficult to allocate funds for awareness programs and other initiatives.
- When creating fundraising and scholastic revenue campaigns, a lack of administrative coordination plagues output.

3.3 ENVIRONMENTAL EDUCATION FOR TEACHER EDUCATION PROGRAMME

The effectiveness of EE relies heavily on the knowledge, skills and attitudes of the educator. EE is not only a change in 'what' is being taught (the content), but also a new perspective on 'why' (the objectives and goals) and how (the approaches and attitudes).

The key to any change in the formal educational system is the teacher, and unless the teacher is convinced about and feels competent to handle this, very little will change. The teacher has to internalize a change in his/her role from one of 'giver of knowledge' to one of 'facilitator in the learning process'.

If teachers are to be effective facilitators in bringing EE into teaching and learning their capacities in understanding and internalizing the characteristics of EE and skills in transacting these need to be built and strengthened. One way to do this is through pre-service and in-service orientation and training. (Mamata Pandya, 2000)

3.3.1 EE in Pre-service Teacher Education at Primary level

Pre-service teacher education for primary school teachers is a two-year course. It covers foundation subjects as well as methodology subjects including educational philosophy and psychology, educational administration, methods of teaching etc. The detailed guidelines and syllabus for the course has been developed by the National Council for Educational Research and Training (NCERT). The State Departments of Education in the respective states administer the institutions for pre-service teacher training courses.

The teaching of Environmental Studies (EVS) is placed under both science and Social Studies syllabi recommended by the NCERT. Context related to EVS teaching takes up a large part of the first year

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syllabus. Training in EVS covers a total of 80 hours in the two-year course, Mamata Pandya(2000).

3.3.2 EE in Pre-service Teacher Education at Secondary level

Teacher Training for secondary level is offered by B. Ed. Colleges affiliated to universities. Several universities have introduced environmental education as one of the optional or elective papers at the B. Ed. Level. This course covers a total of 40 hours and is graded for 100 marks. The course content includes basic concepts and processes of environment and ecology, as well as teaching-learning methodologies in EE, evaluation techniques etc. Practicals and assignments are also part of the course.

In some universities EE is integrated as an exclusive chapter under one of the foundation courses called 'Education in Emerging India'. The National Council of Teacher Education (NCTE) has recommended EE as a chapter in its overall syllabus and guidelines for B. Ed. Colleges in the country. At the post-graduate level (M.Ed.) some universities have introduced EE as a special paper, while a few have given it the status of a full-fledged course of two semesters (Mamata Pandya,2000) .

3.3.3 EE in In-service Training

The NCERT, State Councils of Educational Research and Training (SCERT) and the District Institute of Educational Technology (DIET) are largely involved in in-service training in India. The in-service training/orientation programmes range from one week to one month. Several of these include an orientation of EE as part of the general course. In recent years, some non-governmental agencies with focus and expertise in EE have been invited to run short courses on EE and EE approaches and methodologies as part of in-service teacher training. Another experiment has been to train the teacher instructors of the DIETs in EE approaches so that they may incorporate this into their teaching as part of the in-service teacher training curriculum, and thereby pass these on to the teacher trainees.

3.3.4 Teacher Education for EE: Concerns and Issues

According to Mamata Pandya(2000), there is lack of adequate pre-service training in EE. There is also lack of consensus on what should be the scope and content of EE at various levels of pre-service training programmes. A major concern is the danger that EE should not be perceived as mere introduction of environmental concepts and facts.

While 'Environment' as subject has been incorporated in one way or another in most school curricula, training in EE has not yet infused the

curricula of teacher training courses. Thus teachers are not well equipped to deal with the new subject area.

Where EE has been introduced as an optional or elective subject into teacher training courses, it is not perceived by students to be as useful as other subjects such as Educational Technology, Multimedia Education, Computer Education, etc.

EE is generally perceived as having a heavy natural science content and hence is not chosen by 'non-science' students who feel they may not be able to grasp it.

In-service training is usually a one-time training module. This may help in orienting teachers, and perhaps motivate them in initiating EE efforts. But this may be inadequate to sustain these efforts over a period time. There is need to provide some system through which teachers can receive ongoing support both through formal training programmes and continued networking.

There is great need for relevant source/resource/reference materials and other resources for teachers. The immense value of locale-specific EE materials extends beyond language to also address content, context, concepts, issues and examples.

Lack of resources and support from institutional management and other crucial agencies may also restrict the access of teachers to training opportunities, resource and reference material and ongoing support in implementing EE methodologies and activities in their course of work.

ACTIVITY

Environmental Education can be introduced as an optional or elective subject in teacher training courses-Discuss

3.4 ENVIRONMENTAL EDUCATION IN SCHOOL CURRICULUM

The education system in India had incorporated certain aspects of environment in school curricula as early as 1930. The Kothari commission (1964-66) also suggested that basic education had to offer EE and relate it to the life needs and aspirations of the people and the nation. At the primary stage, the report recommended that " the aims of teaching science in the primary schools should be to develop proper understanding of the main facts, concepts, principles and processes in

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physical and biological environment” Environmental education at primary, secondary, higher secondary levels was treated in a different way. Environmental education is an essential part of every pupil's learning. It helps to encourage awareness of the environment, leading to informed concern for active participation in resolving environmental problems.

The curricular, cross-curricular attempt of environmental education also should be a joy for the learner. In this direction, NCERT has published in collaboration with the Centre for Environmental Education, Ahemadabad a book titled "Joy of learning” with lot of environmental activities, a handbook for teachers.

In order to supplement the analysis of individual and institutional consultations it was decided to organise two face-to-face National Consultations on Environmental Education in Schools. The First Consultation on the academic aspects of Environmental Education (EE) in schools was organised by NCERT on 13-14 February 2004 in New Delhi. Seventy participants comprising eminent scientists, environmentalists, officials of central and state govt. departments dealing with environment, senior academicians attached to Departments/Centres of environmental studies, environmental science, environmental ecology, botany, regional development, geography, marine biology, etc. of different universities, teacher educators, principals of teacher training colleges, prominent Non-Governmental Organisations (NGOs) and NCERT faculty took part in deliberations.

The second consultation on the implementation of EE in schools was held on 13th March 2004. Seventy-two officials comprising Presidents/Chairpersons of Boards/Councils of school education, Directors of State Councils of Educational Research and Training (SCERTs), Directors of Education in the states, eminent scientists, environmentalists and NCERT faculty participated. The initial draft prepared by NCERT faculty presented in the First Consultation was revised as per the suggestions received. This revised version was presented in the Second Consultation and suggestions for further improvement were received. Various issues were deliberated in these Consultations through plenary presentation, open house discussion, interaction in groups and consolidation of recommendations (Gopal and Anand).

Primary stage

EE is imparted as Environmental Science, which forms a common component of syllabus, prescribed by the States and CBSE.. The textbooks for environmental studies which are prepared by

N.C.E.R.T has taken cross curricular approach to teaching environmental concepts through language, mathematics about the environment. The contents and concepts covered in Environmental Science books are as follows:

- Familiarisation with one's own body;
- Awareness about immediate surroundings;
- Need for food, water, air, shelter, clothing and recreation;
- Importance of trees and plants;
- Familiarisation with local birds, animals and other objects;
- Interdependence of living and non-living things;
- Importance of cleanliness and sanitation;
- Importance of celebration of festivals and national days;
- Awareness of sunlight, rain and wind;
- Caring for pet animals;
- Awareness about air, water, soil and noise pollution;
- Need for the protection of environment;
- Knowledge about the source of energy;
- Importance of the conservation of water resources and forests and
- Indigenous and traditional knowledge about the protection of environment.

The textbooks lay emphasis on raising awareness levels and sensitising children about environmental concerns. Emphasis has also been laid on the need to organise learning in local specific contexts, which will provide more meaningful experiences to children. Aspects of indigenous knowledge have also been introduced. There are references and suggestions for conducting activities in and outside the classroom. The NCERT textbooks for environmental studies generally take a comprehensive view of the natural, physical, social and cultural environment.

It is evident that the textbooks represent relevant ideas commensurate with the age and developmental level of children so as to

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provide them the necessary understanding about their immediate environment. However, there is a scope for inclusion of more activities to enable children to translate awareness into effective behavioral action (Gopal and Anand).

Upper Primary stage

The contents of textbooks present an extension and elaboration of the concepts introduced at the primary stage. The textbooks in Tamil Nadu, Rajasthan and Madhya Pradesh (Classes VI-VIII) and in Karnataka (Classes V-VII) contain environmental concepts in the textbooks of science and social science. The textbooks of Karnataka for class V in the subjects of science, social science and language have environmental ideas infused with these subjects. The State of Orissa , deals with the environmental concepts and concerns in its textbooks for science and geography. These are also included in a single textbook of history and civics. The NCERT textbooks of 'Science' and 'Social Science' have incorporated such concepts in the text books.

The major concepts dealt with in these textbooks are:

- Adaptation of living beings in environment;
- Natural resources;
- Water cycle;
- Food chain;
- Importance of plants and trees in keeping the environment clean;
- Classification of plants;
- Role of plants and animals in environmental balance and soil conservation;
- Ecosystems;
- Necessity of clean air for healthy living;
- Animals and their characteristics;
- Effects of environmental pollution and the consequences of air pollution-(i) Greenhouse effect, (ii) Ozone layer depletion and, (iii) increase in carbon dioxide;
- Role of microorganisms in the environment;
- Dependence of the community on the environment;

- Basic knowledge about the Earth and its atmosphere;
- Physical features of the country;
- Population and environment;
- Care and protection of livestock;
- Necessity of wildlife protection;
- Impact of deforestation;
- Impact of industrialisation on environment; and
- Role of civic society in protection of the environment, personal and public property including monuments.

While most of the areas of EE have generally been covered, there is a need for the inclusion of more individual and group activities and project work in order to promote both the effective and cognitive domains of learning. Co-scholastic activities including organisation of plays, cultural programs, debates, mock parliament, discussions and community activities may help further in achieving the objective.

Secondary stage

The concepts of EE have been provided in the textbooks of science and social sciences in various states. In Orissa, there are textbooks, namely science part-I (physical science), Science part-II (biological sciences) and geography. The environmental concepts both are at concrete and abstract levels. The concepts covered are:

- Biosphere;
- Greenhouse effect;
- Ozone layer depletion;
- Use of fertilisers and pesticides;
- Wildlife protection;
- Soil chemistry;
- Management of domestic and industrial waste;
- Pollution of noise, air, water and soil and control measures;

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- Ecosystem;
- Management of non-degradable substances;
- Edible and ornamental plants;
- Sewage disposal and cleaning of rivers;
- Nuclear energy;
- Radiation hazards;
- Gas leak;
- Wind power;
- Bio-energy; and
- Environmental laws and acts.
- Environmental concepts also extend to subject areas like languages and social sciences, which reinforce learning and internalization of all such concepts.

Higher Secondary stage

This is the stage of diversification. Students opt for either the academic stream or the vocational stream. The treatment of concepts becomes deeper and more discipline oriented since the content caters to the demands of the concerned subject, as an independent discipline a comprehensive view about EE is not available in the textbooks. Majority of the concepts are found in the textbooks of biology, chemistry and geography, which are optional subjects. Students opting for any one of these subjects would accordingly benefit in different aspects of EE.

The coverage of EE concepts in the textbooks of various subjects includes:

- Environment and sustainable development;
- Atmospheric pollution- global warming,
- Greenhouse effect,
- Acid rain,
- Ozone layer depletion;
- Water pollution- international standards of drinking water,
- Importance of dissolved oxygen in water,

- Bio-chemical oxygen demand,
- Chemical oxygen demand,
- Land pollution,
- Pesticides,
- Ecology.

ACTIVITY

Identify the general constraints for the implementation of environmental awareness programme in your school.

Check Your Progress

Note: a) Space is given below for your answer

b) Discuss your answer with our faculty members

1) Environmental Education should be in nature.

2) Write True or False

a) Environmental Education should be a continuous life long process.

b) Environmental Education should be taught directly.

3) Write any two objectives of EE.

3.5 EVALUATION

- Define the term Environmental Education.
- Explain in detail about EE in Teacher Education Programme.
- Define the term environmental awareness.
- Describe the nature and scope of environmental education.
- List out the major constraints for the implementation of environmental education at school level.

3.6 LET US SUM UP

Environmental education (EE) connects us to the world around us, teaching us about both natural and built environments. EE raises awareness of issues impacting the environment upon which we all depend, as well as actions we can take to improve and sustain it. Whether

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we bring nature into the classroom, take learners outside to learn, EE has many benefits for youth, educators, schools, and communities. In this unit you have studied about Environmental Awareness and various Environmental Awareness programmes in India. Moreover, you have learnt about the Environmental Education in Teacher Education Programme. It is your bounden duty to identify the suitable areas in your subject to integrate the concept of environmental education by which you are developing environmental awareness among the learners.

3.7 UNIT - END ACTIVITIES

- Describe ways in which you can develop Environmental Awareness among your learners.
- List out the practical activities to develop environmental awareness based on your local needs.

3.8 POINTS FOR DISCUSSION

"Environmental Awareness can be a part and parcel of School Activities" - Discuss.

3.9 SUGGESTED READINGS

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UNIT – 4 ENVIRONMENTAL HAZARDS - I

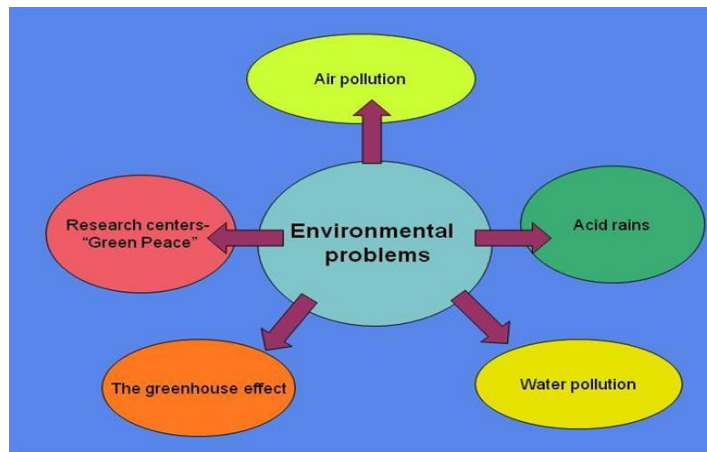
*Environmental
Hazards - II*

STRUCTURE

- 4.1 Introduction
- 4.2 Objectives
- 4.3 Meaning of environmental hazards
- 4.4 Categories of environmental hazards
- 4.5 Environmental pollution
 - 4.5.1 Definitions of pollution
- 4.6 Land pollution or soil pollution
 - 4.6.1 Definition of land pollution
 - 4.6.2 Sources of land pollution
 - 4.6.3 Effects of land pollution
- 4.7 Air pollution
 - 4.7.1 Definition of air pollution
 - 4.7.2 Sources of air pollution
 - 4.7.3 Effects of air pollution
- 4.8 Let us sum up
- 4.9 Unit – end activities
- 4.10 Points for discussion
- 4.11 Answer to check your progress
- 4.12 Suggested readings

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4.1 INTRODUCTION

“A nation that destroys its soils destroys itself. Forest are the lungs of our land, purifying the air and giving fresh strength to our people”

- Franklin Roosevelt.

All of the organic and inorganic components surrounding us, as well as the events, conditions and processes of their interactions are known as environment. Any undesirable change in the environment is known as environmental pollution. A pollutant is a containment that adversely alters the physical, chemical or biological properties of the environment. Literally, pollution means – to make or render unclear. Odum (1971) defines, ‘pollution is an undesirable change in the physical, chemical or biological characteristics of our land, air, or water what may or will harmfully affect human life or that of desirable species.

Pollutants are byproducts of man’s action. The important pollutants which are responsible for the pollution are given below:

- i. Gases – carbon monoxide, carbon dioxide, nitrogen oxides, sulphur oxides, etc.
- ii. Agricultural pollutants – herbicides, pesticides, fertilizers, etc.
- iii. Solid waste – domestic waste, dust, etc.
- iv. Metals – lead, zinc, iron, etc.
- v. Industrial pollutants – Benzene, ether, benzpyrenes acetic acid, etc.
- vi. Radiation pollutants – radio-active substances radio-active during nuclear test

- vii. Photochemical pollutants – ozone, oxides of nitrogen, aldehydes, ethylene, etc.

Basically there are two types of pollutants one is non degradable pollutants and other one is biodegradable pollutants. The former one is the pollutant which is either not altered or is degraded at a very slow pace by the natural biological processes. The non degradable pollutants are mostly inorganic compounds. The biodegradable pollutants include domestic sewage that easily decomposes under natural processes and can be rapidly decomposed by some artificial methods.

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4.2 OBJECTIVES

At the end of the unit, you will be able to:

- define the term environmental hazards and the term pollution
- List out the categories of environmental hazards
- identify the major pollutants which are responsible for the environmental pollution
- describe the nature and causes of air, and soil pollution
- appreciate the nature of the clean environment,.
- Identify the appropriate steps to curb the evil of pollution
- Recognize the way of protecting and management of environment
- Choose the appropriate and effective strategies to preserve and restore the environment.

4.3 MEANING OF ENVIRONMENTAL HAZARDS

‘Environmental hazard’ is the state of events which has the potential to threaten the surrounding natural environment and adversely affect people's health. This term incorporates topics like pollution and natural disasters such as storms and earthquakes.

An environmental hazard is any condition, process, or state adversely affecting the environment. Environmental hazards manifest as physical or chemical pollution in air, water, and soils. Environmental hazards can cause widespread harm to humans and the physical environment.

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Environmental Hazards can be categorized in to the following types:

1. Chemical
2. Physical
3. Mechanical
4. Biological
5. Psychosocial

Thus environmental hazard is defined as a source of potential harm or a situation with a potential to cause loss to the environment. 'It is a natural or manmade event that has the potential to cause harm or loss to our environment. The disaster fact is illustrated here under;



4.4 CATEGORIES OF ENVIRONMENTAL HAZARDS

There are many different ways of classifying hazards.

1. Natural hazards such as earthquakes or floods arise from purely natural processes in the environment.
2. Quasi-natural hazards such as smog or desertification arise through the interaction of natural processes and human activities.
3. Man Induced Hazards such as the toxicity of pesticides to fauna, accidental release of chemicals or radiation from a nuclear plant. These arise directly as a result of human activities.

Activity

List out the various Man Induced Hazards of your area with illustrations.

Natural hazards

A widely accepted definition characterizes natural hazards as "those elements of the physical environment, harmful to man and caused by forces extraneous to him." The term "natural hazard" refers to all atmospheric, hydrologic, geologic (especially seismic and volcanic), and wildfire phenomena that, because of their location, severity, and frequency, have the potential to affect humans, their structures, or their activities adversely. Some of natural hazards are discussed here under; as explained by Burton, I., Robert W. Kates and Gilbert F. White, 1978.

Earthquakes

Earthquakes are caused by the sudden release of slowly accumulated strain energy along a fault in the earth's crust. Earthquakes and volcanoes occur most commonly at the collision zone between tectonic plates. Earthquakes represent a particularly severe threat due to the irregular time intervals between events, lack of adequate forecasting, and the hazards associated with these;

Ground shaking is a direct hazard to any structure located near the earthquake's center. Structural failure takes many human lives in densely populated areas.

Faulting, or breaches of the surface material, occurs as the separation of bedrock along lines of weakness.

Landslides occur because of ground shaking in areas having relatively steep topography and poor slope stability.

Liquefaction of gently sloping unconsolidated material can be triggered by ground shaking. Flows and lateral spreads (liquefaction phenomena) are among the most destructive geologic hazards.

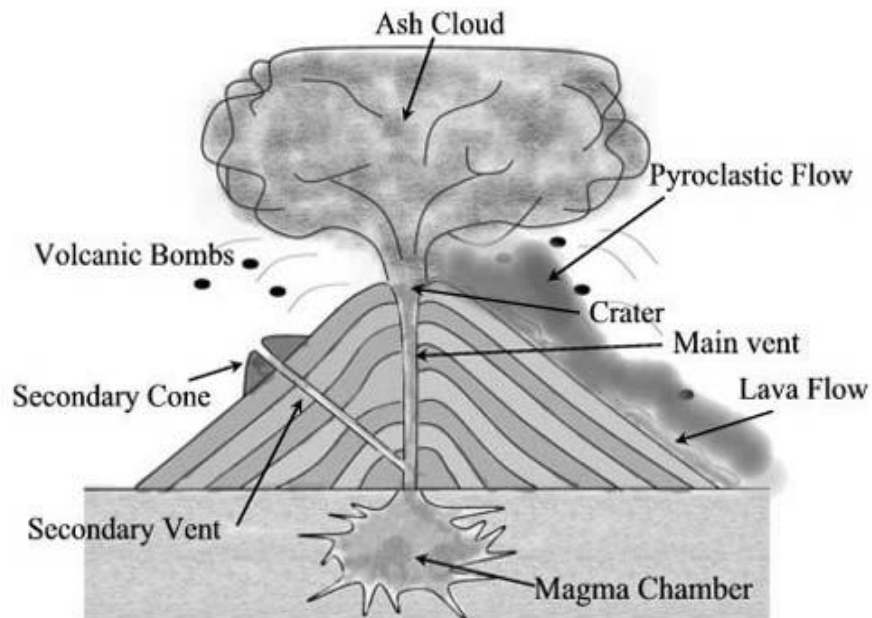
Subsidence or surface depressions result from the settling of loose or unconsolidated sediment. Subsidence occurs in waterlogged soils, fill, alluvium, and other materials that are prone to settle.

Tsunamis or seismic sea waves, usually generated by seismic activity under the ocean floor, cause flooding in coastal areas and can affect areas thousands of kilometers from the earthquake center.

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Volcano



Main Features of a Volcano

es

Volcanoes are perforations in the earth's crust through which molten rock and gases escape to the surface. Volcanic hazards stem from two classes of eruptions:

1. Explosive eruptions

It originates in the rapid dissolution and expansion of gas from the molten rock as it nears the earth's surface. Explosions pose a risk by scattering rock blocks, fragments, and lava at varying distances from the source.

2. Effusive eruptions

In this category material flow rather than explosions is the major hazard. Flows vary in nature (mud, ash, lava) and quantity and may originate from multiple sources. Flows are governed by gravity, surrounding topography, and material viscosity.

Hazards associated with volcanic eruptions include lava flows, falling ash and projectiles, mudflows, and toxic gases. Volcanic activity may also trigger other natural hazardous events including local tsunamis, deformation of the landscape, floods when lakes are breached or when streams and rivers are dammed, and tremor-provoked landslides.

Landslides

The term landslide includes slides, falls, and flows of unconsolidated materials. Landslides can be triggered by earthquakes, volcanic eruptions, soil saturated by heavy rains or groundwater rise, and river undercutting. Earthquake shaking of saturated soils creates particularly dangerous conditions. Although landslides are highly localized, they can be particularly hazardous due to their frequency of occurrence.

Classes of landslide include

Rockfalls, which are characterized by free-falling rocks from overlying cliffs. These often collect at the cliff base in the form of talus slopes which may pose an additional risk.

Slides and avalanches, a displacement of overburden due to shear failure along a structural feature. If the displacement occurs in surface material without total deformation it is called a slump.

Flows and lateral spreads, which occur in recent unconsolidated material associated with a shallow water table. Although associated with gentle topography, these liquefaction phenomena can travel significant distances from their origin.

The impact of these events depends on the specific nature of the landslide. Rock falls are obvious dangers to life and property but, in general, they pose only a localized threat due to their limited areal influence. In contrast, slides, avalanches, flows, and lateral spreads, often having great areal extent, can result in massive loss of lives and property. Mudflows, associated with volcanic eruptions, can travel at great speed from their point of origin and are one of the most destructive volcanic hazards.

Flooding

Two types of flooding can be distinguished: (1) land-borne floods, or river flooding, caused by excessive run-off brought on by heavy rains, and (2) sea-borne floods, or coastal flooding, caused by storm surges, often exacerbated by storm run-off from the upper watershed. Tsunamis are a special type of sea-borne flood.

a. Coastal flooding

Storm surges are an abnormal rise in sea water level associated with hurricanes and other storms at sea. Surges result from strong on-

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shore winds and/or intense low pressure cells and ocean storms. Water level is controlled by wind, atmospheric pressure, existing astronomical tide, waves and swell, local coastal topography and bathymetry, and the storm's proximity to the coast.

Most often, destruction by storm surge is attributable to:

Wave impact and the physical shock on objects associated with the passing of the wave front.

Hydrostatic/dynamic forces and the effects of water lifting and carrying objects. The most significant damage often results from the direct impact of waves on fixed structures. Indirect impacts include flooding and undermining of major infrastructure such as highways and railroads.

Flooding of deltas and other low-lying coastal areas is exacerbated by the influence of tidal action, storm waves, and frequent channel shifts.

b. River flooding

Land-borne floods occur when the capacity of stream channels to conduct water is exceeded and water overflows banks. Floods are natural phenomena, and may be expected to occur at irregular intervals on all stream and rivers. Settlement of floodplain areas is a major cause of flood damage.

Tsunamis

Tsunamis are long-period waves generated by disturbances such as earthquakes, volcanic activity, and undersea landslides. The crests of these waves can exceed heights of 25 meters on reaching shallow water. The unique characteristics of tsunamis (wave lengths commonly exceeding 100 km, deep-ocean velocities of up to 700 km/hour, and small crest heights in deep water) make their detection and monitoring difficult. Characteristics of coastal flooding caused by tsunamis are the same as those of storm surges.

Hurricanes

Hurricanes are tropical depressions which develop into severe storms characterized by winds directed inward in a spiraling pattern toward the center. They are generated over warm ocean water at low latitudes and are particularly dangerous due to their destructive potential, large zone of influence, spontaneous generation, and erratic movement. Phenomena which are associated with hurricanes are:

Winds exceeding 64 knots (74 mi/hr or 119 km/hr), the definition of hurricane force. Damage results from the wind's direct impact on fixed structures and from wind-borne objects.

Heavy rainfall which commonly precedes and follows hurricanes for up to several days. The quantity of rainfall is dependent on the amount of moisture in the air, the speed of the hurricane's movement, and its size. On land, heavy rainfall can saturate soils and cause flooding because of excess runoff (land-borne flooding); it can cause landslides because of added weight and lubrication of surface material; and/or it can damage crops by weakening support for the roots.

Man Induced Hazards

Our environment has been the victim of all sorts of attacks. Some of these attacks are natural such as hurricanes and earthquakes. However, there are attacks that are unnatural and man - made such as wars, explosions, chemical spills, etc. These attacks usually carry with them heavy price tags as property and lives are damaged beyond full compensation and repair. Most of the environmental degradations are man induced.

4.4.1 ENVIRONMENTAL DEGRADATION

Environmental degradation is a result of socio-economical, technological and institutional activities. Degradation occurs when Earth's natural resources are depleted. These resources which are affected include:

- Water
- Air
- Soil

The degradation also impacts our:

- Wildlife
- Plants
- Animals
- Micro-organisms

Environmental degradation is a process through which the natural environment is compromised in some way, reducing biological diversity and the general health of the environment. This process can be entirely natural in origin, or it can be accelerated or caused by human activities. Many international organizations recognize environmental degradation as one of the major threats facing the planet, since humans have only been

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given one Earth to work with, and if the environment becomes irreparably compromised, it could mean the end of human existence.

Environmental degradations are based on many factors including:

- Urbanization
- Population growth
- Economic growth
- Intensification of agriculture
- Increase in energy use
- Increase in transportation

Our land, water and soil are compromised when people exhaust resources or release harmful chemicals into the air. Deforestation, wasting resources, and pollution all add to the demise of an environmentally-sound and safe planet. For example, when trees in forests are cut down in large quantities, so that more homes can be built on the land, the birds and wildlife who lived in the forest must find a new place to live. The vegetation that once grew on the land is destroyed. Trees that absorbed carbon dioxide to help the biosphere are now unable to do so. If the wood from the trees is used to make products and those products (such as paper) are later recycled, that is one hopeful aspect for the planet. However, sometimes trees are just cut down and burned. This is what is known as *slash and burn*, a practice that only destroys forests and all that live in them.

Impacts of Environmental Degradation

When factories produce harmful chemicals and toxic waste into bodies of water, humans suffer. Pesticides and fertilizers can also get into a region's water system and pollute it. Drinking water is contaminated. Some residing in third-world countries are highly effected by the degradation of our planet and these unhealthy practices cause the following:

- Illnesses
- Death in children
- Death in adults

4.5 ENVIRONMENTAL POLLUTION

Environmental *pollution* and degradation are used interchangeably by most of the people because both are concerned with the lowering of the 'quality of environment'. There are two aspects (*i*)

lowering the quality of environment, and (ii) deterioration of the quality of environment. The deterioration of environmental quality refers the magnitude or intensity of the area covered.

Environmental *pollution* means lowering of the quality of environment at local level caused by human activities for exploitation of resources. Environmental *degradation* means deteriorating the environmental quality at global, regional and local levels by both natural processes and human activities.

Notes

4.5.1 Definitions Of Pollution

Various definitions of pollution are listed hereunder:

1. According to the report of the Restoring the Quality of Our Environment, President's Science Advisory Committee, Washington, USA, pollution may be defined as "unfavourable alteration of our surroundings wholly or largely as a by-product of man's actions through direct or indirect effects of changes in energy patterns, radiation levels, chemical and physical constitution and the abundance of organisms".
2. According to D.M. Dixon (1972) pollution includes" all those activities conscious or unconscious of human beings and their domestic cattle and the result thereof, which detract in any way..... in the long-term or short-term, from enjoyment of his environment and his ability to derive full benefit there from".
3. Pollution is viewed as "the release of substances and energy as waste products of human activities which result in changes, usually harmful, within the natural environment". -*Natural Environmental Research Council (NERC), 1976*

On the basis of above definitions we may define pollution as follows:

Pollution is an undesirable change in the physical, chemical and biological characteristics of air, water and soil that may harmfully affect the life or create a potential health hazard of any living organism. Pollution is thus direct or indirect change in any component of the biosphere that is harmful to living organisms and man, affecting adversely the industrial progress, cultural and natural resources or general environment.

Activity

“The Pollution is necessary evil of all development” – Discuss.

Notes

Check Your Progress – 1

Note: a) Space is given below for your answer

b) Compare your answer with these given at the end of this unit

- 1) Environmental pollution means lowering of the of the environment.
- 2) Pollutions are of man's action.
- 3) What are types of pollutants?
- 4) Pesticide is a Pollutants.

4.6 LAND POLLUTION OR SOIL POLLUTION

Soils are infact the very heart of the life layer (the biosphere) because these represent a zone wherein plant nutrients are produced, held, maintained and are made available to plants through their roots and to the micro-organisms which live in the soils. Soil is also very important environmental attribute for human society because (i) it is the basic medium for food and timber production; (ii) it provides formation for building and roads; (iii) it is very important exhaustible natural resource because it cannot be replaced if it is destroyed or lost through excessive soil erosion caused by atmospheric activities and it is the base for the development of human civilization.

4.6.1 Definitions of Land Pollution

“The contamination of soil with excess of chemicals, fertilizers, insecticides, herbicides is known as soil pollution.” The decrease in the quality of soils either due to human activities or natural sources or by both is known as soil pollution or soil degradation. The soil pollution is caused due to soil erosion, decrease in plant nutrients, decrease in soil micro organisms, excess or deficit of moisture content, high fluctuation of temperature and lack of humas content.

4.6.2 Sources of Land Pollution

Following are the source of soil pollution.

1. *The Physical Source* of soil pollution is related to soil erosion and consequent soil degradation caused by natural and anthropogenic factors.

2. **The Biological Sources or Agents** of soil pollution include those micro-organisms and unwanted plants which degrade the quality and therefore fertility of the soils.
3. **Air-born Sources** of pollutants are infact are pollutants which are released into the atmosphere by 'human volcanoes' (chimneys of factories), automobiles, thermal power plants and domestic sources.
4. **Chemical Fertilizers and Biocides** have now become essential part of modern mechanized agriculture. Excessive use of chemical V fertilizers to boost agricultural production causes alteration in the physical and chemical properties of soils, though chemical fertilizers act as inorganic plant nutrients.
5. **Organic Phosphate Compounds** e.g. Malathions. These are used to kill insects by damaging their nerve systems.
6. **Arsenic Containing Pesticides** reach the soils and are transported to plants and thus to food grains. These chemicals cause gastric digestive problems in *humans*.

4.6.3 Effects of Land Pollution

Effects of soil pollution on human beings, animals and plants are far reaching. Since pollution degrades the quality of soils, soil pollution thus results in substantial decrease in agricultural/" production. Some forms of soil pollution even render the land unusable for crop farming. For example, soil erosion through rill and gully erosion converts the land into wasteland.

Chemical pollutants in the form of chemical fertilizers and pesticides, insecticides and herbicides after reaching the soils reach the human and animal bodies through food chains and cause various diseases and several deaths. According to an estimate about 500,000 persons die every year in the world because of insecticides and pesticides. Most of the food grains in the *USA*, mainly wheat and com, have become toxic due to these synthetic chemicals.

It is not only desirable but is also necessary to control soil pollution because the very existence of human beings and animals depends upon soils. It is very necessary not only to maintain but also to enhance the quality of soils because the supply food for billions of world human population, fodder for animals and a host of raw materials come from soils.

Activity

Identify the land pollution in your area and suggest the controlling measures.

Notes

Check Your Progress – 2

Note: a) Space is given below for your answer

b) Compare your answer with these given at the end of this unit

5) The physical source of soil pollution is related to soil

6) Excessive use of chemical fertilizers change the soil

7) Arsenic containing pesticides cause problem in humours.

4.7 AIR POLLUTION

The atmosphere is a gaseous envelope which surrounds the earth from all sides and the air is a mechanical mixture of several gases, mainly nitrogen (78.09%), oxygen (20.95%), argon (0.93%) and carbon dioxide (0.03%). Besides, other trace gases like neon, krypton, helium, hydrogen, xenon and ozone are also present. Air is very important for all types of life in the biosphere. Human life is not possible without air because man can live for a few days without water or for a few weeks without food but cannot survive even for a few minutes without air. The undesirable change in the atmosphere is known as pollution.

4.7.1 Definitions of Air Pollution

H. Perkins (1974) has defined air pollution as "the presence in the outdoor atmosphere of one or more contaminants such as dust, fumes, gas, mist, odour, smoke or vapour in quantities of characteristics and of duration such as to be injurious to human, plant or animal life and to property or which unreasonably interferes with the comfortable enjoyment of life and property." According to World Health Organisation (WHO) air pollution is defined as limited to situation in which the outdoor ambient atmosphere contains materials in concentration, which are harmful to man and his surrounding environment.

On the basis of above discussion we may define air pollution as follows: The *air pollution* is generally accomplished through the pollutants of gases and solid and liquid particles of both organic and inorganic chemical.

4.7.2 Sources of Air Pollution

Many sources of air pollution are *NATURAL SOURCES* (volcanic eruption, deflation of sands and dusts, forest or wild fires of natural

vegetation etc.) and *MAN-MADE SOURCES* (industries, urban centres, automobiles, aircrafts, agriculture, power plants etc.), A brief summary of the pollutants of natural and anthropogenic sources (man-made sources) is given below:

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1. Pollutants from Natural Sources

- a. from volcanoes: dust, ashes, smoke, carbon dioxide and other gases;
- b. from extra-terrestrial bodies: cosmic dusts, dusts produced due to collision of asteroids, meteors, comets etc. with the earth;
- c. from green plants: vapour through evapotranspiration, pollen of plant flowers, carbon dioxide from bacteria;
- d. from fungi: fungal spores, viruses,
- e. from land surface: salt spray from seas and oceans, dusts and soil particles from ground surface.

2. Pollutants from Man-made Sources

- a. gases from kitchen and domestic heating, industries, incineration of municipal and domestic garbages, automobiles, railways mostly from coal and diesel engines, aircrafts etc;
- b. solid or particulate matter from industries, mines and urban centres;
- c. radioactive substances from nuclear plants, nuclear fuel releases, nuclear explosions;
- d. heat from industries and domestic kitchen etc.

Activity

Identify the sources of air pollution in your area.

4.7.3 Effects of Air Pollution

Air pollution causes several kinds of damages to man, animals, plants and also on weather, climate and atmospheric processes. Some significant effects have been enumerated here in the following paragraphs.

1. Air pollution has very serious types of pathological effect on man. It causes several types of diseases to man.

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2. It causes obstruction to vision of pilots and have caused air craft accidents.
3. Air pollution has damaged both agricultural crops and natural plants and vegetation.
4. There has been injury to agricultural live stocks; particularly from air borne fluoride and arsenic pollution.
5. Air pollution also takes its role of buildings and other man made objects such as famous buildings, monuments and art treasures.
6. Air pollution also effects weather and climate on regional, continental or global basis.
7. The increased amount of carbon dioxide in atmosphere causes to increase the temperature of earth. It is known by the phrase 'Green house effect'. It tends to prevent the long wave radiation from earth. Thus it has atmospheric effect. The intensity of radiation will cause skin cancer.
8. The jet engines of supersonic aircraft flying at high attitude release nitrogen oxide which destroy ozone molecules. It has also atmospheric adverse effect.

Activity

List out the adverse effects of air pollution.

Check Your Progress – 3

Note: a) Space is given below for your answer

b) Compare your answer with these given at the end of this unit

- 8) What are the two major sources of air pollution?
- 9) Volcanoes are the example for pollution from Sources.
- 10) The percentage of oxygen in the atmospheric is

4.8 UNIT – END ACTIVITIES

Prepare a list of environmental hazards in your area and suggest some strategies to overcome the problems.

4.8 POINTS FOR DISCUSSION

“Industrailisation and population expositions are major causes for environmental pollution” Discuss.

4.9 ANSWER TO CHECK YOUR PROGRESS

- | | |
|---------------------------------|--------------|
| 1. Quality | 6. Chemistry |
| 2. Byproduct | 7. Digestive |
| 3. Nondegradable, biodegradable | 8. Natural |
| 4. Agricultural | 9. Man-made |
| 5. Erosion | 10. 20.95% |

4.10 SUGGESTED READINGS

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UNIT – 5 ENVIRONMENTAL HAZARDS - II

STRUCTURES

- 5.1 Introduction
- 5.2 Objectives
- 5.3 Water pollution
 - 5.3.1 Definition of water pollution
 - 5.3.2 Sources of water pollution
 - 5.3.3 Effects of water pollution
- 5.4 Noise pollution
 - 5.4.1 Definition of noise pollution
 - 5.4.2 Sources of noise pollution
 - 5.4.3 Effects of noise pollution
- 5.5 Radiation pollution
 - 5.5.1 Sources of radiation pollution
- 5.6 Land pollution
 - 5.6.1 Sources of land pollution
 - 5.6.2 Adverse effects of land pollution
 - 5.6.3 Solutions for land pollution
- 5.7 Let us sum up
- 5.8 Unit – end activities
- 5.9 Points for discussion
- 5.10 Answer to check your progress
- 5.11 Suggested readings



5.1 INTRODUCTION

Over two thirds of Earth's surface is covered by [water](#); less than a third is taken up by land. As Earth's population continues to grow, people are putting ever-increasing pressure on the planet's water resources. In a sense, our oceans, [rivers](#), and other inland waters are being "squeezed" by human activities—not so they take up less room, but so their quality is reduced. Poorer water quality means **water pollution**.

We know that pollution is a *human problem* because it is a relatively recent development in the planet's history: before the 19th century Industrial Revolution, people lived more in harmony with their immediate environment. As industrialization has spread around the globe, so the problem of pollution has spread with it. When Earth's population was much smaller, no one believed pollution would ever present a serious problem. It was once popularly believed that the oceans were far too big to pollute. Today, with around 7 billion people on the planet, it has become apparent that there are limits. Pollution is one of the signs that humans have exceeded those limits.

How serious is the problem? According to the environmental campaign organization WWF: "*Pollution from toxic chemicals threatens life on this planet. Every ocean and every continent, from the tropics to the once-pristine polar regions, is contaminated.*"

5.2 OBJECTIVES

At the end of the unit, you will be able to:

- define the term Water Pollution

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- List out the categories of Water pollution
- identify the major pollutants which are responsible for the environmental pollution
- describe the nature and causes of air, water, noise, radiation pollution
- appreciate the nature of the clear environment,.
- Identify the appropriate steps to curb the evil of pollution
- Recognize the way of protecting and management of environment
- Choose the appropriate and effective strategies to preserve and restore the environment.

5.3 WATER POLLUTION

Water is the most important element in the biosphere because on one hand it is vital for the 'maintenance of all forms of life and on the other hand it helps in the movement, circulation and cycling of nutrients in the biosphere. Though water like other natural substances has self purifying capacity during recycling processes but when the amount of foreign undesirable substances added by the man to the water exceeds the tolerance level and self purifying capacity of water, it gets polluted.

5.3.1 Definitions of Water Pollution

Water pollution may be defined as 'alteration in physical, chemical and biological characteristics of water which may cause harmful effects on human and aquatic life'.

Report, 1965, Restoring the Quality of Our Environment, President's Science Advisory Committee, Washington, USA.

'Foreign materials either from natural or other sources are contaminated with water supplies and may be harmful to life, because of their toxicity, reduction of normal oxygen level of water, aesthetically unsuitable effects and spread of epidemic diseases',

-World Health Organisation (WHO), 1966

Water pollution is defined as 'a natural or induced change in the quality of water which renders it unsuitable or dangerous as regards food, human and animal Health, industry, agriculture, fishing or leisure pursuits.'

– P. Vivier, 1958

5.3.2 Sources of Water Pollution

The substances which degrade the quality of water are called water pollutants. The water pollutants are created from two basic sources e.g. (I) *Natural Sources*-of water pollutants include soil erosion, landslides, coastal and cliff erosion, volcanic eruption and decay and decomposition of plants and animals. (ii) *Anthropogenic Sources* – The anthropogenic sources of water pollution include industrial source, urban source, agricultural source, cultural source (congregation of large number of people during pilgrimage, religious fairs etc.

Urban source contributes water pollutants such as sewage, huge quantity of municipal and domestic garbages, industrial effluents from the industrial units located in the urban centres, fallout of particulate matter of automobile exhausts etc. Various types of chemicals used in the chemical fertilizers, pesticides-and herbicides etc. are the pollutants which are derived from agricultural sources.

Industrial sources pollute streams, rivers, lakes and coastal waters through industrial effluents, solid and dissolved chemical pollutants and numerous metals. In brief there are two main sources of water pollution as follows: 1. *Natural Sources*: Of water pollutants include soil erosion, volcanic eruption, landslides, coastal and cliff erosion, floods, decomposition of plants and animals. 2. *Man-induced Sources*: Of water pollutants include industrial development, urbanization, agricultural sources, cultural sources (*religious fairs and pilgrimage*) *Kumbha fair* at Allahabad and ‘Mahamaham’ at Kumbakonam are the best example of cultural source of water pollution. The main sources of water pollution are:

- (i) Sewage and water in cities,
- (ii) Industrial effluents and waste products,
- (iii) Agricultural discharge, chemical fertilizers used and
- (iv) Thermal power plants and nuclear plants waste.

Activity

Identify the different sources of water pollution in your area.

5.3.3 Effect of Water Pollution

Water is being used by man for cooking, drinking, bathing, disposal of sewage, irrigation, generating electricity in power plants, cooling agent in industry and for the disposal of industrial waste. During

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this process the water hazards and ecological problems. The various effects of water pollution are as follows:

- 1) **Sewage Pollution:** The primary source of sewage pollution is the discharge of untreated sewage in water bodies, sometimes due to improper sewage. This is very common in major cities of the country. *Phosphates* are the major ingredient of most detergents. They favour the luxuriant growth of algae which form water blooms. This extensive algal growth also consumes most of the available oxygen from water. This decrease in O₂ level becomes detrimental to growth of other organisms which produces a foul smell upon decay.
- 2) **Industrial Effluents:** A wide variety of both, inorganic and organic pollutants are present in effluents from breweries, tanneries, dying textiles, paper and pulp mills, steel industries, mining operations etc. The pollutants include oils, greases, plastics, plasticizers, metallic wastes, suspended solids, phenols, toxins, acids, salts, dyes, cyanides, DOT, etc. many of which are not readily susceptible to degradation and thus cause serious pollution problems.
- 3) **Thermal Pollution:** The two chief pollutants are heat and radioactive substances. These are the wastes chiefly from power plants-thermal and nuclear, which use large quantities of water. Some other industries also give our waste after use. Nuclear power plants are the source of radio nuclides.
- 4) **Agricultural Discharges:** It is another kind of water pollution. These include chiefly the chemicals used as fertilisers and the pesticides (biocides) used in disease control. Their discharges reach not the water bodies. As compared to developed nations, India has relatively a low use of these chemicals, thus discharges into water are still low. India uses about 16 kg/ha of fertilisers. The other sources of water pollution are as follows:
 - Ground water pollution by septic tanks, seepage pits etc.
 - Marine water pollution: On their way rivers receive huge quantity of sewage, garbage, agricultural discharge, biocides and heavy metals.
 - Mercury pollution: It is through industrial effluents. It is responsible for smallpox epidemic.
 - Lead pollution: The main source of lead pollution is the industrial effluents. It causes the damage to liver and kidney.

- Fluoride Pollution : It is naturally present in water. The arid and semi-arid soils are due to fluoride contents. It causes the bone diseases.

Activity

List out the effects of water pollution in your area.

Notes

Check Your Progress-1

Note: a) Space is given below for your answer

b) Compare your answer with these given at the end of this unit

- 1) Sewage is the sources of water pollution.

Write 'True' or 'False'

- 2) Agricultural discharge cause water pollution.
- 3) Thermal power plants cause water pollution.
- 4) Biodegradable pollutants are also known as pollutants.

5.4 NOISE POLLUTION

Sound is a special type of pressure wave which is usually transmitted through air (also through solids and liquids but with very low intensity) and is received by the receiving mechanism, the hearing apparatus (ear). In other words, 'sound, the form of energy giving the sensation of hearing, is produced by longitudinal mechanical waves in matter including solid, liquid and gas and transmitted by oscillation of atoms and molecules of matter. The intensity of sound waves, measured in watts per square meter (w/m^2), is the flow of energy per unit time ($second^{-1}$) through a unit area to the area perpendicular to the direction of propagation of waves' (K.P. Singh and S. Sinha, 1983).

5.4.1 Definition of Noise Pollution

Encyclopedia American defines noise as "Noise by definition unwanted sound, what is pleasant to some ears may be extremely unpleasant to others, depending on a number of psychological factors". Thus noise as pollutant produces contaminated environment which becomes a nuisance and affects the health of a person, his activities and mental abilities. Hence, "Noise pollution is unwanted sound 'dumped' into the atmosphere notwithstanding the adverse effects, it may have on living and non-living things." Noise pollution may be defined as the state

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of discomfort and restlessness caused to humans by unwanted high intensity sound known as noise. Thus noise is the main pollutant of noise pollution which may be both natural and artificial. Natural noise pollution results from natural sources such as cloud thunder; high intensity rainfall, hailstorms, waterfalls etc. It may be widespread, sporadic, frequent or rare.

5.4.2 Sources of Noise Pollution

The sources of noise pollution are divided into three categories viz–

- a. **Natural Sources:** such as cloud thunder high velocity wind such as hurricanes, gales, thunderstorms; high intensity rainfall; hailstorm; waterfalls, surf currents, etc.
- b. **Biological Sources:** e.g. sounds of varying intensities of wild and tame animals such as roars of lions in circus cages. Street dogs are perpetual sources of noise pollution in rural areas. Similarly, jackals cause noise pollution in the neighborhood of villages and fringes in urban areas. Man also creates different types of sounds and noise such as during laughing, crying, singing, weeping, quarrelling etc.
- c. **Artificial sources** e.g. noise created .by man through his activities and creations such as musical instruments, automobiles, aircraft's, factories etc.

Activity

Identify the sources of Noise pollution in your area.

5.4.3 Effects of Noise Pollution

- i) **General Effects: General** effects of noise pollution on humans include speech interference, annoyance, sleep interference and related after effects and problems. Speech interference is generally caused by community noise. Speech interference simply means non-audibility of speech to a particular person due to loud community noise.
- ii) **Auditory Effects :** Auditory effects include the damages done to hearing mechanism in humans due to various types of noise. Noise pollution causes hearing damages in a number of ways. It has been shown that a person subjected to exposure of 2,000 cycles frequency of noise levels of 80 dB may lose his hearing ability by 15 dB in ten years. Long and continuous exposure to high intensity sounds leads to permanent loss of hearing rendering a person deaf.

- iii) **Psychological Effects:** High level noise causes many behavioural changes among humans as well as animals. Unwanted noise very often causes annoyance, irritation, and fatigue which result into low performance, low efficiency and frequent errors. Further, high frequency of high level noise and exposure of human beings for long period to such high level noise may cause tension in muscles, nervous irritability and strain and neurotic mental disorder.
- iv) **Physiological Effects:** Annoyance, irritation, anxiety, strains and stresses caused by noise pollution may cause changes in hormone content of blood which in turn may introduce changes in human bodies. Noise pollution of various sorts caused by varying levels of noise may cause high blood pressure, heart diseases, dialation of pupils of the eyes, tensing of the voluntary and involuntary muscles, diminution of gastric secretion, neuromuscular tension, nervousness, stomach and intestinal diseases such as ulcer etc.

Activity

Describe the way of controlling noise pollution.

Check Your Progress – 2

Note: a) Space is given below for your answer

b) Compare your answer with these given at the end of this unit

- 5) Unwanted sound causes pollution.
- 6) Hurricanes, thunderstorms are the examples for sources of noise pollution.
- 7) Sounds of wild and tame animals cues are the example for sources of noise pollution.

Write true or false

- 8) Noise pollution causes hearing damages.

5.5 RADIATION POLLUTION

Radioactive pollution is the product of rapid development of science and technology, which is much more harmful-than any other form of pollution. Radioactive substances are most toxic, as compared to organic poisons which have the harmful and injurious effects. Nuclear war materials, test explosions, great rush for power plants and radio-isotope use in medicines, industry and research are the main sources of

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radioactive pollution that could threaten or degrade the quality of environment.

5.5.1 Sources of Radiation Pollution

1. **Natural Processes in Rocks and Soil Sources**-Such as radium, uranium, thorium, potassium, carbon, etc.
2. **Human Activities**. Sources from atomic bomb, nuclear reactors and other radiation sources-radio isotopes such as iodine, strontium, plutonium, cobalt, cesium, etc. A few. radio-isotopes are concerned with. Environmental pollution such as argon, cobalt, cesium, iodine, krypton, strontium and plutonium and plutonium.

With biotic communities and ecosystem, the radioactive elements may become accumulated or dispersed, depending upon the biological activity of the element and period of radio-activity of the isotope. These are absorbed by plants, ingested by animals which are deposited in bone tissues close to blood forming tissues and it can then be passed on to humans through milk and non-vegetarian food.

The isotopes are accumulated in human tissues as well as those of plants and animals. The isotopes in human tissues cause serious health hazards to man. Man's radiation exposure from artificial sources is already sufficient to produce serious disease problems such as bone tumors, genetic damage and infant mortality.

Activity

List out the adverse effects of radiation pollution

5.6 LAND POLLUTION

Land pollution, in other words, means degradation or destruction of earth's surface and soil, directly or indirectly as a result of human activities. Anthropogenic activities are conducted citing development, and the same affects the land drastically, we witness land pollution; by drastic we are referring to any activity that lessens the quality and/or productivity of the land as an ideal place for agriculture, forestation, construction etc. The degradation of land that could be used constructively in other words is land pollution.

Land Pollution has led to a series of issues that we have come to realize in recent times, after decades of neglect. The increasing numbers of barren land plots and the decreasing numbers of forest cover is at an alarming ratio. Moreover the extension of cities and towns due to

increasing population is leading to further exploitation of the land. Landfills and reclamations are being planned and executed to meet the increased demand of lands. This leads to further deterioration of land, and pollution caused by the land fill contents. Also due to the lack of green cover, the land gets affected in several ways like soil erosion occurs washing away the fertile portions of the land. Or even a landslide can be seen as an example.

5.6.1 Sources of Land Pollution

Below are the sources of land pollution:

1. **Deforestation and soil erosion:** Deforestation carried out to create dry lands is one of the major concerns. Land that is once converted into a dry or barren land, can never be made fertile again, whatever the magnitude of measures to redeem it are. Land conversion, meaning the alteration or modification of the original properties of the land to make it use-worthy for a specific purpose is another major cause. This hampers the land immensely. Also there is a constant waste of land. Unused available land over the years turns barren; this land then cannot be used. So in search of more land, potent land is hunted and its indigenous state is compromised with.
2. **Agricultural activities:** With growing human population, demand for food has increased considerably. Farmers often use highly toxic fertilizers and pesticides to get rid off insects, fungi and bacteria from their crops. However with the overuse of these chemicals, they result in contamination and poisoning of soil.
3. **Mining activities:** During extraction and mining activities, several land spaces are created beneath the surface. We constant hear about land caving in; this is nothing but nature's way of filling the spaces left out after mining or extraction activity.
4. **Overcrowded landfills:** Each household produces tonnes of garbage each year. Garbage like aluminum, plastic, paper, cloth, wood is collected and sent to the local recycling unit. Items that cannot be recycled become a part of the landfills that hampers the beauty of the city and cause land pollution.
5. **Industrialization:** Due to increase in demand for food, shelter and house, more goods are produced. This resulted in creation of more waste that needs to be disposed of. To meet the demand of the growing population, more industries were developed which led to deforestation. Research and development paved the way for modern

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fertilizers and chemicals that were highly toxic and led to soil contamination.

6. **Construction activities:** Due to urbanization, large amount of construction activities are taking place which has resulted in large waste articles like wood, metal, bricks, plastic that can be seen by naked eyes outside any building or office which is under construction.
7. **Nuclear waste:** Nuclear plants can produce huge amount of energy through nuclear fission and fusion. The left over radioactive material contains harmful and toxic chemicals that can affect human health. They are dumped beneath the earth to avoid any casualty.
8. **Sewage treatment:** Large amount of solid waste is leftover once the sewage has been treated. The leftover material is sent to landfill site which end up in polluting the environment (Conserve Energy Future, 2009).

5.6.2 Adverse Effects of Land Pollution

1. **Soil pollution:** Soil pollution is another form of land pollution, where the upper layer of the soil is damaged. This is caused by the overuse of chemical fertilizers, soil erosion caused by running water and other pest control measures; this leads to loss of fertile land for agriculture, forest cover, fodder patches for grazing etc.
2. **Change in climate patterns:** The effects of land pollution are very hazardous and can lead to the loss of ecosystems. When land is polluted, it directly or indirectly affects the climate patterns.
3. **Environmental Impact:** When deforestation is committed, the tree cover is compromised on. This leads to a steep imbalance in the rain cycle. A disturbed rain cycle affects a lot of factors. To begin with, the green cover is reduced. Trees and plants help balance the atmosphere, without them we are subjected to various concerns like Global warming, the green house effect, irregular rainfall and flash floods among other imbalances.
4. **Effect on human health:** The land when contaminated with toxic chemicals and pesticides lead to problem of skin cancer and human respiratory system. The toxic chemicals can reach our body through foods and vegetables that we eat as they are grown in polluted soil.
5. **Cause Air pollution:** Landfills across the city keep on growing due to increase in waste and are later burned which leads to air pollution. They become home for rodents, mice etc which in turn transmit diseases.

6. **Distraction for Tourist:** The city loses its attraction as a tourist destination as landfills do not look good when you move around the city. It leads to a loss of revenue for the state government.
7. **Effect on wildlife:** The animal kingdom has suffered mostly in the past decades. They face a serious threat with regards to loss of habitat and natural environment. The constant human activity on land, is leaving it polluted; forcing these species to move further away and adapt to new regions or die trying to adjust. Several species are pushed to the verge of extinction, due to no homeland.

Other issues that we face include increased temperature, unseasonal weather activity, acid rains etc. The discharge of chemicals on land, makes it dangerous for the ecosystem too. These chemicals are consumed by the animals and plants and thereby make their way in the ecosystem. This process is called bio magnification and is a serious threat to the ecology (Conserve Energy Future,2009).

5.6.3 Solutions for Land Pollution

1. Make people aware about the concept of Reduce, Recycle and Reuse.
2. Reduce the use of pesticides and fertilizers in agricultural activities.
3. Avoid buying packaged items as they will lead to garbage and end up in landfill site.
4. Ensure that you do not litter on the ground and do proper disposal of garbage.
5. Buy biodegradable products.
6. Do Organic gardening and eat organic food that will be grown without the use of pesticides.
7. Create dumping ground away from residential areas.

5.7 LET US SUM UP

In this second unit you have learnt in detail about the various environmental hazards. Definitions, causes and adverse effects of land, air, water, noise and radiation pollution are also learnt by you in detail. You have identified the reason for the extinction of flora and fauna. Various measures to conserve flora and fauna are studied. The most important issues like desertification or deforestation, ozone depletion and soil erosion are learnt by you. Hope you might have realized the urgent need for the preservation of the environment.

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5.8 UNIT – END ACTIVITIES

Prepare a list of environmental hazards in your area and suggest some strategies to overcome the problems.

5.9 POINTS FOR DISCUSSION

“Industrailisation and population exploitations are major causes for environmental pollution” Discuss.

5.10 ANSWER TO CHECK YOUR PROGRESS

1. Man Made
2. True
3. True
4. Organic
5. Noise
6. Natural
7. Biological
8. True

5.11 SUGGESTED READINGS

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UNIT – VI ENVIRONMENTAL ISSUES

*Environmental
Issues*

STRUCTURES

Notes

- 6.1 Introduction
- 6.2 Objectives
- 6.3 Meaning of global warming
 - 6.3.1 Issues related to global warming
- 6.4 Greenhouse effect
- 6.5 Acid rain
 - 6.5.1 Problems related to acid rain
- 6.6 ozone layer depletion
 - 6.6.1 Effect of ozone layer depletion
- 6.7 Meaning of biodiversity
 - 6.7.1 Threats to bio diversity
- 6.8 Evaluation
- 6.9 Let us sum up
- 6.10 Unit – end activities
- 6.11 Points for discussion
- 6.12 Suggested readings



Environmental issues are harmful effects of human activity on the biophysical environment. Environmentalism, a social and environmental movement, addresses environmental issues through advocacy, education and activism.

6.1 INTRODUCTION

Environmental issues are harmful effects of human activity on the biophysical environment. Major environmental issues are forest and agricultural degradation of land, resource depletion (water, mineral, forest, sand, rocks etc.), environmental degradation, public health, loss of biodiversity, loss of resilience in ecosystems, livelihood security for the poor.

The major sources of environmental problems in India include;

- a. the rampant burning of fuel wood and biomass such as dried waste from livestock as the primary source of energy
- b. lack of organised garbage and waste removal services, lack of sewage treatment operations,
- c. lack of flood control and monsoon water drainage system,
- d. diversion of consumer waste into rivers,
- e. cremation practices near major rivers, and

- f. government mandated protection of highly polluting old public transport.

Moreover, air pollution, poor management of waste, growing water scarcity, falling groundwater tables, water pollution, preservation and quality of forests, biodiversity loss, and land/soil degradation are some of the major environmental issues India faces today.

*Environmental
Issues*

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6.2 OBJECTIVES

At the end of this unit, you will be able to:

- Understand the term Global warming
- Identify the issues related to Global warming
- Establish the relationship between Global warming and eco problems
- List out the green house gases.
- Analyse causes for Acid Rain.
- Define the term Bio Diversity
- Realize the threats to bio diversity.

6.3 GLOBAL WARMING - MEANING

Global Warming is the increase of Earth's average surface temperature due to effect of greenhouse gases, such as carbon dioxide emissions from burning fossil fuels or from deforestation, which trap heat that would otherwise escape from Earth.

Global warming and climate change can both refer to the observed century-scale rise in the average temperature of the Earth's climate system and its related effects, although climate change can also refer to any historic change in climate. Multiple lines of scientific evidence show that the climate system is warming. More than 90% of the additional energy stored in the climate system since 1970 has gone into ocean warming; the remainder has melted ice, and warmed the continents and atmosphere.

The observed increases in global average surface temperature and atmospheric carbon dioxide have been much faster in recent decades than the natural changes of previous millennia, and levels are now higher than at any time for hundreds of thousands of years prior. Global warming is already having significant and harmful effects on our communities, our

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health, and our climate. Sea level rise is accelerating. The number of large wildfires is growing. Dangerous heat waves are becoming more common. Extreme storm events are increasing in many areas. More severe droughts are occurring in others.

We must take immediate action to address global warming or these consequences will continue to intensify, grow ever more costly, and increasingly affect the entire planet—including you, your community, and your family.

The good news is that we have the practical solutions at hand to dramatically reduce our carbon emissions, slow the pace of global warming, and pass on a healthier, safer world to future generations.

6.3.1 Issues Related to Global Warming

The climate is changing. The earth is warming up, and there is now overwhelming scientific consensus that it is happening, and human-induced. With global warming on the increase and species and their habitats on the decrease, chances for ecosystems to adapt naturally are diminishing.

Many are agreed that climate change may be one of the greatest threats facing the planet. Recent years show increasing temperatures in various regions, and/or increasing extremities in weather patterns.

Earth's climate is mostly influenced by the first 6 miles or so of the atmosphere which contains most of the matter making up the atmosphere. This is really a very thin layer if you think about it. In the book *The End of Nature*, author Bill McKibbin tells of walking three miles to from his cabin in the Adirondack's to buy food. Afterwards, he realized that on this short journey he had travelled a distance equal to that of the layer of the atmosphere where almost all the action of our climate is contained.

In fact, if you were to view Earth from space, the principle part of the atmosphere would only be about as thick as the skin on an onion! Realizing this makes it more plausible to suppose that human beings can change the climate. A look at the amount of greenhouse gases we are spewing into the atmosphere makes it even more plausible.

Adverse Effects of Global warming

Accelerating Sea Level Rise Global warming is accelerating the rate of sea level rise and dramatically increasing coastal flooding risks, especially on the U.S. East Coast and Gulf of Mexico.

Longer and More Damaging Wildfire Seasons Wildfires are increasing and wildfire season is getting longer in the Western U.S. as temperatures rise.

More Frequent and Intense Heat Waves Dangerously hot weather is already occurring more frequently than it did 60 years ago.

Costly and Growing Health Impacts Climate change has significant implications for our health, including increased air pollution and a longer and more intense allergy season.

Heavier Precipitation and Flooding As temperatures increase, more rain falls during the heaviest downpours, increasing the risk of flooding events.

Solution for Global Warming

Reduce emissions

We must significantly reduce the heat-trapping emissions we are putting into the atmosphere. As individuals, we can help by taking action to reduce our personal carbon emissions. But to fully address the threat of global warming, we must demand action from our elected leaders.

Stop deforestation

Tropical deforestation accounts for about 10 percent of the world's heat-trapping emissions. Reducing tropical deforestation can significantly lower global warming emissions and plays an integral role in a comprehensive long-term solution to global warming.

Fight misinformation

Why has it been so difficult to achieve meaningful solutions to global warming? Media pundits, partisan think tanks, and special interest groups raise doubts about the truth of global warming. This barrage of misinformation misleads and confuses the public — and makes it more difficult to implement effective solutions.

Prepare for impacts

Certain consequences of global warming are now inevitable, including sea level rise, more frequent and severe heat waves, and growing wildfire risks. Even as we work to reduce global warming emissions, we must also prepare for this dangerous new reality. (Union of Concerned scientists).

ACTIVITY

List out the effect of Global warming in India.

Notes

Plan a controlling measure for this issue.

6.4 GREENHOUSE EFFECT

The greenhouse effect is a natural process that warms the Earth's surface. When the Sun's energy reaches the Earth's atmosphere, some of it is reflected back to space and the rest is absorbed and re-radiated by greenhouse gases.

The greenhouse effect is a process by which thermal radiation from a planetary surface is absorbed by atmospheric greenhouse gases, and is re-radiated in all directions. Since part of this re-radiation is back towards the surface and the lower atmosphere, it results in an elevation of the average surface temperature above what it would be in the absence of the gases.

Stepwise Process of Greenhouse effect.

Step 1: Solar radiation reaches the Earth's atmosphere - some of this is reflected back into space.

Step 2: The rest of the sun's energy is absorbed by the land and the oceans, heating the Earth.

Step 3: Heat radiates from Earth towards space.

Step 4: Some of this heat is trapped by greenhouse gases in the atmosphere, keeping the Earth warm enough to sustain life.

Step 5: Human activities such as burning fossil fuels, agriculture and land clearing are increasing the amount of greenhouse gases released into the atmosphere.

Step 6: This is trapping extra heat, and causing the Earth's temperature to rise.

Thus the greenhouse effect is a natural process that warms the Earth's surface. When the Sun's energy reaches the Earth's atmosphere, some of it is reflected back to space and the rest is absorbed and re-radiated by greenhouse gases. Greenhouse gases include water vapour, carbon dioxide, methane, nitrous oxide, ozone and some artificial chemicals such as chlorofluorocarbons (CFCs).

The absorbed energy warms the atmosphere and the surface of the Earth. This process maintains the Earth's temperature at around 33 degrees Celsius warmer than it would otherwise be, allowing life on Earth to exist.

What is Enhanced greenhouse effect?

The problem we now face is that human activities – particularly burning fossil fuels (coal, oil and natural gas), agriculture and land clearing – are increasing the concentrations of greenhouse gases. This is the enhanced greenhouse effect, which is contributing to warming of the Earth.

6.4.1 GREEN HOUSE GASES

Many chemical compounds found in the Earth's atmosphere act as "greenhouse gases." These gases allow sunlight to enter the atmosphere freely. When sunlight strikes the Earth's surface, some of it is reflected back towards space as infrared radiation (heat). Greenhouse gases absorb this infrared radiation and trap the heat in the atmosphere. Over time, the amount of energy sent from the sun to the Earth's surface should be about the same as the amount of energy radiated back into space, leaving the temperature of the Earth's surface roughly constant.

A greenhouse gas (sometimes abbreviated GHG) is a gas in an atmosphere that absorbs and emits radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. Greenhouse gases that are not naturally occurring include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphurhexafluoride (SF₆), which are generated in a variety of industrial processes. Water vapour is the most abundant greenhouse gas. However, human activities have little direct impact on its concentration in the atmosphere. In contrast, we have a large impact on the concentrations of carbon dioxide, methane and nitrous oxide. The figure no 4.1 illustrates the green house gases.

ACTIVITY

India's population growth adds pressure to environmental issues and its resources. - Discuss

Notes

Greenhouse gases	Chemical formula	Pre-industrial concentration	Concentration in 1994	Atmospheric lifetime (years) ^{***}	Anthropogenic sources	Global warming potential (GWP) [*]
Carbon-dioxide	CO ₂	278 000 ppbv	358 000 ppbv	Variable	Fossil fuel combustion Land use conversion Cement production	1
Methane	CH ₄	700 ppbv	1721 ppbv	12,2 +/- 3	Fossil fuels Rice paddies Waste dumps Livestock	21 ^{**}
Nitrous oxide	N ₂ O	275 ppbv	311 ppbv	120	Fertilizer industrial processes combustion	310
CFC-12	CCl ₂ F ₂	0	0,503 ppbv	102	Liquid coolants. Foams	6200-7100 ^{****}
HCFC-22	CHClF ₂	0	0,105 ppbv	12,1	Liquid coolants	1300-1400 ^{****}
Perfluoromethane	CF ₄	0	0,070 ppbv	50 000	Production of aluminium	6 500
Sulphur hexa-fluoride	SF ₆	0	0,032 ppbv	3 200	Dielectric fluid	23 900

Note : pptv= 1 part per trillion by volume; ppbv= 1 part per billion by volume, ppmv= 1 part per million by volume

Gases that trap heat in the atmosphere are called greenhouse gases. Some of the Greenhouse gases are as follows;

Carbon dioxide (CO₂) : Carbon dioxide enters the atmosphere through burning fossil fuels (coal, natural gas and oil), solid waste, trees and wood products, and also as a result of certain chemical reactions (e.g., manufacture of cement). Carbon dioxide is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.

Methane (CH₄) : Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.

Nitrous oxide (N₂O) : Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.

Fluorinated gases: Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for stratospheric ozone-depleting substances (e.g., chlorofluorocarbons, hydrochlorofluorocarbons, and halons). These gases are typically emitted in smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as *High Global Warming Potential gases* ("High GWP gases").

Each gas's effect on climate change depends on three main factors:

1) How much of these gases are in the atmosphere?

Concentration, or abundance, is the amount of a particular gas in the air. Larger emissions of greenhouse gases lead to higher concentrations in the atmosphere. Greenhouse gas concentrations are measured in parts per million, parts per billion, and even parts per trillion. One part per million is equivalent to one drop of water diluted into about 13 gallons of liquid (roughly the fuel tank of a compact car). To learn more about the increasing concentrations of greenhouse gases in the atmosphere, visit the Causes of Climate Change and the Climate Change Indicators Atmospheric Concentrations of Greenhouse Gases pages.

2) How long do they stay in the atmosphere?

Each of these gases can remain in the atmosphere for different amounts of time, ranging from a few years to thousands of years. All of these gases remain in the atmosphere long enough to become well mixed, meaning that the amount that is measured in the atmosphere is roughly the same all over the world, regardless of the source of the emissions.

3) How strongly do they impact global temperatures?

Some gases are more effective than others at making the planet warmer and "thickening the Earth's blanket."

For each greenhouse gas, a Global Warming Potential (GWP) has been calculated to reflect how long it remains in the atmosphere, on average, and how strongly it absorbs energy. Gases with a higher GWP absorb more energy, per pound, than gases with a lower GWP, and thus contribute more to warming Earth.

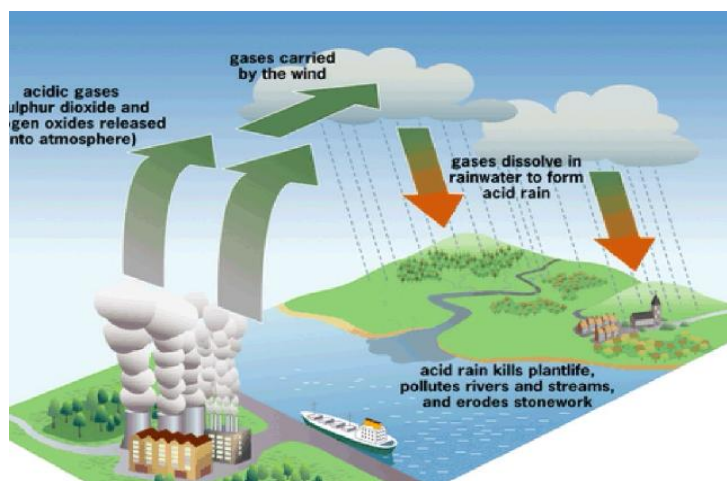
ACTIVITY

How would you educate your students about the issues related to Greenhouse gases? Prepare a plan of action.

Notes

Notes

6.5 ACID RAIN



Acid rain is a rain or any other form of precipitation that is unusually acidic, meaning that it possesses elevated levels of hydrogen ions (low pH). It can have harmful effects on plants, aquatic animals and infrastructure. Acid rain is caused by emissions of sulfur dioxide and nitrogen oxide, which react with the water molecules in the atmosphere to produce acids. Governments have made efforts since the 1970s to reduce the release of sulfur dioxide into the atmosphere with positive results. Nitrogen oxides can also be produced naturally by lightning strikes and sulfur dioxide is produced by volcanic eruptions. The chemicals in acid rain can cause paint to peel, corrosion of steel structures such as bridges, and erosion of stone statues.

What is Acid Rain?

Acid rain is a result of air pollution. When any type of fuel is burnt, lots of different chemicals are produced. The smoke that comes from a fire or the fumes that come out of a car exhaust don't just contain the sooty grey particles that you can see - they also contains lots of invisible gases that can be even more harmful to our environment.

Power stations, factories and cars all burn fuels and therefore they all produce polluting gases. Some of these gases (especially nitrogen oxides and sulphur dioxide) react with the tiny droplets of water in clouds to form sulphuric and nitric acids. The rain from these clouds then falls as very weak acid - which is why it is known as "acid rain".

How acidic is acid rain?

Acidity is measured using a scale called the pH scale. This scale goes from 0 to 14. 0 is the most acidic and 14 is the most alkaline

(opposite of acidic). Something with a pH value of 7, we call neutral, this means that it is neither acidic nor alkaline.

Very strong acids will burn if they touch your skin and can even destroy metals. Acid rain is much, much weaker than this, never acidic enough to burn your skin.

Rain is always slightly acidic because it mixes with naturally occurring oxides in the air. Unpolluted rain would have a pH value of between 5 and 6. When the air becomes more polluted with nitrogen oxides and sulphur dioxide the acidity can increase to a pH value of 4. Some rain has even been recorded as being pH2.

The Effects of Acid Rain

Acid rain can be carried great distances in the atmosphere, not just between countries but also from continent to continent. The acid can also take the form of snow, mists and dry dusts. The rain sometimes falls many miles from the source of pollution but wherever it falls it can have a serious effect on soil, trees, buildings and water.

Forests all over the world are dying, fish are dying. In Scandinavia there are dead lakes, which are crystal clear and contain no living creatures or plant life. Many of Britain's freshwater fish are threatened, there have been reports of deformed fish being hatched. This leads to fish-eating birds and animals being affected also. Is acid rain responsible for all this? Scientists have been doing a lot of research into how acid rain affects the environment from the sun. The UV rays influence the body in many ways. One of its beneficial effects is the formation of vitamin D in the skin. UV radiation also causes ageing of the skin and skin cancer. It influences the immune system by suppressing the immune defense against tumors.

It is estimated that with a decrease in 1 per cent of ozone, there will be 3 per cent increase in non-melanoma skin cancer. UV rays may also increase the incidence of diseases like measles, chickenpox and other viral diseases affecting the skin by inducing rash, bacterial infections like tuberculosis and leprosy and fungal infections. UV radiation has also been found to damage the eye by the formation of cataracts.

Notes

6.6 OZONE LAYER DEPLETION

The ozone layer is a very thin protective layer in the stratosphere through constituting less than 1 ppm of the gases in the atmosphere, it absorbs most of the ultraviolet rays. In 1985, atmosphere scientists of the British Antarctic survey came out with a starting report indicating the vast depletion of ozone in the atmosphere over the Halley Bay in Antarctica. According to the report, between 1977 and 1984 more than 40 per cent of the ozone layer had decreased. It was found that the ozone depletion or the ozone hole was wider than the continent and extended about 12-24 kms in altitude. The concentration of ozone is decreasing at a rate of 0.3 per cent every year. At this rate all life on earth may come to an end within 60 years. A similar hole was also noticed over the thickly populated northern hemisphere. In 1988, under the Montreal Protocol developed countries agreed to eliminate 90 per cent of the ozone depleting substances by 2000.

What Causes Ozone Depletion?

It has been found that the Chemical Chlorofluoro Carbon (CFC) is one of the main destroyers of the ozone layer. The chlorofluoro carbons are made up of chlorine, fluorine and carbon. When the CFC was first introduced in the 1930s, it was called a miracle gas because of its non-poisonous, non-inflammable and highly stable nature. It was soon put to a variety of uses like coolants in refrigerators and air-conditioners, as propellants in aerosol sprays, in blowing plastic foams and as cleansers for electronic parts in computer circuits. The chlorine atom in the CFC disturbs the equilibrium in the formation and destruction of ozone. Chlorine acts like a catalyst and it does not get destroyed in the process. One CFC molecule can destroy 1,00,000 molecules of ozone. The CFC released into the atmosphere finds its way into the stratosphere and remains there.

When the chlorine atom in the CFC collides with an ozone molecule, it splits up the ozone molecule into oxygen, forming chlorine monoxide (ClO). When this chlorine monoxide radical collides with an oxygen atom, it forms an oxygen molecule and a free chloride is given out. This free chlorine collides with a fresh ozone molecule and the reaction continues. It is estimated that 100 grammes of CFC CAN destroy about 3.5 tonnes of ozone. The approximate annual release of CFC is 1.1 million tonnes.

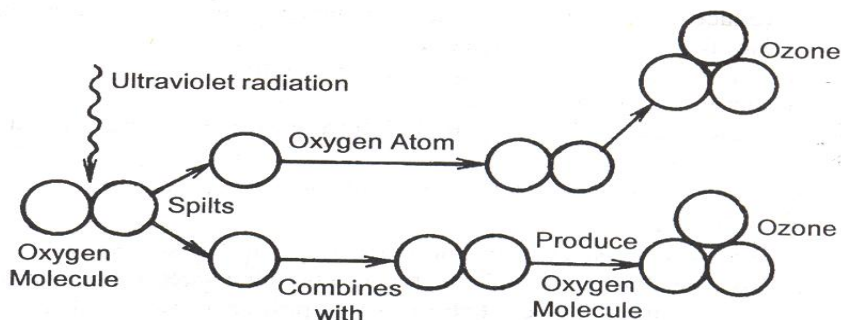


Fig.1 : Ozone Formation

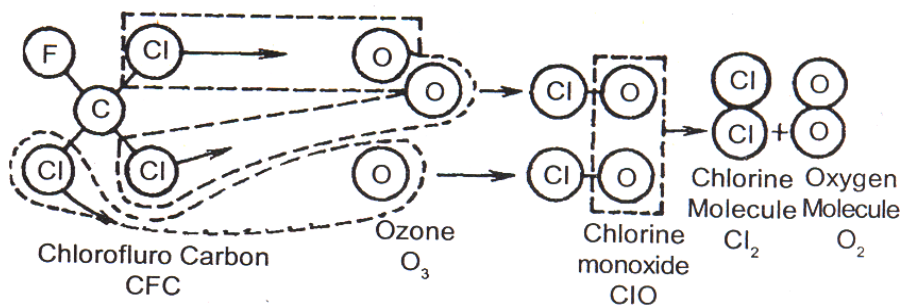


Fig. 2 : Ozone Destruction

ACTIVITY

Collect the photographs of ozone layer destruction.

Check Your Progress I

Note: a) Space is given below for your answer

b) Compare your answer with these given at the end of this unit

- 1) What you mean by *High Global Warming Potential gases* ("High GWP gases")?
- 2) What is QWP?
- 3) Write True or False: Greenhouse gases include water vapour
- 4) 100 gms of CFC can destroy abouttonnes of ozone

Notes

6.7 BIO DIVERSITY

India is one of the twelve mega bio-diversity centers in the world. Currently available data place India in the tenth position in the world and fourth in the Asia in plant diversity. In terms of number of mammalian species, the country ranks tenth in the world and in terms of the endemic species of higher vertebrates, it ranks eleventh. It stands seventh in the world for the number of species contributed to agriculture and animal husbandry.

From about 70 percent of the geographical area surveyed so far, 46,000 plant species and 81,000 animal species have been recorded by the Botanical Survey of India (BSI) and the Zoological Survey of India (ZSI), respectively. These life forms, besides their ecological and intrinsic value, represent a considerable socioeconomic and monetary asset value as these are actually and potentially important for developments in the fields of food, medicine, textiles, energy, recreation and tourism. The areas yet to be surveyed include the inaccessible Himalayan areas, Andaman & Nicobar Islands and Exclusive Economic Zone, which are expected to be rich repositories of endemic and other species.

The biodiversity in forests, grasslands, wetlands and mountains, deserts and marine ecosystems is subject to many pressures. One of the major causes of the loss of biological diversity has been the depletion of vegetative cover in order to expand agriculture. Since most of the biodiversity rich forests also contain the maximum mineral wealth, and also the best sites for water impoundment, mining and development projects in such areas have often led to destruction of habitats. Poaching and illegal trade of wildlife, products too, have adversely affected biodiversity.

6.7.1 Definition of Biodiversity

According to the convention on Biological diversity signed at Rio Earth summit in 1992, "biodiversity is the variability among the living organisms from all sources including the terrestrial, marine and other aquatic eco systems and ecological complexes of which they are part - this includes diversity, within species, between the species of the ecosystem".

The World Wildlife Fund (1989) defines biological diversity as 'the millions of plants, animals, and microorganisms, the genes they contain and the intricate ecosystems they help build into the living environment It can be considered in the following levels: Genetic

Biodiversity, Species Biodiversity, Ecosystem Biodiversity, Domesticated Biodiversity and Micro-organism Diversity.

*Environmental
Issues*

Thus biodiversity or biological diversity refers to the range of variability among the living organisms on the earth. It includes diversity within species and between the species.

Notes

6.7.2 Types of Biodiversity

There are different types of biodiversity of which the following are the important ones.

- (i) Genetic Diversity
- (ii) Species Diversity
- (iii) Ecosystem Diversity

i) Genetic Diversity

Genetic diversity is otherwise known as diversity within species. It refers to the variation of genes within species. The genes are the basic units of hereditary information. For instance, 'tallness' is characterized by some genes; similarly some genes are responsible for 'dwarfness'. The skin colour, hair colour and texture, height etc. are determined by the genes. Changes in these genes cause new characteristic features among the organisms. It results in variation. These variation- of genes within species are known as genetic diversity. For example within rice, lot of varieties are present. Similarly each and every species has a number of variations. India is considered as one of the 12 centres of genetic diversity in the world. It has been reported that the total Indian flora consists of about 45,000 species, of which about 3000 are nonflowering plants and about 15,000 species are flowering plants.

ii) Species Diversity

Species is a smallest classification unit of living organisms. For example, common cockroach is a species. Rat belongs to another species. The variation that occurs between the species we known as species diversity. Each species is distinct from other species. The species diversity is usually measured in terms of the total number of species with in a defined area. Species diversity is the most commonly used level for describing biodiversity of countries. India; Australia, Malaysia, Mexico, Indonesia, Madagascar, Zaire and Peru are the countries noted for the rich species diversity. And hence these countries are often referred as 'Mega diversity Countries'.

Notes

iii) Eco system diversity

The biotic community and its abiotic environment together represent an ecosystem. It comprises of the biotic communities mutually related with their non-living or abiotic community. The biotic communities are plants, animals and microorganisms. The abiotic components are non-living elements such as air, soil, water, minerals etc. The place or site where an organism naturally occurs is known as habitat. The diversity or variation of habitat is known as ecosystem diversity. The ecosystem diversity refers to the variety of species within different ecosystem.

Check Your progress – II

Notes: a) Space is given below for your answers

b) Compare your answers with those given at the end of this unit

- 5 Plant and animals are the examples of _____ type of resources
- 6 Diversity with the species is known as _____
- 7 The diversity or variation of habitat is known as _____
- 8 Natural resources are classified into _____ and _____ resources

Activity

Discuss the factors which affect the biodiversity.

6.8 EVALUATION

- What is Global Warming?
- Briefly explain the issues related to Global Warming.
- What are the effects of Greenhouse Gases?
- Explain the problem of Acid rain?
- List out the effects of Ozone layer depletion.
- Define the term Bio-diversity.
- Identify the threats to Bio-Diversity.

6.9 LET US SUM UP

In this unit you have studied in detail about Global Warming, Green House effects and about acid rain. Moreover, you have learnt about the Ozone layer depletion. Finally the concept of biodiversity, types of biodiversity and threats to biodiversity are also studied in detailed manner.

6.10 UNIT – END ACTIVITIES

- Describe the way in which you can control Green house effect.
- List out the practical activities for strengthening biodiversity.

6.11 POINTS FOR DISCUSSION

"High Global Warming gases are dangerous than low Global Warming gases " - Discuss.

6.12 ANSWER TO CHECK YOUR PROGRESS

- 1) Fluorinated gases are typically emitted in smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as **High Global Warming Potential gases** ("High GWP gases").
- 2) Global Warming Potential (GWP) reflects how long it remains in the atmosphere, on average, and how strongly it absorbs energy.
- 3) True
- 4) 3.5
- 5) Organic
- 6) Genetic Diversity
- 7) Ecosystem Diversity
- 8) Organic and Inorganic

Notes

6.13 SUGGESTED READINGS

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UNIT – VII ENVIRONMENTAL ISSUES IN INDIA

*Environmental Issues
in India*

STRUCTURE

Notes

- 7.1 Introduction
- 7.2 Objectives
- 7.3 Major environmental problems in India
 - 7.3.1 Land / soil degradation
 - 7.3.2 Deforestation
 - 7.3.3 Bio-diversity
 - 7.3.4 Atmospheric pollution
 - 7.3.5 Water pollution
 - 7.3.6 Solid wastes
- 7.4 Environmental policies in India
 - 7.4.1 Constitutional amendments made
 - 7.4.2 Factories act (1948) amended in 1987
 - 7.4.3 Environment conservation act 1980 (amended in 1988)
 - 7.4.4 Wildlife (protection) act, 1972 (amended in 1991)
 - 7.4.5 Water (prevention and control of pollution) act 1974 (amended in 1988)
 - 7.4.6 Air (prevention and control of pollution) act 1981 (amended in 1987)
- 7.5 Environment (protection) act, 1986
- 7.6 Environmental movements in India
 - 7.6.1 Chipko moment
 - 7.6.2 Narmadha valley project
- 7.7 Let us sum up
- 7.8 Unit – end activities
- 7.9 Points for discussion
- 7.10 Answer to check your progress
- 7.11 Suggested readings

Notes

7.1 INTRODUCTION

India has unique environmental heritage. Our country represents almost all types of habits of the world and the land mass of the country and its water bodies sustain our extremely rich variety of living organisms. It is rich in biodiversity which provides various resources for people. Nineteen percent of the land area of India is under forest cover. But the process of deforestation, indiscriminate killing of wild animals leads to instance utilization of natural resources and polluting and energy intensive industrial technology along with population explosion and poverty resulted in the depletion of environmental assets. Hence, there is an urgent need to conserve these environmental assets. The Government of India made many attempts to conserve these environmental assets through the act and various policies. In the previous unit you have learnt about the environmental hazards. In this unit we discuss about various environmental issues in India and policies' that are adopted by the government.

7.2 OBJECTIVES

At the end of the unit, you will be able to :

- identify the environmental problems in India
- understand the environmental policies in India
- appropriate the environmental movements in India
- analyse the objectives of chipko movement
- recognize the importance of Narmadha valley movement
- establishing the relationship between chipko movement and narmadha valley movement in terms of environmental protection.

7.3 ENVIRONMENTAL PROBLEMS OF INDIA

In India, environmental problems are associated with lack of economic development, poverty, population explosion, lack of environmental awareness, urabanisation and industrialization. The population explosion has created several types of problems and has affected the environment adversely. Pollution and environmental degradation are directly related to extraordinary increase in human population. Because of the pressures of a agriculture for more food industries for further development, deforestation is gaming on a very large scale resulting in soil erosion, change in climate and depletion of

natural resources. Particularly in our country, domestic sewage and industrial effluents are often dumped untreated into rivers resulting in contamination of fresh waters.

7.3.1 Land /Soil Degradation

Most of the land area in India show evidence of degradation, thus affecting the productive resource base of the economy. Out of the total geographical areas of 329 million hectares, 175 million hectares are considered degraded (Table 5.1)

Table 7.1

Soil Erosion and Land Degradation

(Million Hectares)

1.	Total geographical area	328.7
2.	Area subjected to water and wind erosion Area degraded through special problems	141.3
3.	Water logged Area	8.5
4.	Alkali soil	3.6
5.	Acid soil	4.5
6.	Saline soil including coastal sandy areas	5.5
7.	Ravines & Gullies.	4.0
8.	Area subjected to shifting cultivation	4.9
9.	Riverine & Torrnets	2.7
	Total 3 to 9	33.7

Source: State of Environment, 1995 MOEF

Erosion by water and wind is the most significant contributor to soil erosion with other factors like water logging, salination etc, While soil erosion by rain and river in hill areas causes landslides and floods, deforestation, overgrazing traditional agricultural practices, mining and incorrect siting of development projects in forest areas have resulted in opening up of these areas to heavy soil erosion. In the arid west, wind erosion causes expansion of desert, dust storms, whirlwinds and destruction of crops; while moving sand covers the land and make it

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sterile. In the plains, riverine erosion due to floods and eutrophication due to agricultural runoff are noticed. Increased dependence on intensive agriculture and irrigation also results in salination, alkalization and water logging in irrigated areas of the country. The Government strategy towards preventing land degradation include treatment of catchment areas, comprehensive watershed development, emphasis on low cost vegetative measures, survey and investigation of problem areas through remote sensing techniques, bio-mass production in reclaimed land, micro level planning and transfer of technology.

Activity:

Identify soil degradation in your area.

7.3.2 Deforestation

India has a very diverse forest vegetation ranging from the moist evergreen forests in the North-East, along the West Coast and the Andaman & Nicobar Islands to the temperate and alpine vegetation in the Himalayas. However, this forest wealth is dwindling due to overgrazing, over exploitation, encroachments, unsustainable practices, forest fire and indiscriminate sitting of development projects in the forest areas. Withdrawal of forest products, including fuel wood, timber etc., are much beyond the carrying capacity of our forests. The current annual withdrawal of fuel wood is estimated at 235 million cubic meters against a sustainable capacity of about 48 million cubic meters. The annual demand for industrial wood is about 28 million cubic meters against the production capacity of 12 million cubic meters. The area affected by forest fire range from 33 percent in West Bengal to 99 percent in Manipur.

Presently, the recorded forest area is 76.52 Million hectare which works out to 23.3 per cent of the total geographical area and actual forest cover is 63.3 million hectare, which constitutes only 19.3 per cent of the total land area, as against the National Forest Policy 1988 stipulation of a target of 33 per cent. Even within this recorded area, only 36.7 million hectare, or only 11.2 per cent of country's total land area, comprises dense forest with a crown density of more than 40 per cent, thus reflecting a qualitative decline of forests in the country (Table 5. 2).

The total forest area diverted for non-forestry purposes between 1950 and 1980 was 4.5 million hectare *i.e.* at an annual rate of 0.15 million hectare. To regulate unabated diversion of forest land for non forestry purposes, Forest (Conservation) Act, 1980 was enacted. It has resulted in reduction of diversion of forest area for non forestry purposes considerably and the present rate of diversion is 16,000 hectare annually.

The forest area in the recent past has not changed much because its diversion for non forestry purposes has been more or less compensated by afforestation and natural regeneration programmes of the Government.

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TABLE 7. 2

Forest Cover Estimates 1981-95

Period	Total Forest (Million hectare)	% of area under		
		% of Cover geographic area	Dense Forest	Open Forest
1981-83	64.08	19.5	-	-
1985-87	63.88	19.4	59.1	40.2
1987 -89	63.94	19.5	60.2	39.1
1989-91	63.94	19.5	60.2	39.1
1991-93	63.89	19.4	60.2	39.0
1993-95	63.34	19.3	58.0	41.3

Forest cover Is the sum .of dense forest plus open forest, plus mangroves forest (not shown)

Source: State of Forest Reports, FSI, MOEF.

Check Your Progress – I

Notes: a) Space is given below for your answer

b) Compare your answer with those given at the end of this unit.

- 1 Erosion by andis the most significant / contribute to soil erosion.
- 2 Write true or false
 - a) Foreign is a renewable resources
 - b) Indian has diverse forest vegetation.
3. Forest (conservation) Act was enacted in the year

Notes

7.3.3 BIO-DIVERSITY

The Country's unique phyto-geographical and agroecological diversity endows it with a wide variety of agro climatic zones that harbor a rich repository of biological resources. With only 2.4 per cent of the total land area of the world, the known bio-diversity of India contributes 8 per cent of the known global biological diversity. It is one of the twelve mega bio-diversity centers in the world. Currently available data place India in the tenth position in the world and fourth in the Asia in plant diversity. In terms of number of mammalian species, the country ranks tenth in the world and in terms of the endemic species of higher vertebrates, it ranks eleventh. It stands seventh in the world for the number of species contributed to agriculture and animal husbandry.

From about 70 percent of the geographical area surveyed so far, 46,000 plant species and 81,000 animal species have been recorded by the Botanical Survey of India (BSI) and the Zoological Survey of India (ZSI), respectively. These life forms, besides their ecological and intrinsic value, represent a considerable socioeconomic and monetary asset value as these are actually and potentially important for developments in the fields of food, medicine, textiles, energy, recreation and tourism. The areas yet to be surveyed include the inaccessible Himalayan areas, Andaman & Nicobar Islands and Exclusive Economic Zone, which are expected to be rich repositories of endemic and other species.

The biodiversity in forests, grasslands, wetlands and mountains, deserts and marine ecosystems is subject to many pressures. One of the major causes of the loss of biological diversity has been the depletion of vegetative cover in order to expand agriculture. Since most of the biodiversity rich forests also contain the maximum mineral wealth, and also the best sites for water impoundment, mining and development projects in such areas have often led to destruction of habitats. Poaching and illegal trade of wildlife, products too, have adversely affected biodiversity.

Activity

Discuss the factors which affect the biodiversity.

7.3.4 Atmospheric Pollution

Air pollution is widespread in India and regular monitoring is being carried out under the National Ambient Air Quality monitoring System. A high level of Suspended Particulate Matter (SPM) is the most prevalent form of air pollution (Table ~). High concentration of Sulphur

Dioxide (SO₂) and SPM occur in about 20 percent of the cities so monitored. High domestic use of coal or biomass fuel is still a serious problem in high human exposure to SO₂, SPM and carcinogenic agents.

The main factors contributing to urban air quality deterioration are growing industrialization and increasing vehicular pollution. It has been aggravated by developments that typically occur as countries industrialize: growing cities, increasing traffic, rapid economic development and industrial growth, all of which are closely associated with higher energy consumption. Industrial pollution is concentrated in industries like petroleum refineries, textiles, pulp and paper, industrial chemicals, iron and steel and non metallic mineral products. Small scale industries especially foundries, chemical manufacturing and brick-making are also significant polluters. In the power sector, thermal power which constitutes bulk of the installed capacity for electricity generation, is an important source of air pollution.

TABLE 7.3

Level of Air Pollution in the Metro Cities

Name of the Metro City	Levels of Air Pollution (micrograms/m ³)		
	SO ₂	Nox	SPM
1. Ahmedabad	5.4-110.9	3.6-70.0	72.4-575.4
2. Bhopal	8.1-22.0	12.2-32.4	85.0-393.3
3. Calcutta	6.0-122.0	6.0-73.1	77.3-833.3
4. Chennai	2.4-161.6	1.8-55.5	26.6-351.4
5. Coimbatore	0-8.9	0.3-19.1	2.5-133.0
6. Delhi	10.1-85.1	20.1-104.5	145.3-929.8
7. Hyderabad	5.1-70.7	7.5-124.13	59.3-458.0
8. Indore	2.6-10.2	4.4-17.4	77.0-812.0
9. Jaipur	6.1-53.7	4.0-64.3	81.6-570.1
10. Kanpur	8.2-22.4	7.7-63.0	233.7-809.2
11. Kochi	3.2-54.3	1.7-137.0	10.5-271.1
12. Lucknow	23.2-37.4	23.0-34.4	382.6-672.7

Notes

13. Mumbai	6.1-111.7	5.4-115.8	60.6-473.2
14. Nagpur	4.3-18.8	3.2-43.2	38.2-403.2
15. Patna	12.7-46.4	8.5-55.7	132.0-1307.0
16. Pune	17.1-29.0	10.1-34.0	112.0-166.5
17. Surat	22.4-304.0	10.0-135.7	81.7-1215.3
18. Varanasi	18.3-27.1	10.6-28.8	155.0-349.0
19. Visakhapatnam	5.5-80.8	5.1-92.0	46.7482.7
NAAQ/Standards	15.0-80.0	15.0-80.0	70.0-360.0
NAAQ : National Ambient Air Quality Standards			
Source: Central Pollution Control Board			

Vehicular traffic is the most important source of pollution in all the mega cities. The number of vehicles in these cities has increased manifold. This increase has been characterized by a boom in private transport. Other reasons for high vehicular pollution are two stroke engines, aged vehicles, congested traffic, poor roads and outdated automotive technologies and traffic management system. It is estimated that two / three wheelers constitute about 75 percent of the total vehicles and cause more than 50 percent of the total vehicular pollution load.

Studies by Central Pollution Control Board (CPCB), on the ambient noise levels show that noise levels in most of the big cities exceed the prescribed standards (Table 5.4). The major sources of noise are vehicles, diesel generator sets, loud speakers, construction activities and bursting of fire crackers. An attempt is being made to control the noise pollution by notifying the standards and monitor their compliance through local authorities.

The toxic nature of air pollutants and their high concentrations in many industrialized regions are posing serious concerns both in terms of human health and damage to manmade structures and to country's ecology in general.

Notes

Table 7.4								
Ambient Noise level in Cities								
Cities	Residential		Commercial		Sensitive		Industrial	
	Day	Night	Day	Night	Day	Night	Day	Night
1. Bhopal	60	44	75	57	73	42	68	47
2. Bangalore	59-79	37-59	68-81	46-64	58-74	-	63-86	42-65
3. Calcutta	76-86	58-76	70-90	57-78	69-89	65-70	15-82	53-70
4. Chennai	57-84	45-50	74-80	69-71	46-70	47-50	69- 1'6	63-69
5. Delhi	53-71	-	63-75	-	62-68	-	65-81	-
6. Dehradun	50	38	70	50	58	42	50	45
7. Hyderabad	56-73	49-50	67-84	58-73	62-78	51-67	44-71	42-70
8. Jaipur	46-82	43-78	64-88	51-80	60-75	55-66	59-81	48--78
9. Kanpur	49-69	39-59	68-82	57-76,47-61		35-57	63-78	57..63
10. Kochi	70	51	85	56	72	51	70	61
11 . Lucknow	55	50	70	58	50	40	60	58
12. Mumbai	45-81	45-68	63-81	60-75	58-77	46-66	73-79	59-72
13. Varansi	50	40	70	50	55	40	50	50
14. Vizag	74	59	85	70	75	57	75	51
Prescribed	55	4 5	65	55	50	40	75	70

Standards *

Ambient noise standards prescribed by CPCB.

Source: Central Pollution Control Board

Notes

Check Your Progress – 2

Notes: a) Space is given below for your answer

b) Compare your answer with those given at the end of this unit.

4. Botanical survey of India, identified plant services.

5. How many animal species are identified by the zoological survey of India?

6. Write True or False

a) Vehicle traffic is the most important source of pollution in village

b) SPM is the most prevalent form of air pollution

7.3.5 Water Pollution

According to an analysis of water quality over 12 years (1986-97) by CPCB, the Biochemical Oxygen Demand (BOD) values, in a sample of 4500 observations, below 3mg/l were above 60 percent during 1986 to 1991, the values gradually declined down to 54 percent in 1994-95 but rose to 58 percent in 1997. This indicates that the water quality which had gone down during 1986-91, improved during 1991-95. Similarly, there was a gradual increase in number of observations having BOD more than 6mg/l from 7 percent in 1989 to 16 percent in 1997. However, there is no significant change in the number of observations belonging to BOD range between 3 and 6 mg/l . The water quality monitoring results indicate that organic and bacterial pollution continue to be pre-dominant source of pollution in Indian aquatic resources. A large part of 'municipal sewage is' allowed to flow in untreated form to nearby receiving water bodies, thereby reducing dissolved oxygen required for supporting aquatic life, increasing the pollution load in terms of BOD and exponential increase in number of coliform bacteria, an indicator of presence of disease causing organism in water.

The ranges of water quality parameters with respect to organic and bacterial pollution as observed in 1997 indicate that out of 4531 observations taken on BOD, about 65 percent were having BOD less than 3mg/l , 21 percent 36mg/l and 14 percent more than 6mg/l . Among most of the observations taken on BOD having values less than 3mg/l , Kerala stands first and Maharashtra tops in BOD values exceeding 6mg/l . The maximum number of fecal coliform bacteria values were found in the states of Uttar Pradesh, Gujarat, Tamil Nadu and Assam. Gujarat tops in

chemical pollution followed by Maharashtra, Andhra Pradesh, Tamil Nadu, Uttar Pradesh and Punjab.

The major sources of water pollution are discharge of domestic sewage and industrial effluents which contain organic pollutants, chemicals and heavy metals and run-off from land based activities such as agriculture and mining. The major water polluting industries include fertilizers, refineries, pulp & paper, leather, metal plating and other chemical industries. Besides, non-point sources such as fertilizers and pesticides run-offs in rural areas are emerging as major cause of concern.

The rising industrial and domestic wastes have resulted in heavy stress of pollution of water bodies such as lakes, rivers, coastal areas and underground sources. A 1994 survey of groundwater quality at 138 sampling locations in 22 industrialized zones indicated that 'Water was unfit for drinking due to high bacteriological and heavy metal contamination. As per data generated by CPCB, mean B.O.D values have shown a marginal increase in all the 28 major rivers between 1979-91. Minimum and maximum coliform values have shown many fold increase over the same period indicating severe pollution.

Activity

Describe the way of controlling water pollution in your area.

7.3.6 Solid Wastes

Unregulated growth of urban areas without necessary infra-structural services and proper collection, transportation, treatment and disposal of solid wastes have resulted in increased pollution and health hazard from these wastes. Urban Municipal Wastes (MSW) is a heterogeneous mixture of paper, plastic, cloth, metal, glass, organic matter etc. generated from households, commercial establishments and markets. Based on surveys carried out, the urban MSW generated in 1997 is estimated at 48 million tonnes.

Although our current per capita waste generation is very low as compared to advanced countries, the actual quantum of waste is large owing to the enormous size of our population. Plastics wastes alone has increased tremendously over the last few years. The mode of waste disposal predominantly remains through land filling, which is a conventional but unhygienic method. Alternative modes like composting and other scientific approaches are sparsely used. An inadequate collection/disposal of such wastes pollutes and degrades land and water resources, besides being a health hazard.

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Flyash, phospho-gypsum and iron & steel slags are the main forms of industrial solid wastes generated in India. It is estimated that 35-40 million tones of flyash is generated annually by the thermal power plants of which only 2-3 percent is currently being utilized. Besides, around 5 million tones of hazardous wastes is generated annual with very little infrastructure for proper disposal of these wastes.

Check Your Progress - 3

Notes: a) Space is given below for your answer

b) Compare your answer with those given at the end of this unit.

7. Entering of domestic sewage into pond lead to the reduction of Oxygen
8. In India about percentage of all communicable diseases are water borne diseases.
9. Flyash, phspho - gypsum and iron & steel slags are main sources of wastes generated in India.

Write True or False.

10. In India, per capital waste generation is low as compared to advanced countries.

7.4 ENVIRONMENTAL POLICIES IN INDIA

To protect the environment, Indian Government resorted to certain activities like laws, seminars, camps, amendments in the constitution etc.

Lists of Acts for protection of Indian environment since 1897.

- 1847 Indian fisheries Act
- 1905 Bengal smoke Nuisance Act
- 1912 Bombay smoke Nuisance Act
- 1917 Mysore Destruction by Insects and Pests Act
- 1919 The poison Act
- 1919 Andhra Pradesh Agricultural, Pest and Discare Act
- 1923 The Indian Broilers Act
- 1927 The Indian Forest Act

- 1946 Bihar wastelands Act (Reclamation, Cultivation and Improvement)
- 1947 Mines and Minerals Act (Regulation and Development)
- 1948 The Factories Act (Pollution and Pesticides)
- 1949 Andhra Pradesh Improvements Scheme Act (Land Utilisation)
- 1951 Industries Act (Development and Regulation)
- 1953 Orissa River pollution and Prevention Act
- 1954 Assam Agricultural Pests and Disease Act
- 1954 Prevention of Food Adulteration Act
- 1955 Acquisition of land for Flood Control and prevention of Erosion Act
- 1956 River Boards Act
- 1958 Ancient Monuments and Archeological sites and Remains Act
- 1958 Kerala Agricultural Pests and Disease Act
- 1962 Atomic Energy Act (Radiation Protection Rules 1971)
- 1963 Gujarat Smoke Nuisance Act
- 1968 The Insecticides Act
- 1969 Maharashtra Prevention of Water Pollution Act
- 1970 Merchant Shipping (Amendment) Act (Harbour and Coastal Water Dumping of Oil etc.)
- 1972 Wild life protection, Act
- 1974 Water Act (Prevention and Control of Pollution)
- 1976 Urban Land Act (Ceiling and Regulation)
- 1977 Water Cess Act (Prevention and Control of Pollution)
- 1980 Forest Conservation Act
- 1981 Air Pollution Prevention and Control Act

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- 1986 Environment (Protection) Act
- 1992 Policy Statement for Abatement of Pollution by Ministry of Environment and Forests
- 1993 Environment Action plan
- 1993 High level advisory body - National environmental council
- 1994 Ratification of CBD
- 1994 MoEF as nodal agency for CBD
- 1994 EIA notification
- 1994 Consultation of biodiversity amongst SAARC, ASEAN and other developing countries
- 1997 Draft national action plan on biodiversity
- 1997 All India coordinated project in taxonomy
- 1997 National environment appellate authority Act
- 1997 MoEF/UNDP capacity 21 program
- 1997 Inter - ministerial task force to develop biosafety protocol
- 1998 GEF General assembly

7.4.1 Constitutional Amendments made

To safeguard environmental conservation, the following amendments were made in the constitutional provisions:

42nd Amendment in the constitution: The Indian constitution was amended in 1976 by late, Mrs. Indira Gandhi. According to this 42nd amendment, the problems regarding forests, wild life and environment were considered. Laws have been made and the fundamental duties imposed on every citizen of this country. Article 48-A of this section states that "the state shall endeavour to protect and improve the environment and to safeguard the forests and wild life of the country",

Article 51-A clause (g). It deals with the fundamental duties of the citizens and it states that, "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures".

Department of Environment and Forests (1972): In 1972 different departments and scientists collectively worked for the study of various environmental problems and their solutions. In January 1982 for the protection of Environment, a committee was formed which works for proper management and handling of the laws. In the recommendations of this committee in 1980, full fledged department of Environment had been started. Later this department was converted into Ministry of forests and Environment.

Activity

Discuss the relevancy of 42nd Amendment in the Constitution

7.4.2 Factoring Act (1948) Amended in 1987

Section 12, of constitution says that it is the duty of every industrialist to properly treat and manage and dispose waste in accordance to the plans made by the state Government.

1. In Section 11 of the act, cleanliness of the factories is taken into 'account. It is the duty of the factory owner to check that factory is free from any effluent.
2. Measures for any emergency in the factory.
3. Any harmful effluent producing factory should be away from habitats of human beings.
4. Limited quantity of harmful waste should be emitted.
5. Proper maintenance and check of the machineries

7.4.3 Environment conservation Act 1980 (Amended in 1988)

In 1894 a policy was made which was amended in 1952 and 1988. These amendments have now become an environment act. According to this law

1. Natural forests on the earth should not be converted into other plantation without acceptance of the Government.
2. For the conversion of land exceeding 20 hectares the acceptance of Government is necessary.
3. If one converted forest area for development project, an equal amount of area is to be planted by him.
4. Proper check on illegal land capture and crop-rotation.

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5. Encouragement to tribal community.
6. Forest planning and management should be stressed.
7. Afforestation near the hills and slopes of the hills.
8. No area should be deforested with the purpose of reforesting it.
9. The cutting of trees in the hills should not exceed 10 hectares whereas in plains it should not exceed 20 hectares.
10. Grazing should be checked.
11. Penalties for any disobedience of laws.

7.4.4 Forest (Conservation) Act, 1980 (Amended in 1988)

A forest policy was framed in 1894, revised in 1952 and then in 1988. Indian Forest Act was promulgated in 1927 with amendments in 1930, 1933 and 1948. Forest (conservation).Act was an improvement over it.

1. Diversion of forest land for non-forest purposes (including cultivation of rubber plants, palms, medicinal plants, spices, tea, coffee etc.) or conversion of a reserved forest into non-reserved one cannot occur without the prior approval of Central Government.
2. Forest land, less than 20 hectare, can be used for nonforest purposes with the approval of State Government. For more than this land, the approval of Ministry of Environment and Forests will have to be taken which will set up an advisory committee for this purpose.
3. If diversion is allowed, compensatory afforestation must be undertaken on an equivalent area of non-forest land or double the area of degraded forest.
4. A control should be exerted over shifting cultivation and encroachments.
5. Tribal rights and concessions must be highlighted along with control mechanisms.
6. All forest working plans should stress conservation and have multidisciplinary approach.
7. As per the previous Forest Act (1927), the State Government has the power to declare any forest or waste land as reserve forests where grazing and felling are not allowed. Grazing, clearing for

cultivation, erosion, maintenance of ground water and lines of communication are prohibited in reserve forests.

8. All critical areas in hills, catchment areas, steep slopes and other parts under erosion and landslides must be protected and quickly afforested. No area above 1000 m altitude should be opened for tree felling, unless and until it has fully recovered.
9. No forest area should be cleared of self grown trees and shrubs for the purpose of reforestation.
10. Clear felling blocks should not exceed a hectare in hills and 25 hectares in plains. Regeneration should be undertaken immediately.
11. Grazing problems of the area should be studied and appropriate measures adopted.

7.4.5 Wildlife (Protection) Act, 1972 (Amended in 1991)

Wildlife is living component of nature which has not been tamed by humans. It includes both plants and animals. Wildlife is essential for maintaining ecological balance, preventing soil erosion, obtaining a number of economic products, potential source for breeding improved varieties, new fodder, drugs, beverages, etc. Attempts have been made previously to protect wildlife through various legislative measures like (a) Madras Wild Elephant Preservation Act 1873, (b) All India Elephant Preservation Act 1879 (c) Wild Birds and Animals Protection Act 1912 (d) Bengal Rhinoceros Preservation Act 1932 (e) Assam Rhinoceros Preservation Act 1954. A Central Board of Wildlife was established in 1952. A comprehensive Wildlife (Protection)/ Act was passed in 1972 which was further amended in 1991. Under this act there is an Indian Board of Wildlife chaired by Prime Minister and a Wildlife Advisory Board for each state. Indian Wildlife Board has asked both Botanical Survey of India (B.S. I) and Zoological Survey of India (Z.S.I) to prepare lists of threatened species of plants and animals respectively.

Activity

Bring out the salient features of Wildlife (Protection) Act 1972.

7.4.6 Water (Prevention and Control of Pollution Act, 1974 (Amended in 1988)

It was preceded by (i) Orissa River Pollution Act, 1953. (ii) River Boards Act, 1956 (iii) Maharashtra Prevention of Water Pollution Act,

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1969 (iv) Merchant Shipping (Amendment) Act, 1970. Water Act was enacted under article 252 (1) of Constitution as a social welfare measure to prevent and control water pollution and maintain or restore wholesomeness of water. Water includes rivers, rivulets, springs, canals, channels, ground water and coastal/tidal water. Pollution under the act includes (a) Contamination of water (b) Alterations in physical, chemical or biological properties of water. (c) Direct or indirect discharge of sewage, trade effluents or any other substance (liquid, solid, gaseous) into water. (d) The discharge is likely to cause nuisance or render such water harmful or injurious to public health or safety or to domestic commercial, industrial, agricultural or other uses or to the life and health of animals, plants or aquatic organisms.

7.4.7 Air (Prevention and control of pollution) Act, 1981 {Amended in 1987}

The act was preceded by Bengal Smoke Nuisance Act 1905, Bombay Smoke Nuisance Act 1912 and Gujarat Smoke Nuisance Act 1963. Air (Prevention and Control of Pollution) Act was promulgated under article 253 of constitution for prevention, control and abatement of air pollution by creating central and state boards. Central and State Pollution Control Boards created under Water Act 1974 also perform the functions of Central and State Boards for prevention and control of air pollution on the same terms and possessing the same powers. Central Board exercises powers and performs the functions of State Board for Union Territories either directly or by delegating powers. The board shall meet at least once in every three months. The chairman can, however, convene a meeting of the board at such time as he thinks fit for any business of urgent nature. The board can also seek advice or assistance from any person.

Activity

Discuss the salient features of Air (Protection and control of pollution) Act 1981.

Environment (Protection) Act, 1986

It is a comprehensive legislation for protection and improvement of environment and matters connected therein. According to Environment Protection Act, environment includes water, air and land; inter-relationships which exist among and between water, air and human beings and other living creatures, plants, microorganisms and property. Pollution has been defined as the presence in the environment of any solid, liquid or gaseous substance in such concentration so as to be injurious to environment. The act does not have a separate official body

at the state level. Central Government constitutes the authority for purpose of exercising powers and performing functions under the act. Officers are appointed by the Central Government. Central Government has delegated some powers to State Governments for issuance of directions, authorization for hazardous waste disposal, submission of environmental audit statements and taking cognisance of such offences through state board.

Check Your Progress -.4

Notes: a) Space is given below for your answer

b) Compare your answer with those given at the end of this unit.

11. Environmental (protection) Act is introduced in the year
12. In the year 1980 conservation Act is implemented.
13. Wild life includes..... and
14. Write True or False.

The central and state boards for prevention and control of air pollution shall meet at least once in every three months.

7.5 ENVIRONMENT MOVEMENTS IN INDIA

Environment movements in the modern sense began in the West. But over the last two decades, it has spread far and wide, even in the so called Third World. It has already taken deep roots in India. Consequent on the lethargic approach of the Central and State Governments and statutory bodies to the environmental problems, local initiatives by the concerned and affected people have come up to fill the gap. Many environmental groups and organisations have been working on varied issues in order to give a new direction to the development through the protection of environment. There are numerous local protests against land being submerged by dams, against pollution of water courses, rivers, lakes and fields, against lakes being encroached, over exploitation of natural resources, deforestation and mining activity harming farming land. Much of these efforts re being aided by a different breed of scientists and academics who identify themselves, with the problems and aspirations of the people and attempt to find the scientific evidence

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needed to back up these aspirations. These people's movements have come up with solutions and alternate proposals for development. They have played an important role in creating environmental awareness among the people. The activities of some important movements are described below:

7.5.1 Chipko Movement

Chipko meaning "to hug" in Hindi, today evokes the romantic images of poor, village women in the hills of northern India determinedly hugging trees to prevent them from being cut down by the very axes of forest contractors.

This was the first people's movement in India in modern times and was against deforestation in the Chamoli district of Uttarakhand. It was a movement of the poor people in a village to establish the right and control over their own resources. In 1960s, when under a working plan trees were cut on a large scale. This increased the intensity of the 1970 flood in the Alakananda river, which swept away 6 bridges, 16 foot bridges and 25 buses. In 101 villages 604 houses and 500 acres of crops were destroyed. Roads were blocked. Despite this, exploitation of forests for commercial purposes continued.

Chipko movement's first battle took place in April 1973 in a village called Mandai in Chamoli district of the then Uttar Pradesh, when villagers led by Chandiprasad Bhatt and Dasholi Gram Swarajya Mandai prevented the Allahabad-based sport company, Symonds to fell trees with the permission of the state government. In March 1974 when the forest Department auctioned 680 hectares of forest to fell trees from the catchment area of Alakananda river, the people mainly women, did not allow the axe men even to enter the forest. Under the leadership of Gouri Devi, they attacked the sheds of the wood-cutters, the forest guard was tied up and taken into custody. The cutters were forced to run away. These success stories encouraged the people who began to resist the deforestation in an organised manner. Always women were in the forefront in the fight against deforestation, The movement under strong and committed leadership of Sunderlal Bahuguna and Chandi Prasad Bhat spread to other parts of Himalayan Valleys like Bhyunder Vallery, Chamchidhar forests, Bhadhyarghats etc. The movement attracted the attention to the entire world. This proved that even illiterate, poor people, when organised, can resist exploitation. It is the movement that is responsible for the enactment of the Forest Protection Act 1980 and the creation of a separate Ministry for Environment at the Centre. It also brought the issues regarding deforestation to the national agenda.

Activity

Discuss the role of Chipko movement.

7.5.2 Silent Valley Movement

Long before the Internet era, a remarkable people's movement saved a pristine moist evergreen forest in Kerala's Palakkad District from being destroyed by a hydroelectric project. The battle for the now famous Silent Valley raged for over ten years and involved thousands of people who did not even live in the vicinity of the area that was to be destroyed. Although the campaign did not have any centralized planning, it was highly effective. The sustained pressure exerted on the government by citizens using every possible means available at the time – letters to the editors of newspapers, seminars, widespread awareness programmes, and finally petitions and appeals in court and other high offices – proved ultimately successful. In 1986 Silent Valley was declared a National Park, a striking testimony to the power of peoples' action. The lessons from this inspiring and hard-fought campaign are still relevant today. Here is a gist drawn from an article by the poet Sugatha Kumari in 'Silent Valley – Whispers of Reason'.

7.5.3 Narmada Bachao Andolar (NBA)

On the 312 km long Narmada river, government had planned to build some 30 big, 300 medium and 3000 small dams. This is known as the country's largest river valley project. The area to be affected by this project is spread over in the states of Madhya Pradesh, Maharashtra and Gujarat. The idea of the project was conceived long back. However the implementation was complicated due to the fact that the three states could not agree upon division of project costs and benefits. In 1969, the dispute was referred to the Narmada Water Dispute Tribunal which handed down its award in 1979.

The Sardar Sarovar Dam, one component of the entire multipurpose project costing 1000 crores, is meant to divert water to users in Gujarat. The Sardar Sarover projects are intended to bring drinking water to Kutch and other drought regions of Gujarat and to irrigate a vast area of the state as well as two districts of Rajasthan. This requires a large reservoir on the Narmada river and an extensive canal and irrigation system. The dam under construction on the Narmada to

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impound water to a full reservoir level of 455 feet will submerge 37,000 hectares of land in three states - Gujarat, Maharashtra and Madhya Pradesh.

Impact of the Project

The impact of the Sardar Sarover Projects extend over a vast area and affects a very large number of people, most of whom are tribals. At least 1 lakh people in 245 villages, live in the area affected by submergence. In addition to this there are likely to be 140,000 farmers who will be affected by the canal and irrigation system. Finally, there are people living in the down stream below the dam, numbering thousands more, whose lives will be significantly affected. In 1985 the World Bank agreed to lend a total of \$450 million for these projects. This immense development and the World Bank's role in it have become the focus of heated controversy.

In 1991, the World Bank appointed Mr. Bradford Morse to organise an independent review of the measures being taken to mitigate the human and environmental impacts of the Sardar Sarover Projects. Finally in 1994, the World Bank pulled out of its commitment to the project. But the Gujarat government exhibited its determination to go ahead with the project. It decided to go to the people to raise funds through the Narmada bonds and emerged triumphant when bonds issue was oversubscribed twice over.

People's Movement: The most vociferous amongst the "antidam" groups has been the Narmada BachaoAndolan led by the veteran Gandhian Baba Amte and MedhaPatakar. It has put all its efforts to oppose the project. What began as a campaign for better rehabilitation of over one lakh ousters of this project, spread across the three states, has crystallized to a movement against large dams. While the actions of the NBA are to oppose the Government's efforts to move people living in the submergence area (mostly tribal people), its ideological stance has centered on questioning the directions of development policy which causes impoverishment of large sections of the people of the area with the benefit being reaped by people elsewhere. The question of equity, in the case of development was raised forcefully by the movement. The resistance movement resorted to many drastic actions. Mr. MedhaPatkar went on a fast unto death against the dam in June 1993 in Bombay. In August 1993, the resistance movement resorted to "Jal Samarpan" Le., staying in place to get drowned by the surging waters. The movement and protest is still going on.

Activity

Identify the impact of Narmadha Valley project.

Check Your Progress – 5

Notes: a) Space is given below for your answer

b) Compare your answer with those given *at* the end of this unit.

15. Chipko means in Hindi.
16. Chipko movement's first battle took place in the year
17. Narmada river isKm long
Write True or False.
18. At least 1 lakh people in 245 villages are affected by the Narmada Vally project.

7.6 LET US SUM UP

In this unit 12: you have learnt in detail about Environmental problems in India. The various problems like soil degradation, deforestation, biodiversity, pollution are discussed. You have also learnt about environment policies in India and environmental movements in India. The origin, development, role of chipko movement and narmadha valley movement are discussed in detailed manner.

7.7 UNIT - END ACTIVITIES

Make a list of environmental policies in India and write about how these policies are effective in terms of environmental pollution in our country.

7.8 POINTS FOR DISCUSSION

Discuss the various environmental problems in India and explain the way of controlling the problem.

7.9 ANSWER TO CHECK YOUR PROGRESS

1. Water and wind
2. a) True b) False
3. 1980
4. 46000
5. 81000

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6. a) False b) True
7. Dissolved
8. 21
9. Industrial Solid
10. True
11. 1986
12. Forest
13. Plant and animals
14. True
15. To hug
16. 1973
17. 312
18. True

7.10 SUGGESTED READINGS

- Nagarajan. K and Sivakumar. P, "Environmental Education", Ram Publishers, Chennai - 93.
- Veer BalaRalogi and Jayaraj, "Animal Ecology and Distribution of Animals", Kadar Nath Ram Nath, New Delhi.

UNIT – VIII ENVIRONMENTAL EDUCATION AND TEACHER EDUCATION

*Environmental Education
and
Teacher Education*

Notes

STRUCTURE

- 8.1 Introduction
- 8.2 Objectives
- 8.3 Need for environmental education in
Teacher education programme
- 8.4 NCERT and environmental education
- 8.5 Teaching strategies in environmental education
 - 8.5.1 Discussion method
 - 8.5.2 Seminar
 - 8.5.3 Workshop
 - 8.5.4 Problem solving
 - 8.5.5 Field survey
- 8.6 Projects
 - 8.6.1 Steps in project method
 - 8.6.2 Characterization of a good project
- 8.7 Exhibitions
- 8.8 Let us sum up
- 8.9 Unit - end activities
- 8.10 Points for discussion
- 8.11 Answers to check your progress
- 8.12 Suggested readings

8.1 INTRODUCTION

Environmental education refers to the awareness of physical and cultural environment and perceives its relevance for real life situation. Environmental education is both a 'style' and 'subject matter' of education. Style of education means using environment as a teaching - learning aid and as an approach to education. Subject matter or content means teaching about the components and constituents of environment.

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Teaching for environment here means controlling the environment, establishing proper ecological equilibrium and proper environmental planning. These definitions of environmental education appear on first reaction to be simplistic and superficial, but actually it is comprehensive and deep; is a medium and process of education; is multi disciplinary in character; is a lifelong process and is concerned with the whole biosphere. In the previous unit we have studied about the environmental issues in India.

In this unit the different dimensions of Environmental education and Teacher education are discussed in detail.

8.2 OBJECTIVES

- To identify the need for Environmental Education in Teacher Education Programme
- Realize the role of NCTE in Environmental Education
- Establish the relationship between for Environmental Education and Teacher Education Programmes.
- Explain the different methods of teaching environmental education.
- Understand the advantages and limitation of different methods of teaching environmental education.
- Identify the major concepts, terms and teaching points required to teach environmental education.
- Choose appropriate and effective teaching methods to achieve the expected behavioural changes.
- Appreciate the role of CCA in environmental education.

8.3 NEED FOR ENVIRONMENTAL EDUCATION IN TEACHER EDUCATION PROGRAMME

Teacher Education identifies different dimensions of Environmental education curriculum. It provides the way of inculcation of environmental values and it explains the method of promoting Environmental awareness among learners. Moreover, it paves way for curriculum planning. Curriculum is a plan for providing sets of learning opportunities to achieve broad goals and related specific objectives for an identifiable population. According to Doll Curriculum is the formal and informal content and process by which learners gain knowledge and understanding, develop skills and alter attitudes, appreciations and

values. Thus, curriculum is the sum total of a series of experiences undergone by the learners in an institution. Curriculum in environmental education has different dimensions which includes,

- (i) Physical dimension
- (ii) Biological dimension
- (iii) Social dimension
- (iv) Cultural dimension and
- (v) Psychological dimension

The physical dimension is the abiotic environment which includes air, water, soil, geographical climate and weather. The biological dimension includes plants and animals. The social dimension refers to the social, economic and political conditions of an individual in which he lives. The cultural dimension includes values of religion, moral values etc., The psychological dimension is more concerned with the development of the personality, attitude, behavioral modifications etc.

The different dimensions are culled from various subjects including science and humanities. The most important dimensions of anyone curriculum in Environment education are: 1. Natural Resources (forests, wild life, fisheries, bio-diversity) 2. Human Ecology (Population and its impact on environment) 3. Impact of Science and Technology on environmental education. 4. Degradation of resources.

ACTIVITY

Discuss how biological dimension is related with psychological dimension.

8.4 NCERT AND ENVIRONMENTAL EDUCATION

The primary aim of environmental education is to enable human beings to understand the complex nature of the environments as the results from the interaction of its biological, physical, social and cultural aspects. Children should be given direct experiences in the real environment, so that they may develop an awareness and appreciation of the factors and interrelationships operating in the environment.

The National Council of Educational Research and Training (NCERT), New Delhi plays a pioneering role in the country in disseminating ideas about environment, environmental crisis and problems of population growth in a number of ways. Curricula for schools designed by the NCERT have centered on the local environment for lower classes while for the advanced grades, interrelated principles

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and global environmental issues have been brought to the fore. These have had a remarkable influence on the curricula developed by the different states of India. The textbooks prepared by the Department of Education in social sciences, Science and Mathematics reflect a broad spectrum of environmental issues that is intended to be a part of general education in India. The textbooks for the social sciences, in Geography for instance, discuss at length the renewable and nonrenewable resources of the country and conservation- and afforestation as policy and practice. In addition, efforts have been made to make pupils aware of the factors related to ecosystem, wildlife, misues of resources and need for their recycling.

Emphasis on evolving concepts of environmental education has been made in various generations of science textbooks developed by the NCERT. The scope and sequence of issues related to environment have been highlighted in three successive generations of instructional materials developed by the NCERT for classes VI to X and XI and XII.

National policy on Education (NPE), 1986 has recommended core areas that are common for all subjects of study. One of the common cores listed in the policy document is the protection of environment. The NCERT developed a National Curriculum for Elementary and Secondary education: 'A Framework (NCF)' in 1988 to incorporate the major thrusts and recommendations of NPE. Among other aspects the NCF also elaborates the need for developing environmental consciousness and preparing children for environmental protection through education.

NCF recommended that at the lower primary level an integrated approach be followed. In grades I and II, the child is to be introduced to the environment as a whole without making any distinction between natural and social elements; from grade **III** onward the environmental focus continues. The physical and social aspects of the environment are to be introduced respectively as environmental studies (science) and social studies as a broad and composite area of study. In view of the policy recommendation for providing science education for all, a composite course of 'science' has been extended from upper primary to secondary stage.

NCERT undertakes the following activities also;

1. Extension activities such as publication of quarterly, journal 'School Science' and 'organizing a National Science Exhibition every year. The Themes of the exhibition are generally environment based.
2. Training Programme for Teachers and teacher educators.

3. Development of films, video programmes on Indian environment. There is a film library in NCERT that loans films to schools.
4. Publication of supplementary reading materials.
5. Collaboration with international agencies like UNESCO, UNICEF, UNEP, etc.

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ACTIVITY

Prepare an action plan to develop Environmental Awareness in light of NCTE in your school.

8.5 TEACHING STRATEGIES IN ENVIRONMENTAL EDUCATION

The term 'method' implies planned instruction. According to the Secondary Education Commission, "Even the best curriculum and the most perfect syllabus remains dead unless quickened into life by the right methods of teaching and the right kind of teachers", Hence, it is essential to employ suitable methods of teaching for effective delivery of environmental education. Suitable methods lead the learner along the lines of least resistance and enable him to derive maximum benefit with minimum effort.

Teaching methodologies or teaching learning strategies used in environmental education are as varied as objectives in various subjects. One of the major reasons for this seems to be the variation in environmental conditions, resources including material, money and personnel available, variety of environmental problems, and educational system. The teaching learning strategies such as class discussions, small group projects, field trips, outdoor studies, use of exhibits, simulation and games, material guides, debates, inquiry and guest lectures are useful in many occasions.

8.5.1 Discussion Method

A discussion is an open forum in which learners can express the opinions as well as review factual materials. In addition, discussion is a natural opportunity for students to exercise their command of the processes of communication, inference and conclusion (Wonfing, 1984). In the discussion method the teacher gives a brief introduction of the topic for discussion. This is followed by supervised study by the students in groups or individually for an hour or so. The references are given by the teacher. The students may study in the class or may be

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allowed to go to the library for reference. The students can get their difficulties removed from the teacher. After the scheduled time the teacher initiates discussion by posing some questions or problems. By putting some key questions or problems in logical sequence the topic is covered through discussion. The objectives of discussion method are listed hereunder:

- To share information
- To clarify ideas
- To inspire interest
- To promote co-operative learning.
- To identify the different views on a problem.
- To get conceptual, clarity
- To develop the skill of expression
- To evaluate progress
- To locate and define the problem and
- To allocate responsibilities to find ways of solving the problem.

There are *two* types of discussion which are as follows:

- i) Open Discussion and
- ii) Planned Discussion

1. Open Discussion

Open discussion is one in which the learner determines the topic and the role of the teacher is to ask questions that will lead the learner to consider various ideas. There can be no planning because the open discussion is spontaneous by definition. It can be extremely effective in getting learner to make inferences and draw conclusions. It is always on a topic of interest to the learners, because they initiate the discussion.

2. Planned Discussion

In a planned discussion, the teacher determines the content of the discussion, plans the questions, and guides the learners toward some predetermined goal. It is a way of introducing and teaching content to the learners in a way that will involve them cognitively.

Hence discussion is a natural opportunity for students to share their ideas freely with others in order to get conceptual clarity.

8.5.2 SEMINAR

The term 'seminar' is generally used *to refer to* a structured group discussion that may proceed or follow a formal lecture, often in the form of extempore speeches or paper presentations. Individual students also prepare papers or report and present before a group of peers, as in the case of seminar paper presentation. The audience critically evaluates the paper and discusses the findings of the paper.

The teacher should take the initiative in acquainting the students with the objectives and purpose of the seminar. Seminar requires much planning in terms of referring to literature on related aspects of the seminar topic, organizing the collected data in a sequential manner and presenting the paper through effective reporting. Duration of the presentation of papers at seminars varies from topic to topic and discipline-to discipline. Generally 30-45 minutes are permitted for presentation followed by discussion for 10-15 minutes. Adequate time should be given to students or other participants to clear their doubts and probe the major aspects of the topic. The following are the advantages of seminar.

- i. The major advantage of the seminar is its stimulation and testing of students' power of comprehension and evaluation.
- ii. The ability to detect and derive the principle from the context is developed.
- iii. Understanding power and questioning ability in a relevant situation are strengthened.
- iv. Self-reliance, self-confidence, sense of cooperation and responsibility are developed.

8.5.3 WORKSHOP

Workshop is a get-together for some creative educational activity. While discussion demands much talk, workshop is a 'shop for work'. It is an activity-oriented technique. The group consisting of teachers, students, administrators, may initiate the workshop in a general session and frame guidelines for the conduct of the workshop. It involves directly the skills of both cognitive and psycho-motor domains. Preparing reports, syllabi, manuals and critical reviews, visiting places, making teaching-learning aids, and planning instructional designs, instructional materials and modules are examples of activities of a workshop session. Recording and reporting the work produced, at the concluding session is an important aspect of the workshop. Advantages of Workshop

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The following are the advantages of workshop:

- i. The workshop is based on the principles of learning by doing.
- ii. It is an activity - oriented technique
- iii. It is co-operative work which promotes the 'work culture'
- iv. Teachers, students and administrators work together which ensure the sharing of ideas and views
- v. It involves the skill of cognitive, affective and psychomotor domains
- vi. A complicated problem can be easily solved in the workshop.
- vii. The workshop focuses on the individual talents as well as the efforts of the group

8.5.4 PROBLEM SOLVING

Problem, solving is a process of adjustment for overcoming difficulties that appear to interfere with the achievement of a goal. It is a process within which creative thinking and reasoning take place. The learner should learn the art of problem-solving. He should be eager .to meet problematic opportunities, and to deal with them confidently and solve them successfully.

Kilpatrick defines a problem as a situation in which between the start and the goal, there exists an obstacle or a difficulty. The solution of a problem consists in surmounting the difficulty and reaching the goal. A problem for one learner may not be a problem for another. The essential skills required for problems - solving are stated below:

- i. Understanding the problematic situation.
- ii. Ability to give correct interpretation of certain apparently doubtful or ambiguous or difficult expressions (in verbal problems).
- iii. Analysing the problem.
 - a. Collection of Data or defining the starting point
 - b. Recognition of impliedly given quantities.
 - c. Determination of the goal or goals.
- iv. Ability to abstract the relevant variables involved.
- v. Knowledge of nature of the relationship between variables.
- vi. Knowledge of the units of measurement of the variables.
- vii. Analysing the method of solution.

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- a. Formulating proposals.
 - b. Rejecting obviously unsuitable line of action.
 - c. Ability to weigh the amount of computational work involved in the proposed methods and choosing the most economical method of getting solutions.
- viii. Determination of plan
- a. Organising ability.
 - b. Relation of each stage in the plan
 - c. Manipulative skill and computational ability.
- ix.
- a. Accurate calculation (correct result)
 - b. Rough estimation
 - c. Use of rough sketches.
 - d. Short cuts and mental work
 - e. Speed in calculation
 - f. Verification.

8.5.5 FIELD SURVEY

Field survey is an analysis of the present status about a particular area. Through the field survey, one can get a correct picture of the status of a particular event. It is a natural observation. Rousseau emphasized that natural observation is the best method of teaching as compared with classroom teaching-learning and studying books. Through the field survey in environmental education, the learner get first hand information about the environmental problems.

Students may study different aspects and objects of environment. They can study a village, a river, a lake, some specific problems of an area which include pollution aspects, inter relationship of living being etc, The outdoor studies also require a detailed planning like field trips, but these studies may be limited to the local environments. The study team has to plan the objectives of the study plan, execute and submit a report to take necessary action and for the benefit of other students.

Objectives of field survey in Environmental Education

The following are the objectives of field survey

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- i. To promote awareness about learner's environment
- ii. To develop the tendency to survey it and utilise it for understanding.
- iii. To develop the ability for interpreting the learners' own experiences and observations
- iv. To promote the skill of observation, and interpretation
- v. To develop the ability of co-operation and group-work.
- vi. To make familiar about the different tools and techniques that are used in the field survey
- vii. To develop the feeling of appreciation about the nature.
- viii. To identify the qualities of the environment.

Steps involved in field survey

The environment field survey has the following steps:

Step (i) Writing objectives

Step (ii) Planning

Step (iii) Identification of tools and techniques

Step (iv) Execution (Collecting information or data)

Step (v) Evaluation

Step (vi) Follow-up activities.

Thus, field survey provides a vivid picture about a particular area. It is a scientific way of investigating the status of environment.

Check Your Progress – 1

Note: a) Space is given below for your answer

b) Compare your answer with those given at the end of this unit

- 1) Who determines the topic in open discussion?
- 2) Indiscussion, the teacher determines the content of the discussion.
- 3) The structured group discussion is known as
- 4) Field survey is an analysis of status about a particular area.

8.5.6 PROJECTS

A Project is a problematic act carried to completion in its natural setting. The project method consists of building a comprehensive unit around an activity which may be carried on in the school or outside. 'Learning by doing', and 'Learning by living' are the two cardinal principles of this method. This method is psychologically sound. The teacher acts as a guide and helps the students to find the facts and principles themselves. The project may be a constructional type such as building up a school museum, running a school garden, collecting specimens for science exhibition or it may be the type meant for investigation such as growing seeds in a pot, the study of plant life or animal life.

The role of teacher is not of a dictator but a friend, guide and a working partner. The teacher should investigate along with the learner and should not claim to everything. Providing democratic atmosphere in the classroom is an important duty of the teacher. The teacher should be active all the time to see that the project is running on right lines.

In the project method, students have to take up certain projects. The total class is either divided into small groups or work at a total unit depending on the nature of the project to be worked out. Sometimes the project is also divided into small units. Each student or small group of students is given a work for which the students take responsibility of completing it successfully. At the end of the project, the activities of all the students or groups are presented to the total class in the form of reports and displays. They explain their experiences, data, conclusions and recommendations. If we take the problem of mosquitoes as a project, a small group will identify the causes of mosquitoes, another will map the ditches, another will look into the eradication techniques, and another group will apply the selected technique's to eradicate the mosquitoes.

Steps in project method

Steps involved in project method are as follows:

Step (i) Sensing a problem

Step (ii) Defining the problem.

Step (iii) Selection of appropriate methodology

Step (iv) Data Collection

Step (v) Process of analysis

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Step (vi) Drawing Conclusion

Step (vii) Evaluation

Step (viii) Recording

Characteristics of a good project

The following are the characteristics of a good project:

- i. Project should allow the active participation teacher of both learners and teacher
- ii. It should be useful and purposeful
- iii. It should have definite educational value
- iv. It should be practicable
- v. It should provide maximum number of activities
- vi. It should not be expensive
- vii. It should promote the investigative ability among the learners.

8.5.7 EXHIBITIONS

Exhibition in environmental education means presentation to view a display or showing off the materials relevant to environmental studies. Exhibits or exhibitions can be arranged to show the project work of the students or to highlight the environmental problems in order to get suitable remedies. Different exhibits explaining various concepts of environmental education can be displayed in collaboration with various environmental organisations. Students will take part very actively in these exhibitions and show their abilities. They also explain the observers about the environmental problems and solutions.

The organisation of the exhibition should provide, for ample spheres for the development of skills of the members. The planning and the procedure should be detailed and should fulfill the ambitions of the members. As funds will be a constraint, adequate finance should be made available.

It is essential to form a committee to organize the exhibition. Work should be distributed among the various committees drawn for the purpose. The execution of the plans should be quick and systematic. The teacher should guide the students in organizing the exhibition. Students should have conceptual clarity about the items that are to be displayed in the exhibition. There should be a spirit of healthy competition among the students to exhibit the materials. Moreover, teachers should be properly

trained in organizing exhibitions. The leadership should gradually be passed from the teachers to students. The teacher should supervise the entire procedures. Evaluation of the items displayed in the exhibition should be done by experts in the respective fields.

Advantages of Exhibition

- i. Exhibition is based on the principle of learning by doing
- ii. The learners can observe, analyse, criticize and apply the scientific laws.
- iii. They get chances of picking up skills by means of participation in the exhibition
- iv. They can learn how to co-operate and show leadership qualities while working in the exhibition.
- v. Exhibition promotes scientific attitude among the learners.
- vi. It helps the learners to use science in life situations.
- vii. It promotes exploration and creative spirit among the learners.
- viii. It propagates scientific information
- ix. It enhances the healthy spirit of competition among the participants.
- x. The spirit of inquiry can be developed by organizing exhibitions.

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8.6 CO-CURRICULAR ACTIVITIES IN ENVIRONMENTAL EDUCATION

The purpose of education is that students shall be trained not only to know the right things but also to behave in the right way. A close relationship between right knowledge and right action is sought for – Here the former is mostly taken care by the Curricular Activities and the latter part is taken care mostly by the Co-curricular Activities.

The Curricular Activities are mainly cognitive in nature and concentrate on intellectual development of the students. However, the objective of education is not confined to intellectual development only but also an all round development of personality, i.e., besides intellectual growth, education shall also cater to the emotional, physical, psychological and social development. The development in these areas may take place if curricular activities are supplemented with the co-curricular activities. Thus CCA may be defined as – The Activities

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undertaken to strengthen the classroom learning as well as other activities, both inside and outside the classroom to develop the personality of the child (Kanan Sadhu).

8.6.1 Importance of Co curricular Activities

All our great philosophers/educators, right from Plato and Aristotle to Herbert Spencer and John Dewey, have stressed the importance of providing opportunities in schools to organizing activities which are known as Co-curricular Activities. In the post independent India, all Education Commissions/Committees set up from time to time and the National Policy on Education also have promoted the importance of involving children in schools in all kinds of co-curricular activities.

Importance of co-curricular activities regained socio-psychological perspective. The importance of activities lies in the fact that there had been an attempt to find a more satisfactory term like CCA. The co-curricular activities, as already mentioned earlier are very important for realizing the goals of Education.

Further they also have certain social and psychological implications. For instance, students who participate in drama or any cultural activity, come in contact with various people, like organizers, fellow participants, teachers, etc. This contact or interaction with various persons satisfies the need of socialization, self-identification and self-assessment - these in turn satisfy the need of belongingness.

Similarly, outdoor activities like tours, rock-climbing, camping, etc. provide ample opportunities where the students develop the spirit of fellow-feeling, sympathy, co-operation, sacrifice etc. Human beings have a psychological tendency to influence their fellow beings by their achievements. Activities like sports and games provide the children many such occasions when they can display their qualities and attain appreciation. At the same time in the course of their participation, they learn how to develop sportsmanship and how to behave when they win or lose an event.

In view of the urgency to make students aware of the new components like adolescent reproductive health, etc. which have been lately included in the Environmental Education, there is a need to adopt an approach that extends beyond prescribed courses, because of its very wide scope. The reason being - as it is not all the components of Environmental Education could be integrated in the textbooks of various subjects at all school stages because of the limitation, of subjects concerned. For the transaction of those 'leftover' components, the CCA

has been an effective medium. Secondly, even those components, which are there in the textbooks, can be communicated much more effectively if reinforced through CCA.

8.6.2 Type of Activities Co curricular Activities in Environmental Education

The school has a strategic role to play in planning and organizing within its scope a wide range of co-curricular activities. Major objective is to promote learning through creative self-expression and at the same time offering enjoyment, relaxation, satisfaction and recreation to the students. There are a number of ways in which learning through CCA can be planned. A suggestive list of activities in 6 broad categories viz. literary, art and craft, dramatics and music, social action, specific projects and celebration of special events, for example Days/Weeks are given in the tabular form (Kanan Sadhu).

Some of the co curricular Activities suitable for Environmental Education are discussed below:

Village Adoption

In this activity, schools are encouraged to adopt villages for intensive work relating to all aspects of Environmental Education. Messages related to the themes of Environment may be communicated in several ways. The approach, in general is that of integration with community development in which messages related to various themes under Environmental Education are transmitted.

Environmental Education Club

The Environmental Education Club should be organized in the School to carry out various co curricular activities in Environmental Education. The club should discuss the ways and means of transmitting Environmental friendly messages and also the innovative materials and programmes for Environmental Education may be developed.

In general, the activities organised in Environmental Education Club are organising Quiz, Group Singing, Lectures, Celebration of Environmental Education Day, Dance event emphasizing Eco Concepts, etc.

Celebration of Important Events

The schools should celebrate special Days/Events/Weeks by organising relevant activities. With a view to make Environmental Education an integral part of the school programme, celebration of

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special events/days/weeks related to Environmental issues and themes like Environmental Day, World AIDS Day, Women's Day, Population Education Week etc. are encouraged.

Debate

Under debate, opposing points of view are presented and defended by the members of two teams. It is an effective technique for probing into controversial issues. The advantages and disadvantages of an issue are presented in the debate. It helps students in taking rational position on any issue. Debate is useful when we wish to explore a topic from several points of view. The issue to be debated should have positive and negative aspects that can be argued for and against by students. The students may be asked to form two teams. One team may be in favour of the motion and the other against the motion. The task of each team is to identify the supporting arguments and assemble the relevant evidence for an assigned position. Each team may then select three or four speakers to represent their group's views in the debate. The teacher may chair the debate. When all the speakers have presented their views, the chairperson may then sum up the points made by students during the debate. Alternatively, a panel of judges may be formed for evaluation and selection of best speakers from both the teams.

Painting Competition

This is one of the most popular activities in schools. The objective behind this activity is to involve the students in this competition so that they give some thought to the topic of painting and then are able to manifest their thoughts in the form of their art work. The topic for the painting may be given to the students well in advance so that they are able to gather information and support material on Environmental issues (the topic of painting) as reference for authentic depiction in their art work.

Alternatively, the topic for painting competition may be given on the spot. In that case the teacher may initiate some discussion on the given topic and indicate possibilities of population related issues and ideas which can be expressed suitably in the form of visuals.

The advantage of holding this activity is that children of all ages can participate. In fact, the competition must be organized separately for Secondary/Higher Secondary, Upper Primary and Primary stages in schools.

The students may be asked to bring with them the art related materials like colours, brushes, paper etc. and allow them to prepare their art composition. A panel of judges may be invited for evaluation and selection of best paintings from each school stage. The selected paintings may be exhibited at appropriate places in the school premises.

Role Play

Role play means presenting small spontaneous plays which describe possible real life situations. A situation is given to the group and they take on the roles of the people involved. The role play amounts to initiating someone else's character. It is an important activity as it allows students to practice such situations before they may meet them in their real life. It also provides them an opportunity to practice skills that are significant for protecting themselves from risky or adverse situations.

For organizing this activity, the teacher may discuss Environmental related issues on the basis of which either the students themselves prepare a small play, or the teacher gives a play. The students may volunteer for enacting the roles of the character involved in the play. They should be encouraged to expand on their roles. After the role play, the teacher may discuss the appropriate actions needed with respect to the action taken under each role in the play (Kanan Sadhu).

Essay Competition

The Essay competition can also make a significant contribution in creating awareness regarding population issues. This is because it provides opportunity to students to gather information from various sources on the topic of Essay. At the same time, while writing the essay students understand and appreciate various aspects of the given topic as exercise which develops in them the competence of logical and rational thinking which is very important for a curricular area like Environmental education.

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Check Your Progress – 6

Note: a) Space is given below for your answer
b) Compare your answer with those given at the end of this unit

5) Write True or False
Field survey is a scientific way of investigating the status of environment

6) Exhibition is based on the principle of learning by

7)is a problematic act carried to completion in its normal settings.

8) What are the two cardinal principles of the project method

8.7 LET US SUM UP

In this unit you have learnt in detail about the curriculum and methods in environmental education. You have identified the different dimensions of environmental education. You have also learnt about the different methods of teaching environmental education. These methods are not only possible method. There could be many other methods, positively; you should adapt any method in accordance with the content. Finally, the role of co curricular activities in Environmental Education has also been discussed. Hope you might have enjoyed the unit.

8.8 UNIT - END ACTIVITIES

Take anyone lesson in environmental education, select appropriate method and teaching aids to teach the lesson. And also prepare the co-curricular activities for the lesson.

8.9 POINTS FOR DISCUSSION

"Both the curricular and co-curricular activities are indispensable for teaching of Environmental Education " - Discuss.

8.10 ANSWERS TO CHECK YOUR PROGRESS

1. Learner
2. Planned
3. Seminar
4. Present
5. True
6. Doing

7. Project
8. Learning by doing, learning by living

8.11 SUGGESTED READINGS

- Benny Joseph, 2005, "Environmental Studies", Tata McGraw Hill Publishing Company Limited, New Delhi.
- Nagarajan and Sivakumar, P. "Environmental Education", Ram Publishers, Chennai - 93.
- Eldon et.al., (2000), "Environmental Science' - A study of Internationalships, McGraw Hill, New Delhi.

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UNIT – 9 MAN AND ENVIRONMENT

Notes

STRUCTURE

- 9.1 Introduction
- 9.2 Objectives
- 9.3 Human ecology
- 9.4 Interaction between man and environment
 - 9.4.1 Human adaptations to environment
 - 9.4.2 Definition
 - 9.4.3 Examples for human adaptations
- 9.5 Population and its effect on environment
 - 9.5.1 Effects of population growth and environmental problems
- 9.6 Impact of science and technology on environment
 - 9.6.1 Direct or intentional impacts
 - 9.6.2 Indirect or unintentional impacts
 - 9.6.3 Industrial growth and its environmental impacts
- 9.7 Degradation of resources
 - 9.7.1 Degradation of water resources
 - 9.7.2 Exploitation of mineral resources
 - 9.7.3 Degradation of land resources
- 9.8 Let us sum up
- 9.9 Unit - end activities
- 9.10 Points for discussion
- 9.11 Answers to check your progress
- 9.12 References

9.1 INTRODUCTION

Man plays an important role in the eco system. The word 'ecology' has been derived from the Greek words 'Oikos' meaning habitation or home and 'logos' meaning discourse or study. Thus the study of the habitations of organisms including man is known as ecology. The term ecology was introduced by Reiter in 1868. The term was properly defined by Earnest Haeckel. Odum (1969) defined-ecology as the study of structure and functions of nature. The environment includes water, soil, air, fire, light, temperature etc. Ecology has been defined as

the scientific study of natural history. It is a study of biotic communities or the study of the science of communities and populations. Man is part and parcel of environment and hence always there is some interactions between man and environment. It is indispensable to identify the nature of interactions between man and environment.

9.2 OBJECTIVES

At the end of the unit you will be able to

- Explain the concept of human ecology
- Realize the importance of human adaptations to environment
- Analyse the problems of population growth .
- Define the term human ecology.

9.3 HUMAN ECOLOGY

Human Ecology is defined as the inter-relationship of human beings with their physical and biotic environments. It is the study of relation of man to his organic (living) as well as his inorganic (non-living) environment. Human ecology is the study of human beings, other living organisms and nonliving things in relation to each other and to their environment. Human ecology is an interaction between man and his living and non-living components of environment.

Human ecology is different from plant and animal ecology because man has knowledge, scientific advancement and innovation.

9.4 INTERACTION BETWEEN MAN AND ENVIRONMENT

Human being is as much a part of environment as any other animal. The socio-economic, political and other problems that are faced by men are all in some way or other related to ecology. For instance, production of paddy, wheat and other grains, live stock, timber fibre, fish, flower, control of pest, conservation of wild-life are all basically ecological problems. Environment plays an important role in agricultural production. Man, as a part of environment is facing lot of problems for his survival. Gradually man has acquired the potentialities to overcome these problems to certain extent. For instance, the problems of crop rotation, weed control, management of grass land, management of wet land, forest development etc., are handled by man based on ecological principles.

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Man plays a vital role in environment. Science and Technological development leads to a sophisticated life for man on the earth which in turn becomes responsible for various environmental problems like disposal of wastes, pollution of air, water and land, deterioration of habitat, contamination of river, lake and sea, radioactive pollution etc. Moreover, man exploits his surroundings for the resources he needs to survive. Human beings are having the potentialities to affect the entire region and the technology has progressed in such a way by which they can level mountains and control the flow of rivers. Population explosion is a major problem for the environment. The world population is currently about six billion and is estimated for the year 2050 to be little under nine billion. Economic disparities among the nations also lead to various environmental problems. Richer countries consume more resources and generate more waste than the less well-off.

Human beings are the most skilled and civilized and hence their social organization is most systematic. The three significant aspects of man are 'physical', 'social', and 'economic'. The 'physical man' is one of the organismic populations or biological community and thus requires basic elements of the physical environment like habitat, air, water, food etc. The 'social man' establishes social organizations, formulate laws, principles, to safeguard his existence, interest and social welfare. The 'economic man' derives and utilizes resources from the physical and biotic environments with his skill and technologies. These may be called physical, social and economic functions of man.

9.4.1 Human Adaptations to Environment

Human beings are totally dependent upon their environment for their sustenance and are inseparably related with it. 'Environment' refers to the surroundings of an organism (including Human being) which have direct influence on the activities of the organisms. The relationship existing between human beings and the environment is of reciprocal nature.

Human being, as a part of the environment, depends upon the environment for his survival. Any changes in the environment can easily affect the human society. Similarly the undesirable activities of human beings can affect the environment. Thus their natural relationship is reciprocal in nature. In order to cope up with the natural problems, the human beings have some adaptive features. These adaptations are derived naturally in accordance with the law of the 'survival of the fittest'.

9.4.2 Definition

Human Adaptation may be defined as 'the morphological modifications developed by man to adjust himself in a particular

environment'. Human beings are living in the terrestrial environment. But the terrestrial ecosystem is not uniform throughout the earth. The temperature, moisture, type of soil, vegetation etc. may vary from one terrestrial ecosystem to other. To survive and thrive well, human beings develop certain modifications, suitable for the respective terrestrial ecosystem. This means that human beings adjust themselves in accordance with the environment by developing special features. This is known as 'Human Adaptation' to environment.

9.4.3 Examples for Human Adaptations

Man occupies in the terrestrial environment which is the most complex type of environment. In terrestrial environment there is a great fluctuation and interaction of environmental factors than in aquatic environment. The interaction of physical climate and biotic factors produces a wide variety of ecological conditions on the continents. When man is exposed to these interactions he develops some adaptive features to cope with the environmental changes. Temperature is one of the physical factors which affects human beings. It causes a lot of variations among them. For example people living in the tropical areas are generally black in colour. The black colour is due to the formation of a pigment namely 'Melanin' which is an adaptation to withstand the temperature. The pituitary gland, which is located on the brain of man has a lobe called 'pars intermedia' or intermediate lobe. This lobe secretes two melanocyte-stimulating hormones, which stimulate melanocytes to produce the black pigment 'Melanin'. This pigment melanin protects man from the hot radiations of sun. However people living in cold regions have very less quantities of the pigment melanin; since they are less exposed to sun's radiation.

Since human beings *are living in the* terrestrial environment, the evaporation of water from the body surface is a major problem. There are some adaptive features to control the evaporation. Hairs give protection against scorching sun. The excessive heat can be reduced by the sweat which is produced by the sweat glands. Moreover some unwanted salt materials are also excreted through sweat. During the summer season the sweat glands work actively where as in winter season the gland works less.

The kidney excretes more amount of water during winter season whereas in summer it reabsorbs water and hence the amount of urination is reduced.

ACTIVITY

Prepare a list of other common human adaptations.

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Check Your Progress – 1

Note: a) Space is given below for your answer

b) Compare your answer with those given at the end of this unit

- 1) The term ecology was properly defined by
- 2) What are the three significant aspects of man?
- 3) The morphological adaptation developed by man to adjust himself in a particular environment is known as

9.5 POPULATION AND ITS EFFECT ON ENVIRONMENT

Population refers to the total number of people living in a particular area, country or within a geographic boundary. Population growth means increase in population living in the same area with high birth rate and low death rate. A steep growth of human population is recorded in this century. The global human population is 6 billion at present. The rate of the growth of the world population has combined with unsustainable consumption patterns of natural resources. The explosion of human population has also created several types of problems. The environmental pollution is a major problem which is generated by over - population.

Generally population growth is graphically represented by 'S' shaped (Sigmoid) growth curves. The Sigmoid curve has four phases namely:

- a. Early phase of little growth
- b. The second rapid phase
- c. The third phase of decelerating growth phase
- d. The fourth stationary growth phase.

This curve is illustrated in the following diagram. All animals are having a particular season for breeding. But man has no seasonal restraint. Perhaps, this may be one of the reasons for increase in human population.

It has been estimated that the human population is not uniformly distributed in various regions of the world. Only about thirty percent of total land area of the world is occupied by man. More than 75 percent of World's. Population lives in South and East Asia, Europe and North eastern parts of North America. Based on the distribution and density of human population, three categories are identified which are as follows:

- i. The countries like China, Japan, India, Pakistan, Bangladesh, Indonesia and some part of Europe are highly concentrated areas in terms of population.
- ii. Minor areas of Population Concentration: These are small areas with thick population. These include Java, South Eastern Australia, New Zealand and South America
- iii. Large relatively empty space: These are Antarctica, large deserts and mountain regions.

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9.5.1 Effects of Population Growth and Environmental Problems

Population explosion is a major environmental problem. Socio-economic, agricultural and industrial development cannot meet the demands of our country because the rate of population growth is higher. The major environmental problems due to population explosion are listed below:

- a. Population explosion results in increased consumption of resources available in the environment resulting in the depletion of these resources.
- b. Degradation of the quality of environment.
- c. The increase in population in urban areas has caused air, water, land and noise pollution.
- d. Acquiring land for agriculture and construction of houses and factories in a large scale, leads to deforestation, desertification, soil erosion, etc.
- e. Availability of food for consumption gets reduced which leads to prevalence of diseases on a large scale.
- f. Poor quality of life and economic status reduces the level of peace in the society to a significant extent.
- g. Rapid urbanization results in the growth of slums in cities and towns.
- h. Lack of educational facilities for mass higher learning.

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- i. The rapid population growth leads to white collar crimes like corruption, adulteration, black marketing, duping, faking etc. in the society.
- j. There is degradation in values in the political, religious, social, and cultural spheres of life.
- k. Public services like transport, supply of water and electricity, posts and telegraph, health and sanitation are highly affected due to the population explosion.
- l. It reduces the per capita income of people and brings pressure on the availability of water, land, food, minerals, fuels and other resources.
- m. It leads to unemployment, inadequacy of housing and health, underutilization of resources etc.
- n. Due to over population there is a great pressure on the availability of medical, educational and social amenities.
- o. The standard of hygiene and quality of nutrition are also low due to excessive population growth, which leads to health problems such as deficiency diseases.

ACTIVITY

Identify the effect of population growth in your local area.

9.6 IMPACT OF SCIENCE AND TECHNOLOGY ON ENVIRONMENT

The emergence of Science and Technology leads to a sophisticated life and it paves the way for the economic development of human society. But at the same time; it initiates the hostile relationship between man and his natural environment. Most of the environmental changes that have taken place as man started to exploit the natural resources with the help of advancement in technology have ended up with newer problems. The 'modern technological man' exploits the natural resources for industrial expansion and urban growth which triggers various ecological problems at global level. One of the major reasons for man-induced change is to manipulate energy transfer and expansion of human population.

Man's impact with the help of Science and Technology on environment can be divided into two types which are as follows:

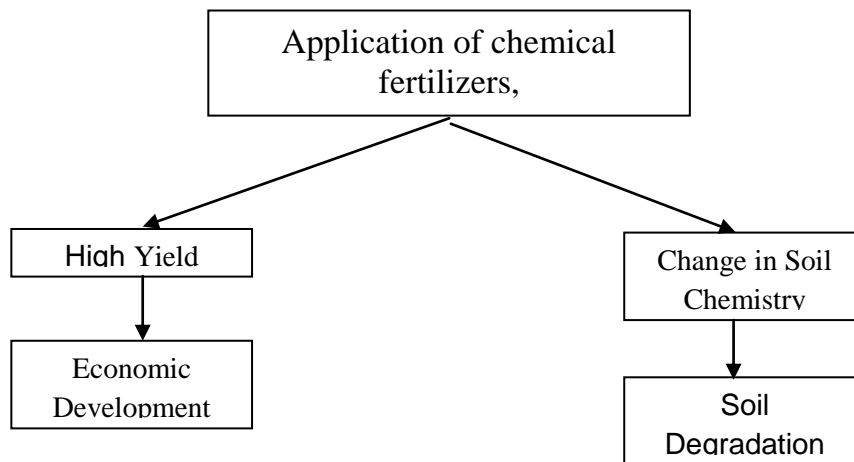
1. Direct or Intentional Impacts
2. Indirect or Unintentional Impacts.

9.6.1 Direct or Intentional Impacts

These are preplanned and premeditated because man is aware of the consequences, both positive and negative, of any programme which is launched based on the development of Science and Technology. For example, clearing of forest and burning of grass lands for crop cultivation, felling of trees for commercial purposes, changes in cropping patterns based on farming techniques etc., are having a serious impact on our environment. In order to increase the yields, various chemical fertilizers, pesticides and insecticides are applied. It may be a green revolution in terms of economic development, but indeed it is a greed revolution in terms of environmental. Concerns because it changes the soil chemistry. This problem is illustrated with the help of the following diagram:

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Fig No. 9.1
Effect of Application of Chemical Fertilizers, Pesticides and Insecticides



The weather modification programmes like cloud seeding to induce precipitation, dispersal and clearing of clouds and fogs etc., are the results of technological innovations but cause a serious concern for environmentalists.

Groundwater is sucked out with the help of giant motor pumpsets for drinking water and irrigational purposes and this is a general practice in almost all the countries. It resulted in the downfall of the ground water level and it also resulted with the formation of big cavities beneath the ground. Consequently saline sea water entered into these cavities and the wells became contaminated due to salty water. Excessive withdrawal of ground water also results in land subsidence.

Notes

The construction of dams and reservoirs upset the equilibrium of the rocks below the ground. Moreover, when large areas are submerged, it leads to various ecological problems. The tribal people living in these areas are displaced

The application of modern agricultural bio-technology has influenced considerable environmental changes. Modern agriculture rely upon synthetic chemicals which include various types of fertilizers and biocides. Many of the environmental changes are the direct results of manipulating biochemical cycles and energy flows and rate, especially to the use of chemical fertilizers and crop protection chemicals. It causes the destruction of natural habitats.

9.6.2 Indirect or Unintentional Impacts

The industrial growth and technological inventions can also trigger the indirect impact on environment. The indirect impacts are not planned and these arise from those human activities which are directed to accelerate the pace of economic development. The after effect of industrial development should be carefully studied. All these are not immediately noticeable because of time-lag. The indirect impacts are experienced after long time when they become cumulative. Sometimes, these effects are not reversible. Mainly the indirect impacts of human activities on the environment are related to pollution and environmental degradation.

The use of chemicals such as DDT, PCB, etc., has adverse effects on environment. The indiscriminate and excessive use of pesticides, fertilizers and a number of other chemicals leads to various indirect effect. For example, these toxic materials are transported across the placenta and reach the developing foetus of women and cause abortions and delivery of premature child.

Check Your Progress – 2

Note: a) Space is given below for your answer

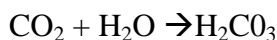
b) Compare your answer with those given at the end of this unit

- 4) Name any two toxic materials that are transported across the plantation.
- 5) The construction of dams upset the equilibrium of below the ground.
- 6) The indirect impact are also known as

9.6.3 Industrial Growth and its Environmental Impacts

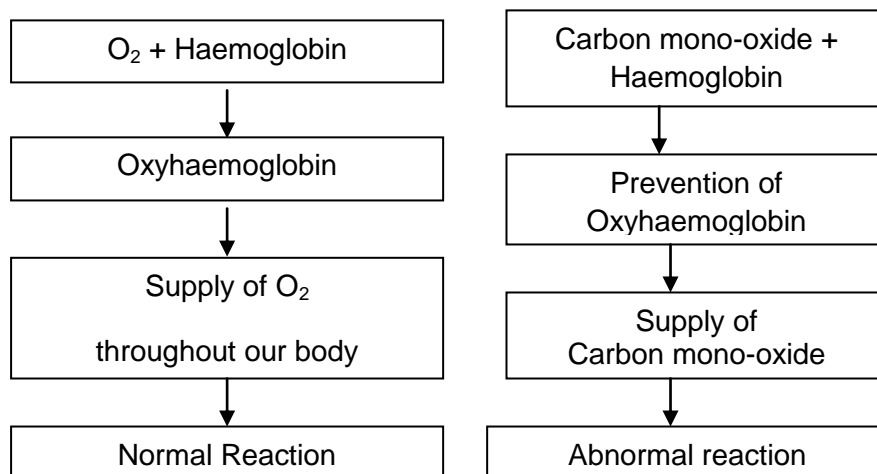
There is rapid industrial development in developed and developing countries. There are industrial estates in cities and towns. The industrial expansion is responsible for the release of enormous quantities of pollutants like ions of chlorine, sodium sulphate, magnesium phosphate etc. There are thermal power plants which consume large quantities of coal. The coal consumption in thermal plants and industries produce flash, smoke, sulphur oxide and other gases which cause air pollution.

The burning of hydrocarbon fuels in industries and automobiles has increased the concentration of CO₂ in the atmosphere. The increase in CO₂ content of the atmosphere may increase the global temperature. Moreover CO₂ gets combined with atmospheric water to produce carbonic acid which is a weak acid.



When the carbonic acid reaches the ground it changes the soil chemistry. Carbon mono-oxide is also liberated by many industries and automobiles which affects the ecosystem. Carbon mono-oxide has a stronger affinity with hemoglobin, a blood pigment which carries O₂ throughout the human body. Hence the hemoglobin combines with Carbon mono-oxide instead of O₂ and it is supplied to various parts of the body. This leads to various metabolic disorders. Similarly the nitrites are also having a stronger affinity with hemoglobin. These phenomenon is illustrated in the figure 7.2.

Fig. No. 9.2 : Normal and Abnormal Reactions



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Industries release enormous quantities of nitrates which is consumed by human beings and other organisms through food and water. The nitrates are changed into nitrites by the bacteria which is present in our digestive system. These nitrites enter into the blood vascular system and combines with haemoglobin which trigger a lot of metabolic disorders.

Industrial wastes include various chemicals, metals, solid wastes and garbage. Release of CFC (Chlorofluorocarbon) in the atmosphere is responsible for the depletion of ozone. Sulphur dioxide released from various industries reacts quickly with atmospheric moisture and forms sulphuric acid which causes many respiratory diseases in man and also it produces 'acid-rain'.

ACTIVITY

Describe how environment is effected by the industrial growth in your area.

9.7 DEGRADATION OF RESOURCES

The degradation of resources lead to various environmental problems. The resources are the base for the economic growth and development of human society. But the excess usages of these resources have enormous adverse effect on the environment. Hence, it is essential to study the proper management of resources and the remedial measures of environmental pollution and degradation arising out of resources used.

9.7.1 Degradation of water resources

Water is a universal solvent which is essential for all life forms. The problems related to the degradation of water resources are as follows:

- i. The surface water resources namely rivers, ponds, pools, streams etc., are affected by the discharge of industrial wastages and domestic sewages.
- ii. Rapid withdrawal of ground water leads to water table depletion.
- iii. Another problem due to the water table depletion is 'subsidence' i.e., sinking of land in response to the removal of water from underlying sediments.
- iv. Over utilization of ground water leads to the leakage of sea water into the ground resulting in the contamination of fresh water. This is known as intrusion of salt water.

- v. Depletion of water table causes the destruction of vegetation.

9.7.2 Exploitation of Mineral Resources

Mineral resources are the non-renewable natural resources. Rapid industrialization and population growth have necessitated exploitation of mineral resources. The problems related to the extracting and using the mineral resources are as follows:

- i. A large quantity of minerals are mined from sizable land which is otherwise suitable for farming. Once the mineral resource has depleted, the land is left as waste.
- ii. Depending upon the nature of mining carried out, mineral exploitation can create a variety of health hazards.
- iii. It leads to water pollution due to washing or sliding of loose materials from waste dumps, tailings, overburden etc.,
- iv. It also leads to air pollution due to the release of some gases into the atmosphere and generation of dust during various operations of mining.
- v. The disposal of mine wastes and tailing, land subsidence etc., lead to land degradation.
- vi. During open-cast mining operations in hill areas, steepening of slopes may occur.
- vii. Sliding down of loose materials is another problem due to the overburden and waste dumps in mines.

9.7.3 Degradation of land resources

Land area accounts for nearly 29% (169 million sq.km) of the world's total area. Land is one of the important natural resources of the earth. On the earth, land is not equally distributed. Land is used for cultivation, construction of buildings, roads, railways etc., By utilizing land, man is able to do the most occupations like agriculture, industries, transportation, mining, cattle and sheep rearing.

Land is not properly utilized by human beings in several parts of the world. Land is eroded by natural agents like rivers, glaciers, sea waves, 'Tsunami' and winds. Moreover, land is also affected by earth quakes, volcanic eruption, landslides etc., These are all the natural forces responsible for the destruction of land. But man is also responsible for the destruction of land resources. The limited land resources on one hand and the rapid population increase and the resulting demand for more land

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on other hand, put pressure on the available land in various countries. The degradation of land affects the living organisms.

ACTIVITY

How would you overcome the impact of industrial growth on environment.

Check Your Progress – 3

Note: a) Space is given below for your answer

b) Compare your answer with those given at the end of this unit

- 7) Mineral resources are..... natural resources
- 8) The process 'subsidence' is due to
- 9) Over utilization of ground water leads to the entry ofwater in to the ground.

9.8 LET US SUM UP

In this unit you have learnt in detail about the Human Ecology with reference to environmental education. You have identified the different interactions between man and environment. How man influences various natural resources like forest, wild life, fisheries and biodiversity are also explained in the unit. Finally we you learnt about the Population Education. Hope you might have enjoyed the unit.

9.9 UNIT - END ACTIVITIES

Discuss about the industrial growth of your area and its impacts on environment.

9.10 POINTS FOR DISCUSSION

"Growth of Indian Population is a boon or bane" Discuss in the light of Human Resource Development.

9.11 ANSWERS TO CHECK YOUR PROGRESS

- 1. Earnest Haeckel
- 2. Physical, social and economical
- 3. Human Adaptation

4. DDT, BHC
5. Rocks
6. Unintentional
7. Non-renewable
8. Water table depletion
9. Sea

Man and Environment

Notes

9.12 SUGGESTED READINGS

- Benny Joseph, 2005, "Environmental Studies", Tata McGraw Hill Publishing Company Limited, New Delhi.
- Nagarajan and Sivakumar, P. "Environmental Education", Ram Publishers, Chennai - 93.
- Eldon et.al., (2000), "Environmental Science' - A study of Internationalships, McGraw Hill, New Delhi

Notes

UNIT – 10 ICT AND ENVIRONMENTAL EDUCATION - I

STRUCTURE

- 10.1 Introduction
- 10.2 Objectives
- 10.3 Information and communication
Technology (ICT)
 - 10.3.1 Meaning & definition
 - 10.3.2 Advantages of ICT in environmental education
- 10.4 Role of ICT in environmental sustainability
- 10.5 Instructional media for environmental
Education
- 10.6 Let us sum up
- 10.7 Unit - end activities
- 10.8 Points for discussion
- 10.9 Answers to check your progress
- 10.10 Suggested readings

10.1 INTRODUCTION

Information and Communication Technology (ICT) is concerned with the storage, retrieval, manipulation, transmission or receipt of digital data. Importantly, it is also concerned with the way these different uses can work with each other. These technologies include computers, the Internet, broadcasting technologies (radio and television), and telephony.

Information and communications technology (ICT) refers to all the technology used to handle telecommunications, broadcast media, intelligent building management systems, audiovisual processing and transmission systems, and network-based control and monitoring functions. Although ICT is often considered an extended synonym for information technology (IT), its scope is broader.

In recent years there has been a groundswell of interest in how computers and the Internet can best be harnessed to improve the

efficiency and effectiveness of education at all levels and in both formal and non-formal settings.

Moreover, different technologies are typically used in combination rather than as the sole delivery mechanism. For instance, the Indira Gandhi National Open University in India combines the use of print, recorded audio and video, broadcast radio and television, and audio conferencing technologies. E learning is quite common in many countries. Web-based learning is a subset of e-learning and refers to learning using an Internet mainly using a browser (such as Chrome or Firefox or Internet Explorer). It can also be viewed as learning through the use of electronic devices.

In this unit a detailed discussion has been made on ICT and Environmental Education.

10.2 OBJECTIVES

- To identify the different dimensions of ICT in environmental education
- Realize the importance of ICT in environmental education
- Establish the relationship between human society and natural resources
- Understand the instructional media for environmental education

10.3 INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

10.3.1 Meaning & Definition

ICT is technology that supports activities involving information such as gathering, processing, storing and presenting data. Increasingly these activities also involve collaboration and communication. Hence IT has become ICT: information and communication technology. Information and communication technology, or ICT, is defined as the combination of informatics technology with other, related technologies, specifically communication technology. Information and communication technology (ICT) has become, within a very short time, one of the basic building blocks of modern society. Many countries now regard understanding ICT and mastering the basic skills and concepts of ICT as part of the core of education, alongside reading, writing and numeracy.

ICTs are a potentially powerful tool for extending educational opportunities, both formal and non-formal, to previously underserved

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constituencies—scattered and rural populations, groups traditionally excluded from education due to cultural or social reasons such as ethnic minorities, girls and women, persons with disabilities, and the elderly, as well as all others who for reasons of cost or because of time constraints are unable to enroll on campus.

One defining feature of ICTs is their ability to transcend time and space. ICTs make possible asynchronous learning, or learning characterized by a time lag between the delivery of instruction and its reception by learners.. Additionally, certain types of ICTs, such as teleconferencing technologies, enable instruction to be received simultaneously by multiple, geographically dispersed learners (i.e., synchronous learning).

Teachers and learners no longer have to rely solely on printed books and other materials in physical media housed in libraries (and available in limited quantities) for their educational needs. With the Internet and the World Wide Web, a wealth of learning materials in almost every subject and in a variety of media can now be accessed from anywhere at any time of the day and by an unlimited number of people. This is particularly significant for many schools in developing countries, and even some in developed countries, that have limited and outdated library resources. ICTs also facilitate access to resource persons, mentors, experts, researchers, professionals, business leaders, and peers—all over the world.

One of the most commonly cited reasons for using ICTs in the classroom has been to better prepare the current generation of students for a workplace where ICTs, particularly computers, the Internet and related technologies, are becoming more and more ubiquitous. Technological literacy, or the ability to use ICTs effectively and efficiently, is thus seen as representing a competitive edge in an increasingly globalizing job market (Rashmi Ranjan Mohanty,2011).

10.3.2 Advantages of ICT in Environmental Education

Teacher of environmental education can use the computer and other ICT instruments in different parts of the lesson. He can use it as an instrument for introducing new contents or for consolidating what is already known in environmental education. According to research Status and trends of ICT use in Slovene primary and secondary schools, primary school teachers feel that ICT use has the most positive effect on consolidation and repetition (79%) and the use of the learned (60%) (Gerlič, 2005, taken from Brečko, Vehovar, 2008). In any case the use of ICT requires thoughtful planning, appropriate selection of ICT tools and developing new teaching strategies from the teacher. According to

Wardle, “appropriate use of technology in teaching extends, enriches, conducts, individualises, differs and broadens the entire curriculum.” (Wardle, 2002, taken from Phalen, 2004). The key factor of a success of this kind of education is the teacher who has to utilize the modern ICT. Here it is not about changing or abolishing of the classic teaching but it is about opening new possibilities in the teaching process that make it more effective and interesting (Brečko, Vehovar, 2008,).

Here are some of the other benefits as suggested by

Rashmi Ranjan Mohanty, 2011.

General benefits

- Greater efficiency throughout the school.
- Communication channels are increased through email, discussion groups and chat rooms
- Regular use of ICT across different curriculum subjects can have a beneficial motivational influence on students’ learning.

Benefits for teachers

- ICT facilitates sharing of resources, expertise and advice
- Greater flexibility in when and where tasks are carried out
- Gains in ICT literacy skills, confidence and enthusiasm.
- Easier planning and preparation of lessons and designing materials
- Access to up-to-date pupil and school data, anytime and anywhere.
- Enhancement of professional image projected to colleagues.
- Students are generally more ‘on task’ and express more positive feelings when they use computers than when they are given other tasks to do.
- Computer use during lessons motivated students to continue using learning outside school hours.

Benefits for students

- Higher quality lessons through greater collaboration between teachers in planning and preparing resources .
- More focused teaching, tailored to students’ strengths and weaknesses, through better analysis of attainment data

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- Improved pastoral care and behaviour management through better tracking of students
- Gains in understanding and analytical skills, including improvements in reading
- Comprehension.
- Development of writing skills (including spelling, grammar, punctuation, editing and re-drafting), also fluency, originality and elaboration.
- Encouragement of independent and active learning, and self-responsibility for learning.
- Flexibility of ‘anytime, anywhere’ access (Jacobsen and Kremer, 2000)
- Development of higher level learning styles.
- Students who used educational technology in school felt more successful in school, were more motivated to learn and have increased self-confidence and self-esteem
- Students found learning in a technology-enhanced setting more stimulating and student-centred than in a traditional classroom
- Broadband technology supports the reliable and uninterrupted downloading of web-hosted educational multimedia resources
- Opportunities to address their work to an external audience
- Opportunities to collaborate on assignments with people outside or inside school

Benefits for parents

- Easier communication with teachers
- Higher quality student reports – more legible, more detailed, better presented
- Greater access to more accurate attendance and attainment information
- Increased involvement in education for parents and, in some cases, improved self-esteem
- Increased knowledge of children’s learning and capabilities, owing to increase in learning activity being situated in the home
- Parents are more likely to be engaged in the school community

- You will see that ICT can have a positive impact across a very wide range of aspects of school life

ACTIVITY

How would you overcome the limitations of ICT ?

10.4 ROLE OF ICT IN ENVIRONMENTAL SUSTAINABILITY

ICT can have tremendous impact on environmental sustainability initiatives in the areas of analysis, planning and action. The majority of ICT applications can be organized into the following categories:

- a. Global environmental research, observation and analysis;
- b. Environmental planning and management capacity building;
- c. Mitigation and action;
- d. Preparedness, adaptation, and emergency management; and
- e. Empowerment and education.

The role of ICT in environmental monitoring and data gathering is paramount and serves as the cornerstone for technological advancements. ICT such as satellite imagery, wireless sensor networks, geographic information systems (GIS), and communications hubs enable a wide variety of applications for environmental sustainability. The International Telecommunications Union (ITU) found ICT like data recording technologies and surveillance systems greatly contribute to observing, monitoring, and ultimately understanding the environment.

However, the task of acquiring relevant data and the ability to draw pertinent conclusions for future actions requires appropriate tools like;

- i. Remote sensing, data collection and storage applications, telemetric systems, meteorological and climate related recording and monitoring systems
- ii. GIS as it applies to data recording and geo-referenced data format
- iii. Computational and processing tools used for analysis and comparison of data sources
- iv. Storage and visualization tools for geographic information and change.

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As environmental issues and impacts become larger and more globally integrated, global collaboration becomes an important contributing factor of ICT usage, development, and success.

Mapping Environmental Hazard in Dhaka, Bangladesh.

Many serious environmental problems, such as land and groundwater, pollution, poor sanitation, and riverbank erosion, pose obstacles to economic development and the improvement of living conditions for the roughly 9,000 slums in Dhaka. ICT have proven to be an effective method by which data can be gathered and analyzed in an attempt to remedy this situation. Census data applied to advanced GIS technology has found a wealth of information helping policy makers and NGOs to understand the complexity of what is happening on the ground and see the diversity within the general slum categorization.

With this data, policy makers can make more informed decisions, ultimately leading to more successful programs aimed at improving the lives of slum dwellers within the city. The Center for Environmental and Geographic Information Services, established as a public trust in 2002 by the government of Bangladesh, has conducted studies of the slums in Dhaka using satellite imagery to map and identify slum settlements, their physical characteristics and boundaries. Such data is accessible online.

COMMONSense Net (CSN) Tumkur in India

COMMONSense Net (CSN) is a project researching and applying the use of wireless networks on small farms in rural India. Another area where ICT show tremendous potential is the use of sensors and sensor networks to boost water usage efficiency. This technique, known as precision agriculture, utilizes computer systems to collect data such as temperature and humidity via remote sensors. This information is then analyzed and other factors such as weather forecasts etc . The computer then calculates the exact amount of water necessary to obtain maximum crop yields, which is an integral step towards economic growth.

This is a vast improvement over farmers who generally irrigate their fields with uniform amounts of water. COMMONSense Net (CSN) is a project researching and applying the use of wireless networks on small farms in rural India. CSN reports that unpredictable and fluctuating rainfall in the already arid region of central India adversely affects poor farmers because they are less likely to invest in yield boosting resources such as additional seeds, fertilizer, or improved technology.

ACTIVITY

How would you effectively utilise ICT in your Class room?

Check Your Progress – 1

Note: a) Space is given below for your answer

b) Compare your answer with those given at the end of this unit

- 1) What are the two components of ICT?
- 2) COMMONSense Net (CSN) is a project researching and applying the use of wireless networks on small farms in _____.
- 3) Write True or False
ICT facilitates sharing of resources, expertise and advice.
- 4) GIS means_____.

10.5 INSTRUCTIONAL MEDIA FOR ENVIRONMENTAL EDUCATION

Media play an important role in environmental education. They are the powerful means of creating environmental awareness. Science and technology made availability of radio and television almost to each house and hence it is possible to impart environmental information through these devices. The media contribute to the efficiency as well as effectiveness of teaching-learning process both in the case of face-to-face and distance education system. The media facilitates to overcome the distance between the teacher and students.

10.5.1 Types of Media

There are two types of media which are :

- Print Media
- Non-Print Media

Print Media

Print as a medium for transmitting information has been commonly used in various fields. Text books are mostly published in the print medium. Printed instructional materials are extensively used in the distance education programme.

Notes

Advantages of Print Media

- i. The print medium is adaptable to different learning environment.
- ii. It is economical
- iii. It has traditionally been used for institutional purposes.
- iv. It is the most important component of learning.
- v. It is the chief component in distance education programme.
- vi. It can be used in any situation; the controlling of environment is not necessary.

Limitations

- i. The print medium does not allow for immediate teacher learner interactions.
- ii. The learner's participation is 'passive' and not active.
- iii. It does not provide opportunities for individualized instruction.
- iv. It lacks instant feedback.
- v. It contributes less towards the development of psychomotor skills.

Non-Print Media

Radio, tape recorder, television, films, video disc, computer, internet etc are the non-print media that can be effectively utilized in the field of environmental education.

a. Film

Film is a valuable medium which helps learners to understand the abstract concepts. By means of films it is possible to bring the reality into the class room as it provides for visual stimulation through colour and motion. Moreover, it paves the way for individualized instruction in the class room. The learner can interact freely with the teacher when they are seeing a particular programme in a film. Specific concepts can be presented and discussed with a small group of students.

Sometimes it is very difficult to bring all the learners to the field in order to investigate a particular environmental problem. For example, to study the Narmada Controversy, it is very difficult to bring the learners to the particular site. Moreover, it consumes a lot of time and it is not economical. Hence, the teacher can show a documentary film about the

Narmadha Controversy, by which the learners can easily understand the problem.

A documentary film can also explain ecological problems that happened in the past. For instance, in March 1973, in Japan it was brought into the notice that Chisso Corporation's aceto-aldehyde plant discharged acetoaldehyde and mercury waste into the sea, where it got into the fish. These fishes were eaten by the local people resulting in loss of hearing; speech and sight and even death. This situation can be well illustrated with the help of the documentary film which is available in the market.

Many complex ideas can be explained by means of films. It provides clarity and concreteness. Moreover, it stimulates interest of the learners and retain their attention of learning.

b. Television

Television is a powerful medium which educate the learners and can develop a sense of participation. The TV. has influence on the young generation and has access to all people. Technologically as a combination of sound and pictures, it provides an effective communication to all. It is useful for mass education through satellite. The Educational Television (ETV) is a system that present learning content in various subject areas through programmes prepared by a central agency. The following are the ETV programmes in India:

- i. Delhi Agricultural Television (DATV) Project.
- ii. Satellite Instructional Television Experiment (SITE)
- iii. Secondary School Television Project
- iv. Post-SITE Project.
- v. Higher Education Television Project (HETV) of UGC

Advantages

- i. The television Programme provides high quality of instruction.
- ii. It promotes social equality for education.
- iii. The learners learn from TV. with their own efforts. Hence, it reduces the dependency on teacher.
- iv. The rapid changes in the curriculum and methods of instruction can easily be incorporated in educational TV. Hence, it ensures flexibility.

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- v. It provides education throughout the country at minimum cost and hence it is highly economical.
- vi. T.V. has the advantage of the audio as well as the video aid.

Limitations

- i. Teaching and learning through TV. is an individualized method and thus co-operation, adjustment, cordial relationship etc. are not developed in viewers.
- ii. The learners can only see the demonstration in the TV screen and thus they have no chance to handle it.
- iii. The learners are the passive observers and are not active participants.
- iv. The screen is small and the focused screens are not clear enough for large size class rooms.
- v. The most important difficulty faced by institutions is to fit its academic schedules to the programme schedules of television stations.

ACTIVITY

List out TV and Radio Programmes relevant to Environmental education for the next month.

10.6 LET US SUM UP

In this unit you have learnt in detail about the ICT and environmental education. Various instructional media for environmental education are also explained in the unit. We have discussed some topics under Educational Radio, Educational T.V. Hope you might have enjoyed the unit.

10.7 UNIT - END ACTIVITIES

Take anyone lesson in environmental education, select an appropriate ICT tool to teach the lesson. And also prepare the model lesson plan to use ICT in teaching and learning process.

10.8 POINTS FOR DISCUSSION

"ICT is a boon or bane in Education" - Discuss.

10.9 ANSWERS TO CHECK YOUR PROGRESS

1. Information Technology, Communication Technology
2. Rural India
3. True
4. Geographical Information System
5. Print media, non print media
6. Instant
7. True
8. Non print

10.10 SUGGESTED READINGS

- Benny Joseph, 2005, "Environmental Studies", Tata McGraw Hill Publishing Company Limited, New Delhi.
- Nagarajan and Sivakumar, P. "Environmental Education", Ram Publishers, Chennai - 93.
- Eldon et.al., (2000), "Environmental Science' - A study of Internationalships, McGraw Hill, New Delhi.

Notes

UNIT: 11 ICT AND ENVIRONMENTAL EDUCATION – II

STRUCTURES

- 11.1 Introduction
- 11.2 Objectives
- 11.3 The satellite instructional television
 - 11.3.1 General objectives of site
- 11.4 Utilization of E-Resources in Environmental Education
 - 11.4.1 E-learning
 - 11.4.2 E-books
 - 11.4.3 E-journals
 - 11.4.4 E-reports and e-clippings
 - 11.4.5 Internet
- 11.5 Let us sum up
- 11.6 Unit - end activities
- 11.7 Points for discussion
- 11.8 Answers to check your progress
- 11.9 Suggested readings

11.1 INTRODUCTION

Apart from being used for broadcasting specific lessons, radio and television can also be used to broadcast general educational programmes. Television is a medium that improves the world, triggers imagination, raises curiosity, encourages education and gathers millions around common interests. Educational Television (**Educational TV**) or learning television is the use of television programs in the teaching and learning process. It may be in the form of individual television programs or dedicated specialty channels. When teachers use educational television programs during class, the relationship between them and their students increases. Internet Protocol television (IPTV) is one of the emerging Internet television technology standards for use by television broadcasters. Web television is a term used for programs created by a wide variety of companies and individuals for broadcast on Internet TV.

Information transferred through **Educational TV** is different from traditional education methods with respect to the audio-visual

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presentation. Explanations related to the subject and examples can be presented visually, so the learner gets motivated, his/her desire for learning increases, and therefore learning and remembering become easier. Allowing thousands of people spreaded a large and distance geographic regions to receive the same program at the synchronous time, television broadcast helps overcome the problem of inequality and imbalance among the regions by providing equality in opportunities.

TV transfers the events or processes through a time process peculiar to itself. In fact a process that might require a long operation can be broadcasted with main points in a short period of time. **Educational TV** may grant positive motivation such as attracting the learner's attention to a certain point or arousing attention with the movements of the camera's coming close, going away, and reflecting details. Invisible or virtual objects, today, can be animated with different expression methods such as cartoon films. It enables distinguished instructors to reach a large mass of students at the same time. The most distinctive specialty of **Educational TV** is its ability to present information to the student which other tools cannot. This is an important opportunity for students who were unable to study at a university at in other educational institutions. (Bates, 1998).

Educational TV is an effective tool in expressing abstract concepts or ideas. Abstract concepts are usually produced and conveyed with words. Besides this, in making an abstract concept concrete, the role of animation and visual experimentation is very important. The limitation here is how to combine the text, which is involving information, with moving views, animation, concrete ideas, utterance and objects like pictures. Educational Television in the learning process could be helpful in understanding abstract ideas directly (Bates, 1998, 215-217).

Besides these advantages, television has some serous disadvantages too which are listed below: i) The experience of watching television has been competed against a lot of activities which a viewer can do whatever want to do at the same time. ii) Each of the programs is compete against to the other programs which are broadcasted from other channels. iii) The viewer can prefer shifting to other program(s) or to daily another activities instead of watching program if television program does not present any attracting or watchable subject for the viewer. (Mutlu 1995, pp. 21-22) One of the important disadvantages of television is that it does not provide instant feedback. In this unit we will discuss about SITE ,a Satellite Instructional TV and utilization of E-resources in Environmental Education.

Notes

11.2 OBJECTIVES

- To understand the Satellite Instructional Television Experiment (SITE)
- Realize the impact of SITE
- Establish the relationship between E-resources and Environmental Education
- Explain the SITE Project
- Identify the way of utilization of E Resources in environmental education.

11.3 THE SATELLITE INSTRUCTIONAL TELEVISION EXPERIMENT (SITE)

The Satellite Instructional Television Experiment (SITE) was an experimental satellite communications project launched in India in 1975, designed jointly by NASA and the Indian Space Research Organization (ISRO). The project made available informational television programmes to rural India. The main objectives of the experiment were to educate the poor people of India on various issues via satellite broadcasting, and also to help India gain technical experience in the field of satellite communications. The beginning of a series of innovative and constructive educational television programmes for national development and for educating the Indian masses living in remote rural areas.

The SITE educational programmes were also aimed at making the children sensitive to, and learn, community living and improve their basic concepts and skills in the areas of numeracy, language and Science.

The programmes were directed at creating a positive attitude to formal education and making education interesting, creative, purposive and stimulating. The educational programmes were so designed as to familiarise children with facts and matters normally beyond their observation and experience.

The experiment ran for one year from 1 August 1975 to 31 July 1976, covering more than 2400 villages in 20 districts of six Indian states and territories. (Andhra Pradesh, Bihar, Karnataka, Madhya Pradesh, Orissa, Rajasthan) The television programmes were produced by All India Radio and broadcast by NASA's ATS-6 satellite stationed above India for the duration of the project.

The project was supported by various international agencies such as the UNDP, UNESCO, UNICEF and ITU. The experiment was

successful, as it played a major role in helping develop India's own satellite program, INSAT. The project showed that India could use advanced technology to fulfill the socio-economic needs of the country. SITE was followed by similar experiments in various countries, which showed the important role satellite TV could play in providing education.

General Objectives of SITE

The following are the General Objectives of SITE;

- To gain experience in the development, testing and management of a satellite-based instructional television system particularly in rural areas and to determine optimal system parameters;
- To demonstrate the potential value of satellite technology in the rapid development of effective mass communications in developing countries;
- To demonstrate the potential value of satellite broadcast TV in the practical instruction of village inhabitants; and
- To stimulate national development in India, with important managerial, economic, technological and social implications.

The study explored:

- The extent to which a climate for development was created by SITE.
- The extent to which SITE accelerated the process of development.
- The extent to which the attitudinal and behavioural changes took place as a result of SITE.

Results of the experiment were:

1. As a System test of satellite broadcast technology in a country like India, the experiment was singular success. The research and development capability generated during setting up of this experiment was an invaluable spin-off.
2. It was more effective than all other media in attracting the female audience.
3. The continuous feedback through everyday interviews showed that the audience favoured instructional programmes as compared to socio- cultural programmes.

Notes

4. A large longitudinal survey showed large gains in information, awareness and knowledge in areas such as health and hygiene, political consciousness, overall modernity, and family planning.
5. It was also found that the gains were greater for under privileged sections of the rural society such as females and illiterates. The gains increased with the degree of television viewing.
6. In the area of agriculture, large number of innovations triggered by the television programmes. Farmers adopted only those new practices which did not demand additional expense on infrastructure.
7. A survey of children showed positive gains in the area of language development and in the attitude of seeking knowledge and information from sources other than conventional classroom teaching.
8. They learnt new stories and songs and activities such as making of models and toys became popular in most of the schools.
9. In both attitudinal, as well as, in behavioural information, the overall modernity increased as a result of TV viewing. It was higher among female frequent viewers as compared to male frequent viewers.

ACTIVITY

Prepare the cost benefit Analysis for the project SITE

11.4 UTILISATION OF E-RESOURCES IN ENVIRONMENTAL EDUCATION

Electronic resources are popularly known as E-Resources which can be effectively utilized in Environmental Education. In this sub section a brief description has been made on the utilisation of e-resources in environmental education.

E-Learning

It refers to the use of modern tools, such as computers, digital technology, electronic media, networked digital devices and associated software and courseware with learning scenarios, worksheets and interactive exercises that facilitate learning.

Features of E-Learning

The following are the features of E-Learning;

Notes

- Learning is self-paced and gives students a chance to speed up or slow down as necessary
- Learning is self-directed, allowing students to choose content and tools appropriate to their differing interests, needs, and skill levels
- Accommodates multiple learning styles using a variety of delivery methods geared to different learners; more effective for certain learners
- Designed around the learner
- Geographical barriers are eliminated, opening up broader education options
- 24/7 accessibility makes scheduling easy and allows a greater number of people to attend classes
- On-demand access means learning can happen precisely when needed
- Travel time and associated costs (parking, fuel, vehicle maintenance) are reduced or eliminated
- Overall student costs are frequently less (tuition, residence, food, child care)
- Potentially lower costs for companies needing training, and for the providers.

E-Books

The E-Books are designed to facilitate the rapid retrieval of discrete items of information to answer specific questions. That is, specific concepts can be quickly and simply identified and retrieved from entire articles or books in order to answer specific reference questions, because it is normally possible to search for occurrences of words or phrases anywhere in the text. Many E-Books are available related to Environment and Environmental Education which can be effectively utilized in teaching and learning process.

The Research Findings indicates that the E-Book publisher Versaware (2001) interviewed students in 63 colleges in 22 states and found 87% students stated that e-textbooks could be more interesting than print textbook.

Eric (2001) surveyed his students about their experiences and performances with e-books. Nearly 95% of the students are wish to study new courses with e-books and all are recommending the use of e-books.

Notes

But, it has some criticisms also. Nielsen (1998) states that people read about 25% slower from computer screen than from printed paper. Schugler (1998) concluded that many opt to print and read digitized material rather than scroll through large chunks of text while sitting in front of a humming monster of a machine.

E-Journals

The publication of Journal in electronic form is called as E-Journals. It is estimated about 2,250 e-journals are available free of cost over the Internet (Aslam Mehdi, 2001). One of the important advantages of e-publishing is the speed of publications and its up-to-datedness. If a learner wants to read the related articles the e-journals provide links. A learner even in sitting inside a class room could refer any relevant articles without any helps. It is reducing the gap between author of the paper and learner. These are not only covering the research articles but also verity of activities such as online services, information about the CD-ROM and other digital products and help line facilities. It provides facilities for downloading printing the appropriate articles at end user work station.

E-Reports and E-Clippings

Reports published by various apex bodies can be digitalized and effectively retrieved. Reading e-reports is much easier and faster and is learner friendly. In the classroom situation the information that are relevant to the specific topic are identified and scanned from the different sources. These are achieved into server and learner can view them instantly and thereby supporting classroom learning.

Internet

The internet can be effectively utilized by the following ways

- As a reference material
- As a research tool for project based learning
- As a great resources for co-operative learning
- For reinforcement of materials already covered in the classroom.
- As a resource for expanding the multicultural aspect of the classroom
- To develop teaching strategies suitable for a specific topic with the help of educators and other experts throughout the world
- Role of Internet in Instruction

Notes

- The internet can be effectively utilized in the classroom by the following ways
- As a reference material
- As a research tool for project based learning
- As a great resources for co-operative learning
- For reinforcement of materials already covered in the classroom.
- As a resource for expanding the multicultural aspect of the classroom
- To develop teaching strategies suitable for a specific topic with the help of educators and other experts throughout the world there are many advantages to online and computer-based learning when compared to traditional face-to-face courses and lectures. There are a few disadvantages as well.

Advantages of E Learning

The following are the advantages of E-Learning;

- Students can study anywhere they have access to a computer and Internet connection
- It Reduces travel time and travel costs for off-campus students
- Students may have the option to select learning materials that meets their level of knowledge and interest
- Self-paced learning modules allow students to work at their own pace
- Flexibility to join discussions in the bulletin board threaded discussion areas at any hour, or visit with classmates and instructors remotely in chat rooms
- Instructors and students both report eLearning fosters more interaction among students and instructors than in large lecture courses
- E-Learning can accommodate different learning styles and facilitate learning through a variety of activities
- Develops knowledge of the Internet and computers skills that will help learners throughout their lives and careers

Notes

- Successfully completing online or computer-based courses builds self-knowledge and self-confidence and encourages students to take responsibility for their learning
- Learners can test out of or skim over materials already mastered and concentrate efforts in mastering areas containing new information and/or skills.

Disadvantages of online or computer-based learning

E-Learning has the following disadvantages;

- It requires some basic E Learning Skills
- Learners with low motivation or bad study habits may fall behind
- Without the routine structures of a traditional class, students may get lost or confused about course activities and deadlines
- Students may feel isolated from the instructor and classmates
- Instructor may not always be available when students are studying or need help
- Slow Internet connections or older computers may make accessing course materials frustrating
- Managing computer files and online learning software can sometimes seem complex for students with beginner-level computer skills
- Hands-on or lab work is difficult to simulate in a virtual classroom.

ACTIVITY

How would you effectively utilise the E Resources in Environmental Education?

Check Your Progress –1

Note: a) Space is given below for your answer

b) Compare your answer with those given at the end of this unit

- 1) What are the two major types of media.
- 2) Print media lacks feedback.
- 3) Write True or False
The print media is adaptable to different learning environment.
- 4) HETV of UGC is an example ofmedia.

11.5 LET US SUM UP

In this unit you have learnt in detail about the Educational TV. You have identified the different dimensions of E-resources. We have discussed some advantages and limitations of Educational T.V. Finally you learnt about SITE and utilisation of E-resources in environmental education. Hope you might have enjoyed the unit.

11.6 UNIT - END ACTIVITIES

Take anyone lesson in environmental education, And also prepare the model lesson plan to teach through Educational TV.

11.7 POINTS FOR DISCUSSION

"E resources can be used for conserving natural resources" - Discuss.

11.8 ANSWERS TO CHECK YOUR PROGRESS

1. Print media, non print media
2. Instant
3. True
4. Non print

11.9 SUGGESTED READINGS

- Benny Joseph, 2005, "Environmental Studies", Tata McGraw Hill Publishing Company Limited, New Delhi.
- Nagarajan and Sivakumar, P. "Environmental Education", Ram Publishers, Chennai - 93.
- Eldon et.al., (2000), "Environmental Science' - A study of Internationalships, McGraw Hill, New Delhi.

UNIT – 12 ENVIRONMENTAL MANAGEMENT

Notes

STRUCTURE

- 12.1 Introduction
- 12.2 Objectives
- 12.3 Meaning of environmental management
 - 12.3.1 Characteristics of environmental management
- 12.4 Approaches of environmental management
- 12.5 Social forest
 - 12.5.1 Definition of social forest
 - 12.5.2 Objectives of social forest
 - 12.5.3 Categories of social forest
 - 12.5.4 Problems in social project
- 12.6 Water resources management
 - 12.6.1 Definition
- 12.7 Rain water harvest
 - 12.7.1 Definition
 - 12.7.2 Rain water harvesting techniques
 - 12.7.3 Advantages
- 12.8 Let us sum up
- 12.9 Unit - end activities
- 12.10 Points for discussion
- 12.11 Answers to check your progress
- 12.12 Suggested readings

12.1 INTRODUCTION

Quality of life discussions have usually centered on the subject of "basic human needs" (Streeton and Burki, 1978; McHale and McHale, 1977) and the moral choices to be made among those needs in development activities (Goulet, 1971).

Human life quality depends on the physical and psychological health or welfare of an individual or a society. Health and welfare in turn, depend on the degree to which a person's or a society's respective environments satisfy their needs.

Needs vary substantially by culture, age, sex, season, climate, education and income. Some must be satisfied before others are felt. It is often difficult to distinguish between "needs" and "wants" and lack of information and understanding often undo efforts to improve one's quality of life. If the allotment of resources required to satisfy any of their perceived needs is not sufficient or, though sufficient is placed in jeopardy, that society will believe that its quality of life is threatened and will fight to save or restore it.

The objective of environmental management is improved human life quality. It involves the mobilization of resources and the use of government to administer the use of both natural and economic goods and services. It is based on the principles of ecology. It uses systems analysis and conflict resolution to distribute the costs and benefits of development activities throughout the affected populations and seeks to protect the activities of development from natural hazards. Conflict identification is one of the more important tasks in environmental management planning and the resolution of conflicts is a fundamental part of what makes up "environmentally sound development."

12.2 OBJECTIVES

- To understand the concept of environmental management
- Realize the importance environmental management
- Establish the relationship between environment and management
- Understand the approaches of environmental management
- Explain the Social forest system
- Identify the techniques of rain water harvest. .

Notes

12.3 MEANING OF ENVIRONMENTAL MANAGEMENT

Environmental management is the process to improve the relationship between the environment and man so that 'environment quality' and human society may be improved. This objective can be achieved through check on destructive activities of man, conservation, protection, regulation and regeneration of nature. It is related to the rational adjustment of man with nature, involving judicious exploitation and utilization of natural resources, without disturbing the ecological balances and ecosystem equilibrium. Environmental management is, therefore, a compromise between ecological balance, ecosystem stability and human socioeconomic progress and thus it must take into consideration the ecological principles and socio-economic needs of the society.

It is difficult to define the term '*environmental management*', because it is understood differently by different experts of different disciplines. The objectives of environmental management are varied, complex and even conflicting in nature. According to Riordan (1971) management refers to conscious preference from the variety of alternative plans and proposals and furthermore that such choices involve purposeful commitment to recognized and desired objectives. Managements employ strategies to realize the objectives." The theme of environmental management is "the reduction or minimization of the impact of human activities on the environment, thus an effort to protect the overuse, misuse of environmental resources".

12.3.1 Characteristics of Environmental Management

The following are the main characteristics of environmental management:

1. The main function is to maintain ecological balance and ecosystem stability for the welfare of man.
2. It is related to the rational adjustment of man with nature.
3. It involves socio-economic development of society and maintenance of 'environmental quality'
4. It compromises between ecological balance, ecosystem stability and socio-economic development of man.
5. It has two major aspects :-
 - a. Socio-economic development and
 - b. Stability of ecological balances and stability of individual ecosystem in particular.

6. The essential prerequisites of environmental management are the conservation of resources and control of pollution.
7. Environmental management has *three* main functions:
 - a. Protection of environment and lowering down the level of pollution,
 - b. Enhancement of socio-economic values of the environment and its resources, and
 - c. Preservation of the environment for future generation.
8. It evaluates the policies, plans, priorities, implemented for the maintenance of the ecological balance and stability of ecosystem in view of the human development.

Activity

Discuss the role of environmental management to ensure sustainable growth.

Check Your Progress – 1

Note: a) Space is given below for your answer

b) Compare your answer with these given at the end of this unit

- 1) The main function of is to maintain ecological balance and ecosystem stability for the welfare of man.
- 2) Environmental management involves socio-economic development of the society and maintenance of
- 3) Preserving and restoring the environment come under
- 4) Write True or False:

Preservation of the environment for future generation does not come under environmental management.

12.4 APPROACHES OF ENVIRONMENTAL MANAGEMENT

Basically there are two approaches in Environmental Management which are as follows;

- i) Preservative Approaches, and

Notes

ii) Conservative Approaches

According to the first approach, man should not disturb the natural system and should adapt to it. But this is difficult because for all types of developmental activities he will have to use nature and its components, resulting in eco-imbalance of varied intensity.

The conservative approach is that there should not be overexploitation of nature and conservation of natural resources is essential for sustainable development. In fact, proper utilisation and conservation of resources is the prime objective of environmental management. In the World Conservation Strategy (1980), the three main objectives stated were:

- Maintenance of essential ecological processes,
- Preservation of genetic diversity, and
- Sustainable utilisation of natural resources.

In recent years, several approaches have been developed for the management of environment. Regional planners often adopt a human ecology approach, while other planners suggest a system analysis or an ecosystem approach. Doxiadis (1977) has developed a science of planning settlement in balance with nature and termed it as ekistics.

The various approaches developed for the environmental management are:

1. **Ad hoc approach-**, developed in reaction to a specific situation.
2. **Problem-solving approach:** for identification of problems and needs and implement solutions.
3. **Systems approach:** such as ecosystem, agro-ecosystem, etc. Regional approach: based on ecological zones such as watershed, river basin, coastal zone, command area development, island, etc.
4. **Specialist discipline approach**, often adopted by professionals for air, water and land management, urban management, tourism management, and environmental health.
5. **Voluntary sector approach** encouraged and supported by NGOs.
6. **Commercial approach:** for environmental management for business.
7. **Human ecology approach-**, for study of relations between humans or society and nature.

8. **Political ecology approach-**, to develop policies and laws.

Apart from the above, an **Environmental Management System(EMS)** approach has been developed as an integrated and proactive approach to environmental issues.

It helps industry or other bodies and is designed to ensure that an environmental policy and environmental objectives are adopted and followed.

Thus, the EMS system approach helps to:

- develop a proactive environment approach;
- ensure a balanced view across all functions;
- enable effective, directed environmental goal setting; and
- make the environmental auditing process effective.

12.5 SOCIAL FOREST

12.5.1 Definition of Social Forest

Social forestry means the management and protection of forests and afforestation on barren lands with the purpose of helping in the environmental, social and rural development. The term, social forestry, was first used in India 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 taking the pressure off currently existing forests by planting trees on all *unused and fallow land*.

Social Forestry is a management and protection of forest and afforestation on the degraded land with the purpose of helping in the Environment, Social& Rural development.

Social forestry is the forestry by the people and for the people, whose main purpose is to fulfill the needs of forestry which are - manure, food, fruit, fibre and productive capacity. As a whole social forestry's main objective is to reconstruct the ecosystem and conserve the environment.

Although, there are lots of definitions of Social Forestry, this sounds to encompass almost all the aspects that are fundamentally pertinent. Social Forestry is the Forestry outside the Conventional Forestry that aims at providing continuous flow of goods and services for the benefit of the rural people by managing forests of their choice. While the Conventional Forestry seemingly targets on a single, usually timber,

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the Social Forestry has manifold targets: timber, fuelwood, fodder, wild vegetables, fruits, water etc., to cover almost all the needs of the people.

12.5.2 Objectives of Social Forest

The National Commission for Farmers has determined the following objectives for social forestry -

- a. To cooperate soil conservation and to prevent spoiling the productive capacity of soil.
- b. To increase fuel availability and to increase the food modification by increasing fruit production.
- c. To encourage plantation of large and beautiful trees which provide shadow to enhance the natural beauty and to plant all around the cultivation field to increase production.
- d. ' To encourage environment conservation by plantation and to create general consciousness regarding environment conservation.
- e. To enhance the natural beauty of the villages and cities by plantation.

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 recognised 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.

12.5.3 Categories of Social Forest

Social forestry scheme can be categorized into following groups :

- farm forestry,
- community forestry,
- extension forestry and
- agro-forestry.

Farm forestry

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 farmland 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 they are interested in growing trees without any economic motive. They may want it to provide shade for the agricultural crops; as wind shelters; soil conservation or to use 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, 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 took advantage and sold 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 planting of Eucalyptus, as a fast growing exotic, 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'.

Notes

Extension forestry

Planting of trees on the sides of roads, canals and railways, along with planting on wastelands is known as 'extension' forestry, increasing the boundaries of forests. Under this project there has been creation of wood lots in the village common lands, government wastelands and panchayat lands.

Schemes for afforesting degraded government forests that are close to villages are being carried out all over the country. Extension forestry which includes the activity of raising trees on farm lands, villages wastelands and community forest areas and on lands along the sides of roads, canal banks and railway lines (Anon., 1976). More recently, there has been emphasis on dynamic land use planning and efforts are made to maximise production on farmlands under agroforestry.

Agro- forestry

Planting of trees on and around agricultural boundaries, and on marginal, private lands, in combination with agricultural crops is known as agro-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.

12.5.4 Problems in Social project

Social forestry programme has certain problems.

These are:

1. The lack of information among people and ignorance regarding social forestry programme.
2. Illegal tree-cutting.
3. In many states there are unsatisfactory activities regarding social forestry.
4. Social forestry has not been implemented extensively.
5. Corruption and misuse of the fund which is for the purpose of social forestry.

ACTIVITY

How would you overcome the limitations of Social Forestry?

12.6 WATER RESOURCE MANAGEMENT

*Environmental
Management*

Notes

Water is an essential resource for all life on the planet. Of the water resources on Earth only three percent of it is fresh and two-thirds of the freshwater is locked up in ice caps and glaciers. Of the remaining one percent, a fifth is in remote, inaccessible areas and much seasonal rainfall in monsoonal deluges and floods cannot easily be used. At present only about 0.08 percent of all the world's fresh water is exploited by mankind in ever increasing demand for sanitation, drinking, manufacturing, leisure and agriculture.

Much effort in water resource management is directed at optimising the use of water and in minimising the environmental impact of water use on the natural environment. Successful management of any resources requires accurate knowledge of the resource available, the uses to which it may be put, the competing demands for the resource, measures to and processes to evaluate the significance and worth of competing demands and mechanisms to translate policy decisions into actions on the ground.

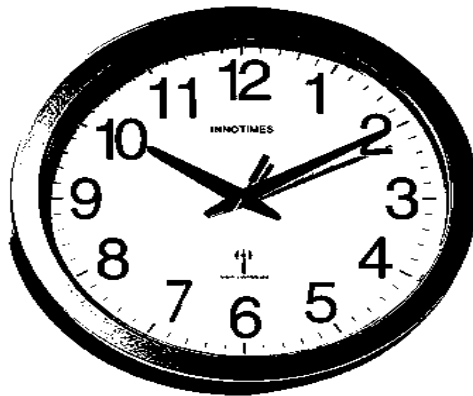
For water as a resource this is particularly difficult since sources of water can cross many national boundaries and the uses of water include many that are difficult to assign financial value to and may also be difficult to manage in conventional terms. Examples include rare species or ecosystems or the very long term value of ancient ground water reserves.

12.6.1 Definition

Water resource management is the activity of planning, developing, distributing and managing the optimum use of water resources. It is a sub-set of water cycle management. Ideally, water resource management planning has regard to all the competing demands for water and seeks to allocate water on an equitable basis to satisfy all uses and demands. As with other resource management, this is rarely possible in practice.

DO YOU KNOW?

CHILDREN



**EVERY MINUTE A CHILD DIES OF A WATER-RELATED
DISEASE**

WOMEN



**WOMEN AND CHILDREN SPEND 140 MILLION HOURS A
DAY COLLECTING WATER**

WATER



1 IN 9 PEOPLE LACK ACCESS TO SAFE WATER

SANITATION



**MORE PEOPLE HAVE A MOBILE PHONE THAN A
TOILET**

ECONOMIC

*Environmental
Management*

Notes



Notes

**FOR EVERY \$1 SPENT ON WATER AND SANITATION
THERE IS A \$4 ECONOMIC RETURN**

ACTIVITY

In your area verify whether ground water is suitable for drinking?
If not analyze the reason.

12.7 RAIN WATER HARVEST

12.7.1 Definition

Rainwater harvesting is a technique used for collecting, storing, and using rainwater for landscape irrigation and other uses. The rainwater is collected from various hard surfaces such as roof tops and/or other types of manmade above ground hard surfaces.

Rainwater harvesting is a technology used for collecting and storing rainwater from rooftops, the land surface or rock catchments using simple techniques such as jars and pots as well as more complex techniques such as underground check dams.

12.7.2 Rain Water Harvesting Techniques :

There are two main techniques of rain water harvestings.

- Storage of rainwater on surface for future use.
- Recharge to ground water.

The storage of rain water on surface is a traditional techniques and structures used were underground tanks, ponds, check dams, weirs etc.

Recharge to ground water is a new concept of rain water harvesting and the structures generally used are :-

Pits :- Recharge pits are constructed for recharging the shallow aquifer. These are constructed 1 to 2 m, wide and to 3 m. deep which are back filled with boulders, gravels, coarse sand.

Trenches:- These are constructed when the permeable stratum is available at shallow depth. Trench may be 0.5 to 1 m. wide, 1 to 1.5m. deep and 10 to 20 m. long depending up availability of water. These are back filled with filter. materials.

Dug wells:- Existing dug wells may be utilised as recharge structure and water should pass through filter media before putting into dug well.

Hand pumps :- The existing hand pumps may be used for recharging the shallow/deep aquifers, if the availability of water is limited. Water should pass through filter media before diverting it into hand pumps.

Recharge wells :- Recharge wells of 100 to 300 mm. diameter are generally constructed for recharging the deeper aquifers and water is passed through filter media to avoid choking of recharge wells.

Recharge Shafts :- For recharging the shallow aquifer which are located below clayey surface, recharge shafts of 0.5 to 3 m. diameter and 10 to 15 m. deep are constructed and back filled with boulders, gravels & coarse sand.

Lateral shafts with bore wells :- For recharging the upper as well as deeper aquifers lateral shafts of 1.5 to 2 m. wide & 10 to 30 m. long depending upon availability of water with one or two bore wells are constructed. The lateral shafts is back filled with boulders, gravels & coarse sand.

Spreading techniques :- When permeable strata starts from top then this technique is used. Spread the water in streams/Nalas by making check dams, nala bunds, cement plugs, gabion structures or a percolation pond may be constructed.

ACTIVITY

How would you recharge ground water in your area?

The techniques usually found in Asia and Africa arise from practices employed by ancient civilizations within these regions and still serve as a major source of drinking water supply in rural areas. Commonly used systems are constructed of three principal components; namely, the catchment area, the collection device, and the conveyance system.

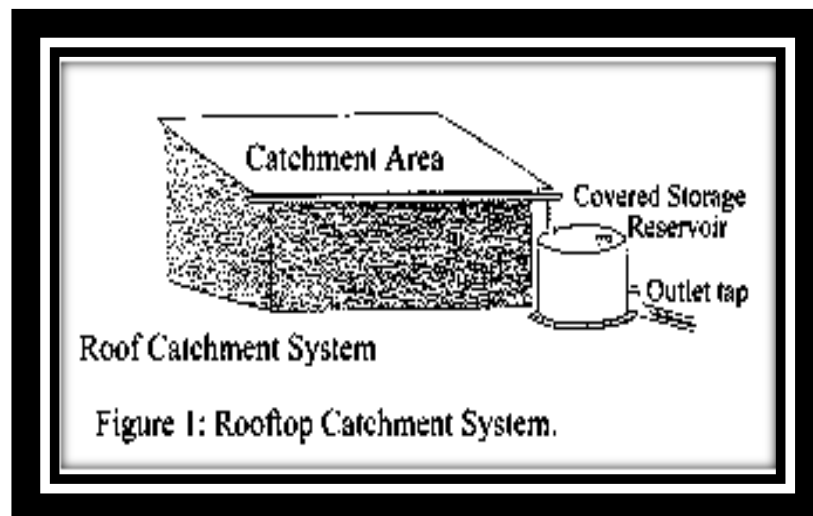
Notes

a. **Catchment Areas**

Rooftop catchments: In the most basic form of this technology, rainwater is collected in simple vessels at the edge of the roof. Variations on this basic approach include collection of rainwater in gutters which drain to the collection vessel through down-pipes constructed for this purpose, and/or the diversion of rainwater from the gutters to containers for settling particulates before being conveyed to the storage container for the domestic use.

As the rooftop is the main catchment area, the amount and quality of rainwater collected depends on the area and type of roofing material. Reasonably pure rainwater can be collected from roofs constructed with galvanized corrugated iron, aluminium or asbestos cement sheets, tiles and slates, although thatched roofs tied with bamboo gutters and laid in proper slopes can produce almost the same amount of runoff less expensively (Gould, 1992).

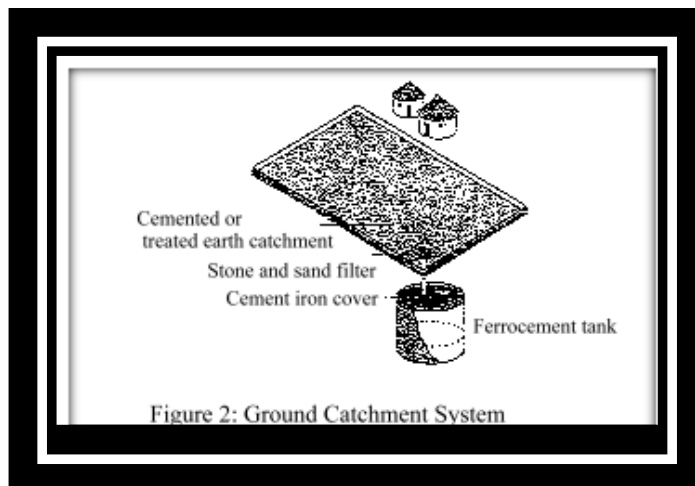
However, the bamboo roofs are least suitable because of possible health hazards. Similarly, roofs with metallic paint or other coatings are not recommended as they may impart tastes or colour to the collected water. Roof catchments should also be cleaned regularly to remove dust, leaves and bird droppings so as to maintain the quality of the product water which is shown in the fig no 9.1



Land surface catchments: Rainwater harvesting using ground or land surface catchment areas is less complex way of collecting rainwater. It involves improving runoff capacity of the land surface through various techniques including collection of runoff with drain pipes and storage of collected water. Compared to rooftop catchment techniques, ground

catchment techniques provide more opportunity for collecting water from a larger surface area.

By retaining the flows (including flood flows) of small creeks and streams in small storage reservoirs (on surface or underground) created by low cost (e.g., earthen) dams, this technology can meet water demands during dry periods. There is a possibility of high rates of water loss due to infiltration into the ground, and, because of the often marginal quality of the water collected, this technique is mainly suitable for storing water for agricultural purposes. Various techniques available for increasing the runoff within ground catchment areas involve: i) clearing or altering vegetation cover, ii) increasing the land slope with artificial ground cover, and iii) reducing soil permeability by the soil compaction and application of chemicals (see figure no 9.2).



Clearing or altering vegetation cover: Clearing vegetation from the ground can increase surface runoff but also can induce more soil erosion. Use of dense vegetation cover such as grass is usually suggested as it helps to both maintain an high rate of runoff and minimize soil erosion.

Increasing slope: Steeper slopes can allow rapid runoff of rainfall to the collector. However, the rate of runoff has to be controlled to minimise soil erosion from the catchment field. Use of plastic sheets, asphalt or tiles along with slope can further increase efficiency by reducing both evaporative losses and soil erosion. The use of flat sheets of galvanized iron with timber frames to prevent corrosion was recommended and constructed in the State of Victoria, Australia, about 65 years ago (Kenyon, 1929; cited in UNEP, 1982).

Notes

Soil compaction by physical means: This involves smoothing and compacting of soil surface using equipment such as graders and rollers. To increase the surface runoff and minimize soil erosion rates, conservation bench terraces are constructed along a slope perpendicular to runoff flow. The bench terraces are separated by the sloping collectors and provision is made for distributing the runoff evenly across the field strips as sheet flow. Excess flows are routed to a lower collector and stored (UNEP, 1982).

Soil compaction by chemical treatments: In addition to clearing, shaping and compacting a catchment area, chemical applications with such soil treatments as sodium can significantly reduce the soil permeability. Use of aqueous solutions of a silicone-water repellent is another technique for enhancing soil compaction technologies. Though soil permeability can be reduced through chemical treatments, soil compaction can induce greater rates of soil erosion and may be expensive. Use of sodium-based chemicals may increase the salt content in the collected water, which may not be suitable both for drinking and irrigation purposes.

b. Collection Devices

Storage tanks: Storage tanks for collecting rainwater harvested using guttering may be either above or below the ground. Precautions required in the use of storage tanks include provision of an adequate enclosure to minimise contamination from human, animal or other environmental contaminants, and a tight cover to prevent algal growth and the breeding of mosquitos. Open containers are not recommended for collecting water for drinking purposes. Various types of rainwater storage facilities can be found in practice. Among them are cylindrical Ferro cement tanks and mortar jars.

The Ferrocement tank consists of a lightly reinforced concrete base on which is erected a circular vertical cylinder with a 10 mm steel base. This cylinder is further wrapped in two layers of light wire mesh to form the frame of the tank. Mortar jars are large jar shaped vessels constructed from wire reinforced mortar. The storage capacity needed should be calculated to take into consideration the length of any dry spells, the amount of rainfall, and the per capita water consumption rate.

In most of the Asian countries, the winter months are dry, sometimes for weeks on end, and the annual average rainfall can occur within just a few days. In such circumstances, the storage capacity should be large enough to cover the demands of two to three weeks. For example, a three person household should have a minimum capacity of 3 (Persons) x 90 (l) x 20 (days) = 5 400 l.

Rainfall water containers: As an alternative to storage tanks, battery tanks (i.e., interconnected tanks) made of pottery, ferrocement, or polyethylene may be suitable. The polyethylene tanks are compact but have a large storage capacity (ca. 1000 to 2 000), are easy to clean and have many openings which can be fitted with fittings for connecting pipes.

In Asia, jars made of earthen materials or ferrocement tanks are commonly used. During the 1980s, the use of rainwater catchment technologies, especially roof catchment systems, expanded rapidly in a number of regions, including Thailand where more than ten million 2 m³ ferrocement rainwater jars were built and many tens of thousands of larger ferrocement tanks were constructed between 1991 and 1993.

Early problems with the jar design were quickly addressed by including a metal cover using readily available, standard brass fixtures. The immense success of the jar programme springs from the fact that the technology met a real need, was affordable, and invited community participation.

c. **Conveyance Systems**

Conveyance systems are required to transfer the rainwater collected on the rooftops to the storage tanks. This is usually accomplished by making connections to one or more down-pipes connected to the rooftop gutters. When selecting a conveyance system, consideration should be given to the fact that, when it first starts to rain, dirt and debris from the rooftop and gutters will be washed into the down-pipe. Thus, the relatively clean water will only be available some time later in the storm. There are several possible choices to selectively collect clean water for the storage tanks. The most common is the down-pipe flap.

In order to safely fill a rainwater storage tank, it is necessary to make sure that excess water can overflow, and that blockages in the pipes or dirt in the water do not cause damage or contamination of the water supply. The design of the funnel system, with the drain-pipe being larger than the rainwater tank feed-pipe, helps to ensure that the water supply is protected by allowing excess water to bypass the storage tank.

12.7.3 Advantages

Rainwater harvesting technologies are simple to install and operate. Local people can be easily trained to implement such technologies, and construction materials are also readily available.

Notes

Rainwater harvesting is convenient in the sense that it provides water at the point of consumption, and family members have full control of their own systems, which greatly reduces operation and maintenance problems.

Running costs, also, are almost negligible. Water collected from roof catchments usually is of acceptable quality for domestic purposes. As it is collected using existing structures not specially constructed for the purpose, rainwater harvesting has few negative environmental impacts compared to other water supply project technologies. Although regional or other local factors can modify the local climatic conditions, rainwater can be a continuous source of water supply for both the rural and poor. Depending upon household capacity and needs, both the water collection and storage capacity may be increased as needed within the available catchment area.

ACTIVITY

Prepare a list of rain water harvesting systems available in your area?

Check Your Progress – 2

Note: a) Space is given below for your answer

b) Compare your answer with those given at the end of this unit

5) Recharge to ground water is a new concept of _____.

6) Conveyance systems are required to transfer the rainwater collected on the rooftops to the storage tanks..

7) Write True or False

Water resource management is the activity of planning, developing, distributing and managing the optimum use of rain water.

8) What are two main techniques of rain water harvestings?

12.8 LET US SUM UP

In this unit you have learnt in detail about the environmental management. You have identified the different concept and meaning of environmental management. Various approaches for environmental management are also explained in the unit. The concept of Social Forest

and its advantages are discussed in detailed manner. Finally you learnt about Rain Water Harvest system. Hope you might have enjoyed the unit.

*Environmental
Management*

12.9 UNIT - END ACTIVITIES

Explain the feasibility of establishing an appropriate rain water harvest system in your area.

Notes

12.10 POINTS FOR DISCUSSION

Whether Environmental management is an Art or Science? - Discuss.

12.11 ANSWERS TO CHECK YOUR PROGRESS

- 1) Environmental Management
- 2) Environmental Quality
- 3) Environmental Management
- 4) False
- 5) Rain water harvest
- 6) Storage Tank
- 7) False
- 8) Two Main Techniques are:
 - Storage of rain water on surface for future
 - Recharge to ground water.

12.12 SUGGESTED READINGS

- Benny Joseph, 2005, "Environmental Studies", Tata McGraw Hill Publishing Company Limited, New Delhi.
- Nagarajan and Sivakumar, P. "Environmental Education", Ram Publishers, Chennai - 93.
- Eldon et.al., (2000), "Environmental Science' - A study of Internationalships, McGraw Hill, New Delhi.

UNIT – 13 EVALUATION OF ENVIRONMENTAL EDUCATION – I

Notes

STRUCTURE

- 13.1 Introduction
- 13.2 Objectives
- 13.3 Concept of evaluation
 - 13.3.1 Learning outcomes in environmental education
 - 13.3.2 Assessment, measurement and evaluation
 - 13.3.3 Measurement in physical science and in behavioural science
- 13.4 Evaluation
- 13.5 Let us sum up
- 13.6 Unit end activities
- 13.7 Points for discussion
- 13.8 Answers to check your progress
- 13.9 Suggested readings

13.1 INTRODUCTION

Evaluation is a systematic continuous process of determining (i) the extent to which specified educational objectives previously identified and defined are attained (ii) the effectiveness of the learning experiences and (iii) the accomplishment of the goals of education. Thus evaluation is integrated with the whole task of education. Environmental education provides for two major areas of evaluation; (i) educational attainment and (ii) the impact on the environment. In the previous unit we have discussed about the curriculum and methods in environmental education. The methods like discussion, seminar, workshop, problem solving etc. are studied in detail. In this unit, we shall deal with evaluation in environmental education.

13.2 OBJECTIVES

Students will be able to

- recognize the concept of evaluation
- analyse the importance of evaluation in environmental education
- Differentiate Measurement and Evaluation

- Understand the measurement in Physical Science and Behavioural Science

13.3 CONCEPT OF EVALUATION

Notes

Evaluation is a comprehensive term which has a wider scope. According to Michaelis, "Evaluation is the process of determining the extent to which objectives have been achieved. It includes all of the procedures used by the teacher, children, principal and other school procedures to apprise the outcomes of instruction".

Kapoor maintains that "Evaluation should consist of not only testing knowledge but should also take note of the changes in pupils' understanding, skills, attitudes and interest".

According to Hanna, "Evaluation is a process of gathering and interpreting evidence on change in the behaviour of all students as they progress through school"

Thus evaluation is a continuous positive process without a negative tone.

13.3.1 Learning Outcomes in Environmental Education

It is necessary to estimate the learning outcomes among the learners. On the completion of the course, learners should have achieved the following learning outcomes in environmental education.

- i. The learners should have detailed knowledge and 'understanding of the principles and practices of environmental education.
- ii. They should be aware of the main national and international policies on environmental conservation and protection and the way in which these are implemented
- iii. They should demonstrate the fundamental knowledge of the relationship between man and environment.
- iv. They should have a detailed understanding of various management techniques in environmental education.
- v. They should be able to critically examine the application of ecological and biographical theory to environmental and conservation management.

Notes

- vi. They should demonstrate a personal interest in the natural world and should appreciate the wonders of nature.
- vii. They should understand the mechanism of nature and its sustainability.
- viii. They should develop the sensitivity to feel good or bad environment, which leads to development of environmental awareness.
- ix. They should have to realize that world population is increasing at an alarming rate.
- x. They should be aware of the impact of population explosion on environment
- xi. They should understand the depletion and degradation of natural
- xii. They should understand and ready to apply the remedial ways to protect the environment in daily life.

One of the important outcomes of environmental education is to create environmental awareness among the learners. Awareness is a state of being conscious. Another important general outcome is the understanding and application of knowledge for protection of environment. The focus is shifted gradually from awareness to understanding and from understanding to application. The awareness can be estimated through an awareness scale and the understanding and application of knowledge for protection of environment could be assessed through various tools and techniques including the achievement and performance tests.

13.3.2 Assessment, Measurement and Evaluation

Assessment, measurement, and evaluation are part of the processes of science and issues related to each topic often overlap.

Assessment refers to the collection of data to describe or better understand an issue. Assessment is a process by which information is obtained relative to some known objective or goal. Assessment is a broad term that includes testing. A test is a special form of assessment. Tests are assessments made under contrived circumstances especially so that they may be administered.

In other words, all tests are assessments, but not all assessments are tests. We test at the end of a lesson or unit. We assess progress at the end of a school year through testing, and we assess verbal and quantitative skills through such instruments as the SAT and GRE. Whether implicit or explicit, assessment is most usefully connected to some goal or objective for which the assessment is designed.

Notes

Measurement is the process of quantifying assessment data, Measurement refers to the process by which the attributes or dimensions of some physical object are determined.

Educational measurement refers to the use of educational assessments and the analysis of data such as scores obtained from educational assessments to infer the abilities and proficiencies of students. The approaches overlap with those in psychometrics. Educational measurement is the assigning of numerals to traits such as achievement, interest, attitudes, aptitudes, intelligence and performance. The differences between assessment and measurement are given below;

Table No 13.1 Differences between assessment and measurement

Dimension of Difference	Assessment	Evaluation
Timing	Formative	Summative
Focus of Measurement	Process oriented	Product oriented
Relationship between Administrator and recipient	Reflective	Prescriptive
Findings	Diagnostic	Judgemental
Mode	Flexible	Fixed
Relationship	Cooperative	Competitive

Evaluation refers to the comparison of data to a standard for the purpose of judging worth or quality. **Evaluation** is perhaps the most complex and least understood of the terms. Inherent in the idea of evaluation is "value." When we evaluate, what we are doing is engaging in some process that is designed to provide information that will help us make a judgment about a given situation

Assessment and/or measurement are done with respect to variables (phenomena that can take on more than one value or level). For example, the variable "gender" has the values or levels of male and female and data could be collected relative to this variable. Data on variables are normally collected by one or more of four methods: paper/pencil, systematic observation, participant observation, and clinical. Three types of research studies are normally performed: descriptive, correlational, and experimental.

Collecting data (assessment), quantifying that data (measurement), making judgments (evaluation), and developing understanding about the data (research) always raise issues of reliability and validity. Reliability attempts to answer concerns about the

Notes

consistency of the information (data) collected, while validity focuses on accuracy or truth.

The relationship between reliability and validity can be confusing because measurements (e.g., scores on tests, recorded statements about classroom behavior) can be reliable (consistent) without being valid (accurate or true). However, the reverse is not true: measurements cannot be valid without being reliable. The measurement, assessment, and evaluation is given in the following diagram.

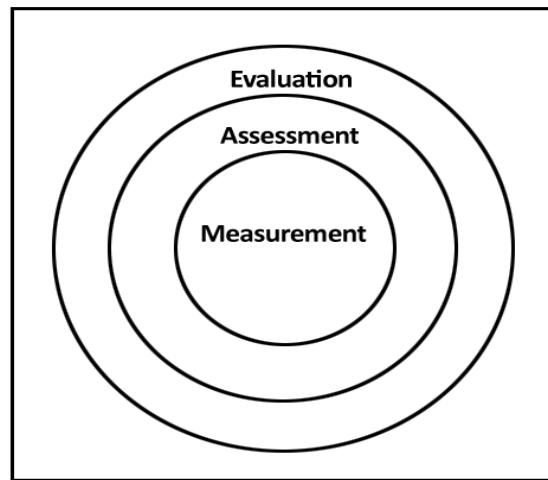


Diagram No 13.1 Measurement, Assessment, and Evaluation

Check your progress – 1

Notes: a) Space is given below for your answer

b) Compare your answers with those given 'at the end of this unit

1. Environmental education provides two major areas of evaluation. They are and
2. Write 'True' or 'False'
 - a) Evaluation is a continuous process
 - b) Evaluation should only consist of testing knowledge
 - c) In the development of awareness scale, pre-pilot state is essential

13.3.3 Measurement in Physical Science and in Behavioural Science

Measurement is a process of assigning numerals to observations according to some established set of rules. Numbers in measurement eliminates ambiguity in classification and promotes uniformity in

Notes

practice. Measurements can be qualitative or quantitative depending the how the number system is applied.

Measurements in the physical sciences tend to be quantitative. The role of measurement is to enable us to classify attributes or properties of “objects” so that we can fruitfully apply mathematical concepts, theories and techniques in reasoning about them. In other words, the answer to why we do measurements in the physical sciences is that if we do it properly we will be able to establish mathematical models with equations and prediction capabilities which are the goal of the inquiry. Measurements in behavior science can be both quantitative and qualitative. But the measurement is not accurate in behavioural science as like in physical science. The measured quantity can always be expressed in different numerical scales and related to each other in precise mathematical ways.

Behavioural science is generally not considered to be “hard” science like physics, chemistry, or astronomy. Nevertheless, behavioural science is very difficult science. It is difficult because its focus is the behaviour of human beings rather than attributes of inanimate objects such as prisms, plastics, and planets. We do not accept the idea, however, that because of the difficulties behavioural science is forever doomed to be inferior to the so-called “hard” sciences. To the contrary, we think there is reason for optimism provided that some fundamental adaptations are made to the ways we theorize about measurement, conduct the measurement process, and use the resulting measurements in research and theory construction.

Measurement is fundamental to science. In our view, major problems in conducting behavioral science are first encountered at the measurement stage. We contend that measurement in behavioural science reflects insufficiently that our primary unit of study—the behaving organism—is animate rather than inanimate and that the methods developed and used effectively by physical science disciplines give rise to serious problems when slavishly applied to the behaviour of living organisms.

Science is mainly about accounting for similarities in the objects being studied and variables are the primary reference frame for such accounting. For behavioral scientists, lawful relations describe similarities, not dissimilarities, in behavioral attributes.

George Bohrnstedt (2011) made three observations about measurement standardization in the physical sciences:

1. Measures are social constructs, and the process of gaining standardization around measures is very much a social process

Notes

involving social actors and negotiations, like any science or any political process.

2. Standardization is impelled along when there are strong commercial, political, or scientific forces at work.
3. Science has a strong, central role to play in the development of standards. An example of the adoption of standards as a social process can be seen in the way political and commercial interests worked against adoption in the United States of the metric system,

According to George Bohrnstedt (2011), there are some clear, tangible measures in the social sciences—such as birth, age, marital status, number of children—but the picture becomes murkier when one considers such concepts as attitudes, values, and beliefs at the individual or organizational level, or such concepts as school climate and organizational learning, or societal-level concepts, such as anomie and social disorganization. In the social sciences, it is often unclear whether the problem is the theory, the measures, or both. Bohrnstedt observed that researchers have not yet discovered how to define the kind of fundamental quantities in the social sciences that exist in the physical sciences. Social science concepts are large in number, fuzzy, and do not bear a simple relationship to one another, as is more frequently the case in the physical sciences. As a result, strong axiomatic theories against which to evaluate and inform measures are lacking. He cautioned, however, that it is not clear that social scientists would develop better measures if in fact strong theories existed.

13.4 EVALUATION

1. Define the term evaluation.
2. Discuss the learning outcomes in environmental education
3. Explain the difference between Measurement and Evaluation
4. Discuss how a Measurement in Physical Science is differ from Social Science.

13.5 LET US SUM UP

In this unit you have learnt about evaluation in environmental education. Evaluation is a continuous process of determining the extent to which the instructional objectives have been achieved. And also you have learnt about the differences between assessment, measurement, and evaluation. Finally we discussed about the measurement in Physical Science and Behavioral Science.

13.6 UNIT END ACTIVITIES

How would you draw a demarcation line between Measurement and Evaluation?

13.7 POINTS FOR DISCUSSION

"Evaluation in social science is a difficult process" - Discuss.

13.8 ANSWERS TO CHECK YOUR PROGRESS

1. Educational attainment, impact on the environment
2. a) True
b) False
c) True

13.9 SUGGESTED READINGS

- lange, Robert R. (1980), Environmental Education Needs Assessment and Evaluation, Manual VoLl, Colorado.
- Lewis, Geraid E. (1982), 'A Review of Classroom methodologies for environmental education', The journal of environmental education, 13(2), 12-15.
- Nagarajan and Sivakumar .P (2005), 'Environmental education', Ram Publishers, Chennai - 93.

Notes

UNIT – 14 EVALUATION OF ENVIRONMENTAL EDUCATION – II

STRUCTURES

- 14.1 Introduction
- 14.2 Objectives
- 14.3 Tools and techniques
 - 14.3.1 Estimating awareness in environmental education
 - 14.3.2 Achievement test in environmental education
 - 14.3.3 Developing an achievement test
- 14.4 Attitude scales
- 14.5 Value scale
 - 14.5.1 Definition of value
 - 14.5.2 Construction of value scales
 - 14.5.3 Uses of value scales
 - 14.5.4 Limitations of value scale
- 14.6 Evaluation
- 14.7 Let us sum up
- 14.8 Unit end activities
- 14.9 Points for discussion
- 14.10 Answers to check your progress
- 14.11 Suggested readings

14.1 INTRODUCTION

A tool of evaluation as used in education is a device or technique that will facilitate the process of measuring and recording the characteristics of students. Tools of evaluation are sophisticated techniques of appraisal, intelligently designed to measure what is required to be measured. Today's evaluator makes use of many techniques which lend efficiency and authenticity to his appraisal of his student. Modern evaluation uses a variety of techniques of appraisal such as achievement, attitude, personality and character testing scales, questionnaires, judgement scales of products, interviews, controlled observation techniques, sociometric technique and anecdotal records. In

this unit an attempt has been made to present various tools and techniques in Environmental Education.

14.2 OBJECTIVES

Students will be able to

- describe the role of awareness scale
- appreciate the different tools of evaluation in environmental education
- explain the development of attitude, value scales
- describe the construction of achievement and performance tests

Notes

14.3 TOOLS AND TECHNIQUES

Depending upon the kind of evaluation and its objectives, different tools are used. However, these can broadly be categorized into two groups: (i) Those which use standardized procedures, and provide the same set of situation to react. Normally used examination papers, attitude scales, questionnaire, environmental awareness tests fall in this category. (ii) Those which are used at individual level and are subject to modification according to the local situation. Photographs, individual project work/observation come in this category.

14.3.1 Estimating Awareness in Environmental Education

Environmental awareness may be defined as a state of being conscious about the environment. Environmental awareness is a process of helping the social groups and individuals to gain a variety of experiences and acquire a basic understanding of environment and its associated problems. The study of physical and biosciences, geography, agriculture etc. provides ample opportunities for environmental education. But awareness does not help in developing skills and attitudes for improving one's environment. At the same time it provides the understanding and competence to recognize environmental resources and interdependence between physical and biological components of the environment for the growth and development.

The awareness can be estimated through an awareness scale. The awareness scale should be developed in accordance with the nature of the study. There are various steps in the construction of an awareness scale. The main phases of the construction process are:

Notes

- Pre-pilot study phase
- Pilot study phase.
- Finalization phase

1. Pre-pilot Phase

The pre-pilot study phase is concerned with items pooling. It consists of the following sub phases:

- a. Item coverage
 - b. Source of items.
 - c. Laying down criteria for Item collection
- a. **Item Coverage:** The areas which are covered by the items should be stated clearly.
 - b. **Sources of Item:** The preliminary item-pool should be made by drawing items from various sources. It may be from books, reviews, journals etc.
 - c. **Criteria for selection of items:** The collected statements (items) can not be directly administered but they are subjected to screening. The following criteria should be considered while screening and thereby some statements may be added or excluded.
 - The language of the statements should be simple, clear and unambiguous.
 - The rater should clearly know that he is rating in a three, four or five point state
 - The directions should be clear and comprehensive. .
 - Each and every statement should be short
 - Double negative statements should be avoided.
 - The compound and complex sentences should be avoided.
 - Items may be arranged in either ascending/descending order or from left to right.

2. Pilot Study Phase

Once the statement are collected, the next step is to go for pilot study. The pilot study is concerned with refining the- items collected during the pre-pilot stage. The refinement of items may be conducted at two levels; a) Judgement analysis and b) Item analysis.

Judgement analysis implies eliciting the opinion of the experts in the area of the study regarding the suitability and objectivity of the items pooled. On the basis of the jury council's judgement, some items may be modified, some may be restructured and some may be eliminated. The next step is item analysis. It is a statistical procedure. The main objective

of item-analysis is to obtain objective information concerning the difficulty level and discriminating power of each of the items pooled.

3. Finalisation Phase

This stage is concerned with the random distribution of final items in the pool. The items or the statements that are retained after the item-analysis procedure are arranged in a systematic way. Now the tool is ready for the estimation of 'awareness'.

Notes

Check your Progress-1

1. The pre-pilot phase is concerned with... .. pooling.
2. The pilot study is concerned with refining the items collected during the stage.

ACTIVITY

Prepare a model environmental awareness scale.

14.3.2 Achievement Test in Environmental Education

To assess pupils 'understanding' and 'application' of knowledge in Environmental education, achievements tests as well as performance tests are primarily used. For assessing 'attitude development', attitude scales are widely used; for measuring values 'value scales' as well as anecdotal records are employed; for skill development, observational techniques using check lists or rating scales, performance test, practical examination etc. are extensively employed. Under this sub-section, achievement tests and performance tests are discussed in detail.

Achievement Tests

Achievement tests measure directly the learner's attainments, accomplishments etc. Achievement tests are the controlling process for teaching-learning activities. It helps in evaluating the effectiveness of teaching instructions. It provides feed back to the learners as well as to teachers. Teaching and testing are the main responsibilities of a teacher. Educational measurement is the task of a teacher. The achievement test that has the focus on the realization of objectives of teaching and learning, is known as a Criterion based test.

Notes

Definition

According to Denis Baron and Harold Benard, the concept of achievement involves the interaction of three factors namely, aptitude for learning, readiness for learning and opportunity for learning. Achievement in education precisely speaking implies one's knowledge, understanding or skills in a specified subject or a group of subjects.

According to Doconie, 'Any test that measures the attainment or accomplishment of an individual after a period of training or learning is called an 'Achievement test'.

Types of Achievement Test

Generally achievement tests are grouped into two categories:

- Teacher-made achievement tests and
- Standardized achievement tests

Teacher-made achievement tests are 'classified into two categories:

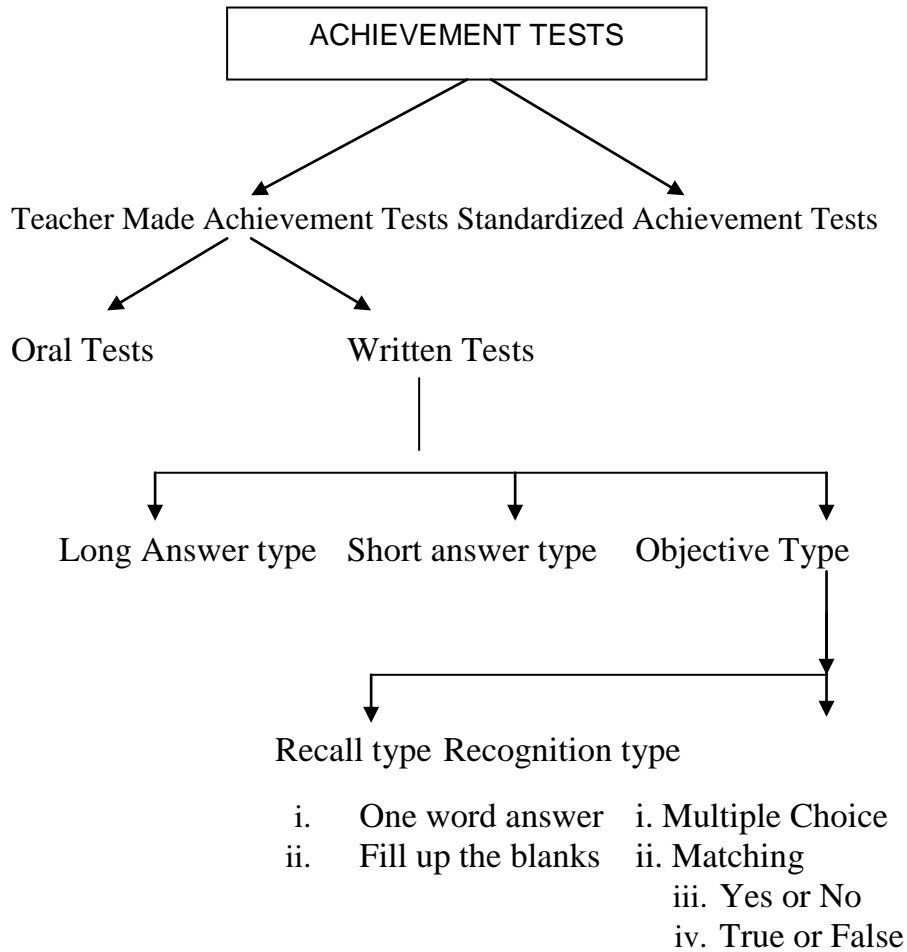
- i) Oral tests and
- ii) Written tests.

Written tests are further classified into:

- a. Long answer type
- b. Short answer type and
- c. Objective type.

The classification of the achievement tests is illustrated in the following diagram.

FIGURE SHOWING THE CLASSIFICATION OF ACHIEVEMENT TESTS



Notes

Objective type questions may be a recall type or recognition type. The one word answer or fill up the blanks may be given in the recall type and the multiple choice items, matching, yes or no type, and true or false type of questions may be given in the recognition type.

Developing an Achievement Test

The preparation of an achievement test has the following steps:

Step 1 : Planning

Step 2 : Writing the test items

Step 3 : Reviewing and editing

Notes

Step 4 : Arranging the items

Step 5 : Providing directions

Step 6 : Preparing the scoring key and marking scheme.

Step:1 Planning

Planning is the first and foremost step in the construction of an achievement test. It has the following sub-steps:

- a) *Identification of the objectives and allotting weightages for the objectives* The objectives of teaching a unit or topic in environmental education should be chosen, classified and made clear, in" terms of behavioral patterns. After the objectives are identified and stated, the test maker has to decide their relative weight in the test. The simplest basis for assigning the weights could be to weigh them in terms of time, devoted for their achievement.
- b) *Selection of the content and allotting weightage, to the content areas.* The content to be covered in the test should be selected and weightage should be given to all the units of the content.
- c) *Selection of different types of test items.* The question paper pattern should be decided by determining the number of items to be included on each type of test item and the relative weightage to be given for each type.
- d) *Distribution of difficulty level:* The distribution of difficulty level in a test depends upon the purpose of the test as also on the group of students for whom it is designed. Generally average difficulty level is to be maintained.
- e) *Preparation of Blue Print:*A blue print is a three dimensional chart showing the weight age given to 1) the objectives 2) content areas and 3) the form of questions in terms of marks. The units or the content is listed in rows in the left while the objectives are listed in columns horizontally. Each column is further sub dived into columns to indicate the forms of questions The format of a blue print is given below:

Notes

Objectives	Knowledge			Understanding			Application			Skill 1			Total
	E	S	0	E	S	0	E	S	0	E	S	0	
Content													
Areas													
Unit I	(10)1					(1)2							12
Unit II		(5)1	(1)2										7
Unit III					(5)2	(1)2							12
Unit IV								(5)2				(1)2	12
Unit V		(5)2		(10)1				(5)2	(1)2				32
Total	10	15	2	10	10	4		20	2			2	75
<p>Note:</p> <p>i) E,S and 0 represent essay type short answer type and objective type items respectively.</p> <p>ii) Figure outside the bracket indicate the number of items and figure inside indicates the marks.</p>													

The teacher must fit in all the questions in different cells in such a way that the blue print reflects the decision of the design.

Step -2: Writing the test item

The next step in the preparation of an achievement test is writing the test items. The teacher has to take up each cell of the blue print and draft an item taking care of the various dimensions, the objective, the content area and the form of item as laid down in the blue print.

Step-3: Reviewing and Editing

After writing the test items, they are to be reviewed by experts in that field. Based on the suggestions given by the experts the teacher has to edit the test items.

Notes

Step -4: Arranging the Test items

The fourth step in the preparation of an achievement test is arranging the items. They should be arranged so that all items of the same type are grouped together. They can be arranged in the order of increasing difficulty.

Step -5: Providing Directions

Proper directions should be given in the achievement test. These directions should be simple and concise. Directions include the purpose of the test, time allowed to complete the test, way of answering, quantum of response expected, marks allotted for each item, number of questions to be answered etc.

Step- 6: Preparing the scoring key and marking scheme

The last step in the preparation of an achievement test is preparing the scoring key for objective type questions and marking scheme for descriptive type questions. The scoring procedure should be simple. The scoring key refers to the prepared list of answers to a given set of objective type questions. The test constructor while preparing the scoring key may feel like reducing to zero, the gain in the score expected resulting from pure guessing. This is known as correction for guessing. The formula of correction for guessing is

$$S = R \frac{KW}{N-K}$$

- Where
- S = Score obtained
 - R = Number of right answers
 - K = Number of responses to be selected or marked for each item in the Case of True or False item.
 - W = Number or wrong answers
 - N = Number of suggested responses for a single item.

For the multiple choice questions in which only one correct answer is expected, the formula reduces to

$$S = R - \frac{W}{n - 1}$$

Notes

ACTIVITY

- i) Develop an achievement test for any two units in environmental education.
- ii) Prepare a model blue print for an achievement test

Check Your Progress – 2

Note: a) Space is given below for your answer

b) Compare your answer with those given at the end of this unit

- 3) The 'attitude development' can be measured byscales.
- 4) What are the two major categories of Achievement test.
- 5)is the first step in the development of achievement test.

14.4 ATTITUDE SCALES

The term attitude has been most frequently associated with emotionally toned responses. An attitude is a variable which is inferred from overt behaviour both verbal and non-verbal responses. Attitude is a tendency to react in certain way towards a designated class of stimuli or an object. Comparatively speaking, measurement of attitude is a difficult process than that of the measurement of achievement.

14.4.1 Construction of an attitude scale

While developing an attitude scale, the following determinants of attitude should be considered.

- Emotional and personal experiences
- Ego-involvement and social perceptions

Notes

- Technology changes and economic developments
- Suggestions and self concept or ideas of life.
- Acceptance of social norms and values.

Moreover in the process of development of attitude scale, the major characteristics of attitude should be considered which are listed below:

1. Attitudes are the preconceived notions and feeling of an individual.
2. There are individual differences in attitudes.
3. It is integrated into an organized system and cannot be changed easily.
4. It varies from culture to culture and society to society.
5. It implies a subject-object relationship.
6. It is a bi-polar trait as it is a position toward an object either 'for' or 'against',
7. Attitude of an individual is generally very rigid and it cannot be easily changed.
8. Attitude is the significant determinant for individual differences

Thurston method of attitude scale construction

Thurston and his colleagues have developed this method and the main feature of this method is the use of judges to determine the points on the attitude. The following are the steps in constructing the Thurston type scale.

Step I The first step in the construction of the Thurston type scale is collection of many statements which seem to express various degrees of negative and positive attitudes towards the object *or* phenomenon that are being studied.

Step II The collected statements are given to judges. Each judge is given the entire collection of the statements and asked *to* rate them on a 11-point scale ranging, extremely favourable *to* extremely unfavourable through neutral point.

Step III In the third step, the statements which are given *to* the judges are collected to compute indices of variability for each item. If all of the judges place a statement in eighth, ninth, and tenth points, this represent a good agreement about the intensity of the item. If the

placement scattered all over and down the 11 points then this indicates that the statement is either ambiguous *or* belong to some other attitude.

Step IV In the last step the refined statements are collected. The final attitude scale is composed by randomly ordering the statements on printed form. The subject is asked to mark these statements with which he agrees.

Example for Thrustone Scale

Attitude towards Environment.

- I believe that environmental cleanliness is very important.
- I think the interaction between man and his environment is significant.
- I understand that the natural resources are vast and varied; they can last long for human satisfaction.

The Likert method of attitude scale construction

Comparatively speaking, the Likert method of measuring attitude is somewhat less time-consuming and economical than the Thurstone Scale. Here judges are not appointed as in the case of Thurstone's approach. The Likert method eliminates the rating by judges and therefore it requires less time for preparation. The statements are given to subjects and they have to check all the given statements. Each statement usually has five possible responses.

- a. Strongly Agree (SA)
- b. Agree (A)
- c. Undecided (UD)
- d. Disagree (D)
- e. Strongly disagree (SD)

The person (subject) taking the test, reacts to every statement by marking one of the five possible responses. The responses have weight of 5,4,3,2, and 1 for favourable statements and 1,2,3,4 & 5 for unfavourable ones. A high score indicate a highly positive and favourable attitude and a low scores indicates the unfavourable attitude

Steps involved in the Construction

The following are the steps involved in the construction of Likert type scale:

Step I Collection of the statements. (both positive and negative statements)

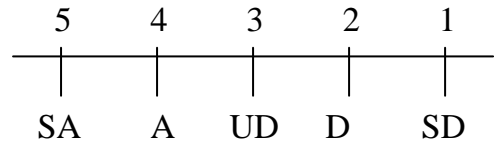
Notes

Step II Refinement of the statements

Step III Item Analysis

Step IV Finalisation

Diagram: Likert Type Scale



Example for Likert Type Scale

S.No.	Items	S.A	A	UD	D	S.D
1.	Increase of carbon-di-oxide (CO2) is mainly responsible for the global warning					
2.	Domestic sewage causes water pollution					
3.	Depletion of ozone layer will not create any environmental problem					
4.	Deforestation leads to soil erosion					
5.	Plants are responsible for the degradation of air as they consume more oxygen.					

Uses of attitude scale

The following are the uses of attitude scales:

- i. Attitude of individuals can be assessed and graded with the help of an attitude scale.
- ii. The overt behaviours are estimated through the verbal responses in the attitude scale
- iii. The estimated attitudes are one of the factors identified for individual differences
- iv. The psychological factors like emotions, perception, experiences etc. which are important determinants of attitude can be studied.
- v. It is possible to estimate the attitude of the learners towards environment education through the attitude Scale.

Notes

- vi. It is helpful to know whether the present curriculum changes the attitude of the learners towards environmental concerns.
- vii. The attitude scale is multi-dimensional in nature which studies the acceptance of social norms and values.
- viii. The emotional and personal experiences are included in the attitude scale. It provides information about the ego involvement and social perceptions.
- ix. The attitudinal change due to science and technological innovations and due to the economic development can be estimated
- x. Through the attitude scale, it is possible to get some information about the self concept or ideas of life of individuals.

Limitations of attitude scale

Limitations of attitude scale are listed below:

- i. Attitude is a bi-polar trait as it is a position toward an object either 'for' or 'against'. Such a bi-polar traits are difficult to be estimated through the attitude scale.
- ii. The term attitude is more connotative of beliefs, feelings and preferences. All the possible feelings and preferences of different individuals are not included in the attitude scale.
- iii. The construction of attitude scale requires a highly skilled person. Availability of such persons is a major problem.
- iv. The respondents may confuse to know the degree of variation between the term 'Agree' and 'Strongly Agree' which are commonly used in the attitude scale.
- v. While responding to an attitude scale, the subject may conceal this feeling and belief.

ACTIVITY

Construct a model environmental attitude scale

Notes

Check Your Progress – 3

Note: a) Space is given below for your answer

b) Compare your answer with those given at the end of this unit

6. Attitudes are the preconceivedand feelings of an individual

7. Write the first step in the construction attitude scale

8. Write true or False

In attitude scale the respondents may not confuse to know the degree of variation.

14.5 VALUE SCALE

Values are related to feeling and beliefs of an individual which are deeply rooted. Socially approved desires and goals and experiences of life which guides the actions and behaviour are known as values. Thus, the term value is more a sociological concept. It determines an individual's preferences and choice which in turn directs his actions.

14.5.1 Definition of Value

According to C.E.M.Joad (1942) 'values seem to reside in the objects as truly as do colour, smell temperature, size and shape'.

Wood Ruff defines 'value is an object, condition or activity which individual feels and as an effect on his well being'.

Jones and Gevard maintains that 'value is a motivation which sustains an individual's efforts to achieve a particular goal.

Thus, values are defined in terms of sentiments and emotions, likes and dislikes etc., which are the significant determinants for individual differences.

14.5.2 Construction of Value Scales:

While constructing the value scale, it is essential to incorporate the major characteristic features of values which are listed below:

1. The term value is more a sociological concept.
2. It is the psychological need of a person (Maslow).
3. It is the satisfaction of human wants.
4. Value is simply the maintenance of a set towards the attainment of a goal.

Notes

5. It is an outcome of human choices among the competitive human interest.
6. It is the psychic - energy invested in the personality of an individual.
7. It is the real determinant of human behaviour and relationship between subject and object.
8. Value is conceptualized in terms of personal happiness, security and existence of the living organism.

Thus, values can be taken as one's own preferences.

The value scale can be constructed in the form of alternative choices or in the form of multiple ranked responses.

Example for alternative choices:

The main objective of Environmental Education is to conserve the natural resources.

- a) Yes b) No c) Can not say

Example for multiple choice response:

Do you think land degradation is due to (the following statements are to be ranked in order of preference)

- a. large scale removal of overburden and their dumping
- b. disposal of mine waste
- c. disposal of domestic waste
- d. disposal of industrial waste

14.5.3 Uses of Value Scales

The following are the uses of value scales:

1. Information about the value of individuals can be derived from the value scale.
2. The value scale estimates the state of values which are significant for finding out individual differences.
3. The feelings and beliefs of an individual can be estimated through the value scale.
4. The outcomes of the value scale significantly contribute towards the development of the personality of an individual.

Notes

5. Estimating the values are one the of the important ways of identifying the psychological needs of a person.
6. Value scales derive the nature of the value which is more useful for teachers in school.
7. All the six categories of values namely i) Theoretical Value ii)Economical value iii) Aesthetic value iv) Social Value v) Political value and vi) Religious value are estimated through the value scales.

14.5.4 Limitations of Value Scale

Various limitations of the value scale are:

- a. The term 'value' has a multidimensional meaning and hence the estimation of value is not an easy task
- b. Construction of value scale requires a lot of experience.
- c. Establishing the reliability and validity of a value scale is very difficult.
- d. It is very difficult to cover all the dimensions of the values in a value scale.
- e. When the number of items are more, the respondents get annoyance with the tool.

Check Your Progress – 4

Note: a) Space is given below for your answer

- b) Compare your answer with those given at the end of this unit
- 9) Values are related to feeling andof an individual.
- 10) Which is the real determinant of human behaviour and relationship between subject and object.
- 11)scale estimates the state of values.
- 12) Write True or False
Value is the psychic-energy.

14.6 EVALUATION

5. Define the term evaluation.
6. Discuss the learning outcomes in environmental education

Notes

7. Explain the tools and techniques employed in 'Environmental Education'.
8. Discuss how an awareness scale is constructed for estimating one's environmental awareness.
9. Write a short notes on 'performance test'.
10. What are the different types of achievement test?
11. What is attitude? How is it measured?
12. Describe a Thurstone Attitude scale.
13. Describe a Likert's attitude scale.
14. What are the advantages and limitations of attitude scale
15. What are values? And how are they measured?

14.7 LET US SUM UP

In this unit you have learnt about the strategies of evaluation in environmental education. Evaluation is a continuous process of determining the extent to which the instructional objectives have been achieved. And also you have learnt that this process is necessary throughout the course to estimate the learning outcomes and to estimate the efficacy of the strategy which have employed. The way of estimating awareness, attitude and values are dealt in detail in this section. Various steps involved in the development of these tools are described. You have studied about the achievement and performance tests in environmental education.

14.8 UNIT END ACTIVITIES

How will you estimate environmental values? Construct a model environmental value scale.

14.9 POINTS FOR DISCUSSION

"Evaluation is a continuous positive process without a negative tone" - Discuss.

14.10 ANSWERS TO CHECK YOUR PROGRESS

1. Item
2. Pre-pilot
3. Attitude

Notes

4. Teacher made and standardized
5. Planning
6. Notions
7. Collection of statement
8. False
9. Belief
10. Value
11. Value
12. True

14.11 SUGGESTED READINGS

- lange, Robert R. (1980), Environmental Education Needs Assessment and Evaluation, Manual VoLl, Colorado.
- Lewis, Geraid E. (1982), 'A Review of Classroom methodologies for environmental education', The journal of environmental education, 13(2), 12-15.
- Nagarajan and Sivakumar .P (2005), 'Environmental education', Ram Publishers, Chennai - 93.

ALAGAPPA UNIVERSITY, KARAIKUDI
Directorate of Distance Education

Model Question Paper

70133-ENVIRONMENTAL EDUCATION

Time 3 hours

Marks 75

PART A

Answer ALL the Questions.

10*2 = 20

1. Define Environment.
2. List out any two activities for Environmental Awareness?
3. Write any two Environmental degradations
4. What are the Green House Gases?
5. Write short notes on Narmada project
6. Write any two co curricular activities in Environmental Education
7. How human population affects our environment?
8. Differentiate Educational Radio and Community Radio
9. List out the importance of Social Forest?
10. Compare the term Assessment and Measurement.

PART B

Answer any FIVE Questions.

5*5 = 25

11. Briefly describe the role of heredity and environment.
12. What are the objectives of environmental education?
13. Write a short notes on environmental hazards.
14. What do you mean by Biodiversity?
15. List out the salient features of Wild life (Protection) Act.
16. How would you organize a field trips?
17. Give an account on 'SITE'.

*Model Question
Paper*

Notes

18. Describe the rain water harvest methods.

PART C

Answer the following Questions.

2*15=30

19. a) Explain the sources and adverse effect of Air Pollution with suitable examples.

OR

b) What is global warming? Explain the issues related to Global warming?

20. a) Describe the role of NCERT in Environmental Education?

OR

b) Define Attitude Scale? How would you construct Attitude Scale in Environmental Education?
