Environmental Education

MAEDN504

MA EDUCATION

3rd Semester

Rajiv Gandhi University
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ENVIRONMENTAL EDUCATION

MA [Education]
Third Semester
MAEDN 504

RAJIV GANDHI UNIVERSITY
Arunachal Pradesh, INDIA - 791 112

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About the University

Rajiv Gandhi University (formerly Arunachal University) is a premier institution for higher education in the state of Arunachal Pradesh and has completed twenty-five years of its existence. Late Smt. Indira Gandhi, the then Prime Minister of India, laid the foundation stone of the university on 4th February, 1984 at Rono Hills, where the present campus is located.

Ever since its inception, the university has been trying to achieve excellence and fulfill the objectives as envisaged in the University Act. The university received academic recognition under Section 2(f) from the University Grants Commission on 28th March, 1985 and started functioning from 1st April, 1985. It got financial recognition under section 12-B of the UGC on 25th March, 1994. Since then Rajiv Gandhi University, (then Arunachal University) has carved a niche for itself in the educational scenario of the country following its selection as a University with potential for excellence by a high-level expert committee of the University Grants Commission from among universities in India.

The University was converted into a Central University with effect from 9th April, 2007 as per notification of the Ministry of Human Resource Development, Government of India.

The University is located atop Rono Hills on a picturesque tableland of 302 acres overlooking the river Dikrong. It is 6.5 km from the National Highway 52-A and 25 km from Itanagar, the State capital. The campus is linked with the National Highway by the Dikrong bridge.

The teaching and research programmes of the University are designed with a view to play a positive role in the socio-economic and cultural development of the State. The University offers Undergraduate, Postgraduate, M.Phil and Ph.D. programmes. The Department of Education also offers the B.Ed, programme.

There are fifteen colleges affiliated to the University. The University has been extending educational facilities to students from the neighbouring states, particularly Assam. The strength of students in different departments of the University and in affiliated colleges has been steadily increasing.

The faculty members have been actively engaged in research activities with financial support from UGC and other funding agencies. Since inception, a number of proposals on research projects have been sanctioned by various funding agencies to the University. Various departments have organized numerous seminars, workshops and conferences. Many faculty members have participated in national and international conferences and seminars held within the country and abroad. Eminent scholars and distinguished personalities have visited the University and delivered lectures on various disciplines.

The academic year 2000-2001 was a year of consolidation for the University. The switch over from the annual to the semester system took off smoothly and the performance of the students registered a marked improvement. Various syllabi designed by Boards of Post-graduate Studies (BPGS) have been implemented. VSAT facility installed by the ERNET India, New Delhi under the UGC-Infonet program, provides Internet access.

In spite of infrastructural constraints, the University has been maintaining its academic excellence. The University has strictly adhered to the academic calendar, conducted the examinations and declared the results on time. The students from the University have found placements not only in State and Central Government Services, but also in various institutions, industries and organizations. MaMy students have emerged successful in the National Eligibility Test (NET).

Since inception, the University has made significant progress in teaching, research, innovations in curriculum development and developing infrastructure.

About IDE

The formal system of higher education in our country is facing the problems of access, limitation of seats, lack of facilities and infrastructure. Academicians from various disciplines opine that it is learning which is more important and not the channel of education. The education through distance mode is an alternative mode of imparting instruction to overcome the problems of access, infrastructure and socio-economic barriers. This will meet the demand for qualitative higher education of millions of people who cannot get admission in the regular system and wish to pursue their education. It also helps interested employed and unemployed men and women to continue with their higher education. Distance education is a distinct approach to impart education to learners who remained away in the space and/or time from the teachers and teaching institutions on account of economic, social and other considerations. Our main aim is to provide higher education opportunities to those who are unable to join regular academic and vocational education programmes in the affiliated colleges of the University and make higher education reach to the doorsteps in rural and geographically remote areas of Arunachal Pradesh in particular and North-eastern part of India in general. In 2008, the Centre for Distance Education has been renamed as "Institute of Distance Education (IDE)."

Continuing the endeavor to expand the learning opportunities for distant learners, IDE has introduced Post Graduate Courses in 5 subjects (Education, English, Hindi, History and Political Science) from the Academic Session 2013-14.

The Institute of Distance Education is housed in the Physical Sciences Faculty Building (first floor) next to the University Library. The University campus is 6 kms from NERIST point on National Highway 52A. The University buses ply to NERIST point regularly.

Outstanding Features of Institute of Distance Education:

(i) At Par with Regular Mode

Eligibility requirements, curricular content, mode of examination and the award of degrees are on par with the colleges affiliated to the Rajiv Gandhi University and the Department(s) of the University.

(ii) Self-Instructional Study Material (SISM)

The students are provided SISM prepared by the Institute and approved by Distance Education Council (DEC), New Delhi. This will be provided at the time of admission at the IDE or its Study Centres. SISM is provided only in English except Hindi subject.

(iii) Contact and Counselling Programme (CCP)

The course curriculum of every programme involves counselling in the form of personal contact programme of duration of approximately 7-15 days. The CCP shall not be compulsory for BA. However for professional courses and MA the attendance in CCP will be mandatory.

(iv) Field Training and Project

For professional course(s) there shall be provision of field training and project writing in the concerned subject.

(v) Medium of Instruction and Examination

The medium of instruction and examination will be English for all the subjects except for those subjects where the learners will need to write in the respective languages.

(vi) Subject/Counselling Coordinators

For developing study material, the IDE appoints subject coordinators from within and

outside the University. In order to run the PCCP effectively Counselling Coordinators are engaged from the Departments of the University, The Counselling-Coordinators do necessary coordination for involving resource persons in contact and counselling programme and assignment evaluation. The learners can also contact them for clarifying their difficulties in then respective subjects.

SYLLABUS

Objectives:

1. To make the students know the concept of the environmental education.
2. To familiarize the students with Environmental resources.
3. To inculcate in student how to manage environmental resources.
4. To make the students analyze the approaches of environmental education

Course outline:

Unit-I. **Environment and Education:**

- Man-Environment relationship: The concept of environment, meaning and nature, concepts of determinism, possiblism and neo-determinism
- Environmental Education - Meaning, nature and scope

Unit-II. **Environmental Resources:**

- Natural resources - Land, Air, Water, Flora and Fauna
- Cultural Resources - Monuments, buildings, Specimen of art/architecture, cultures their protection and promotion .

Unit-III. **Environmental Resources Management:**

- Natural resources and associated problems
- Resource depletion, natural disasters/hazards and their management

Unit-IV. **Approaches for Environmental Education:**

- Curriculum for Environmental Education - Stage specific - primary, secondary and senior secondary.
- Approaches- Inter and intra-disciplinary,
- Topical units and integrated units
- Model - Infusion and infused

Practicum

(i) Preparation of an activity based curriculum on Environmental Education for primary/elementary classes.
(ii) Development of kitchen garden and reporting
(iii) Development of Nursery and reporting

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INTRODUCTION

The large-scale exploitation of natural resources has resulted in the depletion of almost all of the available resources. Unchecked population growth and rapid industrialization has accelerated the process of deterioration of natural resources. The world finally woke up to the collective damage done over the centuries, after experiencing drastic climatic change and other related incidents, such as unpredictable rains, earthquakes and floods. Environmental education, thus, lays emphasis on spreading awareness and education regarding the need to preserve and protect our natural environment.

This book highlights the increasing importance of our environment and the need of educating the people for protecting the environment. Environment, as you know, is the sum of water, air and land and the inter-relationships among them and also with all the living organisms. Natural resources play a vital role in sustaining life on the earth. Natural resources are usually classified into two, namely renewable and non-renewable resources. If one has to understand the environment, one has to first have knowledge about ecology and ecological balance. Biodiversity is the variation of life forms within a given ecosystem, biome or the entire earth. Biodiversity is often used as a measure of the health of biological systems. A study of different types of pollution and their impact on the environment will make you contemplate your future actions in conserving and utilizing the available resources in a prudent manner. This book will make you aware of the various actions taken by the government and non-government organizations and certain international programmes that help to safeguard the environment.

This book - *Environmental Education* - has been designed keeping in mind the self-instruction mode (SIM) format and follows a simple pattern, wherein each unit of the book begins with the *Introduction* followed by the *Unit Objectives* for the topic. The content is then presented in a simple and easy-to-understand manner, and is interspersed with *Check Your Progress* questions to reinforce the student's understanding of the topic. A list of *Questions and Exercises* is also provided at the end of each unit. The *Summary, Key Terms* and *Activity* further act as useful tools for students and are meant for effective recapitulation of the text.

This book is divided into eight units:

Unit 1: Explains the man-environment relationship

Unit 2: Deals with the various natural resources and cultural resources and the steps that can be taken for their protection and promotion

Unit 3: Describes the management of environmental resources

Unit 4: States the various approaches for environmental education

UNIT 1 ENVIRONMENT AND EDUCATION

Structure

1.0 Introduction
1.1 Unit Objectives
1.2 Man-Environment Relationship

- 1.2.1 Definitions of Environment
- 1.2.2 Concept and Meaning of Environment
- 1.2.3 Concept of Determinism
- 1.2.4 Concept of Possibilism
- 1.2.5 Neo-determinism

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1.0 INTRODUCTION

Education is the means and mechanism of over all development of a human being's personality. Environment is the composition of external conditions that affect life and development of man and all other living organisms. Mankind is surrounded by natural, socio-cultural as well as psychological environment. Human beings are at the centre of concern for sustainable development. They are entitled to a healthy and productive life in harmony with nature. Educational process of development is an important aspect of biological process of environment. The environmental processes are both developmental and destructive in nature. This critical aspect makes the studies of environment very significant for human survival.

In this unit, you will learn about the concept, meaning and nature of environment; concept of determinism, possibilism and neo-determinism.

1.1 UNIT OBJECTIVES

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

- Define environment and environmental education
- Discuss the nature and principles of environmental education
- Explain the scope of environmental education
- Discuss various environment educational programmes
- Explain the concept of determinism, possiblism and neo-determinism

1.2 MAN-ENVIRONMENT RELATIONSHIP

Environment is the life support system on which the existence and perpetuation of all living organisms depend. The present day environment can be considered to have physical, chemical, biological, scientific and technological components in which the organisms remain embedded. The whole environment is composed of three complexes.

- Abiotic
- Biotic
- Scientific and technological

All the three sub-complexes interacting with each other constitute the total environment. The environment today is subjected to large-scale transformations in various abiotic and biotic components. The third sub complex has witnessed massive changes occurring due to scientific and technological revolutions that have taken place during the past century. Haber (1989) has called this artificial environment as 'techno-ecosystems'.

1.2.1 Definitions of Environment

- AccordingtoMisra(1962), 'The organismis supposed to remain embedded in a matrix called environment.'
- 'Aggregate of all conditions affecting the existence, growth and welfare of an organism or group of organisms.'— Webster's concise dictionary
- 'A Person's environment consists of the sum total of the stimulations which he receives from his conception until his death.' — Boring.
- 'The environment is everything that affects the individual except his genes.' — AnneAnastasi.
- 'The term environment is used to describe in the aggregate all the external forces, influences and conditions which affect the life, nature, behavior and the growth, development and maturity of living organisms.' — Douglass and Holland.

Viewing all the definitions, it is very easy to answer the question—What is environment?

- Sum total of stimulations an individual receives up to death
- External forces, influences and conditions
- Inseparable whole which is constituted by the interacting systems of physical, biological and cultural elements
- Surroundings of an organism which includes both living and non-living components
- Holocoenotic concept of environment propounded by Allee and Park (1939) that all the components of environment act collectively and concurrently
- The parameters of environment are interwoven with each other constituting a spiderweb like.structure. — Cain (1944), Billing (1952,1964)

These parameters are

- Earth, Water, Energy, Space, Air, Food, Fodder, Fuel, Fiber, Hand pollution, Water pollution, Air pollution, Nuclear emissions.

1.2.2 Concept and Meaning of Environment

Environment has been derived from the French word 'Environ' which implies 'to encircle or surround.' All living and non-living things surrounding us comprise the environment. According to the Environment (Protection) Act 1986, 'environment'includes water, air and land and the inter- relationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organism and property. The concept of environment can be shown as follows:

Figure 1.1 represents the elements, that is, air, water and land which surround human beings. These elements comprise the environment and hence have a direct influence on human beings. Simultaneously, human beings also influence the environment either through exploitation of natural resources or by polluting the environment. Plants, animals, micro-organisms and the structures made by man in our surroundings have a direct and indirect influence on us. The entirety of all these elements and their interactions make up the environment.

Urban environment is to some extent different from rural environment. Human beings deeply influence the urban environment. Several natural landscapes in cities have been modified or altered and replaced by man-made structures like commercial complexes, factories and transportation networks. Air, water and soil of the urban environment are completely filled with several kinds of chemicals and wastes. The range of plants and animals present in the urban environment is far less as compared to the rural environment. Also, population is dense in the urban areas as compared to the rural environment.

1.2.3 Concept of Determinism

Determinism is a concept which conveys several characteristic features which are found to define a society or an individual. Human beings are controlled by the environment, and the technologies which they use. Therefore, in a given situation they present a definite behavioural pattern.

'Determinism is a metaphysical philosophical position stating that for everything that happens there are conditions such that, given those conditions, nothing else could happen. There is much determinism, depending upon what pre-conditions are considered to be determinative of an event.'

'It is not possible for a human being to do anything different from what he actually wants. In actual case, the circumstances decide the actions of an individual'

Human beings are a part of the environment and thus, have to follow the rules of nature and the laws of science. If we feel that whatever one does is already decided then there is no blame on the events that take place. In this respect, determinism is found to be true.

The concept of determinism is a complex phenomenon. It states that whatever things are found in nature depends on their present status or conditions and the facts how things are affected by the natural laws. When position and status of the biotic agents and functioning of natural laws is understood we can easily interpret the laws of nature and science.

The hypothetical views of theory of physics explain the presence of small particles in the universe and their interactions. The present theory helps in defining the different aspects involved in determinism. The three aspects are:

1. The present status and position of things.
2. How the things follow natural laws.
3. Response of things against the applied laws. Determinism

provides-

- What conditions would be found in future estimating the status of universe.
- As determinism is a metaphysical concept, the future conditions will be existing and must be followed by natural laws.

Determinism is defined in some other ways as well:

- The event and reactions that take place have a certain cause. Without definite cause nothing is possible.
- The facts related with the effect of natural laws on the present situations explain the future pattern of things.

Views on Quantum Theory

- Quantum physics generally believes that determinism is false.
- Human actions are decided by quantum actions as it affects human responses.
- The future conditions can be predicted in advance if a person has sufficient computational powers.
- The freedom of one's actions can be compared with determinism.
- Determinism is not a philosophical issue rather it is an issue settled by physics.

Any theory which is not accepting the views that every event takes place is earlier decided by some causal factors cannot be a part of determinism. Many forms of determinism are defined. Some can be tested with the help of physics and philosophy of physics.

Determinism is often contrasted and confused with the following terms:

1. **Free will:** The different positions related to free will and determinism are shown below:

	determinism is true	**determinism is false**
Free will is compatible with determinism (i.e. compatibilism is true)	Soft determinism	[no name]
Free will is not compatible with determinism (i.e. incompatibilism is true)	Hard determinism	Libertarianism

2.Compatibilism: Free will can be compared with determinism. The other views state that determinism cannot be compared with free will. Some are of the opinion that when any event is held by determinism, free will cannot exist. On the other hand, when an event is held with free will, determinism cannot exist. Free will never considers any cause, conditions and any other determinants of behavior

3.Materialism: The term materialism explains the interaction between non-biotic things only; therefore, it cannot be compared with determinism as determinism explains the reaction of biotic and non-biotic agents by using mind and soul.

Types of Determinism

The different types of determinism are as follows:

1. **Causal determinism:** As the name suggest, it explains the law of cause and J effect. Whenever there is a cause there will be an action and action will produce an effect as a response to it. The present status of the environment changes with causes bonded to it. It explains (a) The changes that place in the universe and have a long sequence which attracts our attention to their past or their origin, (b) The events are caused by some specific causes and not by their own self causal factors.
2. **Historical determinism:** As causal determinism explains the causes of events from their origin, the historical determinism adds that everything that happens is caused by antecedent conditions.
3. **Nomological determinism:** This type of determinism is a combination of past status of universe and the natural laws which decides the events of future. This form of determinism suggests that the past and present events combine to design the future by obeying the

natural laws.

4. The terms scientific determinism and physical determinism are synonymously used with nomological determinism.
5. **Necessitarianism:** It is a metaphysical concept which infers that every event takes place with certain causes and whatever happens has a cause and reason.
6. **Predeterminism:** This concept helps in understanding that an event which takes place is already decided in advance. There is a long sequence of occurrence which stretches the ideas back to the origin of universe which is already established. Human activities cannot check and disturb the responses of these sequences. It can be compared with causal determinism and biological determinism as it explains about the existence of future status caused by specific causes.
7. **Fatalism:** This type of determimsm believes in thedestinyofanindividual.lt explains that whatever events take place in an individual's life depend on his/her fate and human actions cannot control it.
8. **Theological determinism:** It is a form of determinism which refers to the occurrence of events by pre-decided patterns and the presence of destiny. There are two types of theological determinism namely: strong and weak theological determinism.
9. **Strong theological determinism:** Favours the occurrence of events by the dominance of super powers or the powers of God.
10. **Weak theological determinism:** Explains that whatever happens is already known to God and future is fixed.
11. **Logical determinism:** Logical determinism explains that whatever the idea formed behind the present, past and future will be either true or false. Some theories make attempts to explain the interaction between nature and creature which can be predicted.
12. **Biological determinism:** Biological determinism believes that behaviour, belief and desires depend on genetic characteristics of human beings. The behaviour of a human being is framed according to environmental reflexes that one gets.
13. **Environmental determinism:** This type of determinism is also known as climatic or geographical determinism. According to this form of determinism, the physical and social conditions of environment design, and the culture patterns decides the behaviour of an individuals. The formation of behaviour is dependent upon the stimulus response theory. Human beings act or show their response according to the type of stimulations they absorb. The climatic conditions mould the psychological setting of mind and human beings behave accordingly. Sometimes, humans migrate from one geographical location to another for survival.
14. **Cultural determinism:** Man is a social creature. Cultural determinism means that a human being is identified by the culture in which he/she lives. It is a nurture focused theory.
15. **Psychological determinism:** It is a concept which refers to the psychology of human mind. Humans act according to their requirement, need and interest and interact with their surroundings.
16. **Linguistic determinism:** Language is the mirror of mind. Whatever a human being thinks and understands, he/she expresses through language.
17. **Economic determinism:** It explains the role of economy and political features in the development of human beings. The political conditions affect the economic structure of a country.
18. **Technological determinism:** The social structure and cultural values are developing in

a society through the application of technology.

19. **Media determinism:** This kind of determinism explains the role of media in a particular society. The philosophical and sociological set up of a society is influenced by media.
20. **Mathematical determinism:** This determinism accepts the concept of chance. The things that will happen in future show probability to occur or not. The probability can be confirmed only by the past experiences and the previous results.

Factors Influencing Determinism

Some of the factors influencing determinism are:

1. **Interrelationship among individuals**
   - Mutual dependency and cooperation among individuals
   - Affection and attachments among individuals
   - Interaction between the individual and nature
   - Biotic and non-biotic agents build the environment
   - Actions and responses are the bases of determinism
2. **Grouping**

   When an affectionate bonding is developed among individuals, a group is formed. For example, family is a group. Families unite together to form a social group, ultimately, becoming a society.
3. **Continuous existence**

   Existence of an individual is dependent on the favourable conditions and circumstances. The favourable conditions are the presence of air, water, food, clothing, earth, fire and shelter for survival.
4. **Likings or disliking**

   The group of individuals is classified and identified by their liking and disliking between the groups and among the individuals. The sex, age, language, family, race, regions, religions, wealth, politics, occupation, health, physique, looks, temperament, interest and abilities are the factors that cause classification.

5. Infirmity and mortality

Darwin's theory states' Survival of the fittest.' Individuals in a biotic world are always at a risk of survival.

- Injuries, defects, diseases can cause death
- Genetic defects at the time of development
- Exposure to dangerous things These are the three

risks of survival.

6. **Coping Strategies**

   The strategies by which humans cope with their environment are: adhibition, inhibition and explication.

   - **Adhibition:** It means the actions, responses which are taken in use or the human remains engaged with them. These responses are used to control the situation and get perfection to fulfill the requirement.

     Adhibitory strategies:

     o Perseveration o Orderliness o

     Constant exertion o Risk of exploitation o

Displacement o Addiction

- **Inhibition:** In contrast, inhibition means avoiding the present situation. Its strategies are fixation, regression, phobia, sleeping spells, depression, suicide, mutilation of body parts.
- **Explication:** It implies getting knowledge about the experiences, situations, signals or stimulations obtained from the environment. This type of coping strategies comprises construction, inferences, conceptualization,] formulation, designing, and evaluation to get knowledge about what should take place in the environment.

1.2.4 Concept of Possibilism

Possibilism is a theory of geographical culture that explains that environment has certain hmitations. Its culture is defined by the actions of human beings. According to Marshall Sahlins, 'Possibilism is an alternate concept of environmental determinism.'

According to Mackinder and Kropotkin, 'Possibilism in geography is, thusj considered as a distinct approach to geographical knowledge directly opposed to geographical determinism.'

Possibilism explains the relationship between the human and physica environment. Humans have a specific ability to adjust with the environment by modifyin their responses. They react to the changes in environment according to the stimulus the receive from it. It is directly matched with the concept of environmental determinisrt which is in favour of the fact that the environment is responsible for shaping, limiting an' controlling the development of culture.

The main emphasis is given to:

- The relationship between people and their surroundings.
- People are free to decide their own direction in which they can adapt to different lifestyles.
- According to this concept, environment does not decide the actions, nature and behaviour of individuals rather it provides opportunities to human beings to shape themselves.
- People are adaptive in nature. Tliey adapt themselves in different places and in different habitat on earth.

The French historian Lucien Fabvre explained the concept of possibilism by saying that, 'When possibilism relates with human behaviour to their environment, there are no necessities but everywhere possibilities.'

Possibilism lays emphasis on thoughts, actions and ability to cope with environment and control one's own destiny.

Main Conclusions

- PossibiUsm does not accept the influence of environmental factors in human life.
- Environment does not play any role in the development of culture.
- It provides choices to human beings.to adapt and show their responses.
- Man is the main partner of the environment and he moulds his surroundings according to his needs.
- Man makes many changes and modifications in environmental conditions according to his needs to fulfil his demands.
- A physical environment provides opportunity to human beings to act.
- The physical and social environment creates many chances and possibilities for human beings to choose freely and respond.

- Possibilism is a philosophy which explains the relationship between man and environment.
- The concept of possibilism accepts man as an active agent of environment.
- It asserts that the natural environment provides many options as knowledge and technology of cultural group increases.
- There are three reasons:

(a) Industrial revolution
(b) Agricultural Advancement
(c) Technological revolution

industrial Revolution

Icreased demand for basic necessities due to rapid growth of population in India led to Mi Industrial Revolution. Industrial Revolution started way back in 1960s when India #as struggling from the problems of poverty, unemployment and over population. The Braergence of newer technologies helped India to become a self-reliant state.

Though it was a remarkable achievement for the Indian economy, it also gave Birth to various environmental concerns like pollution, global wanning, urbanization, deforestation, creation of slums and deteriorated living conditions.

Agricultural Advancement

India is an agricultural country. With the advent of 1947, the Indian economy was hugely dependent on the agriculture sector. With 70 per cent of national income obtained from this sector, agriculture also witnessed a lot of advancement since its onset. To fulfill the increasing demands of food, the use of fertilizers and pesticides, modem irrigation methods, green revolution and organic farming methods have been adopted by the Indian farmers so as to increase the yield of crops.

No doubt, there is a great increase in the productivity; simultaneously it is inversely affecting the environment. Acid rains, soil erosion, adulteration, soil degradation, disturbance in monsoon cycle affect the growth of agriculture.

Technological Revolution

The world has witnessed drastic changes in the past few years; the lifestyle of people has been affected greatly. Due to the emergence of new technologies, the modern societies are thriving to get the edge of the newest up gradation.

Today the use of computers, television, internet and modern means of transport has reduced the distance across the globe but it has widened the gap among human beings. Not only the physical environment but also the social and the psychological environment is getting affected.

1.2.5 Neo-determinism

Taylor, in 1920s put forward the concept of neo-determinism. He believed that agricultural production mostly depended on the physical environment. As agriculture is affected by physical nature of environment the economy of the country is also affected. The producers of agricultural products are the main agents who play an important role in the economical progress of the country.

Man is the main source of development who is capable of bringing about significant changes in a country's development by changing the rate and direction of progress.

Environment offers several opportunities to man to select his actions either wisely or foolishly. He therefore has the wisdom to not take actions which will act against the environment.

Nature has two phenomena in common 'possible and impossible.'

Environment does not provide equal chances to everyone. Sometimes, very little amount of possibilities of actions are found; sometimes harsh struggles resulting in more or less amount of production.

Nature never decides and never gives any clue to human beings to show its preferences of actions. It is not clear which action will be accepted by the nature.

The concept of determinism accepts that man is not a free agent of nature and he has no freedom to decide his actions. On the other hand, the concept of neo-determinism agrees that man is a free agent of nature, he is free to choose his actions, he is free to take decisions and free to select alternative actions.

He has limitless possibilities out of which he selects his best actions. His actions are determined wisely to achieve the goals.

When we compare determinism, possibilism and neo-determinism, we reach to the conclusion that:

- **Determinism** is the concept which explains that nature affects the physical, mental and moral mind sets and habits of mankind and determines the culture and behaviour of the individuals and the society. Further, it suggests that whatever the actions, the actions of the individuals are already predetermined.
- **Possibilism** is that concept which suggests that man decides his actions according to the possibilities he finds from the environment. His actions determine the culture. He has limitless possibilities out of which he can select according to his needs and demands.

On the other hand, neo-determinism believes that environment provides many chances to man out of which he has to select his actions by using his wisdom. The opportunities are not equal for all but only wise people can select the best actions to reach their goals.

CHECK YOUR PROGRESS

1. Define nomological determinism.
2. What is Fatalism?
3. List the factors affecting determinism.
4. What does possibilism emphasise on?
5. What do you understand by the concept of neo-determinism?

1.3 INTRODUCTION TO ENVIRONMENTAL EDUCATION

Environmental education is an important segment within the educational system. In many countries government supported programmes are constituted which are pursued by social -groups, scientific community and educational institutions.

The main objectives of such programmes are:

- To overcome the environmental crisis
- To understand the factors, causes and find solutions to the environmental problems
- To evaluate and analyse problems in the management of natural resources
- To evaluate the success and failure in implementing educational tasks
- To develop ability to assess environmental situations which are leading to environmental damages

- To develop relationship between social, economic and physical factors which are mutually responsible for various negative outcomes
- To provide feedback for the future generation
- To define economy and set up the limits of the use of natural resources
- To make behavioural changes in everybody's life as a consumer, industrial producer, employee, citizen, policymaker, traveller, tourist, farmer, or student
- To integrate Gandhian principles and values as a part of environmental education

1.3.1 Need for Environmental Education

The pursuit of sustainable development and environmental conservation policies, objectives and targets requires the public to be sufficiently sensitized about the multiple dimensions of environment and development. Awareness and understanding of environmental issues provide the basis and rationale for commitment and meaningful action towards environmentally sound and sustainable development.

Environmental education is now being seen as an instrument and a process that enables participation and learning by people of all ages, based on two-way communication rather than the old paradigm of a one-way flow of information, from teachers to pupils. The content and substance of environmental education is also undergoing review and change. Reorienting education as a whole towards sustainability involves the various levels of formal, non-formal and informal education at all levels of society. Environmental education has developed within the conceptual framework that emerged from the first international conference in Tbilisi (1977) and is now seen as education for sustainability. This allowed environmental education to address the broad range of issues and concerns included in *Agenda 21* and others which evolved through the meetings of the Commission on Sustainable Development (UNESCO 1997).

The key international conventions on environment place a high value on public awareness, education and training and obtaining information through monitoring as essential elements for the success of the conventions. For example, the Convention on Biological Diversity emphasizes the importance of public education and awareness through promoting and encouraging measures required for the conservation of biological diversity.

Since the convention came into force in December 1995, the contracting parties (countries) have been motivated to address issues related to education and awareness on biodiversity.

In addition, countries in the region recognize the immensity of the challenges they face, and of the vital role that environmental education can play in meeting these challenges. There is a growing perception by governments for the need to integrate environmental education information and communication into the country's on-going programmes. As a result of the *Agenda 21,* the level of cooperation and collaboration between environmental and the educational institutions has increased. In some countries, governmental environmental agencies have statutory requirements to engage in activities related to environmental education and awareness.

For example, the Malaysian Department of Environment has established an educational division under the Environmental Quality Act, which is actively engaged in promoting and implementing a variety of activities.

In many countries of the Asian and the Pacific Region environmental topics have been included in education courses, through integrating environmental concerns in other subjects and through specific courses for the environment. Government, NGOs(i educational institutions and media have undertaken some serious efforts to meet the growing environmental challenges by promoting environmental education, information and communication in their respective countries. Activities such as green bank, green press, eco-clubs, eco-policies, eco-farming and eco-harvesting; are emerging in the

region Special economic incentives (such as subsidy, tax-exemption and other incentives) are provided to schools in some countries where environmental education courses are offered

There is greater recognition of the role of NGOs and civil society organizations, and the need for meaningful community participation in debates and action programmes aimed at education and training for sustainable development. NGOs and governments are increasingly working together, reinforcing each other's strengths and outreach.

Linkages between governmental institutions and NGOs are improving in most countries of the region, and in some cases, governments are actually depending on mature and experienced NGOs to promote environmental awareness, communication, and training activities.

1.3.2 International Meets of Environmental Educations

1. Stockholm Conference

Environmental education (EE) gained international recognition in 1972 with the UN Conference on the Human Environment, in Stockholm, Sweden, which called upon environmental education as the means to address environmental issues worldwide. The Conference considered the need for a common outlook and for common piinciples to fnspire and guide the peoples of the world in the preservation and enhancemznt of the human environment. It proclaimed that:

- Man is both creature and moulder of his environment, which gives him physical sustenance and gives him the opportunity for intellectual, moral, social and spiritual growth. In the long and tortuous evolution of the human race on this planet, a stage has been reached when, through the rapid acceleration of science and technology, man has acquired the power to transform his environment in countless ways and on an unprecedented scale. Both aspects of man's environment, the natural and the man-made, are essential to his well-being and to the enjoyment of basic human rights— the right to life itself.
- The protection and improvement of the human environment is a major issue which affects the well-being of people and economic development throughout the world. It is the urgent desire of the people of the world and the duty of all the governments.
- Man has constantly to sum up experience and go on discovering, inventing, creating and advancing. Man's capability to transform his surroundings, if used wisely, can bring to all people the benefits of development and the opportunity to enhance the quality of life. Wrongly or heedlessly applied, the same power can do incalculable harm to human beings and the human environment. We see around us growing evidence of man-made harm in many regions of the earth: dangerous levels of pollution in water, air, earth and living beings; major and undesirable disturbances to the ecological balance of the biosphere; destruction and depletion of irreplaceable resources; and gross deficiencies, harmful to the physical, mental and social health of man, in the man-made environment, particularly in the living and working environment.
- In the developing countries most of the environmental problems are caused by under-development. Millions continue to live far below the minimum levels required for a decent human existence, deprived of adequate food and clothing, shelter and education, health and sanitation. Therefore, the developing countries must direct their efforts to development, bearing in mind their priorities and the need to safeguard and improve the environment. For the same purpose, the industrialized countries should make efforts to reduce the gap themselves and the developing countries. In the industrialized countries, environmental problems are generally related to industrialization and technological development.
- The natural growth of population continuously presents problems for the preservation of the environment, and adequate policies and measures should be adopted, as appropriate, to face these problems. Of all things in the world, people are the most precious. It is the people that

propel social progress, create social wealth, develop science and technology and, through their hard work, continuously transform the human environment. Along with social progress and the advance of production, science and technology, the capability of man to improve the environment increases with each passing day.

- A point has been reached in history when we must shape our actions throughout the world with a more prudent care for their environmental consequences. Through ignorance or indifference we can do massive and irreversible harm to the earthly environment on which our life and well being depend. Conversely, through fuller knowledge and wiser action, we can achieve for ourselves and our posterity a better life in an environment more in keeping with human needs and hopes. There are broad vistas for the enhancement of environmental quality and the creation of a good life. What is needed is an enthusiastic but calm state of mind and intense but orderly work. For the purpose of attaining freedom in the world of nature, man must use knowledge to build, in collaboration with nature, a better environment. To defend and improve the human environment for present and future generations has become an imperative goal for mankind-a goal to be pursued together with, and in harmony with, the established and fundamental goals of peace and of worldwide economic and social development.
- To achieve this, environmental goal will demand the acceptance of responsibility by citizens and communities and by enterprises and institutions at every level, all sharing equitably in common efforts. Individuals in all walks of life as well as organizations in many fields, by their values and the sum of their actions, will shape the world environment of the future.
- Local and national governments will bear the greatest burden for large-scale environmental policy and action within their jurisdictions. International cooperation is also needed in order to raise resources to support the developing countries in carrying out their responsibilities in this field. A growing class of environmental problems, because they are regional or global in extent or because they affect the common international realm, will require extensive cooperation among nations and action by international organizations in the common interest.

2. Tbilisi Conference

In 1975, in pursuance of the above recommendation of the United Nations Conference on the Human Environment (Stockholm, 1972) UNESCO and the United Nations Environmental Programme (UNEP) launched the International Environmental Education Programme (IEEP). In 1977 the Intergovernmental Conference on Environmental Education (Tbilisi, USSR), considering that there was a sharply felt need in all countries for international cooperation in this field, called upon UNESCO and UNEP to continue their efforts to further the development of this education within the international community.

Environmental education (EE) is included among the objectives of UNESCO's Medium-Term Plan for 1977-1982, which was approved by the UNESCO General Conference at its nineteenth session (Nairobi, 1976).

The Declaration and Recommendations of the Tbilisi Conference made it possible to define the nature, objectives and pedagogical principles of environmental education and to establish broad guidelines for action in this field at the national and international levels. Since the Tbilisi Conference, the environment has been seen as a whole, simultaneously comprising natural aspects and those that result from human action. Environmental Education is viewed as a dimension of the subject matter and practice of education directed towards the solution of practical environmental problems through an interdisciplinary approach and the active and responsible involvement of each individual and of the community.

The Tbilisi Conference considered that EE should be made an integral part of the entire educational process and aimed at every category of the population such as:

- General public and non-specialists

- Socio-occupational categories whose activities have a significant impact on the environment
- Scientists and technicians whose fields, whether in the natural or the social sciences concern the environment and who need to receive specialized training.

3. The Earth Summit

The Earth Summit in Rio de Janeiro was unprecedented for a UN conference, in terms of both its size and the scope of its concerns. Twenty years after the first global environment conference, the UN sought to help Governments rethink economic development and find ways to halt the destruction of irreplaceable natural resources and pollution of the planet. Hundreds of thousands of people from all walks of life were drawn into the Rio process. They persuaded their leaders to go to Rio and join other nations in making the difficult decisions needed to ensure a healthy planet for generations to come.

The Summit's message—that nothing less than a transformation of our attitudes and behaviour would bring about the necessary changes—was transmitted by almost 10,000 on-site journalists and heard by millions around the world. The message reflected the complexity of the problems facing us: that poverty as well as excessive consumption by affluent populations place damaging stress on the environment. Governments recognized the need to redirect international and national plans and policies to ensure that all economic decisions fully took into account any environmental impact. And the message has produced results, making eco-efficiency a guiding principle for business and governments alike.

- Patterns of production — particularly the production of toxic components, such as lead in gasoline, or poisonous waste — are being scrutinized in a systematic manner by the UN and Governments alike.
- Alternative sources of energy are being sought to replace the use of fossil fuels which are linked to global climate change.
- New reliance on public transportation systems is being emphasized in order to reduce vehicle emissions, congestion in cities and the health problems caused by polluted air and smog.
- There is much greater awareness of and concern over the growing scarcity of water.

The two-week Earth Summit was the climax of a process, begun in December 1989, of planning, education and negotiations among all Member States of the United Nations, leading to the adoption of 'Agenda 21', a wide-ranging blueprint for action to achieve sustainable development worldwide. At its close, Maurice Strong, the conference secretary-general, called the summit a 'historic moment for humanity'. Although Agenda 21 had been weakened by compromise and negotiation, he said, it was still the most comprehensive and, if implemented, effective programme of action ever sanctioned by the international community. Today, efforts to ensure its proper implementation continue.

The Earth Summit influenced all subsequent UN conferences, which have examined the relationship between human rights, population, social development, women and human settlements — and the need for environmentally sustainable development. The World Conference on Human Rights, held in Vienna in 1993, for example, underscored the right of people to a healthy environment and the right to development, controversial demands that had met with resistance from some Member States until Rio.

1.3.3 Definitions of Environmental Education

'Environmental Education is away of implementing the goals of environmental protection. It is not a separate branch of science of field of study. It should be carried out according to the principle oflife-long integral education.'—FinnishNationalCommissionEducation, UNESCO (1976) Seminar at Jammi, 1974.

According to Mishra (1993), 'Environmental Education appears to be a process that equips human with awareness, knowledge, skill, attitude and commitment to improve environment.'

International working meeting on environmental education in the school curriculum, Paris UNESCO, 1979: 'Environmental Education is the process of recognizing values and clarifying concepts in order to develop skill and attitude necessary to understand and appreciate the interrelatedness among man, his culture and his bio-physical surroundings. It also entails practice in decision making and self formulation of a code of behaviour about problems and issues concerning environmental quality.'

According to Cook and Hearu (1971), 'Environmental education is problem centered, interdisciplinary, value and community oriented, and concerns with man's survival as species, based on student initiated activities and involvements.'

As per R.A. Sharma (1996), 'Environmental education refers to the awareness of physical and cultural environment and perceives its relevance for real life situations. The problems and issues are to be identified. The imbalances of environment are to be improved in view of sustainable development.'

Reviewing all the definitions, environmental education can be summarized as:

- A way to meet the goals of environmental protection.
- A process by which one develops awareness about environment.

Environment Education is significant because of the following reasons:

- Comprises of a learning process that increases people's knowledge and awareness about associated challenges
- Develops the necessary skills and expertise to face challenges
- Facilitates better attitude, motivations and commitments to take responsible action
- Enhances critical thinking, problem solving and effective decision-making skills
- Enables individuals to calculate various sides of environmental issue
- Encourages inquiry and investigation
- Ensures literate individuals to make healthy citizen and community
- Improves everyday life by protecting human health
- Encourages expansion of natural resources
- Establishes ecological equilibrium which explains proper use and conservation ofresources
- Controls environment pollution
- Understands the importance of balanced environment and remedial measures for checking the imbalances of environment

Apart from this, some more objectives of environmental education have been chalked out by various international seminars and conferences.

- 'To create an awareness and an understanding of the evolving social and physical environment as a whole, its natural, manmade, cultural, spiritual resources, together with the rational use and conservation of these resources for development.' - Report of a conference of African educators, EDC and CREDO, Nairobi, African Social Studies programmes, 1968.
- ' In order to enable people to enjoy good health and a high quality of life, it is vital to prevent harmful effects to human health or damage to the environment caused by pollution of air, water, and soil, noise, vibration, noxious, smells, etc., caused by firms and individuals. The environment includes animals and plants and their ecological systems which are closely bound to the livelihood ofpeople.'-National Antipollution Law, Japan, 1968.
- Environmental Education is an integral part of the education process. It should be centered on

practical problems and be interdisciplinary in character. It should be aimed at building up a sense of values, contribute to public well being and concern itself with the survival of the human species. Its force should reside mainly in the initiative of the learners and their involvement in action and it should be guided by both immediate and future subjects of concern - Final report of the Tbilisi Conference, 1977.

1.3.4 Nature of Environmental Education

Environmental education is significant because of the following reasons.

- Action against real problems
- Interdisciplinary in nature
- Solution for environmental situations and problems
- Modification of values in relation to environment
- Development of skills and attitude
- A continuous process
- An educational experience which provides solution for environmental problems
- Newly created field for all socio-professional groups
- Vital to prevent harmful effects to human health
- Relationship between man, its culture and biophysical environment
- Decision-making practice
- Self-formulation of a code of behaviour
- Not a separate branch of science
- An integral part of the educational process
- Formal as well as informal
- For all age groups
- A style and subject matter of education

1.3.5 Nature and Scope of Environmental Education

Environmental education is the need of the day. It is a part of education for society in the developed, developing and least developed countries. It strives to improve things through environment, about environment and for environment.

The scope of environmental education is designed under two categories: (i) Scope in terms of subjects (ii) Scope in terms of environmental issues and subj ect matter

According to Tbilisi conference, environmental studies as a subject has immense opportunity. It includes a variety of subjects and arenas which can be listed as:

- Maintenance and protection of natural resources
- Natural science and biodiversity
- Management and reduction of environmental pollution
- Community related issues with respect to development and environment
- Human population and environment

SCOPE OF ENVIRONMENTAL EDUCATION

General Public	Specific Occupational or Social Groups	Certain Professionals and Scientist
(a)Pupil and teachers (b)Adolescents and old people (c)Handicapped	Engineers, architects, administrators, planners, industrialists, trade unionists policy makers, agriculturist metrologists and sainitary engineers	Biologists, ecologist, hydrologists, toxicologists, soil scientist, agronomists, foresters, landscape, limnologists,

Fig. 1.2 Scope of Environmental Education for Different Categories of Individuals

These are the fundamental characteristics of environmental education which have an immediate influence on society. Environmental Studies are also at times, highly focused on more technological features like environmental science, environmental engineering or environmental management.

In modern times, the range of environmental studies has increased significantly. A number of career opportunities have become known in these fields that are largely classified as:

(i) Research and Development (R&D) in Environment: Proficient environmental scientists play a significant role in investigating numerous environmental problems in a scientific manner. In this manner, they are able to perform R&D activities for developing cleaner technologies and ensuring that the present development is able to meet the needs of the current generation without compromising on the needs of the future generations. Environmental management and environmental engineering are emerging as new career opportunities for environmental protection and management. In India the pollution control boards (PCB) are taking stringent action to execute pollution control laws.

(ii) Green Advocacy: Environment Studies as a subject now needs to have advocates since several Acts and Laws related to environment have been implemented. Advocates will need to fight for cases related to water and air pollution, forests and wildlife.

(iii) Green Marketing: We now find products in the market which have ISO 14001 Certification. This certification implies that the products are environment friendly and will not adversely affect the environment. As a result, environmental auditors and environmental managers are the emerging career opportunities in the coming years.

(iv) Green Media: In the age of technology, awareness about the environment can be easily spread not only by television, radio, newspapers but also through the Internet, magazines, hoardings and advertisements.

(v) Environment Consultancy: A lot of non-government organizations (NGOs), corporate bodies and government organizations are hiring the services of environmental professionals for thoroughly studying and confronting environment related problems.

Universal vs Local Nature of Environment

Environment is one focus that is both global and local in nature.

Issues like global warming, diminution of ozone layer, declining forests and energy resources, loss of diverse plants and animals at the global level are some of the problems which are going to have a direct and indirect influence on human beings at the global level.

However, there are some environmental problems which have to be handled at the local level. For example, impact of mining, or hydroelectric project in an area, difficulty in disposal and management of solid waste, pollution of water bodies, soil erosion, water logging, and salinization of soil, and arsenic pollution of ground water have to be handled at the local level.

Individualistic Nature of Environment: Environmental studies is an indispensable subject matter. It deals with the most commonplace problems of life which concern every human being such as provision of safe and clean drinking water, clean living conditions, fresh air, fertile land, healthy food and sustainable development. If we want to lead a healthy life, live long with less number of health problems and preserve the same for the future generations, it is most essential to understand the basics of environment.

Sustainable development requires public-private partnership. However, the public can be encouraged to participate only when they are made conscious about the environmental issues.

All individuals should be made conscious of their duty to keep the environment neat and clean. This will ensure that the environment is conserved and preserved for a better tomorrow.

CHECK YOUR PROGRESS

6. What is the significance of environmental education?
7. List the career options that have emerged in the field of environmental studies.

Do You KNOW

Van Mahotsav is an annual pan-Indian tree planting festival which takes place for a week in the month of July. During this event millions of trees are planted.

ACTIVITY

Find out the reason as to why the construction of wooden houses has been replaced with concrete houses in the hilly stations making them extremely prone to earthquakes and other natural calamities.

1.4 SUMMARY

In this unit, you have learnt that:

- Environment is the life support system on which the existence and perpetuation of all living organisms depend. The present day environment can be considered to have physical, chemical, biological, scientific and technological components in which the organisms remain embedded.
- Environmental Education is an important segment within the educational system.. In many

countries government supported programmes are constituted which are pursued by social groups, scientific community and educational institutions.

- Education is preparation for an adaptation to the mechanical life and workplace for active participation in confronting the problems created by human causes as well as natural causes itself.
- Environmental Education is the need of the day. It is a part of education for society in the developed, developing and least developed countries. It strives to improve things through environment, about environment and for environment.
- Environment Studies as a subject now needs to have advocates since several Acts and Laws related to environment have been implemented. Advocates will need to fight for cases related'to water and air pollution, forests and wildlife.
- Issues like global warming, depletion of ozone layer, dwindling forests and energy resources, and loss of global biodiversity will have a direct and indirstet effect on mankind on a global level.
- Environment is made up of biotic and non biotic agents and they have interaction between them. Humans are different because they have their wishes, interest and will.
- Human beings are the part of environment and thus, they have to follow the rules of nature and laws of science. If we feel that whatever one does is already decided then there is no blame on the events that takes place. In this respect the determinism is found to be true.
- The hypothetical views of theory of physics explain the presence of small particles in the universe and their interactions. The present theory helps in defining the different aspects involved in determinism.
- Free will can be compared with determinism. The other views state that determinism cannot be compared with free will. Some have an opinion that when any event is held by determinism, free will cannot exist.
- Causal Determinism explains the law of cause and effect. Whenever there is a cause there will be an action and action will produce an effect as a response to it.
- Nomological Determinism is a combination of past status of universe and the natural laws which decides the events of future.
- Necessitarianism is a metaphysical concept which infers that every event takes place with certain causes and whatever happens has a cause and reason.
- The Weak theological determinism explains that whatever happens is already known to God and future is fixed.
- Logical determinism explains that whatever the idea formed behind the present, past and future will be either true or false.
- Environmental determinism is also known as climatic or geographical determinism. According to this form of determinism, the physical and social conditions of environment design, the culture patterns of an individual decide their behaviour.
- When an affectionate bonding is developed among individuals, a group is formed. For example, family is a group. Families unite together to form a social group, ultimately, becoming a society.
- Explication implies getting knowledge about the experiences, situations, signals or stimulations obtained from the environment.
- Possibilism explains the relationship between the human and physical environment. Humans have a specific ability to adjust with the environment by modifying their responses.

1.5 KEY TERMS

- **Abiotic:** It is a biological term that means nonliving or not alive.
- **Possibilism:** It is a theory of geographical culture that explains that environment has certain limitations. Its culture is defined by the actions of human beings.
- **Determinism:** It is the concept which explains that nature affects the physical, mental and moral mind sets and habits of mankind and determines the culture and behaviour of the individuals and the society.
- **Adhibition:** It means the actions, and responses which are taken in use. These responses are used to control the situation and get perfection to fulfill the requirement.
- **Inhibition:** It means avoiding the present situation.
- **Nomological Determinism:** This type of determinism is a combination of past status of universe and the natural laws which decides the events of future.
- Necessitarianism: It is a metaphysical concept which infers that every event takes place with certain causes and whatever happens has a cause and reason.

1.6 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Nomological determinism is a combination of past status of universe and the natural laws which decides the events of future. This form of determinism suggests that the past and present events combine to design the future by obeying the natural laws.
2. Fatalism believes in the destiny of an individual. It explains that whatever events take place in an individual's life depend on his fate and human actions cannot control it.
3. Some of the factors affecting determinism are:

    - Interrelationship among individuals
    - Grouping
    - Continuous existence
    - Likings or disliking
    - Infirmity and mortality
    - Coping Strategies

4. Possibilism lays emphasis on thoughts, actions and ability to cope with environment and control their own destiny.
5. Taylor, in 1920s put forward the concept of neo-determinism. He believed that agricultural production mostly depended on the physical environment. As agricultural is affected by physical nature of environment the economy of the country is also affected. The producers of agricultural products are the main agents who play an important role in the economical progress of the country.
6. Environment Education is significant because it,
   (i) Comprises a learning process that increases people's khosffedge and awareness about associated challenges, (ii) Develops the necessary skills and expertise to face challenges.
   (iii) Facilitates better attitude, motivations and commitments to take responsible action, (iv) Enhances critical thinking, problem solving and effective decision-making skills, (v) Enables individuals to calculate various sides of environmental issues.

7. The career options that have emerged in the field of environmental studies are:
   (i) Research and Development (R&D) in Environment
   (ii) Green Advocacy (iii) Green Marketing (iv) Green Media
   (v) Environment Consultancy

1.7. QUESTIONS AND EXERCISES

Short-Answer Questions

1. Explain the meaning of environment.
2. Define environmental education.
3. List the characteristics of environmental education.
4. Write short notes on (a) Possibilism (b) Neo-determinism.

Long-Answer Questions

1. Describe the nature and scope of environmental education.
2. Explain the concept of determinism.
3. Describe the different types of determinism.
4. What factors influence determinism?
5. Discuss the need for environmental education.
6. Describe how international bodies have tried to deal with environmental education.

1.8 FURTHER READING

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UNIT 2 ENVIRONMENTAL RESOURCES

Structure

2.0 Introduction
2.1 Unit Objectives
2.2 Natural Resources
  2.2.1 Classification of Natural Resources
2.3 Land Resources
2.4 Air Resources
  2.4.1 Air Pollution
2.5 Water Resources
2.6 Forest Resources
2.7 Mineral Resources
2.8 Food Resources
2.9 Energy Resources

2.10 Role of Individuals in the Conservation of Natural Resources
2.11 Cultural Resources

  2.11.1 Obstacles of Cultural Harmony
  2.11.2 Specimens of Art/Architecture
  2.11.3 Protection of Monuments
  2.11.4 Indian Architecture
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2.12 Summary
2.13 Key Terms
2.14 Answers to 'Check Your Progress'
2.15 Questions and Exercises
2.16 Further Reading

2.0 INTRODUCTION

The word 'environment' is derived from the French word *environ,* which means 'to surround' or 'around' and is referred to as the external conditions in which an organism lives. Hence, environment can be defined as the whole of physical, chemical and biological factors, which work upon living beings or a natural community and decide its structure and nature of survival.

Living and non-living entities together comprise the natural environment making human beings an essential component of the environment. Man is the most advanced creature of all living beings and is considered to be a social animal. Hence, one can say that man lives in a socio-cultural environment that either directly or indirectly has an influence on him. In turn, human beings also alter or vary the nature of environment according to their requirements. However, it should be noted that these changes are not always advantageous.

The environment does not remain constant for any living creature; it changes with time as well as it changes from place to place. Human beings live in a condition of vigorous stability with the environment. Hence, every living creature has to make certain alterations in response to the modifications in one or more environmental factor(s) such as temperature, humidity, pH, etc., in order to survive, grow, feed and reproduce. Plants and animals, just like human beings, draw nourishment from the environment and survive in its lap. They grow, develop, reproduce and

ultimately perish in the environment.

Living beings react differently to the changes taking place in the environment. Some creatures are extremely vulnerable to even the least environmental change, while others are capable enough to adjust their metabolic processes and deal with these modifications. Living beings which could not deal with any modification in environment have either been wiped out or are on the verge of being destroyed.

Resources do not refer to a thing or a substance, but to a function which a thing or a substance may perform or to an operation in which it may take part, namely the function or operation of attaining a given end such as satisfying a want. Resource, therefore, is a means to attain the given ends. The aspect of satisfaction is so important that we consider a thing or a substance as resource, so long as it meets our needs.

Life on this planet depends upon a large number of things and services provided by nature, which are known as natural resources. Water, air, soil, minerals, coal, forests, crops and wild life are all examples of natural resources.

Any material which is required or used to sustain life or livelihood is termed as a resource. In other words, resources are all these requirements of organisms, population and communities which tend to help in the accumulation of energy by their increased availability. Some examples of resources are air for breathing, water for drinking, land for living and growing food, forests for timber and paper, ores for aluminium, copper, iron and other metals and coal, oil and natural gas for producing energy.

2.1 UNIT OBJECTIVES

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

- Explain the concept of natural resources
- Distinguish between renewable and non-renewable resources
- Discuss the important natural resources such as forest, water, minerals, food, energy and land resources
- Identify the role of an individual in the conservation of natural resources
- Discuss the cultural resources
- State the various steps that can be taken for the protection and promotion of cultural resources

2.2 NATURAL RESOURCES

According to Ramade (1984), a natural resource is defined as a form of energy and/ or matter which is essential for the functioning of organisms, populations and ecosystems. In the case of humans, natural resource refers to any form of energy or matter essential for the fulfillment of physiological, socio-economic and cultural needs, both at the individual level and that of the community. Examples of natural resources are water, air, soil, minerals, coal, forests, crops and wildlife.The basic ecological variables—energy, space, time and diversity are sometimes together called natural resources. These natural resources maintain the ecological balance among themselves. Man is the only organism who has disrupted this delicate balance.

Resource is a means, which may or may not be material. It has specific functions and can be utilized to meet the needs of individual and society as a whole, in a given space and time.

Resources can be natural such as air, water and soil or they can be a human resource, such as population or a cultural resource like knowledge.

The generation of such important resources is hampered by various resistances such as, natural resistance like cyclone, flood, drought; human resistance like war, over- or under-population and cultural resistance like superstition and religious fundamentalism. Although, natural resistance cannot be controlled, the other two can and should be prevented in order to safeguard existence.

Resistance

A material or energy, which creates disturbance at the time of formation of resource, is called 'resistance' and can be classified into three categories.

1. *Natural resistance:* Such resistances come from natural processes, e.g., cyclones, floods, droughts, etc.
2. *Human resistance:* Such resistances are man-made and can be prevented through scientific and logical measures, e.g., population increment or decrement, war, etc.
3. *Cultural resistance:* Such resistances come from human society due to certain beliefs that may not be logical and are mainly caused due to illiteracy, e.g., superstitions.

Resource and resistance are interrelated as well as interdependent.

Neutral Stuff

There are many materials in the world that can neither be termed as resources nor resistances. These materials are known as 'neutral stuff'.

The neutral stuff has functionality but no utility. For example, the materials of Antarctica has functionality but no utility. These materials can, therefore, be termed as neutral stuff because they cannot be utilized as a resource but at the same time do not create any resistance in the formation of other resources.

Impact of Population Growth on Resources

Development and growth of population use natural resources to a large extent. However, since these resources are hmited, they get depleted at an increasingly faster rate. This results in environmental degradation causing ecological imbalance.

2.2.1 Classification of Natural Resources

There are different classifications of natural resources. According to Odum (1971), natural resources can be divided into two categories, renewable and non-renewable fesources. They can also have two further categories of Biotic/Abiotic and Inexhaustible Resources.

A. Renewable Resources

Resources that can be replenished through rapid natural cycles are known as renewable resources. These resources are able to increase their abundance through reproduction md utilization of simple substances. Examples of renewable resources are plants ,'crops and forests), and animals who are able to reproduce and maintain life cycles. Some examples of renewable resources which do not have life cycle, but can be recycled are wood and wood-products, pulp products, natural rubber, fibres (e.g., cotton, jute, animal wool, silk and synthetic fibres) and leather. In addition to these resources, water and soil are also classified as renewable resources. Water is no longer referred to as a renewable resource. This is because of its loss in natural replenishment due to global warming, increased deforestation and resulting disturbances in the hydrological cycle. Water's status of infinity is severely under threat. These resources may have a life-cycle. These can be replaced from time to time, such as plants and animals or those that do not have a life-cycle but can be recycled, for example, water. Replaceable renewable resources, such as plants and animals, if not

managed properly, may not become available with the same speed and become extinct soon. On the other hand, these inexhaustible resources that are hardly affected by man's activities are abundantly available and expected to be so for millions of years. Solar energy, wind energy, atomic energy, etc., are examples of such kind.

The renewable resources are of two types:

1. *Conventional type,* such as water resources, plants and forests, wildlife, livestock, aqua culture, etc.
2. *Non-conventional type,* such as solar energy, wind energy, biogas, atomic energy, etc.

I. Conventional Type Resources

Water: Water is essential for domestic use, generation of electricity, irrigation, navigation and also for living organisms. Currently, a lot of underground water is being used mainly for agricultural purposes, creating enormous load on the ecosystem. Sufficient care needs to be taken to manage water efficiently. Water is a renewable resource and has a life-cycle (the hydrologic cycle) which should be properly maintained. However, due to large-scale deforestation the water cycle gets disturbed.

Forests: Forests constitute 90 per cent of the global biomass. They are important as they regulate climatic conditions, such as rainfall, humidity, temperature and protect soil from erosion. Forests provide timber, fruits, medicine (medicinal plants); protect public health by absorbing contaminants of the environment and provide suitable habitats for a number of plant as well as animal species. Due to improper management, vast stretches of forests are lost every year. To compensate the loss of forest cover due to its diversion, afforestation should be done so that the net area under the forest cover remains the same. Only then can forests act as a renewable resource.

Wildlife: Wild animals provide us meat for food, skin for leather goods and are used for research as well as recreational purposes. Human beings have killed millions of wild animals only to show their supremacy. The discriminate cutting of woods too has led to the extinction of at least one mammal and bird species every year. In order to make wildlife a renewable resource, proper management and awareness among people is very important.

- **Livestock:** The livestock such as cattle, goats, buffaloes, sheep, horses, camels, as well as fowls, ducks and turkeys, provide meat, milk, eggs, skin, wool and also dung, which can be utilized as biogas and manure. Livestock can be utilized as renewable source only through proper management of their health/breeding and diet.
- **Aqua Culture as a Renewable Resource:** Fish, crabs, prawns, molluscs, etc., are very important sources of animal protein for human beings. The food proteins of marine animals are generally obtained from fish. Marine resources are: the seas numerous gulfs, rivers, lagoons, water lakes and other inland water resources. Fish is cultured in ponds, artificial enclosures and net pens by providing fertilizers like cow dung, domestic and agricultural waste and also animal excreta. The aqua culture production can be increased by using composite fish culture, *i. e.,* using the surface, middle and bottom for feeding fish in the same pond, avoiding competition among them for food.

2. Non-conventional Type Resources

- **Energy:** Although fossil fuels are non-renewable, they still form very slowly as compared to their consumption. Biomass although non-renewable can be made renewable by fuel-wood plantations. However, due to indiscriminate felling of trees, forests have depleted and fuel-wood has become scarce.
- **Solar Energy:** The main source of energy for the biological world is solar energy. The readily

available solar radiations, particularly in tropical countries, can be trapped and converted to electrical energy, using devices such as a photo-cell. Thus, advanced researches for the development of efficient photovoltaic devices must be carried out to harness solar energy.

- **Wind Energy:** Wind energy can be converted into electrical energy by developing suitable technology. The electrical energy or electricity can solve energy problems in small towns or villages to a large extent. A common example of this usage is windmills that convert wind energy into mechanical energy for raising water from Wells and rivers to the ground surface.
- **Wave and Tidal Energy:** Areas where rivers meet the sea, experience waves and tides. This enables the generation of large amount of electricity. Energy can also be generated by a natural or artificial water fall. The hydroelectric power thus generated turns a turbine fast, thereby generating electricity.
- **Geothermal Energy:** Hot springs are the contributors of geothermal energy as they have lot of steam. This steam can be utilized to run turbines in order to generate electricity.
- **Biogas:** The huge amount of cattle dung can be utilized for biogas production, which in turn can be used for cooking and to generate electricity.
- **Atomic Energy:** Radioactive elements are utilized to harness energy in the atomic reactors. The nuclear reactors produce an enormous amount of heat that is used to produce steam, which in turn is used to run turbines to generate electricity. Atomic energy is a very important source of energy. One kilogram of natural uranium (U238) generates energy equal to that generated by 35,000 kg of coal, which shows its tremendous potential. As a special case, solar energy although having a finite life, is considered as a 'newable resource in as much as solar energy stocks are inexhaustible on the human.

B. Non-renewable Resources

The resources that cannot be replenished through natural processes are known as nonrenewable resources. These are available in limited amounts, which cannot be increased. These resources include fossil fuels (petrol, coal, etc.), metals (iron, copper, gold, silver, lead, zinc, etc.), minerals and salts (carbonates, phosphates, nitrates, etc.). Once anon-renewable resource is consumed, it is gone forever. Then we have to find a substitute for it or do without it.

As the name suggests, these resources cannot be reused or recycled. Examples of non-renewable resources are mineral deposits, soil, and fossil fuels like coal and petrol. These elements do not have a life cycle and have limited deposits. Such resources are available only in finite quantities and their rate of generation is so slow that they may be available only in minute quantities.

Some important non-renewable resources are as follows:

- **Mineral resources:** These are natural substances, both organic and inorganic. They may be in the form of ores such as iron (Fe), copper (Cu), zinc (Zn), manganese (Mn) and aluminium (Al). They serve various purposes, such as, manufacturing automobiles, ships, rail tracks and as components of glass and ceramics. Mineral products like coal and petroleum are used as energy resources as well. Minerals like uranium and thorium are very important for generation of atomic energy.
- **Oceanic resources:** Several minerals, such as, cobalt (Co), nickel (Ni), copper (Cu), and iron (Fe), which are found in the form of sulfides and oxides of manganese (Map_3), are found under the sea-level.
- **Land resources:** Land is used for multiple purposes, which needs no explanation. Although land and soil are non-renewable resources and the extent of exploitation of this resource is excessive, thought must be spared on its preservation.

Non-renewable resources can further be divided into two categories, viz. (a) recyclable and (b) non-recyclable.

(a) Recyclable: These are non-renewable resources which can be collected after they are used and can be recycled. These are mainly the non-energy mineral resources which occur in the earth's crust (e.g., ores of aluminium, copper, mercury, etc.) and deposits of fertilizer nutrients (e.g., phosphate stock and potassium and minerals used in their natural state (asbestos, clay, mica, etc.)

(b) Non-recyclable: These are non-renewable resources which cannot be recycled in any way. Examples of these are fossil fuels and uranium, which provide 90 per cent of our energy requirements.

C. Biotic and Abiotic Resources

Some authors prefer to classify resources into biotic and abiotic resources.

(i) **Biotic resources:** These are living resources (e.g., forest, agriculture, fish and, wild life) that are able to reproduce or replace them.

(ii) **Abiotic resources:** These are non-living resources (e.g. petrol, land, minerals,! etc.) that are not able to replace themselves or do so at such a slow rate that they are not useful to consider them in terms of human life times.

D. Inexhaustible and Exhaustible Resources

Natural resources can also be classified as (a) inexhaustible and (b) exhaustible resources.

(i) **Inexhaustible resources:** Resources which are not changed or exhausted by man's activities and are abundantly available are said to be inexhaustible. Examples are solar energy, atomic energy, wind power, power from tides, etc. Most of the renewable resources are classified as inexhaustible but if not maintained properly, they become extinct. For example, ground water is renewable only if water continues to percolate in the soil at a rate at which it is removed.

(ii) **Exhaustible resources:** These resources are limited in nature and they are non-maintainable, e.g., coal, petrol and some minerals. Hence, they come under the non-renewable category.

If we continue to consume our resources at a rapid pace, then even our renewable resources will become non-renewable, leaving no scope for regeneration. For instance, if a species is exploited to such an extent that its population size declines below the threshold level, then there is a possibility that the species may become extinct.

We should protect and conserve our natural resources and use them in a prudent manner so that the resources are not exhausted. Natural resources should be used in such a manner so that our future generations are able to utilize them.

The following are some of the major natural resources:

- Forest resources
- Water resources
- Mineral resources
- Food resources
- Energy resources
- Land resources

CHECK YOUR PROGRESS

1. What is a natural resource?
2. Name the two categories of natural resources.

2.3 LAND RESOURCES

Land resources refer to a delineable area of the earth's terrestrial surface, encompassing all attributes of the biosphere immediately above or below this surface, including those of the near-surface, climate, the soil and terrain forms, the surface hydrology (including shallow lakes, rivers, marshes and swamps), the near-surface sedimentary layers and associated groundwater and geohydrological reserve, the plant and animal populations, the human settlement pattern and physical results of past and present human activity (terracing, water storage or drainage structures, roads, buildings, etc.) (FAO/UNER 1997).

Land is a finite and valuable resource upon which we depend for our food, fibre and fuel wood—the basic amenities of life. Soil is also a valuable resource.

Land degradation

Competing uses of land for forestry, agriculture, pastures, human settlements, and industries exert pressure on the finite land resource influencing land-use patterns and sometimes causing degradation. Changes in land use and land cover, and land degradation, have adverse impacts on forest resources and biodiversity. Given that they are intertwined in various ways, there is a need for treatment of land, forests, pastures, and biodiversity as an integrated resource.

India supports approximately 16 per cent of the world's population and 20 per cent of its livestock on 2.5 per cent of its geographical area. This pressure on land has led to its deterioration—soil erosion, water logging, salinization, nutrient depletion, lowering of groundwater tables, and soil pollution—largely caused by human interventions. Water erosion accounts for 45.3 per cent of the total land area, chemical deterioration 4.2 per cent, wind erosion 4.1 per cent, physical deterioration 3.5 per cent, and 5.5 per cent is not fit for agriculture and this is likely to continue—land under soil erosion rising from 166.0 million hectares (MHa) in 1997 to 189.0 MHa in 2019; water-logging, 12.7 to 22.3 MHa; and salinity, ll.Oto 15.1 MHa(NarayanandRamBabu 1983).

According to the data provided by the National Remote Sensing Agency and Forest Survey of India based on satellite imagery, 80 MHa of 142 MHa under cultivation is substantially degraded and about 40 MHa of 75 MHa under the forest department has a canopy density cover less than 40% (Gadgil 1993). Nearly 11 MHa of pasturelands is substantially degraded, thus a total of 131 MHa representing about 40 per cent of the country's landmass, has productivity below its potential. However, according to the Wastelands Atlas of India 2000 (1:50 000 scale map), the total wastelands area covered in 584 districts is 63.85 million which accounts for 20.17% of the total geographical area. It is this figure of about 64 MHa that has been used in the projections.

Due to the increase in population, the demand for arable land for producing food and fuel wood is also increasing. Hence, there is more and more pressure on the limited land resources which are being depleted due to overexploitation. Soil erosion, waterlogging, salinization and contamination of the soil with industrial wastes like fly ash, press mud or heavy metals all cause degradation of land.

Soil erosion: Soil erosion means wearing away of soil. It is defined as the movement of soil components, especially surface-litter and top soil from one place to another. It results in the loss of fertility.

It is basically of two types, viz, normal erosion or geological erosion and accelerated erosion. The agents that cause such erosions are climatic agents and biotic agents.

Wind is also responsible for land erosion through saltation, suspension and surface creep.

In order to prevent soil erosion and conserve the soil, the following conservation practices are employed:

- Conservationaltill farming
- Contour farming
- Terracing
- Strip cropping
- Alley cropping
- Wind breaks or shelterbelts
- Waterlogging

Landslides: Various anthropogenic activities like hydroelectric projects, large dams, reservoirs, construction of roads and railway lines, construction of buildings and mining are responsible for clearing of large forested areas.

Desertification: It is a process whereby the productive potential of arid or semiarid lands fall by ten per cent or more. Desertification is characterized by devegetation and loss of vegetal cover, depletion of groundwater, salinization and severe soil erosion. The causes of desertification are deforestation, overgrazing, mining and quarrying.

Concerns

- Soil erosion has led to loss of topsoil and terrain deformation. Siltation, an off-site effect of erosion, is reducing the reservoir storage capacity by 1 %-2% annually.
- Human-induced water logging is resulting in a rise in the water table.
- Salinization is likely to render more land unfit for biomass production, especially in the irrigated areas in Uttar Pradesh, Haryana, Punjab, Rajasthan, and Karnataka.
- Most regions have a net negative balance of nutrients and suffer from a gradual depletion in the level of organic matter, a trend that is likely to continue. Maintaining the nutrient balance and preventing nutrient deficiencies is a major concern given that the required demand for food production will have to be met through increased intensity of cropping (Sehgal and Abrol 1994).
- Over-extraction far exceeding recharge in areas where groundwater is mostly used for industrial and agricultural purposes, has led to progressive lowering of water table affecting the economy of water in use and the environment.
- Improper and indiscriminate use of agrochemicals and untreated sewage sludge and municipal wastes has led to the pollution of soil and water with toxic substances and heavy metals.

Directions, innovations and strategies to combat land degradation

The following strategies are suggested: ***Short-term***

- *Assessment of land degradation:* Assessment of the nature and extent of degradation using scientifically sound criteria, indicators, and techniques will help plan appropriate reclamation measures. The SOTER (Soil and Terrain) database and GLASOD (Global Assessment of Human-induced Soil Degradation) can be helpful along with rapid inventorying using remote-sensing techniques and GIS (geographical information system).
- *Improvement of degraded land:* There is a need for adopting location-specific soil and water

conservation measures to arrest further deterioration and for following practices that suit local conditions to restore the productivity of degraded lands. A multi-level stakeholder approach for the planning process is essential to obtain socially balanced results in which both the economic and ecological objectives are given due weightage. This requires data about the properties of the land, different types of land-use options and their effect on the resilience of ecosystems, and technology transfer and training of farmers, especially small and marginal farmers.

Short- and medium-term strategies

- *Revamping agricultural extension:* 'Lab [oratory]-to-land' concept should be put into practice by providing land-users multidisciplinary technical information and viable land-use options and alternatives identified for various agro-ecological and socioeconomic units. Crop combinations/rotations suitable for different agro-ecological regions (as suggested by the Indian Council of Agricultural Research) need to be advocated for better land management.
- *Waste management:* Domestic and municipal wastes, sludge, pesticides, industrial wastes, etc. need to be used with caution to avoid polluting the soil with heavy metals and other toxic substances.

Medium-term strategies

- *Nutrient deficiency monitoring:* Projected increase in cropping intensity and consequent nutrient depletion make it necessary to develop a system of monitoring mechanism for soil nutrients. Fertilizer use will need to be optimized.
- *Land and water management:* Effective management and rational utilization of land and water resources for optimum production with minimum hazard to resources is possible treating natural watershed as a unit. In rain fed areas, *in situ* soil and moisture conservation on mini-watershed basis, irrespective of the ownership of land, should be a major thrust area for increasing productivity.
- *Discouraging shifting cultivation with short fallow periods:* Shifting cultivation, a traditional practice responsible for large-scale land degradation due to shortened fallow cycle, should be discouraged and alternatives provided.

2.4 AIR RESOURCES

Air is a precious resource which is mostly underestimated by human beings. Air supplies us with oxygen, which is essential for our bodies to live.

The thick, gaseous cover of air surrounding the earth is called atmosphere. It sustains life on earth by removing dangerous cosmic and ultraviolet rays through absorption, provides oxygen for respiration and carbon dioxide for photosynmesis. Hence, in this manner atmosphere is able to support life on earth.

The atmosphere can be divided into five types on the basis of temperature rise or fall.

(a) Troposphere
(b) Stratosphere
(c) Mesosphere *id)* Thermosphere
(e) Magnetosphere

- Air is a renewable resource replenished by natural,processes,

o Oxygen, for example, is produced by plants:

o Air can also be cleansed by natural processes, sudh-as rain.

- But air quality is changed by human and natural piucesses (the latter including volcanoes, forest fires)

2.4.1 Air Pollution

The major sources of air pollution are motor vehicles, industries, thermal power plants, and domestic fuels. It would be useful to study the impact of the sectors on the air quality and then consider strategies that would lead to an alternative scenario with better air quality.

- **Domestic and commercial sectors:** Fuel combustion from domestic sources is a major source of indoor air pollution with about three-quarters of all Indian households using unprocessed biomass as the primary fuel, mostly for cooking (Census of India 1991). Emissions from traditional fuels in the residential sector are estimated under the B AU scenario. Urbanization and economic development will result in a shift towards cleaner gaseous fuel, and emissions from the residential sector will decrease. However, due to their significant health impacts, adequate measures need to be taken to reduce indoor air pollution.
- Transport **sector:** Transport is the major source of air pollution in many cities with road transport being the predominant source. The critical issues of this sector include increasing number of vehicles (annual growth of 10% or more), outdated engine technology and old vehicles, fuel quality, and inadequate traffic planning. Emissions of major pollutants are estimated for urban areas under the B AU scenario (Table 19) based on the projections of the number of vehicles, which considered the population growth and economic development.
- **Manufacturing industry:** Air pollution in terms of SPM loads has been analysed for some of the resource-intensive and highly polluting industries: copper, aluminium, steel, cement, fertilizers, textiles, and PVC (poly vinyl chloride) (Table 19). Emission loads have been worked out on the basis of emission load per unit of output from these industries (WHO 1993). The extent of installed pollution control systems in these industries has been estimated by the CPCB on the basis of regular surveys (CPCB 1996). In the BAU scenario, it is assumed that due to strict environmental regulations, all industrial units would have installed adequate pollution control devices. The critical issues of this industry include low efficiency of resource use, fuel quality, and lacunae in environmental governance (which is overly dependent on command-and-control type of environmental management).
- **Power industry:** Thermal generation contributes substantially to the total emission load and since bulk of the thermal power generation is coal and gas-based, projections are based on these two categories. The critical issues in this sector include process technology, fuel quality (with coal-based power generation having severe adverse impacts due to 30%-45% ash content and nuclear power generation associated with issues of radiation and disposal of radioactive wastes), and pollution control measures (with some of the older thermal power plants using such low-efficiency control devices as mechanical dust collectors and those with electrostatic precipitators having operational problems leading to overall reduction in efficiency).

CHECK YOUR PROGRESS

3. What are the factors responsible for the degradation of land?
4. What constitutes the atmosphere?

2.5 WATER RESOURCES

Water is an essential natural resource for every living being to be sustained on this Earth. Ninety-seven per cent of the Earth's surface is covered by water and 60-65 per cent is the composition of water in the body of plants and animals.

Water possesses unique characteristics which make it an incredible resource:

- It remains in the liquid form over a broad range of temperature i.e., from 0 to 100°C.
- The specific heat of water is 1 calorie / gram °C due to which its temperature increases and decreases very gradually without causing much fluctuations in temperature and hence protecting the aquatic life.
- It has high latent heat of vapourization. Hence, it takes huge amount of energy for getting vapourized and produces a cooling effect as it evaporates.
- It is an outstanding solvent for numerous nutrients. Hence, it acts as a very good carrier of nutrients, including oxygen, which are vital for life. It can also easily dissolve various pollutants and become a carrier of pathogenic micro-organisms.
- It has high surface tension and unity due to which it can easily rise through great heights, through tree trunks even in the tallest of the trees like Sequoia.
- It has a peculiar behaviour relating to expansion, i.e., as it freezes it expands instead of contracting and thus becomes lighter. It is due to this property that even in extreme cold, lakes freeze only on the surface. Being lighter, the ice keeps floating, whereas the bottom water remains at a higher temperature and therefore, can sustain aquatic organisms even in extreme cold.

The water we use keeps on cycling endlessly through the environment. This is known as the hydrological cycle. We have vast resources of water on earth equivalent to 1404 million km^3. The water from various moist surfaces evaporates and again falls on the earth in the form of rain or snow and passes through living organisms and ultimately returns to the ocean. Annually approximately 1.4 inch thick layer of water evaporates from the oceans, out of which 90 per cent returns to the oceans through the hydrological cycle. Solar energy sets in motion the water cycle by evaporating it from various bodies, which afterwards return through rainfall or snow. Also, plants play a significant role by soaking the groundwater from the soil and releasing it into the atmosphere by the process of transpiration.

Distribution of water on a worldly basis is unbalanced largely due to numerous geographic factors. Maximum rainfall takes place in the tropical rain forests while the major world deserts occur in zones of dry, descending air (20-40° N and S) and receive very little rainfall.

Water Use and Overexploitation

Water has distinct properties which makes it extremely useful for **all living** creatures. Water is extremely necessary for life. Most of the life processes take place in water contained in the body. Intake of nutrients, their distribution in the bodv, temperature regulation, and removal of wastes all takes place through water.

Human beings use water in the following two ways:

- **Water withdrawal:** This implies extracting water from groundwater or surface water resource.
- **Water consumption:** Here, the water which is taken up is not returned for reuse.

Water: A Valuable Natural Resource

Even though water is available in plenty on earth, yet it is very precious. About 97 per cent of the total water reserves of the world is salt water (marine), 2 per cent at present in ice caps and only 3 per

cent is fresh water. Even this small amount of fresh water is not available to human beings and just 0.003 per cent is easily available to us in the form of groundwater and surface water.

Too much use of groundwater for drinking, irrigation and domestic purposes has resulted in exhaustion of groundwater in various regions leading to reduction of water table and drying of wells. Not only this, contamination of many of the groundwater aquifers has resulted in making these wells unhealthy for consumption.

Since, long time rivers and streams have been used for releasing wastes. Since time immorial, most of the civilizations have developed and flourished on the banks of rivers, however, growth in turn has been responsible for contamination of the rivers.

Groundwater: About 9.86 per cent of the total fresh water resources are in the form of groundwater and it is about 35-50 times that of surface water supplies.

Effects of groundwater usage:

- Subsidence
- Lowering of water table
- Waterlogging

Surface water: When the water formed through precipitation (rainfall, snow) does not seep into the ground or does not return to the atmosphere through evaporation or transpiration loss, it takes the form of streams, lakes, ponds, wetlands or artificial reservoirs known as surface water. The surface water is by and large used for irrigation, industrial use, public water supply and navigation. A country's economy is mainly dependent upon its rivers.

The problems arising out of water resources are floods, and droughts. Apart from these, there are disputes over water. The unavoidable nature of water and its uneven distribution has often led to conflicts between states within a country or conflicts between two or more countries. The distribution of river water between states has become a matter of concern for the governments as well as farmers. Some major water conflicts are—

- Water conflict in the Middle East: Countries involved are Sudan, Egypt, and Turkey. It also affects countries who are water starved, viz., Saudi Arabia, Kuwait, Syria, Israel and Jordan.
- The Indus Water treaty: A dispute between India and Pakistan.
- Cauvery water dispute: Involves two major southern states of India, viz. Tamil Nadu and Karnataka.
- Satluj-Yamuna Link canal dispute: Involves two northern states, viz. Punjab and Haryana. Affected states include UP, Rajasthan as well as Delhi.

In traditional water management, innovative arrangements ensure equitable distribution of water. The 'gram sabhas' approve these plans publicly. While water disputes between states and nations often resume battle-like situations, our traditional water managers in villages prove to be quite effective.

Big Dams: Benefits and Problems

Benefits

River valley projects with big dams have usually been considered to play a key role in the developmental process due to their multiple uses. India has the distinction of having the largest number of river valley projects. These dams are often regarded as a symbol of national development. Such projects result in providing employment, raising the standard of living and improving the quality of life. Such projects have remarkable scope for economic growth and development. It can check floods and famines, generate electricity and reduce water and power shortages, provide irrigation water to low

lying areas, provide drinking water in far-off areas and bring about overall development of the region.

Environmental problems

Big dams pose a number of problems for the environment and hence become an issue of controversy. The problems can relate to both upstream and downstream levels.

Upstream problems:

- Dislodgment of tribal people
- Loss of plants, animals and aquatic life
- Changes in fisheries and the breeding grounds
- Siltation and sedimentation of reservoirs
- Loss of non-forest land
- Stagnation and waterlogging near reservoir
- Breeding of vectors and growth of infectious diseases
- Reservoir induced seismicity (RIS) causing earthquakes
- Growth of aquatic wild plants
- Microclimatic changes *Downstream*

impacts

- Waterlogging and salinity due to over-irrigation
- Microclimatic changes
- Reduced water flow and silt deposition in rivers
- Flash floods
- Salt water intrusion at river mouths
- Fertility of land near the river gets exhausted since the sediments carrying nutrients get settled in the reservoir
- Outburst of vector-borne diseases like malaria

Hence, one can understand that dams are built to fulfil certain needs of the society however; it has several shortcomings as well. Due to this reason there is now a change towards construction of small dams or mini-hydel projects.

Water Situation in Northeast India

Northeast India is comprised of a group of eight small states located in the northeastern corner of India. These states are Arunachal Pradesh, Assam, Manipur, Meghalaya, |/[izoram, Nagaland, Sikkim and Tripura. Geo-ecologically it is a part of the eastern Himalayas known for its richness in water resources, biodiversity and ethnic and cultural diversity. Two large river systems of the world drains this region— mainly the Brahmaputra and the Barak (Meghna). Both these rivers are transnational which flows through the bordering countries. This region receives one of the heaviest rainfall in India. As a result the region is endowed with the highest water resources and hydropower potential in India. The prevailing approach to developing and utilizing natural resources without the participation of communities or traditional institutions in the decision making process has been a source of dissatisfaction for the indigenous communities of the region.

The hydropower potential of the region has attracted national and international attention with the result that more than 168 hydropower projects with large river dams are being planned for the

region. A number of these projects are in different stages of execution by public and private sector companies. There is widespread concern over the observed and probable social and environmental impacts in the region. Protests against the negative impacts of the large dams have started a mass movement in Assam.

- Flood, river bank erosion and sand deposition are three serious water induced hazards that have significantly affected people's lives, livelihoods and agriculture and economy of states like Assam. Floods are also disasters for Tripura and Manipur.
- Quality of drinking water is another area of growing concern where conflicts are building up slowly.
- The region is also facing increasing contamination of ground water with fluoride and arsenic resulting health hazards.
- Transboundary issues like building of dams by China and alleged attempts of China to divert the Brahmaputra River within that country have given rise to serious apprehension and concerns in the region.
- Landslides, dams getting breached or diffused in Bhutan or Tibet have caused catastrophic floods in downstream areas in Arunachal and Assam.
- Unwarranted release of water to rivers from dams both in Bhutan and within the region has caused devastating flash floods in the plains.

The conflicts over water are not limited to the issues and examples cited above. These are rather indicative of many other observed or potential conflicts situations centered on water.

CHECK YOUR PROGRESS

5. What are the two ways in which water is used by human beings?
6. List some of the characteristics of water.

DID YOU KNOW

The Ministry of Water Resources in India has launched a National Water Mission with the main objective of conserving water resources, reducing wastage, and ensuring just distribution of water across the various states in India.

ACTIVITY

Find out some of the rainwater harvesting methods that are being used in modern times.

2.6 FOREST RESOURCES

A forest is a complex ecosystem which is predominantly composed of trees, shrubs an# is usually a closed canopy. Forests are storehouses of a large variety of life forms such-as plants, mammals, birds, insects and reptiles etc. Also the forests have abundant microorganisms and fungi, which do the important work of decomposing dead organic| matter thereby enriching the soil. Nearly 4 billion hectares of forest cover the earth's! surface, roughly 30 per cent of its total land area.

The forest ecosystem has two components — the non-living (abiotic) and the living (biotic) component. Climate, soil type are part of the non-living component and the, living component includes plants, animals and other life forms. Plants include the trees,; shrubs, climbers, grasses and herbs in the

forest. Depending on the physical, geographical; climatic and ecological factors, there are different types of forests like evergreen forest (mainly composed of evergreen tree species i.e. species having leaves throughout the year) and deciduous forest (mainly composed of deciduous trees i.e. species having; leaf-fall during particular months of the year). Each forest type forms a habitat for a specific community of animals that are adapted to live in it.

The term forest implies 'natural vegetation' of the area, existing from thousands of years and supporting a variety of biodiversity, forming a complex ecosystem. Plantation is different from natural forest as these planted species are often of the same type and does not support a variety of natural biodiversity. Forests provide various natural services and products. Many forest products are used in day-to-day life. Besides these, forests play important role in maintaining the ecological balance and contributes to economy as well.

Ecological Role of Forest

- Forests provide an environment for many species of plants and animals and thus, protects and sustains the diversity of nature.
- Plants provide habitat to different types of organisms. Birds build their nests on the branches of trees, animals and birds live in the hollows,-insects and other organisms live in various parts of the plant.
- Forests act as hydrologic flow modulators.
- Plants provide a protective canopy that lessens the impact of raindrops on the soil, thereby reducing soil erosion. Roots help to hold the soil in place. They provide shade which prevents the soil from becoming too dry. This increases the moisture holding capacity of the soil.
- Forests help in maintaining microclimate of the area.
- Plants clean the air, cool it on hot days, conserve heat at night, and act as excellent sound absorbers. Transpiration from the forests affects the relative humidity and precipitation of a place. Forests clean the environment by muffling noises, buffering strong winds and preventing dust and gases.
- The layer of leaves that fall around the tree prevents runoff and allows the water to percolate into the soil. Thus, helping in groundwater recharge.
- Dead plants decompose to form humus, organic matter that holds the water and provides nutrients to the soil.
- Through the process of photosynthesis, forests renew the oxygen supply in the atmosphere by absorbing atmospheric carbon dioxide and moderating the greenhouse effect.

As per the report published by Ministry of Environment and Forests during August 2009, the annual $C0_2$ removal by India's forest and tree cover is enough to neutralize 11.25 per cent of India's total GHG emissions ($C0_2$ equivalent) at 1994 levels. This is equivalent to offsetting 100 per cent emissions from all kinds of energy in residential and transport sectors; or 40 per cent of total emissions from the agriculture sector. Clearly, India's forest and tree cover is serving as a major mode of carbon mitigation for India and the world.

- Forest cover of an area plays an important role in the amount of precipitation received by the area. Thus playing an important role in maintaining the water cycle of the area.
- Some species of trees have the ability to return nitrogen to the soil through root decomposition of fallen leaves. Such trees are planted to increase the nitrogen content of the soil.
- Forests absorb suspended particles in air which helps in reducing pollution.
- Forests also help in the process of soil formation by causing weathering of rock

. • They play vital role in maintaining healthy watershed. Rivers that originate in a forest area carry the organic matter from forest to the downstream. This helps to support a variety of fishes and

aquatic animals. The richness of forest in upstream decides the biological value of the river ecosystem supported by it.

- Forests provide forest food which has great medicinal value and used by local people.

In performing all these functions, forest stabilizes the climate, maintains the ecological/environmental balance of the area and shapes the landscape of the area.

Contribution to Economy

- Forest provides valuable items like timber, paper, fuel wood, bamboo, cane, food, fibers, essential oils, etc.
- Forest plants provide hundreds of medicinal plants, spices, poisons, insecticides, soap substitutes like *ritha* and *shikakai, tendu* leaves used in *bidi* wrapping, etc.
- Forests also provide fodder for cattle and other grazing animals. Leaves and twigs of some plants have high fodder value. It is useful fodder source during drought.
- Forests are also popular areas for relaxation and recreation and they add to thf aesthetic value of the area.

Classification of Forests

Forests can be classified in different ways. The forest type depends upon the abiotil factors such as climate and soil characteristics of a region. Forests in India can be broadly divided into coniferous forests and broadleaved forests. They can also be classified according to the nature of their tree species—evergreen, deciduous, xerophytes or thori trees, mangroves, etc. They can also be classified according to the most abundant species, of trees, such as Sal or Teak forests. In many cases, a forest is named after the first three or four most abundant tree species.

- Coniferous forests grow in the Himalayan mountain region, where the temperatures are low. These forests have tall trees with needle-like leaves and; downward -sloping branches, so that the snow can slip off the branches.
- Broad-leaved forests are of several types, such as evergreen forests, deciduoui forests, thorn forests, and mangrove forests. Broad-leaved trees usually have] large leaves of various shapes and are found in middle to lower latitude.
- Evergreen forests grow in the high rainfall areas of the Western Ghats, Northeastern India and the Andaman and Nicobar Islands. These forests grow ia areas where the monsoon period lasts for several months.
- Deciduous forests are found in regions with a moderate amount of seasonal; rainfall that lasts for only a few months. Most of the forests in which Teak trees grow are of this type. The deciduous trees shed their leaves during the winter and hot summer months.
- Thorn forests are found in the semi-arid regions of India. The trees, which are sparsely distributed, are surrounded by open grassy areas.
- Mangroves forests grow along the coast especially in the river deltas. These plants are uniquely adapted to be able to grow in a mix of saline and freshwater. They grow luxuriantiy in muddy areas covered with silt that the rivers have brought down. The mangrove trees have breathing roots that emerge from the mud banks,

Threats to Forests

As the rate of development is increasing, it is putting pressure on all the natural resources around us. Forests are also getting depleted at a fast rate all over the world.

Over use and irrational use, technological and industrial growth, population growth and increasing consumption levels are major factors causing depletipn^ffprcst resources. Some other factors are mining,

submergence due to big dams, shifiing^ulti vaiion, use of forestlands for rehabilitation, agriculture, transport and tourism. All these activities are causing qualitative as well as quantitative depletion of forests. The forest wood is used up for construction, furniture, deriving energy (coal and firewood), and thus the increasing demand for timber, energy, paper and paper products has led to massive destruction of forests.

When forest is cut, it is not just the trees that go but the entire ecosystem is lost which is invaluable. The full grown forests, existing since thousands of years cannot be replaced by plantations. As forests grow very slowly, people cannot use more resources than they can produce during a growing season. If timber is felled beyond a certain limit, the forest cannot regenerate.

The gaps in the forest change the habitat quality for its animal, and the more sensitive species cannot survive under these changed conditions. Over-utilizing forest resources is an unsustainable way of using our limited forest resources. As the forest resources are exploited, the forest canopy is opened up, the ecosystem is degraded, and its wildlife is seriously threatened.

Increasing tourism activities are also causing destruction to forest ecosystem. When the frequency of visitors and tourists becomes excessive, problems of soil erosion occur along and adjacent to footpaths. Wildlife is also disturbed, plants and saplings are trampled, and the waste is dumped at these places which disturbs the entire ecosystem.

Forest fire is also an important threat to forests, which destroys large areas of forest every year all over the world. It has detrimental impact on forest, wildlife and people living around. Along with the loss of biodiversity, it results in increased air pollution, migration of animals to different areas. It directly affects the livelihood of people dependant on forest resources.

Natural disasters like Tsunami, and earthquake destroys large forests areas in a short span of time.

All these natural as well as man-made factors cause destruction of forests on a large scale.

Forest Management

Conservation, protection and overall management of forests are important. Entities involved in it and their role can be summarized as follows:

- Government
- Community and community organizations
- Individuals and Private Bodies

1. **Government:** Making policy and laws for conservation, protection and overall management of resources is one of the important aspects of government initiatives. India's first Forest Policy was enunciated in 1952. Between 1952 and 1988, the extent of deforestation was so great that it became essential to formulate a new policy on forests and their utilization. The earlier forest policies had focused only on revenue generation. In the 1980s it became clear that forests must be protected for their other functions such as the maintenance of soil and water regimes centered on ecological concerns. Thus, the role of India's forests in the national economy and ecology has been reemphasized in the National Forest Policy, 1988, which focuses on ensuring environmental stability, restoring the ecological balance and preserving the forests. The policy aims at increasing the forest and tree cover to 33 per cent of the country's land area. It also provided for the use of goods and services of the forest for its local inhabitants.

   Various laws like Forest Conservation Act, Wildlife Protection Act have been prepared and are being implemented by the government. The Forest Conservation Act of 1980 was enacted to control deforestation. In 1988, this act was amended to facilitate stricter conservation measures. Under the Wildlife Protection Act, 1972, different animals are categorized under specific schedules and there are restrictions on their hunting. As per this act specific ban is

imposed on hunting of all Schedule 1 animals like tigers, leopards etc.

Another important government initiative is declaration of protected areas for conservation of wildlife. Sanctuaries and National Parks play a very important role in conservation of plants and animal gene pool. Several of these are present in catchment areas of major rivers, and so they are very important for water conservation and conservation of entire ecosystem. The government also implements many schemes for conservation of forests and for their sustainable management.

Maharashtra Forest Policy, 2008

Maharashtra State has prepared the 'Maharashtra Forest Policy, 2008' with focus on ' Sustainable management of forests and wildlife in the State'. The policy also focuses on formulation of District wise plan for achieving 33 per cent of forest cover in the State.

Some of the objectives of the policy

- To achieve sustainable development and conservation of forests through their scientific management, this will help in maintaining ecological balance and environmental stability.
- Afforestation on wastelands for soil and water conservation
- To increase forest cover on available government, public and private lands through participation of women and unemployed people, with the help of Social Forestry and Agricultural nurseries.
- Implementing long term plans and action plans for Conservation of wildlife and biodiversity.
- Management of Catchment areas for soil conservation
- Joint Forest Management
- Eco-tourism policy
- Reduction in use of timber and other forest produce
- Establishing Forest Development Corporation of Maharashtra (FDCM)

Working Strategies

1. Afforestation through Social /Community Forestry
   - Afforestation will be done on wastelands and saline soils. Trees for firewood, fodder and NTFP (non-timber forest produce) will be planted. The work will be done through Social / Community Forestry with involvement of local people.
   - Land near railway tracks, state and national highways, canals will be used for plantations.
   - Green belts will be developed in urban and industrial areas to absorb carbon dioxide from the atmosphere and control the pollution. Urban forestry will be promoted on available areas in cities like gardens, open spaces, with the help of technical support from FDCM and Social Forestry.
   - Village lands and community lands will be brought under afforestation to meet the increasing demand for timber, firewood and NTFP. This work will be undertaken with involvement of *Grampanchayat* and with technical help from Social Forestry Department.
   - Organizations and individuals will be promoted to do tree farming on their land by providing necessary facilities and bringing required changes in Land Acquisition Rules and related rules, if any.

2. Community and Community Organizations

Community organizations are at the interface of government and individuals. Community participation is a very important aspect in implementation of resource management programmes.

Communities take various initiatives for conservation—like Sacred Groves. These are forest patches protected for religious or cultural reasons. It is an excellent example of community conservation. Many of these groves are at the origin of rivers, thus helping in water conservation.

It also protects rare varieties of plants and animals. India has over 19,000 sacred groves. All these areas are also being disturbed due to increasing pressure on available land resource, so they need to be conserved. There are many examples of communities' role in conservation of forests e.g. the Chipko Movement *andBishnois* in Rajasthan.

The Chipko Movement

The 'Chipko movement' was started around 260 years back in the early 18th century in Rajasthan by the *Bishnoi* community. The name of the movement comes from the word ' embrace', as the villagers hugged the trees, and prevented the contractors from felling them. Alarge group of them from 84 villages led by a lady called Amrita Devi laid down their lives in an effort to protect the trees from being felled on the orders of the Maharaja of Jodhpur. After this incident, the maharaja gave a strong royal decree preventing the cutting of trees in all Bishnoi villages.

In the 20th century, this movement began in the hills where the forests are the main source of livelihood, since agricultural activities cannot be carried out easily. The Chipko Movement of 1973 was one of the most famous among these, which was initiated in the village of Mandal in the upper Alakananda valley and over the next five years spread to many districts of the Himalayas in Uttar Pradesh. It was sparked off by the government's decision to allot a plot of forest area in the Alaknanda valley to a sports goods company. This angered the villagers because their similar demand to use wood for making agricultural tools had been earlier denied. With encouragement from a local NGO, DGSS (Dasoli Gram Swarajya Sangh), the women of the area, under the leadership of an activist, Chandi Prasad Bhatt, went into the forest and formed a circle around the trees preventing the men from cutting them down. The success achieved by this protest led to similar protests in other parts of the country.

The *Bishnois*

The *Bishnois,* a Vaishnavite sect, living in western Rajasthan on the fringe of the Thar Desert, have for centuries, been conserving the flora and fauna to the extent of sacrificing their lives to protect the environment. For these nature-loving people, protection of the environment, wildlife, and plants is a part and parcel of their sacred traditions. The basic philosophy of this religion is that all living things have a right to survive and share all resources.

In the fifteenth century, Swami Jambeshwar Maharaj laid down 29 tenets for his followers which included a ban on killing animals, a ban to felling of trees (especially the *Khejri* - which grows extensively in these areas). Nature protection was given foremost importance in these tenets. Since then, the sect has religiously followed these tenets. The heartland of the *Bishnois* in the forests near Jodhpur is abundant in trees and wildlife. The landscape around here is greener than elsewhere and the animals mainly antelopes, particularly the blackbuck and the chinkara, in these forests are not afraid of humans and are often seen near the villages eating out of the hands of the villagers. The Bishnois have indeed proved that human lives are a small price to pay to protect the wildlife and the forests around them.

3. Individuals and Private Bodies

Many individual efforts have led to conservation of tree cover in a particular area. Some people have carried out successful restoration activities on many acres of land for the revival of forest ecosystem. There are also examples of people who have done plantations of variety of tree species on their land, which has helped maintain green cover of the area.

Major Activities in Forests

- **Timber extraction:** The activity of extracting precious timber from the forests such as Teak and Mahogany involves both a few large trees per hectare and a dozen more trees since they are strongly interlocked with each other by vines etc., and construction of roads in forest causes further destruction of forests.
- **Mining:** Extraction of minerals and fossil fuels such as coal is carried out in extensive forest areas. Minerals from shallow deposits are extracted through surface mining, while that from deep deposits is done by sub-surface mining. In India, more than 80,000 ha of land is currently subject to mining activities. Mining and its associated activities necessitate the removal of vegetation along with the primary layer of soil and overlying rock masses. As a result, the topography gets spoilt and the landscape in the area gets ruined.

  Extensive deforestation has been registered in Mussorie and Dehradun valley on account of arbitrary mining of various minerals over an area of approximately forty kilometres. The forested area has reduced at a standard rate of 33 per cent and the growth in non-forest area due to mining activities has created moderately unbalanced zones, leading to landslides.

  Since 1961 random mining in the forests of Goahas wiped out more than 50,000 ha of forest land. Coal mining in Jharia, Raniganj and Singrauli areas has resulted in large-scale deforestation in Jharkhand. Mining of magnetite and soap-stones have destroyed 14 ha of forest in hill slopes of Khirakot, Kosi valley, Almora. Mining of radioactive minerals in Kerala, Tamil Nadu and Karnataka are putting up related fears of deforestation. The luxurious forests of Western Ghats are also confronting a similar risk due to mining proposals for excavation of copper, chromite, bauxite and magnetite.
- **Milling** Engmeenig:MinmgEngmeermg is a M^
  disciplines as applied to extracting and processing minerals from a naturally occurring environment.

A technologically advanced society certainly deals in mineral extraction and production. As minerals are produced from within the natural environment, they are bound to disturb the environment. Hence, modern mining engineers must ensure that minimal damage or modifications are made to the environment as a result of mineral processing and production.

The two main kinds of mine are underground mines and open-pit mines. Minerals that exist moderately deep underground (e.g., some coal seams, gold and some metalliferous ores) are usually recovered using underground mining methods. Minerals like iron ore, shallow coal seams and bauxite are generally recovered from the surface by open pit mining.

Dams and their Effects on Forests and People

Big dams and rivers valley projects have multi-purpose uses and Pandit Jawaharlal Nehru used to refer to these dams and valley projects as 'Temples of modern India'. However, these dams are also accountable for the devastation of vast areas of forests. More than 1550 large dams have been constructed in India, the maximum being in the state of Maharashtra (more than 600), followed by Gujarat (more than 250) and Madhya Pradesh (130). The highest one is Tehri Dam, on river Bhagirathi in Uttarakhand and the largest in terms of capacity is the Bhakra Dam on river Satluj in Himachal Pradesh.

Numerous environmental groups across the globe have been focusing on the construction of large dams as their construction requires the cutting down of tress which further creates several socio-economic problems for the natives of the hilly regions.

For instance, the Silent Valley Hydro-Electric Project situated in the tropical rain forest area of Western Ghats, was one of the earliest projects which drew attention of the people.

The leader of Chipko Movement, Shri Sunderlal Bahaguna, vehemently led the campaign

against the ecological damage and deforestation caused due to Tehri Dam. Similarly, several environmental issues related to Sardar Sarovar Dam were campaigned by the environmental activitist Medha Patkar, joined by Arundhati Roy and Baba Amte.

The construction of large-scale dams requires cutting down of trees and leads to devastation of precious species which could be possessing medicinal properties and hence could be used in saving lives. Not only this, the ecological balance of the region gets broken which further leads to natural disasters such as floods, droughts and landslides.

CHECK YOUR PROGRESS

7. What are forests basically used for?
8. List the major causes of deforestation.

2.7 MINERAL RESOURCES

Minerals are natural, inorganic, crystalline solids having distinct chemical composition and typical physical properties. Thousands of minerals are found in different parts of the world. However, most of the rocks that we see daily are just composed of a few common minerals like quartz, feldspar and biotite. These minerals, in turn, are composed of elements like silicon, oxygen and iron.Minerals are generally used for development of industrial plants, generation of energy, construction, equipment and armament for defence, transportation, medical system, communication, jewellery- gold, silver, etc.

Environmental impacts of mineral extraction are devegetation and defacing of landscape, subsidence of land, groundwater contamination, surface water pollution, air pollution, occupational health hazards, etc.

Remedial measures include adoption of eco-friendly technology, microbial leaching technique, re-establishment of mined areas by re-vegetating them with suitable plant species, stabilization of the mined lands and growing plants in the area again.

Case Example: Tracing Health and Happiness in the Mining Belt of Goa

New tools promote the sustainable development of mining

Goa, the Indian state is famous for its beaches and is world renowned as the ideal destination for travellers. Very few are aware of the fact that Goa is a major contributor of India's iron ore industry. The mining belt located in the middle of this state is responsible for 60 per cent of the nation's iron ore exports. There is a sharp dissimilarity between the picturesque beaches of Goa and the mining belt located in the interior of the state. The practice of open cut mining has led to several ramifications in the state which include flattened hills, clearance of forests, and fields covered with run-off silt from waste locations and processing plants. Apart from the disheveled landscape, one will realize that the mining operations in Goa have brought about several positive changes such as the creation of jobs, improvement in the health and education standards, and enhancement of material aspects of the local people.

The story of mining operations in Goa is akin to the several mineral-rich regions of the world where economic considerations have gained prominence over environmental issues.

The search for balance

According to Dr Ligia Noronha of the Western Regional Centre of the Tata Energy Research Institute (TERI), 'Closing the mines because of their environmental impact is not an option for Goa... But there is a need to bring about some balance between the economic gains and the

environmental losses to ensure greater sustainability for the region and local communities....' Building local trust 'Early on, we understood that we needed a broad perspective for understanding well-being and its determinants, as well as a means of addressing the various realities of the people living and working in mining areas,' says Dr Noronha. 'We chose an ecosystem approach because it places an equal emphasis on concerns related to the environment, the economy, and the community in assessing the significance of an economic activity to human well-being. For us, it seemed the best way to go....'

The general set of primary issues to surface from this progression were:

- **Land**: its availability for mining operations and issues of reimbursement to farmers.
- **Environmental quality**: anxiety about the degradation of air, water, land and forests.
- **Post mine-closure:** concerns relating to unemployment, possibility of income, rate of migration, alcoholism, and environmental clear out.
- **Human and physical investment in the region:** education, basic amenities, rent-sharing with locals, training opportunities, and health care facilities.
- **Social and community relations:** nongovernmental organizations' interference, political interference, media under-reporting of problems, cosmetic attention to problems, and consultation.
- **Effective administration:** implementation of rules, accomplishment of goals and responsibility.

Keeping the above set of issues in mind, the TERI researchers devised three methods for determining the impact of mining activities and their effect on the general health and happiness of the people:

(i) A set of environmental and social performance signs to calculate the economic, environmental, and social costs of mining; (ii) A 'quality of life' device to evaluate the health and happiness of people in mining areas over a time frame; and (hi) A tool for calculating the income derived from the mining activity as a sustainable means of livelihood.

Evaluating change

The TERI team developed a number of signs and tools for determining the contribution of various stakeholders in enhancing the performance of environmental and social factors. For instance, for mining companies, an indicator of environmental performance is whether wastewater was treated and tailings water was recycled or not. Another indicator of environmental quality could be gauged from the water levels in wells and rivers of the villages. Since the government agencies monitored the assessment and evaluation, they also served as indicators of good environmental governance.

Monitoring quality of life

In developing the quality of life (QOL) instrument, the TERI team collaborated with focus groups of 10 to 12 people who represented different groups of the community and included members of the three stakeholder groups.

... In Goa, the QOL instrument will provide stakeholders with a rough estimate of how the mining.activity played a vital role in changing the quality of life over time depending on whether mining is new to the area, well established, or in the process of closing down. According to Dr Noronha, this comprehensive view of changes over time can' suggest policies and promote improved industry and government practices that will lead to improved health and well-being of people.'

Promoting sustainable development

The role of mining activity in the sustainable development of the community has been a much debated topic among the policy and decision makers. The TERI researchers with the development of income

calculation tool have made attempts to show how the mining activity which has a limited life, can be combined with social and environmental issues in a way that enhances the development of the community in times to come.

The method adopted by the TERI team also takes into account the ill-effects of mining, which include air and water pollution, deforestation of forests, groundwater depletion and reduced agricultural productivity. The method also considers the direct and indirect advantages to the society. For instance, in the case of forests, the method considers the production of marketable products which generates revenue for the local people and the indirect benefits from watershed protection and other services. Moreover, in return for the economic benefits derived from the mining activity, the mining company should finance environmental rehabilitation.

The TERI team used alike evaluation practices to place values on the health and social costs of mining. Some sort of financial assistance would also be made available to the community after closure of the mining activity in the region. This would assist in compensating the main problems linked with the closure of mines, the lack of skills and resources required for an alternate means of livelihood.

A step forward

However, it should be mentioned that the methods and instruments devised by the TERI team do not provide a complete solution. For instance, they do not focus on the distorted power relationship which is generally found in the mining areas. 'In Goa, mining is big business and mine owners are politically powerful,' says Dr Noronha. 'Mining is causing serious environmental problems, but few questions are asked.'

Dr Noronha views the development of these methods and indicators as a stride ahead in rectifying this unevenness. 'Mining companies are now aware and, more importantly, acknowledge that they have to act responsibly, that their activities are being monitored and assessed,' opines Dr Noronha. 'Communities have information, both positive and negative, about the activity and its impact in relation to certain societal goals or standards, if they want to act toward improved conditions for themselves. And government officials know there is access to information if they want to use it to improve governance in mining regions.'

According to Dr Noronha, this can enhance responsibility and transparency in resource development.

Source: Adapted from the Case Study written by Kevin Conway, a writer in Canada's International Development Research Centre's (IDRC) Communications Division.

2.8 FOOD RESOURCES

There are innumerable edible plants and animals all over the world, yet only about three dozen types comprise the main food of humans. The main food resources include wheat, rice, maize, potato, barley and oats and about twenty or so common fruits and vegetables, milk, meat, fish and seafood.

World Food Problems

Annually the number of people killed due to food problems is equivalent to the number of people that were killed by the atomic bomb dropped on Hiroshima during World War n. This shows that there is a drastic necessity to boost food production, even distribution and also to monitor and regulate population growth. Even though India is the third largest producer of staple crops, approximately 300 million Indians are still malnourished. This is because India's population is growing at a rapid pace and its food production is not sufficient enough to feed every individual.

Because of overgrazing, the agricultural land gets affected in the following way:

- Land degradation
- Soil erosion
- Loss of useful species

Agriculture also makes an impact on the usage of land as follows:

- Deforestation
- Soil erosion
- Depletion of nutrients

The impact of modern agriculture is as follows:

- Impact related to high yielding varieties (HYV).
- Fertilizers related problems include micronutrient imbalance, nitrite pollution and eutrophication
- Pesticide-related problems include creating resistance in pests and producing new pests, death of non-target organisms, biological magnification
- Some other problems include waterlogging and salinity problems

Case Example: Statement by the Advisory Group on Nutrition on the World Food Problem Hunger and Malnutrition

The World Food Conference of 1974 and the two decades which followed the conference subsequently, have long debated the issue of food production in the world and its method of distribution. Moreover, the question of supply of food to people has long been overlooked. The focus has mostly been on access to food and its distribution. However, we tend to assume that the focus was correct. It concentrated focus on the right to food, individual and food security, and issues concerning the standard of food made available for consumption of human beings. These issues have been generally highlighted in international forums such as the International Conference on Nutrition held in 1992. International policy obligations have made attempts to bring about a reasonable increase in the flow of resources related to the area of nutrition and other associated areas, which would further help not just in famines but also help secure food and nutrition goals in the coming future.

Of late, the focus has now shifted to the problem of food supply rather than on the production of food and its distribution. Factors such as increasing population, rising urbanization, dilemmas about the practice of intensive farming and the irrigation systems, and a gradual decline in the production of essential food staples have led several observers to lay emphasis on agricultural research and outlays intended to boost agricultural productivity and production. These concerns or issues are going to be reinforced with the structural changes taking place in the world economy, which would comprise changes in Eastern Europe and the former Soviet Union and the outcome of the GATT agreement on world food trade.

Agricultural research and investment will go a long way in alleviating hunger if they are planned in accordance with the changing geographical and socio-economic scenario of the world and also while considering the perception of poor people towards their malnutrition related problems. In the present times, this implies an increased emphasis on the capacity of producing food by poor people, encouragement of safe and sustainable methods of income in Africa, to the requirements of households headed by females and semi-urban population, and to steps that will reduce the dreadful effects of drought and issues of food supply, prices of food and the accessibility to food by poor people. The outlays and investments in the field of agricultural production need to be constantly re-evaluated to ensure sustainable and adequate food supply all across the world.

We believe that increased investments in these areas are entirely in concert with the massive programmes of action required to achieve the goals set by the International Conference on Nutrition. At the same time, and in a world where aid resources are increasingly scarce, the additional resources required to address issues related to world food supply should not be sought at the expense of those needed to strengthen the effective demand of the deprived of food, health and household care. In our analysis of the world food problem, household access to food remains one of the most urgent food problems for the foreseeable future.

Source: Report on the Twenty-First Session of the Sub-Committee on Nutrition, UNICEF, New York, 7-11 March 1994.

2.9 ENERGY RESOURCES

Energy consumption of a nation is usually considered as a manifestation of its development. This is due to the reason that the element of energy is an essential component for all developmental activities. Per capital energy consumption varies in both developing and developed countries.

One of the earliest based technology that was invented was fire, which produced heat and the early man used it for cooking and heating purposes. Wind and hydropower has also been used. Invention of steam engines replaced the burning of wood by coal and coal was further replaced by oil.

Energy resources are primarily divided into two categories, viz. renewable and non-renewable sources.

Renewable energy resources must be preferred over the non-renewable resources. This will seek to end the energy crisis which the world is facing today. It is inevitable truth that now there is an urgent need of thinking in terms of alternative sources of energy, which are also termed as non-conventional energy sources. These include: (1) solar energy, (2) wind energy (3) hydropower, tidal energy, ocean thermal energy, geothermal energy, biomass, biogas and biofuels. The non-renewable energy sources include coal, petroleum, natural gas and nuclear energy.

Wind energy is used after the kinetic energy present in it is converted into mechanical or electrical energy. The energy derived from the wind is sustainable and non-polluting. This type of energy does not require any fuel, does not produce toxic or radioactive wastes. Like other forms of energy, the wind energy does not produce greenhouse gases and neither does it create harmful effects for birds or wildlife of the adjoining areas.

Windmills date back to as far as the 9th century in Persia, when these were used to grind grains or draw water. Typically, the wind energy was converted in order to crush, press and grind grains to pulps. The windmills, during this period, had six to twelve sails, covered with reeds or cloths. These were different from the European-style horizontal windmills of the next century. In the 12th century in Europe, windmills were mostly perched on top of castles and city wall towers.

The modern use of the wind energy is generation of electricity, pumping water, etc. Presently, wind energy machines are called wind turbine generators, wind pumps, or more generally, wind turbines. The use of wind energy, worldwide, started during the early 1990s. In 1999, over US $3.5 billion was invested in this sector, especially in farms that use wind energy. Most of this amount was spent in Europe in order to lessen greenhouse gas pollution. By the end of April 1999, some 22.5 TWh of electricity was produced that was enough for meeting the domestic and industrial requirements of a population of about eight million people.

Late 1970sandearly 1980s saw a great surge ofwindpowerindustry due to the oil embargo of the OPEC countries. The wind industry is one of the fastest growing industries with an average annual growth rate of 31 per cent of the world installed capacity of wind power. The tremendous environmental, social and economical benefits of the wind industry make way for its unprecedented

benefits. The industry is also growing at this pace due to its technical maturity, public support and government incentives.

2.10 ROLE OF INDIVIDUALS IN THE CONSERVATION OF NATURAL RESOURCES

Different natural resources like forests, water, soil, food, mineral and energy resources play a vital role in the development of a nation. With our small individual efforts we can help in conserving our natural resources to a large extent. The following are some of the ways:

Conserve Water

- Do not keep water taps running while brushing, shaving, washing or bathing.
- In washing machines, fill the machine only to the level required for your clothes.
- Install water-saving toilets that use not more than six litres per flush.
- Check for water leaks in pipes and toilets and repair them promptly.
- Reuse the soapy water of washing from clothes for gardening, driveways, etc.
- Water the plants and the lawns in the evening when evaporation losses are minimum. Never water the plants in mid-day.
- Install a system to capture rain water.

Conserve Energy

- Turn off lights, fans and other appliances, when not in use.
- Obtain as much heat as possible from natural sources. Dry the clothes in sun instead of using dryers.
- Use solar cooker for cooking which will make the food more nutritious and will save your LPG expenses.
- Build your house with provision for sunspace which will keep your house warmer and will provide more light.
- Drive less, make fewer trips and use public transportations whenever possible. Share a car-pool if possible.
- Control the use of air conditioners.
- Recycle and reuse glass, metals and paper
- Use bicycle or just walk down small distances instead of using an automobile.

Protect the Soil

- Grow different types of ornamental plants, herbs and trees in your garden. Grow grass in the open areas which will bind the soil and prevent its erosion.
- Make compost from your kitchen waste and use it for your kitchen-garden.
- Do not irrigate the plants using a strong flow of water as it would wash off the soil.
- Use sprinkling irrigation.

Promote Sustainable Agriculture

- Do not waste food; take only as much as you can eat
- Reduce the use of pesticides
- Fertilize your crops with organic fertilizers

- Use drip irrigation.
- Eat local and seasonal vegetables
- Control pests

CHECK YOUR PROGRESS

9. What are minerals generally used for? 10. What is the impact of agriculture on the usage of land?

2.11 CULTURAL RESOURCES

India is a country which is extremely rich in cultural resources. Despite diversity of cultures, religions, traditions, customs, languages, dressing, thoughts, ideas and the living styles, there is harmony in Indian culture. The Hindus are in majority but other religions like Sikhism, Islam, Buddhism, and Christianity are also found in our country and are equally respected.

India has witnessed many reformers, revolutionaries in different periods. Indian culture has been enhanced from their presence and ideologies. This has made a significant impact on the development of Indian culture and it has helped in setting up an example all over the world.

Since several years, Indian culture has emphasized on the joint family system, unity among various castes and religions. The Indian culture has also kept at par all the ideals, faith and beliefs, principles of all the religions that exists in our country.

Cultural heritage of India is characterized by the cultural diversity of our country. As India has a diversified culture consisting of different religions different festivals are celebrated in various parts of India with their traditional fervour and gaiety. Hence, the Indian culture is symbolic of'Unity in diversity' culture. For example, Ganpati Poojan of Maharashtra, Durga Pooja of Bengal, and Dandiya Raas in Navratras in Gujarat are the different festivals that are celebrated vibrantly and exhibit their exquisite traditions of folk dances and music.

Cultural diversity has been defined by UNESCO as; 'it is the common heritage of humanity and should be recognized and affirmed for the benefits of the present and future generation.' The beliefs, values, visions, practices, expressions, innovations, creativity differ depending on the caste, religion, place, language, customs, traditions and thoughts.

2.11.1 Obstacles of Cultural Harmony

Some of the obstacles that one comes across while maintaining cultural harmony are given below:

Globalization: Globalization is causing fear of differences in views, therefore, breaking the uniformity of culture.

Marginalization: Marginalization, also known as social exclusion means the formation of social groups by individuals who are reluctant to change their ideologies and principles. They are normally, reluctant to accept any modification happening in the society. This becomes a major hurdle in the way of cultural diversity.

Age-old traditions: Traditions which are continuing from a very long period lose their core meaning with the passage of time. These prolonged traditions create a gap between the elderly group of people and the youth. This gap between the thought processes of two generations blocks the development of cultural harmony.

Westernization and Modernization: The influence of western culture on Indian society has ruined the identity of Indian culture. On the other hand, modernization refers to the change in one's lifestyle, thought process and overall change in an individual due to an external influence.

These two factors are the major obstacles in the development of cultural harmony in India.

Extinction of Cultural Resources: Cultural resources comprise literature, folk dance forms, music, architecture and festivals. These cultural resources are being replaced by modern dance forms. Nowadays, festivals are rarely celebrated and folk music is losing its identity. In a nutshell, our cultural resources are extinguishing leading to the non development of cultural harmony.

Economical and social differences: Inequality of income and socio-economic status has created a gap among the people of our country. People form societies\groups according to their status. People belonging to the upper class have a different lifestyle as compared to the people belonging to the middle class or low class. Thus, this indifference causes a hurdle in cultural harmony.

2.11.2 Specimens of Art/Architecture

India is rich in cultural resources and has a wide range of monuments, buildings, diversified languages, dance forms, sculptures, religions, etc. Some of them are mentioned below:

1. Monuments:

The Ancient Monuments and Archaeological Sites and Remains Act, 1958 defines ar 'Ancient Monument'Ss follows:

'Ancient Monument means any structure, erection or monument, or any tumulus or place of interment, or any cave, rock-sculpture, inscription or monolith which is of historical, archaeological or artistic interest and which has been in existence for not less than 100 years and includes—

- Remains of an ancient monument
- Site of an ancient monument

Such portion of land adjoining the site of an ancient monument as may be required for fencing or covering in or otherwise preserving such a monument,

The means of access to, and convenient inspection of, an ancient monument;' □

2. **Archaeological sites and remains**

The Section 2(d) defines archaeological site and remains as follows:

'Archaeological site and remains means any area which contains or is reasonably believed to contain ruins or relics of historical or archaeological importance which have been in existence for not less than one hundred years, and includes such portion of land adjoining the area as may be required for fencing or covering in or otherwise preserving it, and the means of access to, and convenient inspection of the area;' D

The World Heritage has recognized twenty-two cultural and five natural sites in India. Agra Fort was built by Akbar in AD 1565-1575. Apart from other important units, it comprises Jahangiri Mahal, Khass Mahal, Diwan-i-Khass, Diwan-i-Am, Machchhi Bhawan and Moti Masjid. Several existing buildings were erected by Shah Jahan (AD 1630-1655).The world famous Ajanta Caves including the unfinished ones are thirty in number. These caves were discovered in AD 1819.The magnificent group of rock-cut shrines of Ellora, represent three different faiths, Buddhist, Brahmanical and Jaina which were excavated during the period from fifth to the thirteenth century AD.

Taj on the bank of river Yamuna, about 1.5km from the Agra fort, was built to enshrine the remains of Arjumand Banu Begam entitled Mumtaj Mahal, the queen of the Mughal emperor Shah Jahan. Its construction commenced in AD 1631 and took seventeen years to complete. Mahabalipuram Group of Monuments (1984). Mahabalipuram or Mamallapuram the city of Mamalla, is named after the title of great Pallava ruler Narasimhavarman-I (AD630-668).

Though monolithic sculpturing, both cut-in and cut-out, continued even during later periods (Atiranachanda cave, Pidari rathas and Tiger- cave), the structural architecture was introduced on a grand scale by Pallava Rajasimha (AD 700- 728), culminating in the erection of the world famous Shore temple.

Konark is the Kainapara of the Periplus (first century AD)—an important port of the Orissan coast. Sun Temple was built in AD 1250, during the reign of the Eastern Ganga King Narasimhadeva-I (AD 1238-1264), to enshrine an image of Sun (Arka), the patron deity of the palace. The entire complex was designed in the form of a huge chariot drawn by seven spirited horses on twelve pairs of exquisitely carved wheels.

Hampi is situated on the southern bank of the Tungabhadra. Monuments were built here between AD 1336 and 1570, from the time of Harihara I to that of Sadasiva Raya. Royal buildings were raised by Krishnadeva Raya (AD 1509-1530). Hampi covers an area of nearly 26 sq km and is enclosed by seven lines of fortifications. The largest extant temple is that of Pampapati with a magnificent entrance tower created by Krishnadeva Raya.

2.11.3 Protection of Monuments

In 1972, the General Conference of UNESCO adopted a resolution named 'Convention concerning the protection of the World Cultural and Natural Heritage.' India is an active member state of the World Heritage from 1977 and has been cooperating with various International agencies like ICOMOS (International Council of Monuments and Sites), IUCN (International Union for the Conservation of Nature and Natural Resources) and ICCROM (International Centre for the Study of preservation and Restoration of Cultural Property). The Archaeological Survey of India (ASI) under the provisions of the AM ASR Act, 1958 makes decision to bring a monument under its protection. There are at present more than 3,650 ancient monuments and archaeologica sites and remains of national importance ranging from temples, mosques, tombs, churches, cemeteries, forts, palaces, step-wells, rock-cut caves. The main objectives of ASI are: (i) To look after the ancient monuments and preserve them, (ii) To carry out research and conservation activities, (iii) The Science branch of ASI carries out the job of chemical preservation, (iv) The horticulture branch of ASI develops and maintains the garden sites that come under the purview of ASI.

Museums

The Indian Museum in Kolkata and the Salar Jung Museum in Hyderabad come under the legislation of the Central Government.

The Indian Museum Act, 1910 established a body by the name of' The Trustees of the Indian Museum' for the purpose of maintaining and preserving the Indian Museums. The responsibilities of the trust are listed below:

- The trustees have the power to lend, exchange, sell or destroy the articles in the museum's collection.
- They can make bye-laws for the execution of the trust.
- They can appoint officers and servants for the care and management of the trust property.

The Salar Jung Museum Act, 1961 established the Salar Jung Museum Board for the maintenance and administration of the museum. The duties of the Board are:

- To manage the museum efficiently.
- To organize, promote and implement programmes for the development of the museum.
- To give instructions, do research; disseminate information in matters related to the museum and the library.
- The Board is also free to purchase and acquire articles for preservation in the museum and replace the articles of the museum.

2.11.4 Indian Architecture

The Indian civilization is undoubtedly a gifted architecture which has evolved through the centuries. Specimens of Indian architecture were first witnessed in the Indus Valley Civilization and later on in the Buddhist monasteries in India.

Some of the magnificent architectural works existing in Indian history are: Great Stupa at Sanchi, the rock-cut caves of Ajanta and Ellora, temples of Mahabalipuram, temples at Thanjavur and Belur in South India, Nagara style architecture of North India and Khajuraho in Central India.

Architectural styles of different time periods are:

1. Temple Architecture

Ancient India exhibited the development of temple architecture. The rulers of different periods in different parts of India constructed temples which exhibit a unique architectural style and due to which there is a significant diversity in the temple architectural style of temples. Also, this architecture depicts geographical, climatic, ethnic, racial, historical and linguistic diversities.

2. Rock Cut Architecture

The Rock-cut structures present the most spectacular architectural patterns. These rock-cut structures are related to various religious communities. Reflection of Buddhism and Jainism can be witnessed in this rock cut architectural style.

3. **Cave Architecture**

The cave architecture in India began in the third century BC by Buddhist and Jain monks as places of worship and residence.

4. Ancient Architecture

Indian architecture is the oldest in the history of the civilization. Among India's ancient architecture remains the most characteristic are temples, chaityas, viharas, stupas and other religious structures.

5. **Indo Islamic Architecture**

The Indo Islamic architecture developed in the medieval period. It came into existence with the emergence of Mughals and Muslim conquerors in India. The Indo-Islamic style was neither stringently Islamic nor Hindu.

6. Colonial Architecture

Colonial architecture has also significantly contributed to the history of architecture in India. The colonies of Dutch, Portuguese and the French made their presence felt through their monuments\buildings.

2.11.5 Protection and Promotion of Cultural Resources

Following are the ways in which one can protect and promote cultural resources.

- Protect and promote the art, craft and cultural heritage by recognizing the traditional and

contemporary art forms and maintaining their identity.

- Plan, organize and implement various programmes to protect, promote, conserve and preserve the art work, paintings, sculptures, and handicrafts.
- Coordinate with the artists, small craftsmen, associations, NGOs and governmental organizations at the local, district, state, national and international level.
- Search, identify, collect, store, preserve, and conserve the art and craft products, items and materials.
- Also the activities of documenting, distributing, exhibiting, exchanging, selling, purchasing, processing, packaging and marketing of such items.
- Organize study courses, workshops, conferences and lectures on the conservation of natural and cultural property and resources.
- Provide information services and setting up of libraries.
- Develop awareness among the public for the preservation of the art, cultural and natural resources and heritage of India.
- Strengthen and extend cooperation with the professional, regional, national, international organizations, government and semi government bodies.
- Plan projects related to art, craft, manuscripts and paintings, statues, museums, etc.
- Conduct and organize seminars, trainings, workshops relating to conservation and maintenance of the Indian heritage.
- Organize lectures and performances including skits, street plays, etc., to spread awareness about the cultural monuments among different sections of the society.
- Encourage professionals to undertake and stimulate research on problems of conservation in an Indian environment and to find out the alternatives.
- Organize exhibitions related to the preservation of cultural heritage.
- Provide guidance and counselling services to corporate and private collectors on the storage and preservation of art and craft and architecture material.
- Plan, set up, develop and maintain art galleries, craft centres, museums to promote artistic, aesthetic and technical knowledge.
- Develop a sense of social responsibility towards preserving art and architecture.
- Protect and conserve the natural and manmade, monuments, buildings by taking the necessary actions and measures.
- Get the necessary documentation of the unprotected buildings of archaeological, architectural and historical significance.
- Formulate heritage policy and regulations, and make legal compliances to protect our heritage, when necessary.
- Undertake emergency response measures during natural or manmade disasters, and to support local administration wherever heritage is threatened.
- Foster collaborations, MOUs and partnerships with government and other national and international agencies.
- Generate sponsorships for conservation and educational projects.
- Facilitate and assist conservationists in the restoration of works of art and other monuments and buildings.
- Promote cultural tourism, facilitate heritage festivals, organize craft melas, etc.
- Spread awareness through the setting up of heritage clubs and heritage societies in

educational institutions.

- Make provisions for awards, fellowships, grants, scholarships and prizes in cash or kind to artists, artisans, craftsman, art galleries engaged in the promotion of art, culture and literature.
- Develop and design educational material on art, culture and creating awareness regarding the cultural sites and monuments through worksheets, handy guides, books, manuals heritage maps, CDs and websites.
- Make legal interventions through the Public Interest Litigations when to conserve and protect the art and heritage of the country.
- Promote, establish, support, maintain or grant aids to institutions for the promotion of science and technology, literature, music, drama and fine arts.
- Promote handicrafts, cottage industries and self-employment activities and providing assistance to the traditional artists and to work towards the improvement of the lives of the artists.

CHECK YOUR PROGRESS

11. List some of the hurdles in the path of cultural harmony.
12. Name some of the specimens of art/architecture that exist in Indian history.
13. State some of the architectural styles that existed during the different time periods in India.

2.12 SUMMARY

In this unit, you have learnt that:

- According to Ramade (1984), a natural resource is defined as a form of energy and/or matter which is essential for the functioning of organisms, populations and ecosystems.
- Resource is a means, which may or may not be material. It has specific functions and can be utilized to meet the needs of individual and society as a whole, in a given space and time.
- There are many materials in the world that can neither be termed as resources nor resistances. These materials are known as 'neutral stuff'.
- There are different classifications of natural resources. According to Odum (1971), natural resources can be divided into two categories, renewable and nonrenewable resources. They can also have two further categories of Biotic/Abiotic and Inexhaustible Resources.
- Resources that can be replenished through rapid natural cycles are known as renewable resources. These resources are able to increase their abundance through reproduction and utilization of simple substances.
- The renewable resources are of two types:
- *Conventional type,* such as water resources, plants and forests, wildlife, livestock, aqua culture, etc.
- *Non-conventional type,* such as solar energy, wind energy, biogas, atomic energy, etc.
- Forests constitute 90 per cent of the global biomass. They are important as they regulate climatic conditions, such as rainfall, humidity, temperature and protect soil from erosion.
- Although fossil fuels are non-renewable, they still form very slowly as compared to their consumption. Biomass although non-renewable can be made renewable by fuel-wood plantations.
- Radioactive elements are utilized to harness energy in the atomic reactors. The nuclear

reactors produce an enormous amount of heat that is used to produce steam, which in turn is used to run turbines to generate electricity.

- Minerals are natural substances (organic and inorganic) that occur as ores in the earth's crust. Minerals like iron (Fe), copper (Cu), zinc (Zn), manganese (Mn) and aluminium (Al) are used as building materials for manufacturing automobiles, ships, rail tracks, etc., as nutrients for plants and as components of glass and ceramics.
- Non-renewable resources can further be divided into two categories, viz. (a) recyclable and (b) non-recyclable.
- We should protect and conserve our natural resources and use them in a prudent manner so that the resources are not exhausted. Natural resources should be used in such a manner so that even the coming ages are able to utilize them.
- Due to the increase in population, the demand for arable land for producing food and fuel wood is also increasing.
- Various anthropogenic activities like hydroelectric projects, large dams, reservoirs, construction of roads and railway lines, construction of buildings and mining are responsible for clearing of large forested areas.
- Water is an essential natural resource for every living being to be sustained on this earth. 97 per cent of the earth's surface is covered by water and 60-65 per cent is the composition of water in the body of plants and animals.
- The water we use keeps on cycling endlessly through the environment. This is known as the hydrological cycle. We have vast resources of water on earth equivalent to 1404 million km^3.
- About 97 per cent of the total water reserves of the world is salt water (marine), 2 per cent in present in ice caps and only 3 per cent is fresh water. Even this small amount of fresh water is not available to human beings and just 0.003 per cent is easily available to us in the form of groundwater and surface water.
- The problems arising out of water resources are floods, droughts. Apart from these, there are disputes over water.
- River valley projects with big dams have usually been considered to play a key role in the developmental process due to their multiple uses. India has the distinction of having the largest number of river valley projects.
- Forest Resource is the dense growth of trees, together with other plants, covering a large area of land. Forests are one of the most natural resources found on earth. Covering earth like a green blanket, these forests not only produce innumerable material goods, but also provide several environmental services which are essential for life.
- Since a long time, human beings have been largely dependent on forests for food, medicine, shelter, wood and fuel. With the rapid growth of population the demands for raw materials such as timber, pulp, minerals and fuel wood increased drastically resulting in extensive logging, mining, road-building and clearing of forests.
- Minerals are natural, inorganic, crystalline solids having distinct chemical composition and typical physical properties. Thousands of minerals are found in different parts of the world.
- There are innumerable edible plants and animals all over the world, yet only about three dozen types comprise the main food of humans. The main food resources include wheat, rice, maize, potato, barley and oats and about twenty or so common fruits and vegetables, milk, meat, fish and seafood.

- Energy consumption of a nation is usually considered as a manifestation of its development. This is due to the reason that the element of energy is an essential component for all developmental activities. Per capital energy consumption varies in both developing and developed countries.
- Energy resources are primarily divided into two categories, viz. renewable and non-renewable sources.
- Renewable energy resources must be preferred over the non-renewable resources.
- Different natural resources like forests, water, soil, food, mineral and energy resources play a vital role in the development of a nation. With our small individual efforts we can help in conserving our natural resources to a large extent.
- There is a big division in the world in the use of resources, viz. north and south, more developed countries (MDCs) and less developed countries (LDGs), haves and have-nots.
- India is a country which is extremely rich in cultural resources. Despite diversity of cultures, religions, traditions, customs, languages, dressing, thoughts, ideas and the living styles, there is harmony in Indian culture. The Hindus are in majority but other religions like Sikhism, Islam, Buddhism, and Christianity are also found in our country and are equally respected.
- Cultural diversity has been defined by UNESCO as; 'it is the common heritage of humanity and should be recognized and affirmed for the benefits of the present and future generation.'
- India is rich in cultural resources and has a wide range of monuments, buildings, diversified languages, dance forms, sculptures, religions, etc.
- In 1972, the General Conference of UNESCO adopted a resolution named 'Convention concerning the protection of the World Cultural and Natural Heritage.'
- The Archaeological Survey of India (ASI) under the provisions of the AMASR Act, 1958 makes decision to bring a monument under its protection.
- The Indian civilization is undoubtedly a gifted architecture which has evolved through centuries and comprised different periods of history. Specimens of Indian architecture were first witnessed in the Indus Valley Civilization and later on in the Buddhist monasteries in India.

2.13 KEY TERMS

- **Abiotic Resources:** Non-living resources (e.g., petrol, land, minerals, etc.) that are not able to replace themselves or do so at such a slow rate that they are not useful to consider them in terms of the human life times.
- **Biotic Resources:** Living resources (e.g., forest, agriculture, fish and wild life) that are able to reproduce or replace them.
- **Exhaustible Resources:** These resources are limited in nature and they are non-maintainable, e.g., coal, petrol and some minerals.
- **Inexhaustible Resources:** Resources which are not changed or exhausted by man's activities and are abundantly available are said to be inexhaustible.
- **Non-recyclable Resources:** These resources cannot be recycled in any way, e.g., fossil fuels and uranium, which provide 90 per cent of ourenergy requirements.
- **Non-renewable Resources:** The resources that cannot be replenished through natural processes and are available in limited amounts, which cannot be increased.

- **Recyclable Resources:** These are non-renewable resources which can be collected after they are used and can be recycled.
- **Renewable Resources:** Resources that can be replenished through rapid natural cycles and are able to increase their abundance through reproduction and utilization of simple substances.
- **Soil Erosion:** Defined as the movement of soil components, especially surface-litter and top soil from one place to another.

2.14 ANSWERS TO 'CHECK YOUR PROGRESS'

1. The basic ecological variables—energy, space, time and diversity are sometimes together called natural resources. These natural resources maintain the ecological balance among themselves.
2. The two categories of natural resources are renewable and non-renewable resources.
3. Soil erosion, waterlogging, salinization and contamination of the soil with industrial wastes like fly ash, press mud or heavy metals all cause degradation of land.
4. The thick, gaseous cover of air surrounding the earth is called atmosphere. It sustains life on earth by removing dangerous cosmic and ultraviolet rays through absorption, provides oxygen for respiration and carbon dioxide for photosynthesis.
5. The two ways in which water is used by human beings are: (i) Water withdrawal (ii) Water consumption.
6. Some of the characteristics of water are:

    - It remains in the liquid form over a broad range of temperature i.e., from 0 to 100°C.
    - The specific heat of water is 1 calorie / gram °C due to which its temperature increases and decreases very gradually without causing much fluctations in temperature and hence protecting the aquatic life.
    - It has high latent heat of vapourization. Hence, it takes huge amount of energy for getting vapourized and produces a cooling effect as it evaporates.
    - It is an outstanding solvent for numerous nutrients. Hence, it acts as a very good carrier of nutrients, including oxygen, which are vital for life. It can also easily dissolve various pollutants and become a carrier of pathogenic micro-organisms.
    - It has high surface tension and unity due to which it can easily rise through great heights, through tree trunks even in the tallest of the trees like Sequoia.

7. Forests are basically used for commercial and ecological purposes.
8. The major causes of deforestation are:
    - Shifting cultivation
    - Fuel requirements
    - Raw materials for industrial use
    - Development projects like dams
    - Growing food needs
    - Overgrazing
9. Minerals are generally used for development of industrial plants, generation of energy, construction, equipment and armament for defence, transportation, medical system, communication, and jewellery.

10. Agriculture also makes an impact on the usage of land as follows:
    - Deforestation
    - Soil erosion
    - Depletion of nutrients
11. Some of the obstacles that one comes across while maintaining cultural harmony are:

    Globalization: Globalization is causing fear of differences in views, therefore, breaking the uniformity of culture.

    Marginalization: Marginalization, also known as social exclusion means the formation of social groups by individuals who are reluctant to change their ideologies and principles. They are normally, reluctant to accept any modification happening in the society. This becomes a major hurdle in the way of cultural harmony.

    Age-old traditions: Traditions which are continuing from a very long period lose their core meaning with the passage of time. These prolonged traditions create a gap between the elderly group of people and the youth. This gap between the thought processes of two generations blocks the development of cultural harmony.
12. Some of the specimens of art\architecture that exist in Indian history are:
    (i) Agra Fort, Agra
    (ii) Ajanta Caves
    (iii) Ellora Caves
    (iv) Mahabahpuram group of Monuments
13. Some of the architectural styles that existed during the different time periods are:
    (i) Temple Architecture
    (ii) Rock Cut Architecture
    (iii) Cave Architecture
    (iv) Ancient Architecture
    (v) Indo Islamic Architecture
    (vi) Colonial Architecture

2.15 QUESTIONS AND EXERCISES

Short-Answer Questions

1. What are renewable and non-renewable resources? Give examples.
2. Give a brief account of non-renewable energy resources.
3. What is soil erosion? How can it be checked?
4. How can you, as an individual, conserve different natural resources?
5. What is your perception of the cultural resources of India?
6. What are the uses of various types of minerals?
7. What is overgrazing? How does it contribute to environmental degradation?

Long-Answer Questions

1. Discuss the major uses of forests. How Would you justify that ecological uses of forest surpass its commercial uses?
2. What are the maj or causes and consequences of deforestation?

3. Discuss with the help of examples around you, how big dams have affected forests and the tribals.
4. What are major causes for conflicts over water? Discuss one international and one interstate water conflict.
5. Should we build big dams? Give reasons for your answer.
6. Write a short note on cultural resources.
7. What are the steps that can be taken to promote and protect the cultural resources?

2.16 FURTHER READING

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UNIT 3 ENVIRONMENTAL RESOURCES MANAGEMENT

Structure

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3.0 INTRODUCTION

Rapid growth of human population has made direct assault on the natural resources. Father of our Nation Mahatma Gandhi indicated that even today earth has enough for the 'needs' of man but not for the 'greed'. Thus, the exploitation of nature driven by human greed and ignorance has been the root cause of pollution and environmental degradation. A rational evaluation would demonstrate that explosion in human population, deforestation, urbanization, industrialization, and blind race towards development are the real culprits of the environmental crisis. The environmental concern in India dates back to the Vedic period. The Upanishads outline the ethics of protecting the resources for the use of future generation. The so-called progress associated with the technological revolution and a wild race to accord greater technological development has subdued the concern for environmental conservation. There is a gap between the economic theory of value and the empirical measurement of benefits. It exists in large part because of the difficulties in determining this relationship.

The adverse changes by human activities in the environmental quality at local level is generally called pollution, but sometimes the affects of human activities are so wide that the environment is degraded at global and regional level as well.

In this unit, you will study about the management of natural resources.

3.1. UNIT OBJECTIVES

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

- Explain the problems associated with natural resources
- Explain the causes of environmental degradation
- Describe the basic steps involved in the prevention of environmental degradation
- Discuss various man made disasters and their prevention

- Interpret the role of education in environmental awareness
- List different sources of formal and non-formal education for environmental awareness

3.2 NATURAL RESOURCES AND ASSOCIATED PROBLEMS

Environmental degradation means overall lowering of environmental quahties because of adverse changes brought in by human activities in the basic structure of the components of the environment to such an extent that these adverse changes affect adversely all biological communities in general and human society in particular.

To check the degradation of the environment and to restore the balance of nature is the single most important challenge to mankind. Hazel Henderson explained in her book, *Creating Alternative Future,* 'Whether we designate them as "energy crises", "urban crises", "environmental crises or population crises" we should recognize the extent to which they all are rooted in the larger crises of our inadequate narrow perception of reality.' The expressions 'environmental pollution' and 'environmental degradation' are used interchangeably but these are different concepts and have different meaning.

- The degradation of environment is caused by pollution and hazards/disasters. The hazards or disasters are sudden natural processes or are caused by human activities which require immediate relief. It is required that prediction is made for safeguarding against them.
- Environmental pollution is taking place due to slow and gradual human activities, e.g., increase in human population, establishment of factories and industries, development of transportation facilities, etc. Environment pollution degrades the quality of the environment which can be protected by proper environmental management and assessment.
- Environmental degradation leaves direct impact on the ecology and thus cause ecological imbalance due to marked reduction in the ecosystem and ecological diversity.
- Environmental degradation can be summarized as, 'When the environment becomes less valuable or damaged, it means that environmental degradation has occurred.' In environmental degradation
    - o Habitats are destroyed
    - o Biodiversity is lost
    - o Natural resources are depleted
    - o Environment is hurt due to loss of forests, ozone depletion, and marine environment destruction

Factors of Environmental Degradation

Degradation occurs due to the following reasons.

- "Vigorous interaction of socio-economic, institutional and technological activities
- Unsustainable economic growth
- High population growth
- Rapid urbanization
- Intensification of agriculture
- Increased use of energy and transportation
- Poverty

Some major factors are given as under:

- Deforestation, i.e., excessive cutting of trees and forests
- Overpopulation

- Pollution of air, water, soil and marine
- Depletion of ozone layer
- Global warming
- Unplanned development, urbanization and industrialization
- Emission of poisonous gases
- Right and manageable use of energy
- Excessive use of resources
- Mismanagement of waste disposal
- Poisonous waste poured into rivers and sea
- Unequal distribution of resources
- Lack of environmental awareness and appropriate legislation
- Uncontrolled laws
- Decrease in the nutritive value of products

3.2.1 Causes of Environmental Degradation

With the socio-economic, scientific and technological development, serious problems of environmental degradation have emerged. Some causes are:

1. **Religious Causes:** Sometimes, religious values degrade the air and marine environment. Mixing dead bodies, their ash, submerging statues of Gods and burning of idols are the main causes.
2. **Development of Modern Technology:** Although the modernization of a country is required, but excessive development causes imbalance in nature. Use of air conditioners, various means of transportation, use of heavy machineries, construction of dams, use of chemical and nuclear techniques are causing severe environmental degradation.
3. **Agricultural Development:** To increase the yields of crops an excessive use of chemicals, pesticides and fertilizers are being used. Again chemicals are used in large quantities for ripening fruits. All these factors degrade the quality of soil as well as nutritive value of products.
4. **Population Growth:** Increasing population causes excessive consumption of resources, which in turn creates imbalance of nature.
5. **Deforestation:** Population increase also affects deforestation because forest land is converted into agriculture land and for residential and industrial use.
6. **Industrial Development:** As industries are introducing new products, these are also introducing harmful gases and waste products into the environment.
7. **Urbanization:** Modernization is affecting rural areas. Therefore, the villagers are now migrating towards cities for education, jobs and comforts. These cause more slum area in big cities, more houses to live, and more resource to use.
8. **Overuse and Dearth of Resources:** Resources are used excessively and are wasted due to lack of awareness.
9. **Natural Calamities:** Floods, drought, cyclone, excessive rain, earthquakes, volcanoes, acid rains and ozone depletion cause environmental degradation.
10. **Abrupt Environmental Changes:** Global warming, unpredictable behaviour of weather, desertification and rise in sea level are the main causes for environmental changes and the loss of quality of environment.

11. **Biological Hazards:** Cutting of trees, hunting of animals, disposal of biological waste, contamination of air and water by viruses and bacteria spread epidemics. All these cause the degradation of environment. The fertility of soil decreases which affects the production.
12. **Domestic Instability:** It results in the reduction in economic opportunities.
13. **Unpredictable Behaviour of Weather:** As the environmental balance is getting disturbed, the weather is also changing. Day temperatures are increasing and the night temperature is decreasing to a great extent. Rainfall patterns have been changing with increased droughts in some areas and heavier rains in others, winds are increasing in power and cyclone frequency is increasing.
14. **Eradication of Habitat and Species Extinction:** Due to imbalance of nature, shortage of living space, increase of air and water pollution, excessive hunting, and lack of proper food, water, temperature and extreme climatic changes, some animal species are getting extinct.
15. **Rise in the Sea level:** Due to global warming, the glaciers are melting. It is causing a rise in the sea level. In fact some of the countries and even some Indian cities like Mumbai are in the danger list of getting submerged.
16. **Scarcity of Portable Drinking Water:** Water consumption is unfairly distributed. The per capita water conscription in the United States is about 2300 m^3 per annum, as compared to 1500 m^3 for the Canadians and 225 m^3 for the British. The average per capita consumption of water in the developing countries ranges between 20 to 40m^3. However, due to excessive use of water resources and water pollution the scarcity of portable water is caused.
17. **Global Warming:** Due to the exhaust gases from vehicles and industries and the use of dangerous chemicals, the atmospheric temperature is increasing and causing global warming.
18. **Acid Rain:** Various gases from exhaust fumes increase the amount of carbon content in the air. The rain water mixes with gases like $C0_2$ and $S0_2$ and form acids. These acid rains cause damage to crops and human and natural habitations.
19. **Desertification:** Excessive cutting of trees, industrialization and changing forest or green lands into desert are causing havoc across the world. Concrete jungles are cropping up at the cost of natural jungles, thus, creating a massive imbalance in nature.
20. **Acute Diseases:** Lack of green healthy areas, hygienic conditions, spreading slums and overpopulation are the reasons that are causing viral and bacterial diseases to human beings as well as animals. The death rates are increasing due to new viral diseases like Rota virus, Brain fever, and Swine Flu.
21. **Deterioration of Land and Soil:** Fertile lands are now converted into colonies and industrial institutions. Fertile soil is deteriorating in quality due to excessive cropping, use of chemicals and fertilizers and bad irrigation practices. It is affecting the yields of crops and economy of the nation.
22. **Environmental Racism:** Environmental racism is also one of the causes of environmental degradation. According to this concept, environment degradation caused by the developed world during the past few centuries is justified on the account of development and civilization, while the developing and third world countries undergoing the initial stages of development are blamed for the rise in pollution levels across the world.
23. **Reduction in Economic Opportunities:** As agricultural lands are being converted into residential colonies and industries, rural population is migrating towards urban areas. Excessive migration of people causes unemployment. Degradation of the resource base has a negative affect on production which in turn affects income.

3.2.2 Steps for Prevention of Environmental Degradation

There has been a change in people's viewpoints towards environmental awareness. If one accepts that—

(a) People live in a delicate environment which is being over-exploited and ignored and the fact that people now need to focus their attention towards regeneration and restoration of the environment.

(b) The environment belongs to the people hence, people by organizing themselves in groups, societies, cooperatives and associations should collectively work together towards the development, conservation and restoration of the environment.

Some steps that can be taken for prevention are as follows:

- Rehabilitation of degraded land
- Change in institutional arrangements
- Reforestation programmes
- Thought for renewable energy resources
- Creating mass awareness
- Setting of environmental issues in syllabus
- Feedback mechanism for different regions
- Role of state government in building up the laws and rules for conservation
- Transformation of science and technology knowledge
- Alternatives for waste disposal and management of waste material
- Reduction and control of greenhouse gases; check on emission of gases
- Role of regional and international organizations
- Role of mass media, print media and electronic measures
- Role of Government in developing pro-environmental policies
- Introduction of new techniques, e.g., geothermal, geo-engineering, filters, catalytic converters in vehicles
- Alternative sources of energy
- Injunction of $S0_2$ into stratosphere
- Encourage communication among people for assessment and reduction of disasters
- Assessment of impact of plans, projects, dams, reservoirs, factories and deforestation on human life
- Education provisions for moral and religious values
- Education for general awareness and optimum economic value of resources

The Environmental Management Plan (EMP) includes the following steps to maintain the quality of environment.

- Safeguard and prevent the adverse environmental impacts
- Plans for dealing with accidents and disasters
- Plans for rehabilitation
- Monitoring and feedback mechanisms on the implementations of necessary safeguards

Several approaches are adopted to counter the effects:

Recycling: Reprocessing of waste product for reuse, e.g., paper, plastic.

Restrictions: A check on the use of DDT; encouraging pollution-free fuels.

Organizations controlling: Direct and non-violent activities by groups.

On the contrary, people have become increasingly aware about the importance of environment and its conservation. People have now changed their perspective towards the poverty problem in developing countries. In recent times, the global community and the central government of various countries have developed a tendency not to appreciate the necessity for combining poverty alleviation programmes along with environmental management in rural areas. Various efforts in this direction are being taken by NGOs and other voluntary organizations but the scope of these efforts small and at a local level. Simultaneously, the viewpoint of rural people towards their environment and a better relationship with it has also changed.

The recent developments, such as launching of World Conservation Strategy (1984) and the Report of the World Commission on Environment and Development-Our Common Future-culminated into Agenda 21 agreed upon by 170 nations and adopted at the United Nations Conference on Environment and development held at Rio, Brazil in June 1992.

Agenda 21 takes into account all areas/subjects with bearing on global environment. It also covers different areas which could be employed to promote environmentally sound development policies. Some of the subjects are poverty, consumption patterns, demographic dynamics, deforestation, desertification, etc.

Agenda 21 suggested:

- Safeguarding and promoting human health conditions
- Combining environment and development in decision-making
- Protection of the atmosphere
- Combating deforestation
- Managing fragile ecosystems; combating desertification and drought
- Managing fragile ecosystems and sustainable mountain development
- Promoting sustainable agriculture and rural development
- Conservation of biological diversity
- Environmentally sound management of biotechnology
- Protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living resources
- Protection of the quality and supply of fresh water resources application of integrated approaches to the development, management of toxic chemicals including prevention of illegal international traffic in toxic and dangerous products
- Environmentally sound management of toxic chemicals including prevention of illegal international traffic in toxic and dangerous products
- Environmentally sound management of hazardous wastes, including prevention of illegal international traffic in hazardous wastes
- Environmentally sound management of solid wastes and sewage-related issues
- Safe and environmentally sound management of radioactive wastes
- Scientific and technological community
- Strengthening the role of farmers
- Transfer of environmentally sound technology
- Science for sustainable development
- Promoting education for public awareness and training
- Integrated approach to the planning and management of land resources

3.2.3 Saving Resource from Depletion

Imagine a world of spiralling food prices, water shortages and soaring energy costs. For many living in the world today, this nightmare scenario is already a reality. Even for the well-off living in developed economies, it is becoming all too familiar. And on current projections, it is going to get a whole lot worse. Short-term fluctuations in supply and demand aside, a global population explosion combined with finite resources means that the planet cannot sustain ever-increasing levels of consumption using current models of production.

But it is not just physical depletion that leads to scarcity. For some resources, political and financial factors can escalate the problem, particularly in the short-term.

A recent survey by consultants PricewaterhouseCoopers (PwC) found, a shortage of key minerals and metals could 'disrupt entire economies'. It compiled a 'critical list', including lithium, which is widely used in batteries and wind turbines, cobalt, again a key component in rechargeable batteries, and tantalum, which is used in mobile phones and computers.

Geologists prefer not to speculate on the planet's finite reserves of these valuable resources, some of which are already running low, for the simple fact that more could be discovered, but political factors alone make them hard to come by.

China, for example, where most so-called rare-earth elements are found, severely restricts exports to other countries. India and Vietnam have also curbed exports of mineral resources and the pressure for other countries to follow suit is growing.

Equally, increasingly volatile commodity prices, borne in part of increasing uncertainty over supply, mean companies are less willing to invest in discovering new supplies as they are unsure of the return they will make on their investment.

This creates a potential vicious circle, where volatile prices have an impact on supply, making prices yet more volatile, all the while exacerbating the problem of scarcity.

Radical Solution

Clearly, then, something needs to be done if humans are to live within the resources that the Earth has. Some argue mat the answers are already there. Productivity improvements would alone help meet almost 30 per cent of demand for resources by 2030 and present trillions of dollars of savings to global companies. New technologies, substitute materials and greater investment in supply will also be needed. McKinsey estimates that about $3trillion a year would help meet demand for steel, water, agricultural products and energy. This is about 50 per cent more than current investment. Others argue more radical solutions are required.

Policy intervention is needed to protect resources that are not priced or incorrectly priced. Water is a case in point. Despite being the world's most precious and increasingly scarce resource, it is incredibly cheap, and in many parts of the world, free. Correcting this price anomaly would have huge consequences for businesses. Trucost has calculated that more than a quarter of profits of the world's biggest companies would be wiped out if water was priced to reflect its value, as it must be.

Land is another example. Huge chunks of the natural world have no monetary value yet they provide services worth trillions of dollars to the global economy. Only now is this value being recognized and painstakingly calculated. Energy efficiencies, renewable energy and a massive increase in recycling will also be needed. Some are even calling for what is known as a circular economy, a comprehensive rethink of our current model of production and consumption, where one company's waste is another's raw material, and where obsession with the ownership of material goods is moderated. One thing is certain, as things stand, the numbers do not add up and the odds are stacked against us. Drastic change is needed.

CHECK YOUR PROGRESS

1. List some of the factors responsible for environmental degradation.
2. What are the steps that can be taken to prevent environmental degradation?
3. State the steps that can be taken to maintain the quality of environment under the Environmental Management Plan (EMP).

3.3. NATURAL DISASTERS/HAZARDS AND THEIR MANAGEMENT

The events caused by natural processes on human activities are called extreme events. These disturb and degrade natural environment causing disaster for the human society. For example, floods, droughts, cyclone, heavy rains, volcano and earthquakes make adjustment difficult for human beings and loss of property and lives is caused.

The terms environmental hazards, environmental stresses and environmental disaster are used simultaneously when there is a dramatic effect on natural resources, ecosystem and human beings.

The environmental disasters are defined in terms of:

1. **Extreme event:** Disasters are the extreme events which are caused either by natural changes or by man's activity. These changes destabilize the fauna and flora, therefore loss of life and property occurs.
2. **Abnormal process:** The environmental disasters are again defined as abnormal processes made by human beings. The excessive loss of heat and gases from vehicles, air conditioning, burning of waste, mixing of industrial waste in rivers, use of pesticides, and disturbance in the composition of air and water cause loss of life and vegetation.
3. **Environmental stress:** Environmental stress occurs when lives and property are affected by sudden natural hazards.

What is a hazard? How is it classified?

Hazard is a dangerous condition or events that threaten or have the potential for causing injury to life or damage to property or the environment. They can be categorized in various ways but, based on the origin, hazards worldwide are basically grouped into two broad headings:

1. Natural Hazards (hazards with meteorological, geological or even biological origin)
2. Unnatural Hazards (hazards that are caused by humans or technological origin)

It is also important to know that natural phenomena are extreme climatological, hydrological, or geological, processes that do not pose any threat to persons or property. A massive earthquake in an unpopulated area, for example, is a natural phenomenon, *not a hazard.* It is when these natural phenomena interact with the man-made environment or fragile areas which cause widespread damage.

What are disasters?

Almost everyday we witness in the newspaper or on the TV, reports of disasters around the world. So what are disasters? How are they different from accidents? Disaster is defined as: 'A serious disruption of the functioning of a society, causing widespread human, material, or environmental losses which exceed the ability of the affected society to cope using its own resources.'

A disaster is the product of a hazard such as earthquake, flood or windstorm coinciding with a vulnerable situation which might include communities, cities or villages. There are two main components in this definition: hazard and vulnerability. Without vulnerability or hazard there is no

disaster. A disaster occurs when hazards and vulnerability meet. There are several important characteristics that make disasters different from accidents. The loss of a sole income earner in a car crash may be a disaster to a family, but only an accident to the community. Variables such as causes, frequency, duration of the impact, speed of onset, scope of the impact, destructive potential, and human vulnerability determine the difference.

The difference between a hazard and a disaster is that a hazard is a part of the natural environment whereas disasters occur only when a hazard and development intersect and significant damage to the built environment results. Hazards can occur and cause no damage to humans or the built environment and so there is no disaster.

3.3.1 Types of Environmental Hazards/Disasters

When the discharged residuals spoil the ambient environmental quality, it causes changes in the flow of environmental services and the uses man makes of the environment.

Physical Hazards and Disasters

Environmental pollutants arise from many sources and exposures may occur through different routes. For instance, earthquake causes injury or destroys property. Landslides or flooding disasters are closely linked to rapid and unchecked urbanization that forces low-income families to settle on steep hillsides or ravines or along the banks of flood prone rivers. Famines can be closely linked to shortages caused by rural unemployment or a sudden influx of refugees into a country from a strife-torn neighbouring country. High numbers of deaths accompanying earthquakes almost always result from structural collapse of poor, low-cost houses.

Deforestation, desertification, erosion, over-cultivation, overgrazing, urbanization caused by migration from villages to the towns, excessive constructions and spreading of towns are the factors that are causing physical hazards and disasters. The damaged area in such disasters is usually relatively small, while the area affected in a continuing disaster may be extremely large.

Chemical Hazards

Millions of people in the developing world are on a regular basis exposed to extremely harmful indoor emissions, which are considered to lead to persistent lung diseases and cancer. The sources are:

- Emission of toxic gases like $S0_2$, NO, Ozone, CO, $C0_2$ as the by-products of energy production, industry and transportation.
- Emission of smoke and soot by burning of biomass fuels such as dung and wood, burning of garbage, fires and domestic exhaust causing acid rains.
- The use of pesticides, fertilizers, organic compounds and manures causes contamination of surface water or ground water and soil. Pesticides and organic compounds which degrade at a slow pace tend to remain in the environment for years which thus, amass in animals and human diseases.
- Chemicals like PCBs, leaded gasoline, lead-based paints, l,2-dibromo-3-chloropropane-D.D.T. leave a very unsustainable trail in the environment.

  The reproductive organs of seabirds and other wildlife were damaged due to the unfavourable effects of DDT In addition, some chemicals also produced adverse effects by disturbing the normal functioning of the body. Approximately, 74 chemicals or mixtures have been found to cause cancer in humans. Hundreds of other chemicals cause cancer or mutations in cells or in animals which raises concerns about their effects on humans.
- Ozone layer depletion is a cause of great concern. Burning of fossil fuels causes air pollution and leads to global warming. Excessive heat causes breaking of ozone layer and this exposes earth to ultraviolet radiation. Skin cancer and other vector borne diseases come to

stalk the normal pace of human and ecological systems.

- Leakage of oil and fire in oil tanks causes great risk to man and environment. Leakage of oil in Bombay and fire in oil tanks in Jaipur affected human beings and marine fauna.
- Bomb explosions come at the risk of big ecological and human costs. Nitrogen, hydrogen and sulphur salts are used for blasts. Not only casualties but toxicity in the air is also caused.

Social Hazards and Disasters

- Rapid population growth
- Inequitable patterns of land ownership
- Urban migration
- Lack of education
- Subsistence agriculture on marginal lands
- Unsafe location of buildings and settlements
- Unsafe homes
- Malnutrition
- Unemployment and under-employment
- Illiteracy
- Poverty
- Downfall in moral and religious values
- Wars, strikes and riots
- Multistoried buildings
- Residential and industrial use of agriculture land
- Lack of awareness
- Antisocial activities
- Recreational uses of ecosystem (fishing, hunting)
- Overproduction of food products, milk, etc.
- Adulteration

Man is the product of his social as well as his physical environment. In time of disaster, these strong bonds manifest themselves and take precedence over his ordinary behaviour. Social response to natural and man-induced disasters is generally in the positive direction. There should be check on human population by introducing family planning programmes.

Biological Hazards and Disasters

Up to 17 million deaths every year take place due to contagious and parasitic agents. 1. **Microbial threats:** Viruses, bacteria, protozoa and Helminths cause sickness. Insufficient access to clean water, sanitation and poor hygiene leads to cholera and other diarrheal diseases. Inadequate water supply and inappropriate preparation of food or unhygienic conditions give rise to intestinal worms.

2. **Insect borne diseases:** According to figures provided by WHO, approximately 300 to 500 million people die due to malaria every year. The growth of mosquito requires a particular combination of altitude, rainfall, heat and humidity and available surface water. Anopheles is propagated in stagnant contaminated water stores and causes thousands of malarial deaths even to this day.
3. **Soil borne diseases:** The dirty and polluted soil get carried into homes on the soles of the feet. This leads to infection which takes place recurrently and the disease becomes more serious as the worms build up their strength in the body.

4. **Airborne diseases:** Contaminated air is caused by sewage, garbage disposal, open drainage system and decaying of biological waste. Around 4 million people every year die due to such symptoms. It is also the leading cause of death among children below the age of five. According to the estimate of World Bank in 1992 the use of better fuels can decrease the number of pneumonia deaths by almost half.

   Other diseases like tuberculosis, asthma and skin diseases are caused due to conditions of poverty, below par standards of life in enclosed spaces, crowding and poor hygienic conditions.

5. **Vaccination:** Inspite of mass vaccination efforts organized by the governments of various countries, about 42 million children still fall short of receiving vaccine. Out of which approximately 1 million children die. Measles and diphtheria are just two childhood (vaccine-preventable) diseases. Decline in immunization efforts and disintegration of families and unawareness cause these hazards.

Disaster management mechanism was carried out by the Government of India after Bhuj Earthquake. It was noted that there was a need for building up holistic capabilities for disaster management so as to be able to handle both natural and man made disasters. The subject of Disaster Management was transferred from the Ministry of Agriculture to the Ministry of Home Affairs (excluding drought and epidemics and those emergencies/disasters which were specifically allotted to other ministries). The Government (Allocation of Business) Rules, 1961 were accordingly amended in February, 2002. A strategic roadmap has been drawn up for reducing the country's vulnerability to disasters. The road map will be reviewed every two years to see if any change in direction is necessary.

3.3.2 Disaster Management Cycle

Disaster management can be defined as the body of policy and administrative decisions and operational activities which pertain to the various stages of a disaster at all levels. Broadly, disaster management can be divided into pre-disaster and post-disaster contexts. Hazards are natural phenomenon, they cannot be prevented. But we can certainly learn to live in harmony with nature by not taking steps that can turn hazards into major disasters. If one takes into account the cost that we finally pay when a disaster strikes that the cost of averting it, we come to a conclusion that it is prudent to be prepared rather than inviting the wrath of nature on a very large scale. There are three key stages of activity that are taken up within disaster management. They are:

- **Before a disaster strikes (pre-disaster):** Activities taken to reduce human and property losses caused by the hazard and ensure that these losses are also minimized when the disaster strikes. Risk reduction activities are taken under this stage and they are termed as mitigation and preparedness activities.
- **During a disaster (disaster occurrence):** Activities taken to ensure that the needs and provisions of victims are met and suffering is minimized. Activities taken under this stage are called as emergency response activities.
- **After a disaster (post-disaster):** Activities taken to achieve early recovery and does not expose the earlier vulnerable conditions. Activities taken under this stage are called as response and recovery activities.

Preventing Disaster

1. Personal and community awareness

As Indians we need to be aware of likely hazards and potential hazards, how, when and where they are likely to occur, and the problems which may be a result of an event. With 60 per cent of the land mass

susceptible to seismic hazard damage (Moderate, High and Very High Zone); 40 million hectares (8%) of landmass prone to floods; 8000 Km long coastline with two cyclone seasons; 68 per cent of the total area vulnerable to drought; Hilly regions vulnerable to avalanches/landshdes/hailstorms/cloudbursts; other human caused hazards, it is important to be aware of how to cope with their effects.

During the time of a disaster there will be delay before outside help arrives. At first, self-help is essential and depends on a prepared community - that is a community which has:

- An alert, informed and actively aware population
- A Preparedness and Response Plan
- An active and involved local Government,
- Agreed, coordinated arrangements for response, preparedness and mitigation measures.

In case of tsunami

Hazard mapping: A hazard map should be prepared with designated areas expected to be damaged by flooding by tsunami waves. Historical data could be of help in showing areas inundated in the past. Keeping in mind the vulnerable areas, evacuation routes should be constructed and mapped. The plan should be followed by evacuation drill.

Early warning systems: A well networked system in place can warn the communities of the coastal areas when the threat is perceived. Tsunami warning should be disseminated to local, state, national as well as the international community so as to be prepared as they are capable of crossing across continents. The information can be broadcasted to the local emergency officers and the general public. On receiving of the warning, the action should be to evacuate the place as decided in the evacuation plan.

Community preparedness: Communities in the coastal areas are faced by the wrath of cyclones, storm surge and tsunami waves. It is important that the community is better prepared to take suitable actions on receiving of the threat and follow emergency evacuation plans and procedures. Communities which choose to ignore warning may get severely affected if they are not prepared to take immediate measures.

Main Mitigation Strategies

1. **Site planning and land management:** Within the broader framework of a comprehensive plan, site planning determines the location, configuration, and density of development on particular sites and is, therefore, an important tool in reducing tsunami risk.
   - The designation and zoning of tsunami hazard areas for such open-space uses as agriculture, parks and recreation, or natural hazard areas is recommended as the first land use planning strategy. This strategy is designed to keep development at a minimum in hazard areas.
   - In areas where it is not feasible to restrict land to open-space uses, other land use planning measures can be used. These include strategically controlling the type of development and uses allowed in hazard areas, and avoiding high-value and high-occupancy uses to the greatest degree possible.
   - The capital improvement planning and budgeting process can be used to reinforce land use planning policies.
2. **Engineering structures:** As most of the structures along the coast area comprises of fisherman community, which are constructed of light weight materials without any engineering inputs. Therefore, there is an urgent need to educate the community about the good construction practices that they should adopt such as:
   - Avoid building or living in buildings within several hundred feet of the coastline as these areas

are more likely to experience damage from tsunamis.

- Construct the structure on a higher ground level with respect to mean sea level.
- Elevate coastal homes: Most tsunami waves are less than 3 meters in height. Elevating house will help reduce damage to property from most tsunamis. Structural columns resist the impact while other walls are expendable. It is important to also take note that adequate measures are brought into the design to cater for earthquake forces.
- Construction of water breakers to reduce the velocity of waves.
- Use of water and corrosion resistant materials for construction.
- Construction of community halls at higher locations, which can act as shelters at the time of a disaster.

Flood management" Flooding will result from a tsunami. Tsunami waves will flood the coastal areas. Flood mitigation measures could be to building barriers or buffers such as special breakwaters or seawalls can be an effective risk reduction measure against gushing waters in ease of tsunami/storm surge during cyclones.

National disaster management framework

I. Institutional Mechanisms

Expected Outputs	**Areas of intervention**	**Agencies/sectors to be involved and resource linkages**
Nodal agency for disaster management at the national level with appropriate systems	(i) Constitution of National Emergency Management Authority with appropriate legal, financial and administrative powers (ii) Roles and responsibilities of theNEMA: • Coordinating multihazard mitigation, prevention, preparedness and response programmes • Policies for disaster risk reduction and mitigation • Preparedness at all levels • Coordination of response • Coordination of post disaster relief and rehabilitation • Amendment of existing laws, procedures, instructions	Ministries/Departments of Health, Water Resources, Environment and Forests, Agriculture, Railways, Atomic Energy, Defence, Chemicals, Science and. Technology, Rural Development, Road Transport and Highways
Creation of State Departments of Disaster Management	Departments of Relief and Rehabilitation to be re-designated as Department of Disaster Management with enhanced areas of responsibility to include mitigation, prevention and preparedness	State Government/UT Administration

Setting up State Disaster Management Authorities	(i) (ii)	State Disaster Management Authority to be headed by the Chief Minister The Authority to lay down policies and monitor mitigation, prevention and preparedness as also oversee response	Ministers for Agriculture, Home Disaster Management, Water Resources, Health, Road and Transport, Civil Supplies, Environment and Forests, Rural Development, Urban Development and Public Health Engineering Departments as Members

II. Disaster Mitigation/Prevention

Disaster mitigation/prevention to be mainstreamed into the development process.	(i) (ii) (iii) (iv)	Each Ministry/Department which has a role in mitigation/prevention will make appropriate outlays for schemes addressing mitigation/ prevention. Where there is a shelf of projects/ schemes, projects/schemes contributing to mitigation to be given a priority. Wherever possible schemes/ projects in areas prone to natural hazards to be so designed as to contribute to mitigation, and preparedness. Projects in vulnerable areas/areas prone to natural hazards to be designed to withstand natural hazards,	Ministries/Department of Govt, of India/State Governments/ UT Administration
Techno-legal regime	(i)	Regular review of building codes and its dissemination	Bureau of Indian Standards/Ministry of urban Development
	(ii)	Construction in seismic zones III, IV and V to be as per BIS codes/National Building Codes.	State Urban Development Department/Urban Local Bodies
	(iii)	Construction in areas vulnerable to cyclones to be so designed as to withstand the wind hazard as per BIS codes/National Building Codes.	State Urban Development Department/Urban Local Bodies
	(iv)	Comprehensive review and compliance of • Town and Country Planning Acts • Development Control Regulations • Planning and Building Standard Regulations	State Urban Development Department/Urban Local Bodies

	(v)	Put in place appropriate techno-financial regime	State Urban Development Department/Urban Local Bodies
	(vi)	Capacity enhancement of Urban Local Bodies to enforce compliance of techno-legal regimes	State Governments
Land-use Planning and Zoning regulations	(i)	Legal framework for Land-use planning and zoning regulations to be reviewed.	Ministry of Urban Development, Department of Land Resources [MORD]
	(ii)	Zoning regulations to be enforced.	Ministry of Environment and Forests [GOI]/ State Governments
Plan schemes for vulnerability reduction and preparedness	State Governments to formulate Plan Schemes and submit to Planning Commission.		State Governments

III. Legal/Policy Framework

Disaster Management to be listed in List-III- [Concurrent List] of Seventh Schedule to the Constitution	(i) (ii)	Bill to be drafted, Bill to be brought before Parliament	Ministry of Home Affairs/Ministry of Law (Legislative Department)
State Disaster management Acts	Model Act to be circulated to the States.		Ministry of Home Affairs State Governments
National Policy on Disaster Management	(i) (ii) (iii)	Mainstreaming disaster management into planning and development process. Mandate safe construction. Coordinated action by all relevant Departments as per policy.	Ministry of Home Affairs, Ministry of Finance, Planning Commission, Ministry of Environment and Forests, Rural Development, Urban Development and other relevant Ministries to be consulted.
States to enunciate Policy on Disaster Management.	(i) (ii) (iii)	Mainstreaming disaster management into planning and development process. Mandate safe construction. Coordinated action by all relevant Departments as per policy.	State Governments

State Disaster Management	Amendment of existing relief codes/scarcity codes/famine codes to incorporate mitigation, preparedness and planning measures at all levels from community to State constitution of Emergency Support Teams/Disaster Management Teams/Committees/State Disaster Management Authorities, delegation of administrative and financial powers to disaster incident managers etc, protocol to update the inventory of resources and plans,	State Governments

CHECK YOUR PROGRESS

Fill in the blanks.

(a) Lowering of environmental quality is termed as _____ .

(b) The contamination of environment is known as _____ .

(c) Conversion of rural agriculture land into township and population extension is called .

(d) Cutting of excessive forest/trees is a phenomenon referred to as

State whether True or False.

(a) Recycling of waste helps in the management of environmental hazards.

(b) Environmental disasters are neither a process nor an event.

(c) Sudden natural hazards which affect lives and property are called environmental stress.

(d) Farmers have to use more and more fertilizers to increase the yield.

3.4. ENVIRONMENTAL AWARENESS

Some scholars use environmental awareness and environmental education interchangeably. However, there is a great difference between these two terms. Environmental education is a comprehensive concept and it includes environmental awareness also. Some definitions of'Environmental Awareness' are as follows:

- Environmental awareness implies the knowledge and understanding of the issues relating to changes in the environment.
- Environmental awareness makes us aware of the attitudes involved in the environmental issues.
- As environmental education provides the opportunities and situations for performing certain activities and tasks, environmental awareness excludes the operational or practical elements of environmental education.
- Environmental awareness makes us aware to keep surroundings clean.
- Environmental awareness is limited to the knowledge of problems and solutions but does not involve activities.
- Environmental awareness is confined to the cognitive level. It can be imparted from primary stage to university level directly and indirectly through teaching.
- Environmental awareness makes students and general public aware in recognizing

ways and means of making effective use of environmental resources for survival, growth and development of the nation.

3.4.1 Objectives of Environmental Awareness

To increase people's awareness towards the importance of environmental protection, and to enable them to participate in the efforts of environmental conservation, the government must implement environmental education and awareness programmes. The main objectives for environmental awareness are to:

- Enable the students and public to recognize the interdependence among material and physical environment, plant and animal for survival, and growth and development.
- Enable the students to identify human, material and biological resources.
- Enable the students to learn proper use of environment.
- Enable the students to recognize ways and means of making effective use of environmental resources for social, economical and cultural growth and development.
- Enable the students and public to develop a sense of conservation, and think about alternative sources for future.
- Enable the students to learn and develop moral, economical and social values.

3.4.2 Education and Environmental Awareness

Human beings have reached a stage where they are no longer content merely to respond to the environment. They now seek to adapt the environment to their own needs. Since conscious purposes govern the continually expanding area of human activity, any change in social objectives is invariably accompanied by a change in the system of education.

a.Priority of environmental education in relation to environmental awareness

Environmental education is a learning process that increases knowledge and awareness about the environment and develops skills that enable responsible decisions and action that impact the environment.

- Environmental education'encourages inquiry and investigation.
- Environmental education enables a learner to develop critical thinking, problem solving and effective decision-making skills.
- Enable an individual to understand the values of various sides of an environmental issue.
- At the primary level, environmental education contributes to solve the problem of nutrition and health, and help in recognizing the uses of resources and their prevention and conservation.
- Environmental education is an important factor in fostering social cohesion and democratic government.
- Environmental education is a scientific means of education which especially widens the knowledge in the area of eco-technology and the development of renewable energy resources.
- Environmental education provides motivation, justification and social support for pursuing and applying them.
- Environmental education increases the capacity to transform their visions of society into operational realities.

- The goal of environmental education is to generate awareness among the masses, make them informed with the latest information, be responsible, follow ethical standards, analyse critically a given situation and still continue to learn.
- Environmental education is one of the ways of spreading knowledge and developing skills for bringing about the requisite changes in behaviours, values and lifestyles.

(b) Forms of environmental education for environmental awareness

(i) Basic Education

(ii) Formal Education (iii) Non-formal Education (iv)

Non-Governmental Agencies

(v) Education through Media

Basic education: Basic education is the concept formulated by Gandhi. It treats the child as a member of a cooperative group. The school is recognized as a community which offers the most suitable atmosphere for training in citizenship. The basic education is based on the recognition that the child can learn more quickly through active participation in a process than by passive reception of instruction given by a teacher. In basic education, the activity chosen for the training of the child is a purposive, creative and socially useful activity. The system prevalent in India tended to become more and more book-centered. Even in the case of children it became a mere exercise of the memory than a development of intellect, emotions and character.

Basic education suggests the following methods and strategies to develop environmental changes and attitudinal changes:

1. **Activity based teaching:** The child is active.
2. **Task oriented assignments:** The child does self activity.
3. **Outdoor observation and self thinking:** The child observes the situation and thinks solution by self decisions.
4. **Cooperative or group learning:** A situation is created where child performs his action in group with cooperation.
5. **Environmental or community based projects:** The opportunity to work for outer world.
6. **Outdoor class:** Freely chosen and self initiated activities outside the classroom.
7. **Self assessment:** Assessment is not memory based but it is task based which the child himself evaluates and feels joy and motivation on satisfactory completion.

   The above strategies help a child to:

   - Develop a social sense and a sense of responsibility
   - Make him aware as a productive agent in society
   - Learn the value of cooperation
   - Collect information about environment and to find solutions by self-regulating activities
   - Feel happy and j oyful, and lessen the fatigue and monotony of the subj ect
   - Develop personality, confidence, values and devotion

Formal education: Education is the most effective method that society has in hand for dealing with future challenges. Global and local environmental issues are becoming critical year by year, which are to be attributed to climatic changes and human activities. Considering all this, the decision makers all over the world agree that the goal of education reform is to improve learning. Many advocates of education reform are stressing the need to use new approaches in teaching and learning, and changes in curriculum and instructions.

- Content of book should be real world context.
- Link the classroom to the need of community.
- Take away the students from textbook-driven, teacher-led instructions by using 'hands-on andminds-on' strategy.
- Emphasis on cooperative learning in class where students can take part in the learning process with interest, capability and experience.
- Student-driven investigative learning process where students participate actively in collecting data and analyse them to reach a conclusion.
- Activities are decided and guided by teachers to develop critical thinking, problem solving and decision-making skills in students. For this purpose, a problem or research topic is decided and survey method, questionnaire and rating scales are used to collect data and then analysis is done to reach a conclusion.
- There is a need of re-deciding of curriculum. In place of traditional academic subjects, interdisciplinary curriculum must be decided which can connect students to different fields of knowledge.
- Lectures, demonstrations and discussions must be done with subject specialist and guest lectures can be organized.
- The literary activities, co-curricular activities like tours, exhibitions, visits must be included in the schedule.
- Library periods must be placed in the routine time table.
- Use of educational technology, CD-ROMs, slides should be used in teaching.

Environmental education: Children at pre school level need education for joy, play and wonder rather than books, words and learning facts. Therefore, environmental education for very young students is based on:

(i) Developing a sense of respect and caring for the natural environment during their first few years

(ii) Positive interaction with the natural environment for healthy development

To construct environmental education programme for preschool children the following points are kept in mind.

- *Simple and familiar experiences:* The young children learn better when things are presented in simpler form and things are used which are familiar to them. For example, the teacher using a plant to explain the process of plantation and the fact of forestation.
- *Outdoor positive experiences:* When the concepts of colours, birds, animals, planet and satellites are taught, the children are made to visit the parks, zoo, planetarium and other such places. In this manner, the children can learn through direct realistic experiences.
- *Personal experience in place of teaching:* Young children learn through discovery and self-initiated activities, active involvement, sensory engagement and self-initiated explorations.
- Teaching by creating interest and enjoyment in learning nature's facts.
- *Models of caring and respect for nature:* If the concept of caring and respect is taught then a model of care for plants and respect of animals is shown to them in the class.

Non-formal environmental education: Non-formal or out-of-school education plays an essential part in:

- Preservation and improvement of the environment
- Participating in activities contributing to the social, economic and cultural development of the community

- Changing the attitude of all members of a particular community
- Inculcate a sense of responsibility with regard to the management, protection and development of the environment

The fundamental strategy for developing non-formal environmental education is to integrate explicitly into the ever-widening range of out-of-school education programmes already available. In recent years, non-formal education programmes and institutions for carrying them out have increased in number. These programmes are as follows:

- Extend literacy teaching to crash refresher course.
- Courses for manual workers, farmers and civil servants.
- Processed not only by education ministries but also cooperated with ministries of labour, industry, agriculture, public health, social welfare, civil organizations, professional associations, trade unions, consumer groups, sports, tourist and cultural associations.
- Programmes are offered to institutions and their role and activities regarding environmental education are explained well in advance.
- Institutions with the help of technical bodies prepare materials for preservation and improvement of environment.
- Some bodies are advised to adapt measures responsible for curricular research, elaboration, experimentation and evaluation to include environmental education among their activities.
- A collaboration between planning institutions and implementing institutions at local, regional and national levels.
- Environmental projects are designed in which technicians, professionals and educators work together.

' Kothari Commission suggested the following programmes for non-formal education.

(i) *Literate the illiterates:* In this programme the urban and rural individuals in the age group of 15 to 35 are taught in either evening classes on during day with the help of teaching aids. First objective is to mark them literate and then make them aware of environment. The farmers of rural area are getting advantage of it. They learn several methods of soil protection, quality protection, ways of cropping, adequate use of fertilizers and manures.

(ii) *Continuous and vocational education:* Education is a continuous process, thus, education for awareness of environment is taught with vocational knowledge.

(iii) *Distance education:* Distance education is a very important way of imparting education. Many courses are provided by universities in formal and non-formal education system.

(iv) *Libraries:* The libraries established by universities, departments, clubs, non-government agencies help in distributing environmental knowledge.

There is a need to launch a country-wide movement for providing awareness of environmental pollution and degradation along with eradication of illiteracy.

Awareness and education through mass media: At this moment, India is facing environmental problems of extreme enormity that have an unfavourable influence on the lives of its people. However, most of these problems have taken place due to ignorance and lack of understanding about environmental and sustainable development issues. This has led to over-exploitation of natural resources and badly planned development and industrial projects. In order to ensure people make positive choice about the environmental impacts of their lifestyles, there is an urgent need to create mass scale awareness on environmental and development issues.

Mass media are the means or instruments of communication that reach large number of people and students. The media may be printed like newspaper or may take the form of cinema, radio, and T.V. Now new media like Internet and e-mail, etc., are also increasingly being used. EarUer the teacher was the only medium of communication for children. The other means of communication of information, news, ideas, comments, pictures, and the newspapers, the radio and television have a deep impact on the life and culture of the people. Whatever the people read, hear or see at the same time or the same day they think over it, analyse and generally discuss among themselves, exchange their views and judge or think what is good what is wrong about a subject. Media is helpful as it helps in:

- Expansion of literacy and knowledge of environment
- Spreading social education to all groups of society
- Providing useful information about life, its survival and how to make it comfortable
- Shrinking of whole world into a single unit, decrease the distances, make everyone closer
- Converging the issues, problems and solution all over the world into a classroom
- Sending of news in that area where man himself cannot reach easily
- Helping in getting knowledge of action, activities, experiments, researches, discussions carried in different places of a country to the needed place
- Getting ways of solving problems, skills, new additions, references, etc.
- Help in modification of views and values as well as in changing attitudes
- Provide knowledge speedily
- Making the world dynamic—A news reaches speedily to a large group
- Motivating a group when a group performs actions successfully
- Present an example for society to encourage people to participate
- Helping the students by lectures, T. V. shows, discussions in T. V. programmes
- Smart class and active class teach students of each level
- Helping illiterate by hearing and watching radio and T.V. shows
- Some educational channels like Discovery channel and news channels, provide important knowledge about environment and their conservation
- Animated films and cartoon networks also provide useful message by their documentary films
- Providing new techniques and new solutions by Internet and e-mail
- The availability of e-messages, e-ecoclubs, e-journals on the Internet spread new techniques at a time in a large group. New researches help in developing awareness and attitude
- Printed books, published material, encyclopedias help in getting solutions and spread the knowledge
- School broadcast programmes supply knowledge not only related to curriculum but also of general issues of environment
- As T.V. is a quick means of information, it makes visual and aural impressions of fauna, flora, biodiversity, energy conservation, cleanliness and other problems of pollution
- Observing the teaching processes, experimentations and actions of experts
- Educational CD-ROM specially prepared for environmental issues can be helpful for children to collect various type of information

- PowerPoint presentation, Transparencies, LCD shows can explain the content to a large group in

less time

- Newspapers have more advantages as more details can be provided in the form of news and stories of the latest development of environment, population, science, sports, government policies, national problems, disasters and their management

Despite the explosion of technological media in the developed countries, the teacher still occupies the place of importance.

Environmental education is a learning process that increases knowledge and awareness about the environment and develops critical thinking, problem solving and effective decision making skills.

The National Policy on Education (NPE) 1968 has envisaged the protection of the environment as the core element of education at all levels. The policy has also recommended the creation of environmental consciousness among all ages starting with school education. There is a paramount need to create a consciousness of environment. It must permeate all age groups and all sections of society beginning with the child. Environmental consciousness should be part of teaching in schools and colleges. These aspects should be integrated in the entire educational process.

The coverage of environmental concepts in the curricula materials developed by the NCERT as part of the implementation of the NPE (1936), has been considered to be adequate by the National and International experts in Environmental Education. The instruction materials would enable the children to understand the structure and functioning of the environment and its problems and prepare them to make efforts for it protection and improvement.

Science and social studies are the two main subject areas with intensive coverage of environmental topics. Several topics covered in science, geography, biology, chemistry and economics would help in understanding the structure and functioning of the environment. Several poems and stories on trees, insects, animals, in language subjects like Hindi and English create interest and motivate the children to contribute to the protection of the environment.

The Department of Education in Science and Mathematics of NCERT has undertaken a project (1993) to analyse the school curricula developed by the council as part of the implementation of National policy of Education (1986). The analysis was done to identify the environment education concepts and activities vis-a-vis the universal objectives of education (knowledge, skills, attitudes, participation) as agreed at the Tbilisi Conference (1977).

The Department of Science and Mathematics, on behalf of the NCERT also undertook a UNESCO sponsored case study on environmental education in India. This opportunity provided insight into the present states of environment education concepts and training at the school level, higher education and technical education levels. This would help in strengthening environment education components at the school level. Agenda 21 agreed at Rio conference Brazil in June 1992 on the various subjects suggests analysis of the specific problems concerning each subject and also gives possibilities for procuring resources to initiate and take suitable action.

Chapter 36 of Agenda 21 is titled 'Promoting Education, Public Awareness and Training'. The three programmes are:

(i) Reorienting education towards sustainable development (ii) Increasing public awareness (iii) Promoting training

Reorienting education towards sustainable development: Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues. Formal education includes public awareness and training is recognized as a process by which human beings and societies can reach their fullest potential.

The basic education provides the underpinning for any environmental and development education, the latter needs to be incorporated as an essential part of learning. Both formal and non-formal education are indispensable for changing people's attitudes for achieving environmental and ethical awareness, values, attitudes, skills and behaviour consistent with sustainable development and for effective public participation in decision-making.

Increasing public awareness: Due to inaccurate or insufficient information, there is still a considerable lack of awareness of the interrelated nature of all human activities and environment. There is a need to increase public sensibility about the environment and development problems. There should also be involvement of the public in finding solutions to environmental problems and a sense of personal environment responsibility and commitment towards sustainable development.

Promoting training: Training is one of the most important tools to develop human resources and facilitate the transition to a more sustainable world. Training programmes should promote a greater awareness of environment and development issues as a two way learning process.

According to Salas (1982)

- Children should frequently leave the classroom to study various environments firsthand.
- The school and the community should learn to communicate with each other about environmental problems and decisions.
- The school and community should interact for the improvement of environmental quality.
- The school and community should execute some plan together.

Stapp (1978) has provided some guiding principles to help in achieving environmental awareness.

- The environment should be considered in its totality. It's all aspects including natural, political, social, ecological, technological and aesthetic must be taken into account.
- Environment education should be a lifelong process. It should begin at preprimary level and continue through all formal and non-formal stages of education.
- It should be truly interdisciplinary, based on the principles of all the disciplines and taking a deistic view.
- It should incorporate active participation of children in the prevailing environment and finding out the solutions.
- Environment education should provide a chance to plan their learning encounters, taking decision and finally accepting their consequences.
- It should focus on current and potential environmental situations.
- It should consider and promote interrelationship of people and the environment.
- Environment education should analyse the problem from local, regional, national and international point of view to help see various viewpoints and receive insight deep into it.
- It should emphasize the multi-dimensionality of the problem and their interrelationship to develop critical thinking.
- Environment education should use various kinds of learning environment and educational approaches to show environmental problems, practical encounters and firsthand experience.

Very few programmes do really integrate the environment in the curricula, pay attention to experimentation and meet the needs of the children. These are all necessary ingredients for an environment education programme. For this to achieve, one would need to adapt the content and methods of education more loosely and also show more flexibility for the natural, cultural and human environment in which education is provided. What is needed is the appropriate mixture of awareness programme, exposure to real life, and conservation and developmental programme.

Different kinds of the programmes are needed at primary, lower, secondary and tertiary adult level.

At the primary level, environmental awareness is most important where development is of little use. As one goes to higher stages of education, environment awareness becomes less important and other components gain more importance. Finally, at tertiary and adult education level development is the most important aspect of environment education. Another way of looking at different aspects of environment education, i.e., environment sensitivity, factual knowledge, problem solving skills and planet earth philosophy with varying emphasis can be shown. Factual knowledge which is closely related to environmental awareness is very important in the early years of education. Their importance decreases with increases in the years of education.

3.4.3 Attitudinal Changes and Environmental Education

The primary objective of environmental education is to bring about a change in the attitude of the students.

According to Anastasi, 'An attitude is often defined as tendency to react favourably or unfavourably towards a designed class of stimuli, such as a national or a racial group, a custom or an institution.'

Positive environmental attitude implies,

- Awareness
- Cleanliness in actions
- Conservation
- Promoting environment

Programmes for Environmental Education

Following are the important programmes:

1. **School environment:** Many researches are carried on studying the effect of school environment on environmental awareness, values development, attitude changes and personality, and it is found that if a school provides a clean, hygienic, comfortable, emotional, social and creative environment, it will affect positively on awareness, value, attitude, creativity and interest of a child. This can be possible if the school provides:
   - Proper location
   - Building condition
   - Ventilation
   - Sanitation
   - Water supply
   - Cleanliness
   - Classroom
   - Facilities
   - Recreational programmes

   All these things provided in a proper and adequate form leave a positive effect on the child's personality and mind. A cooperative, emotional, integrated, organized and planned environment is provided to the students. They learn humanity for animals and plant life, and cooperative attitude towards solving environmental problems. He can learn to plan scientifically and solve critically. Therefore a cooperative, scientific, emotional, social positive attitude is developed.
2. **Presentation of curriculum:** The curriculum is pre-decided for a specific age group but it makes a significant effect on students if it is presented well.
   - Topic should be presented with teaching aids to make them interesting and more

informative.

- Different teaching methods and strategies should be decided for different topics.
- Arrangement of the topics in class must be simpler to difficult.
- Subject material is provided according to the need of students fulfilling the objectives.

- Creative assignments, projects and interesting experiments must be planned.

3. **Co-curricular activities:** In a monotonous schedule of classes, co-curricular activities play a role as a thirsty man finds a glass of water. Activities like tours, excursions, picnics, visits to zoos, gardens, movies, exhibitions, debate, essay, poem writing, slogan, poster, drawing competitions, etc., develop creativity, interest and attitude towards the subject which is involved in it. If the exhibitions, camps, rallies and tours are arranged to study environmental problems and find out their solutions, the students participate with interest.

   A proper coordination with teachers and peer group develops positive attitude. A motivated environment encourages students and their creative thinking and problem-solving attitude increase.

4. **Integrated and interdisciplinary approach:** Environmental education is interdisciplinary thus when this subject is taught the other subjects are also integrated. The content becomes more interesting and informative.
5. **Role of mass media:** In the race of development, mass media plays an important role. The media is store of knowledge. Therefore, the knowledge given by the Internet, printed material, radio, and T.V. programmes provide indirect knowledge to the students. Such programmes based on these techniques not only increase the students' participation but also improve their attitude.
6. **Involvement of students:** The active participation of students is the main objective of environmental education. As students are active they collect, analyse and make decisions independently. This way problem-solving attitude is developed among the students.
7. **Environmental values and ethics:** Environmental ethics and values develop new life style and new development patterns.
8. **Programmes for community awareness:** Many programmes decided by Government, non-government agencies include community to change the general views and develop positive attitude.
9. **Role of teachers:** A teacher plays a very important role in building attitude of the students. Teachers are the 'builders of nation' therefore a teacher's personality, behaviour, knowledge, teaching strategies and knowledge of technology helps to develop an environment of awareness. Teacher-pupil interaction creates an enthusiastic environment and students develop interest and attitude.

In order to ensure that people make positive choices about the environmental impacts of their lifestyles, there is an urgent need to create mass scale awareness on environmental and development issues.

According to study (Schwab, 1982-83) done on 117 teachers to observe rating of the effectiveness of different methodologies. Following is the result of the analysis of response.

Table 3.1 *Effectiveness of Different Methodologies*

	Method	Extent of use (%)	Mean effectiveness
1.	Teacher led discussion	**92**	**4.4**
2.	Lecture	**92**	**3.9**
3.	Individual projects	**87**	**4.7**
4.	Demonstrations	**86**	**4.1**
5.	Individual reports	**86**	**4.1**
6.	Reading	**85**	**3.9**
7.	Inquiry	**80**	**4.8**
8.	Student led discussion	**80**	**4.3**
9.	Group reports	**74**	**4.1**
10.	Independent study	**68**	**4.7**
11.	Cognitive skill development	**68**	**4.2**
12.	Debates	**50**	**4.5**

Many kinds of resources are being used for environment education ranging from low cost/no cost environmental material. A study (Tewkslew 1982) shows that the material prepared by the teacher in combination with commercial agencies is most popular. This is closely followed by material provided by the state education agency.

Selected results of this study are shown in Table 3.2.

Table 3.2 *Selected Results of Tewkslew's Study*

	Material	Percentage of Use
1.	Combination of commercial and teacher prepared material	**62%**
2.	Materials provided by the state education agency	**60%**
3.	Materials from various other resource agencies	**55%**
4.	Materials developed by teaching staff	**48%**
5.	Text books representing one or more disciplines	**29%**
6.	Text books of one discipline	**26%**
7.	Materials developed by the school committee	**19%**

The resources used for environment education may be classified under the following categories:

- **Resources of the locality:** The resources of the locality that establish link between community and education.
- **National organization:** Organizations such as NCC, Scouts and Guides and Railways can provide much needed information.
- **Grounds of the schools:** School ground can be developed into an important study centre with some planning and care.
- **Student's contributions:** Students' contributions are kept well and are made available for the future children.
- **Equipments:** Equipments are necessary for making accurate observations, collecting samples, measuring and recording.
- **Printed words:** Printed words can be in the form of publicity materials, handouts, posters, charts,

reports, etc.

- **Audio-visual aids:** Films, film strips, chart, tapes and tape recorder are important resources.

Study made by Schwaab (1982-83):

	Sources	**Extent of use %**	**Mean effectiveness**
1.	Journals and magazines	**71**	**4.9**
2.	Films	**68**	**5.1**
3.	Newspapers	**68**	**5.1**
4.	Supplementary books	**62**	**5.0**
5.	Textbook	**60**	**4.5**
6.	Filmstrips	**59**	**4.9**
7.	Personal slides	**45**	**5.2**
8.	Commercial TV	**39**	**4.9**
9.	Educational TV	**35**	**4.9**
10.	Audio Tapes/Records	**32**	**5.0**
11-	Commercial Slides	**28**	**4.2**

In one case (SC, 1974) the total list of all the resources is the following: **Resources**

1. Resources of Locality: Pupils, home areas, libraries, polluted water sources, etc.

2. National Organization: Telephone, directories, Bulletin of E.E., Environment Magazine,
3. The grounds of the school
4. Students contribution
5. Equipment

    - Monitoring, measuring and sampling apparatus
    - Recording equipment

6. Printed words
    - Publicity handouts
    - Statement of policy
    - Poster and charts
    - Catalogues of literature and visual aids
    - Government publication
    - Annual reports
    - Periodicals
    - Books

7. Visual aids
8. TV and Radio

CHECK YOUR PROGRESS

6. Fill in the blanks.
   (a) The curriculum is pre-decided for a specific age group but it makes a significant effect on students if it is _____ well.
   (b) School ground can be developed into an important _____ centre with some planning and care.
7. State whether True or False.
   (a) Basic education provides sense of responsibility and social sense.
   (b) Mass media is the quickest source of creating mass scale awareness.

ACTIVITY

Prepare a report on the major causes of environmental degradation in your state.

DID YOU KNOW

The Disaster Management Act was enacted by the Government of India in December 2005 which envisaged the creation of the National Disaster Management Authority (NDMA) to lead and execute a holistic and integrated approach to Disaster Management in India.

3.5 SUMMARY

In this unit, you have learnt that:

- Environmental degradation means overall lowering of environmental qualities because of adverse changes brought in by human activities in the basic structure of the components of the environment to such an extent that these adverse changes affect adversely all biological communities in general and human society in particular.
- Environmental pollution is taking place due to slow and gradual human activities, e.g., increase in human population, establishment of factories and industries, development of transportation facilities, etc. Environment pollution degrades the quality of the environment which can be protected by proper environmental management and assessment.
- With the socio-economic, scientific and technological development, serious problems of environmental degradation have emerged.
- Some steps taken for prevention of environmental degradation are:
- Rehabilitation of degraded land.
- Change in institutional arrangements.
- Reforestation programs.
- Thought for renewable energy resources.
- Creating mass awareness.
- Setting of environmental issues in syllabus.
- Feedback mechanism for different regions.

- Role of state Government in building up the laws and rules for conservation
- Agenda 21 takes into account all areas/subjects with bearing on global environment. It also covers different areas which could be employed to promote environmentally sound development policies. Some of the subjects are poverty, consumption patterns, demographic dynamics, deforestation, desertification, etc.
- The events caused by natural processes on human activities are called extreme events. These disturb and degrade natural environment causing disaster for the human society. For example, floods, droughts, cyclone, heavy rains, volcano and earthquakes make adjustment difficult for human beings and loss of property and lives is caused.
- When the discharged residuals spoil the ambient environmental quality, it causes changes in the flow of environmental services and the uses man makes of the environment.
- Agents which pollute the environment may arise from several sources and exposure to them can take place through different methods. Earthquake is an event in nature that causes injury or destroys property. Landslides or flooding disasters are closely linked to rapid and unchecked urbanization that forces low-income families to settle on steep hillsides or ravines or along the banks of flood prone rivers.
- Millions of people in the developing world are on a regular basis exposed to extremely harmful indoor emissions, which are considered to lead to persistent lung diseases and cancer.
- Man is the product of his social as well as his physical environment. In time of disaster, these strong bonds manifest themselves and take precedence over his ordinary behaviour. Social response to natural and man-induced disasters is generally in positive direction.
- Some scholars use environmental awareness and environmental education interchangeably. However, there is a great difference between these two terms. Environmental education is a comprehensive concept and it includes environmental awareness also
- To increase the people's awareness towards the importance of environmental protection, and to enable them to participate in the efforts of environmental conservation, the Government must implement environmental education and awareness programmes.
- Human beings have reached a stage where they are no longer content merely to respond to the environment. They now seek to adapt the environment to their own needs. Since conscious purposes govern the continually expanding area of human activity, any change in social objectives is invariably accompanied by a change in the system of education.
- Basic education is the concept formulated by Gandhi. It treats the child as a member of a co-operative group. The school is recognized as a community which offers the most suitable atmosphere for training in citizenship.
- Formal education is the most effective means that society possesses for confronting the challenges of the future. Global and local environmental issues are becoming severe year by year, which are considered to be attributed by climatic changes and human activities.
- The fundamental strategy for developing non-formal environmental education is to integrate explicitly into the ever-widening range of out-of-school education programmes already available. In recent years, non-formal education programmes and institutions for carrying them out have increased in number.
- India is presently facing environmental problems of enormous magnitude that adversely affect the lives of its people from all walks of life. Many of these problems have resulted due to a lack of understanding and concern about environmental and sustainable development issues.
- The National Policy on Education (NPE) 1968 has envisaged the protection of the environment as the core element of education at all levels. The policy has

' also recommended the creation of environmental consciousness among all ages starting with

school education.

- The Department of Science and Mathematics, on behalf of the NCERT also undertook a UNESCO sponsored case study on environmental education in India. This opportunity provided insight into the present states of environment education concepts and training at the school level, higher education and technical education levels.
- Due to inaccurate or insufficient information there is still a considerable lack of awareness of the interrelated nature of all human activities and environment. There is a need to increase public sensibility about the environment and development problems and involvement in their solutions and for a sense of personal environment responsibility and greater motivation and commitment towards sustainable development.
- Many researches are carried on studying the effect of school environment on environmental awareness, values development, attitude changes and personality, and it is found that if a school provides a clean, hygienic, comfortable, emotional, social and creative environment, it will affect positively on awareness, value, attitude, creativity and interest of a child.
- In a monotonous schedule of classes, co-curricular activities play a role as a thirsty man finds a glass of water. Activities like tours, excursions, picnics, visits to zoos, gardens, movies, exhibitions, debate, essay, poem writing, slogan, poster, drawing competitions, etc., develop creativity, interest and attitude towards the subject which is involved in it.

3.6 KEY TERMS

- **Environmental degradation:** It means overall lowering of environmental qualities because of adverse changes brought in by human activities in the basic structure of the components of the environment.
- **Environmental stress:** Environmental stress occurs when lives and property are affected by sudden natural hazards.
- **Vaccination:** Immunization with a vaccine in order to protect against a particular disease.
- **Environmental awareness:** It implies the knowledge and understanding of the issues relating to changes in the environment.

3.7 ANSWERSTO'CHECK YOUR PROGRESS'

1. Some major factors responsible for environmental degradation are:
   - Deforestation, i.e., excessive cutting of trees and forests
   - Overpopulation
   - Pollution of air, water, soil and marine
   - Depletion of ozone layer
   - Global warming
2. Some of the steps that can be taken to prevent environmental degradation are:
   - Rehabilitation of degraded land
   - Change in institutional arrangements
   - Reforestation programs
   - Thought for renewable energy resources
   - Creating mass awareness
   - Setting of environmental issues in syllabus
   - Feedback mechanism for different regions

- Role of state Government in building up the laws and rules for conservation
- Transformation of science and technology knowledge

3. The Environmental Management Plan (EMP) includes the following steps to maintain the quality of environment
   (i) Safeguard and prevent the adverse environmental impacts
   (ii) Plans for dealing with accidents and disasters (iii) Plans for rehabilitation
   (iv) Monitoring and feedback mechanisms on the implementations of necessary safeguards
4. (a) Environmental degradation
   (b) Pollution
   (c) Urbanization
   (d) Deforestation
5. (a) True
   (b) False
   (c) True
   (d) False

6 (a) presented (b) study

7 (a) True
   (b) True

3.8 QUESTIONS AND EXERCISES

Short-Answer Questions

1. State the causes of environmental degradation.
2. What do you mean by deforestation?
3. What is the significance of non-formal education for environmental education?
4. What are the essentials of school environment to bring about attitudinal change?

Long-Answer Questions

1. How is environmental degradation different from environmental pollution? Give steps for the prevention of environmental degradation.
2. Prepare a list of major non-governmental organizations in your region that are spreading environmental awareness among the masses.
3. Explain the different types of man-made disasters.
4. Describe the role of mass media in expanding environmental awareness.
5. Discuss the role of environmental awareness in environmental education.

3.9 FURTHER READING

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UNIT 4 APPROACHES FOR ENVIRONMENTAL EDUCATION

Structure

4.0 Introduction
4.1 Unit Objectives
4.2 Curriculum for Environmental Education 4.2.1 Stage Specific Curriculum
4.3 Inter and Intra-Disciplinary Approaches
4.3.1 Multidisciplinary Approach (Infusion)
4.3.2 Interdisciplinary Approach (Insertion)
4.4 Topical Units and Integrated Units
4.4.1 NCERT Approach to Teaching Environmental Education
4.5 Models—Infusion and Infused
4.6 Summary
4.7 Key Terms
4.8 Answers to'Check Your Progress'
4.9 Questions and Exercises
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4.0 INTRODUCTION

Environmental Education is holistic in nature. It has an idealistic approach which endeavours to change minds, promote greater awareness, greater understanding and critical reflections on the values of individuals about environmental issues and its dimensions.

The term curriculum comes from the Latin word 'Currere' which means 'to run', the course of the study. With time it came to mean the course of study. Thus, curriculum is a course of study or training leading to a product or education.

In this unit, you will study about the curriculum, the different approaches and models for environmental education.

4.1 UNIT OBJECTIVES

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

- Explain the need for curriculum development in education
- Describe the stages of curriculum development
- Summarize the two approaches for environmental education
- Recall topical and integrated units
- State the two models—infused and infusion

4.2 CURRICULUM FOR ENVIRONMENTAL EDUCATION

Agenda 21, the action plan of the United Nations on sustainable development, states 'Education, including formal education, public awareness and training should be recognized as a process by which human beings and societies can reach their fullest potential. Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues. It is widely accepted that *Education* is the most effective means that society possesses for tomorrow. Education is humanity's best hope and most effective means in the quest to

achieve Sustainable Development' (UNESCO, 1997).

Realizing *Education* as a potential instrument of social change, the National Policy on education, 1986 made Environmental Education apart of the general education at all levels, in particular at the school level. The significance and urgency of creating environmental awareness in school children has also been upheld by the Supreme Court through its directive to the Central and State educational authorities to make EE compulsory at the school and collegiate levels. (Hon'ble Supreme Court Directive - 2003).

One of the major concerns of this millennium is taking good care of the environment which nurtures all of us. We have now been living in a situation where environmental degradation is occurring at an unprecedented pace. Hence, the immediate need of the day is to bring about an awareness of the environment and its problems at all levels. Sincere efforts are needed to re-establish our links with the environment. We must protect the environment from 'ourselves'. It is our own life style, greed, selfishness and lack of awareness that is the starting point of all the problems related to the environment. The great scientist Albert Einstein said 'you cannot solve a problem with the same mindset which created it at the first place'.

An important challenge before us at present is to infuse in to the learning process, a spirit of question. In this process, environment becomes a medium for engaging young minds in the excitement of first-hand observation of nature and understanding the patterns and processes in the natural and social worlds.

Recognizing the central role of education in environmental protection and preservation, the National Policy on Education (NPE) states that, 'There is a paramount need to create a consciousness of the Environment. It must permeate all ages and all sections of society, beginning with the child. Environmental consciousness should inform teaching in schools and colleges. This aspect will be integrated in the entire educational process' (NPE, 1986).

The NPE, 1986 and the subsequent educational policies have positioned environmental awareness and education firmly in school education. The National Curriculum Framework (NCF) 2005 recognizes the critical role of the environment as the context in children's learning by emphasizing that 'Learning takes place through interactions with the environment around, nature, things and people, both through actions and through language. The physical activity of moving, exploring and doing things, on one's own, with one's peers or in the company of adults, and using language—to read, to express or ask, to listen and to interact—are the key processes through with learning occurs. The context in which learning takes place is thus of direct cognitive significance for meaningful learning' (NCF 2005).

EE aims at bringing awareness about the relationship between human beings and environment and the environmental problems/issues we are facing today because of our negative impact. It also provides the basic knowledge about how indigenous tradition and cultural practices are related to the environment. It inculcates habits, values, emotions and attitudes required to maintain and promote quality environment for the survival of mankind. EE aims at developing a sense of responsibility and eagerness to ensure appropriate actions to solve environmental problems. It aims at bringing about a change or transformation in the cognitive, affective and psychomotor behaviours of children. It is an action-oriented, project centred, and participatory process. It enables the development of self-confidence, positive attitudes and personal commitment towards environmental protection and improvement of the environment.

Significance of Environmental Education in Schools

EE in the education is visualized as an integrated subject area which draws upon insights from sciences (physical, chemical and biological), social studies (history, geography, civics, etc) and environmental education (protection and conservation). The approach in EE goes beyond single subject approach

and helps children to use the contents and methods of science and social sciences and environment to solve environmental problems/ issues in future.

One of the main focuses of EE is to expose children to the actual world they live in. The learning situations/experiences of EE help children to explore and connect with their natural and man-made surroundings. EE helps children to develop their own insights into the functioning of several things or understanding human processes in the environment. Such interactions with their surrounding environment are immensely important in the healthy development of children. Such interactions also enhance the learning capabilities of children by providing concrete learning experiences. The concept of local specificity with global thinking is the key to Environment Education. Think globally and act locally is a well known phrase in EE.

Schools should become a demonstration of the environmental values that the education system is trying to convey. The schools need to exemplify good environmental practices and should commumcate these to not only students, but also to the community at large. A comprehensive support system both within and outside the school system needs to be developed. This would involve various components with inputs from academicians, intellectuals and the society outside the school system. It would also involve media, networking with different media groups, institutes, NGOs, and other organizations.

Environmental Education with the inherent values of environment and its conservation is just not a subject area alone. It is a process leading to transformation of behaviours and a way of life. It focuses on all the three domains of learning-cognitive, affective and behaviours/actions in a graded manner.

Thus, the scope of EE at the school level may be summarized as enabling children to:

- Connect with their natural and man-made environment understanding our dependence on the various components of environment (biotic, abiotic and man-made)
- Develop a holistic understanding of their environment
- Develop a multidisciplinary perspective to understanding of our environmental issues/ problems and appreciate the impact/s of our daily activities on its integrity
- Develop favourable attitudes and habits to protect and preserve our environment

A careful reflection on the above objectives would reveal that they are centred on developing in children curiosity and awareness about their surroundings, knowledge and understanding of their environment and their relationships or connections, appreciation, values and attitudes, skills of observation and measurement, collection of information and its processing, creative expression, etc.

Schools play a critical role in supporting and helping children explore their environment and construct their own meaning from their interactions/experiences. By structuring and organizing learning experiences for children to explore, understand and express their experiences, EE in the primary stage contributes to development of conceptual understanding, attitudes and values, skills and habits/practices relating to a range of subjects at the primary, secondary and higher secondary level. Such learning experiences also introduce students to some of the hidden benefits such as development of appreciation and respect for nature and natural resources, diversity that exits in the environment, ability to express feelings and thoughts, etc.

4.2.1 Stage Specific Curriculum

The National Curriculum Framework (NCF) 2005, has prepared a fresh curriculum of environmental education for different class levels. The design is based on the feedback collected from school textbooks of different states. NCF structured the framework on the basis of the following:

- Achievement of educational goals in the schools

- Role of environmental education in achieving the goals
- Organization of environmental education experiences
- Evaluation

For effective teaching of environmental education following objectives related to knowledge, skill, and attitudes are essential:

Knowledge

To develop a sense and awareness of environmental issues the following objectives were taken into consideration:

- Natural environment
- Impact of human activities on the environment
- Comparison of past with present scenario of environment
- Environmental issues such as: (i) The greenhouse effect (ii) Acid rain and (hi) Air pollution
- Legislative provisions, Acts and regulations for dealing with environmental issues
- Formation of policies and framework for the environment
- Interdependence of Human life and environment
- Political Conflicts and issues arising from the use and misuse of natural resources
- Effectively implementing the laws made to govern the environment

Skills

Skills recognized to teach have been identified as:

- Communication skills
- Observation skills
- Analytical skills
- Problem solving skills
- Interaction skills
- Social skills and information technology skills

Attitudes

There is a need to promote a positive attitude towards the environment:

- Appreciation of care and concern for the environment
- Concern for other living beings on earth
- One's thoughts and views on the environmental issues
- Respect for others opinion
- Respect for rational argument and evidence

Going through the above objectives, the integrated course content was framed for different stages which is detailed below:

Primary Stage

The concepts covered in this framework are as follows:

- Familiarization with one's own body
- Awareness about immediate surroundings

- Need for food, water, air, shelter, clothing and recreation
- Importance of trees and plants
- Familiarization 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 occasion of national importance like Independence Day
- Awareness of sunlight, rain and wind
- Caring for pet animals
- Awareness about air, water, soil and noise pollution
- Need for protection of the environment
- Knowledge about the various sources of energy
- Importance of conservation of water resources and forests
- Indigenous and traditional knowledge about the protection of the environment

Upper Primary Stage

The major concepts covered at this stage are:

- Adaptation of living beings to the 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 industrialization on the environment
- Role of civic society in protection of the environment, personal and public property including monuments

Secondary Stage

The concepts of environmental education have been provided in the curriculum framework in the states of Rajasthan and Madhya Pradesh. The environmental concepts are taught both at the concrete and abstract levels. The concepts covered are:

- Biosphere
- Greenhouse effect
- Ozone layer depletion
- Use of fertilizers and pesticides
- Wildlife protection
- Composition of Soil
- Management of domestic and industrial waste
- Pollution of noise, air, water and soil and control measures
- 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
- 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 diversified students where two streams are found: academic stream or the vocational stream. Majority of the concepts are found integrated with the subjects like biology, chemistry and geography. Students opt for any one of these subjects.

The coverage of environmental education concepts in the textbooks of various subjects includes:

- Environment and sustainable development
- Pollution of the Atmosphere like 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

Along with these concepts, some co-curricular activities are also required to enhance the practical knowledge and skills. The approaches which can be applied in the teaching/ learning process can be

summed up as the following:

ACTIVITY

Conduct a survey among the students of fourth and fifth classes and find out about their knowledge of environmental education.

CHECK YOUR PROGRESS

1. What are the aims of environmental education?
2. What is the scope of environmental education at the school level?

4.3 INTER AND INTRA-DISCIPLINARY APPROACHES

The first international environmental conference at Stockholm in 1972 made some decisions about environmental education. It was felt that to solve the problems created by man's activity within the environment, environment oriented education is required. In India in the five-year plan the relationship between ecology and development was recognized. In this plan it was stated that 'The physical environment system is a dynamic, complex and inter-connected system in which any action in the first part affects the other parts. There is also the interdependence of living beings and their relationship with land, water, air, and planning for harmonious development which recognizes this unity of nature and man.'

In 1981, NCERT felt that environmental education must be an integral part of education from the early stages.

In 1986, the National policy on education felt the importance and need of environmental education. It was expressed as, 'There is a paramount need to create consciousness about the environment. It must permeate all edges and all sections of the society, beginning with the environmental consciousness inculcated in the child by teaching in schools and colleges. This aspect should be integrated in the entire educational process.'

The international environmental educational workshop held in Belgrade diverted attention towards environmental values and attitude by making environmental education an integral part of the curriculum.

According to the national curriculum for Elementary and Secondary Education; Framework 1988, presented the NCERT's view' School curriculum should highlight the measures for protection and care of the environment, prevention of pollution, and conservation of energy.'

After keeping these points in mind, it was decided to keep environmental education as a separate subject and other related topics to be integrated with subjects like science and social science in the higher classes.

The National Curriculum Framework for School Education (NCFSE), 2000 also felt the need of teaching environmental studies in the various stages of schooling. The fundamental duties (Article 51 A) of Part IV A of the Indian Constitution, promotes protection and improvement of the national environment including forests, lakes, rivers, wildlife and to have compassion for living creatures. 'Further, it mentions the general objectives as, 'understanding the environment in its entirety both natural and social, and its interactive processes, the environmental problems and the ways and means to preserve the environment.'

Therefore, the environmental concerns, issues and environmental basics were included in the curriculum taught in the schools.

Class	Subjects
I and II	1. Healthy and productive living
	2. Language and Mathematics
	3. Environmental Concerns
ni-v	1. Environmental Studies as a separate
VI-X	1. Social Science
	2. Language
	3. Science and Technology
	4. Environmental Studies
xn	1. Integrated with other subjects with topics related to Environment
	2. Conservation
	3. Disaster Management
College Level	
(Vocational Courses)	1. Environmental Education
	2. Rural Development as general foundation

Thus, a value based, action oriented course of environmental education is needed to:

- Acquaint students with the environment related issues and problems.
- Understand the problems, analyse, evaluate, draw inferences and equip themselves to resolve them.

In order to achieve the above mentioned objectives curriculum must focus on the following aspects:

- Learning about the environment
- Learning through the environment—exploring various activities
- Learning for the environment—developing sensitivity towards the environment, its protection and preservation.

To fulfill the above objectives, the curriculum must be designed in such a way that it not only provides knowledge but more importantly develops awareness, attitudes, values and skills by participating in activities, at all levels of school education both inside and outside the classroom.

4.3.1 Multidisciplinary Approach (Infusion)

Infusion means the component of environmental education (EE) is instilled into the various existing disciplines like Biology, Chemistry, Physics, Geography, Economics, Political Science, English and Hindi.

- In this approach, the content and skills are integrated into the existing course so as to focus on that content without losing the integrity of the course itself. Here, the emphasis is not given on the knowledge of content but on spread of awareness
- Attitude and skills
- Leading to actions

A combination of content and process (including projects and activities) is used to achieve the goals.

The major concerns and the environmental issues which are required to be addressed through the curriculum at different levels are:

- Concept and meaning of environment
- Components of environment
- Natural Resources
- Pollution and related problems
- Current environmental concerns and interdependence between man and nature.
- Energy Management
- Toxicology
- Health Hazards
- Agricultural Environment
- Ecology or Ecosystem
- Bio technology and environment
- Sustainable development
- Population and development
- Quality of life
- Environmental policies and provisions

At the national level, this has been emphasized in the context of different disciplines (NCERT), 1988.

1. Science

The views of NCERT to integrate environmental issues and concerns with the science subject is explained as—'there are three aspects of the study of physical and natural environment under the education of science.

- The pupil has to learn about the flora and fauna, natural resources, sources of energy, etc.
- Knowledge acquired through the physical and natural environment of the learner.
- Learning should be aimed at the development of a genuine concern, sensitivity and the ability necessary for the preservation and protection of physical and natural resources.'

'National Curriculum Framework for School Education (NCFSE), 2000, states that the school curriculum should therefore, help, to generate, to promote among the learners understanding of the environment in its totality, both social and natural and its interactive processes, the environmental problems and the ways and means to preserve the environment'

According to guidelines given by NCERT 2001:

Primary Stage: The science subject is included in the curriculum to make a child—

- Realize the beauty and arouse interest in the environment
- Develop aesthetic values and the ability to express them in different art forms
- Give respect, show concern towards mankind and the environment
- Coverage of topics is related to the child's surroundings, health and hygiene, field activities and observations
- Make the student physically, emotionally, and mentally healthy
- Function effectively as a member of the several groups (family, community) one belongs to
- Develop skills, attitude and values for improving the quality of the student as well as that of the community
- Realize the need to live in harmony with nature The learning

outcomes as defined by Delores' Report are: **Learning to get knowledge**

- Understand the structure and functions of human body
- Understanding of social, cultural, natural, manmade environment and their relationship
- Develop awareness about the need to conserve the surroundings and keep it neat and clean
- Conservation of natural resources, their protection and the ability to properly use the resources

Learning to acquire skills

- Develop skills of observation, reporting, collecting information, discrimination, and classification, experimentation, making predictions, estimations and drawing inferences
- Practicing healthy habits such as cleanliness, discipline, punctuality, proper care ofbelongings
- Develop skills of reading and drawing maps, use of globes and use of standard and non-standard units of measurement

Learning to live together

- Develop social skills, spirit of tolerance, team spirit, cooperation, unity and integrity
- To live together with people and with the surrounding environment in faith and harmony
- To respect the rules and laws of the various communities and abide by them **The child will**
- Understand the role of the individual at home, school and in community
- Indulge in creative activities
- Acquire self-learning habits and discuss about the surrounding environment
- Develop values like truthfulness, honesty, brotherhood and patriotism
- Develop aesthetic values, interest in environment, culture and traditions and express them by actions of respect
- Develop scientific temper in day-to-day life

Upper Primary Stage: As technology is increasingly influencing our lives; NCERT 2000 has recommended Science and Technology as a part of the curriculum to be taught at the upper primary stage. The main objectives are to provide:

- Promotion of scientific and technological literacy among learners
- Understanding the nature of science, scientific principles and laws relating to technology
- Values, joint enterprises of science, technology and society
- Development of manipulative skills
- Skill of handling equipments and experiments
- Awareness of the immediate environment
- Realize the need of protecting and conserving the natural resources
- Knowledge of renewable and non renewable sources, pollution, disasters, recycling and a lookout for alternative sources
- Development of skills to prepare assignments, field reports, projects, charts and models
- Opportunities to make a child self-sufficient and capable of solving problems
- Knowledge of the life process of human beings and dependence on nature, the natural cycle, diseases, nutrition and health

2. Social Science

The infusion of environmental concepts in social science has some objectives which are:

- To develop an understanding of the natural and human resources and their protection for further use.
- Develop a positive attitude towards conservation and preservation of the environment.
- Realize the importance of resources and the cultural heritage.
- Develop skills to collect different environmental data (rain, water, soil, petroleum, and air), their relation with human beings, presenting data in tables, graphs and drawing conclusions.
- Develop skills to prepare projects, assignments on the social, political and geographical environment.

Secondary Stage

Science and Technology: Develop an understanding of the various processes of the environment and concern for its conservation and preservation.

Senior Secondary Stage

Geography: Understanding and analysing the interrelationship between the physical and human environments and their impact on each other.

Chemistry: To equip students to face various challenges related to health, nutrition, environment, population, weather, industries and agriculture.

Biology: Encourage rationale/scientific attitude to issues related to population, environment and development, enhance awareness about environmental issues, problems and the appropriate solutions, develop appropriate environmental ethics and values.

Economics: To encourage and enhance knowledge about population control and statistics of census, and to promote knowledge regarding graphs and analysing data regarding national issues.

Infusion is visible at the elementary level but becomes less towards the Secondary and Higher Secondary level where classes are departmentalized and topically related.

Environmental Education Curriculum (Topical Units)

Social Science

The topics taught in class I-H:

1. MyBody
2. My Needs
3. My family and my home
4. My neighborhood
5. Transport and Communication
6. Natural Environment Class HI- V

Unit - Me and My Surroundings

1. Mybody
2. My needs

    - Food, water, air

- Shelter
- Clothing
- Health and hygiene
- Recreation

- Community service

3. My Surroundings
    - Natural phenomenon and resources
    - Transport and communication

Teaching\Learning Strategies

- Environmental visits
- Guided simple experiments
- Projects
- Individual/group activities
- Quiz/puzzles/games
- Role play/drama
- Teacher guided classroom activities **Class VI- VIH**

Unit- The Earth - Our Habitat

- **Four realms of the earth:** lithosphere, hydrosphere, atmosphere and biosphere.
- **Major relief feature of the earth:** continents and oceans.
- **India on the world map:** Physiographic divisions of India - Mountains, plateaus, and plains, climate, natural vegetation and wild life and the need for their conservation.

Project and Activity

- Preparing charts of trees, flowers, fruits and fibres
- Making maps and showing wildlife sancturies
- Trip to zoo and wildlife sancturies

Learning Outcomes

Students will be able to:

- Explain the interrelationship between the different realms of the earth
- Understand major landforms of the Earth
- Comprehend broad physiographic division of India
- Describe the influence of land, climate, vegetation and wildlife on human life
- Appreciate the need for conserving natural vegetation and wildlife **Class VII**

Unit II: Our Environment

- **Environment in its totality:** Natural and Human Environment
- **Natural Environment:** Land - interior of the Earth, Rocks and minerals - Earth movements and major land forms
- **Air:** Composition, structure of the atmosphere, elements of weather and climate, temperature, pressure, moisture and wind
- **Water:** Fresh and saline, distribution of major water bodies, ocean water and their circulation

- Natural vegetation and wildlife
- Human Environment: Settlement, transport and communication
- Man - Environment interaction: Case studies - Life in the desert regions - Sahara and Ladakh, life in tropical and sub tropical regions - Amazon and Ganga -Brahmaputra, life in the temperate region - Prairies and the Veldt

Proj ect and Activity

- Observations regarding the local, cultural environment, types of houses, settlement patterns, transport systems, communication methods and vegetation
- Collection of stories and the changes taking place in the surroundings
- Collect more information about the areas other than given in unit

Unit III: India - Land and the People

- **India:** Location, relief, structure, major physiographic units, rocks and minerals, soils, their distribution and impact on life
- **Climate:** Factors influencing the climate, monsoon - its characteristics, rainfall, temperature distribution, seasons, climate and human life
- **Drainage:** Major rivers and tributaries, lakes and seas, role of rivers in the economy, pollution of rivers, measures to control river pollution
- **Natural vegetation:** Vegetation types, distribution as well as altitudinal variation. Need for conservation and various measures of conservation
- **Wildlife:** Major species, their distribution, need for conservation and various measures to protect wildlife
- **Population:** Size, distribution, age, sex composition, population change - migration as a determinant of population change, literacy, health, occupational structure, and national population policy - adolescents as an underserved population group with special needs

Project and Activity

- Survey and reporting of landforms, locality, and its influence on transport, communication and settlement
- Posters -Pollution of rivers, rainfall harvesting, depletion of forests, global warming and soil erosion

Environmental Education Curriculum (Topical Units) Science and

technology

Course Structure Class VI

Unit 1-Our Earth

- Factors essential for life on earth
- Structure of the earth- its crust, mantle and core
- Atmosphere, oceans, water and soil
- The Earth and Solar system
- Uniqueness of the planet earth

Unit 2- Our Environment

- Physical and biological environment
- Biotic and Abiotic components
- Biotic components- plants and animals
- Abiotic components- light, temperature, air, water, soil
- Interaction between biotic and abiotic components
- Socio-cultural environment

Course Structure Class VII

Unit 1- Life on Earth

- Role of man in the conservation, maintenance and judicious use of resources with reference to forests, soil, minerals, water and air

Unit 2-Water

- Water Pollution-cause and prevention

Course Structure Class VIII

Unit 3

- Soil pollution, soil erosion and prevention
- Air pollution- causes and prevention
- Green house effect, acid rain

Course Structure Class IX & X (infused in Social Sciences)

- Climate and human life
- Measures to control river pollution
- Wildlife- major species and their distribution, need for conservation and various measures
- Population

Class X

Unit 4

- Degradation and conservation of natural resources
- Forest and wildlife, conservation and protection of forest and wildlife
- Need for conservation of water resources and checking pollution
- Industrial pollution and degradation of the environment, measures to control degradation

Course Structure Class IX & X (infused in Science & Technology)

Class IX

Unit 5- Environment

- Habitat and adaptation
- Ecosystem

Unit 5- Environment

- Causes, prevention and control of soil erosion, pollution of air, water, etc.
- Ecological Balance
- Environment and its development
- Environmental laws

Environmental Education curriculum (Topical Units)

At Higher Secondary Stage (Class XI & XII)

1. Geography

Class XI

- Life on Earth
- Wildlife
- Soil Conservation
- Natural Hazards

Class XII

- Resources and sustainable development
- Environmental pollution

2. Economics

Class XI

- Population-Environment

4.3.2 Interdisciplinary Approach (Insertion)

In the Insertion approach, relevant components of many discipUnes are drawn to create a unit of environmental education. A course on the global or environmental issues which is developed as per the investigation skills format is an example of insertion. This approach with the teacher (educator) acting as the facilitator and advisor is more effective in developing awareness and fostering positive attitude towards environmental issues.

The present efforts to develop curricula in the area of environmental or population education indicate a trend towards interdisciplinary approach to curriculum design. These areas are challenging in the sense that they require consideration in the context of biological, sociological, historical, economic and political realities.

The interdisciplinary approach in curriculum helps in the following ways:

- Understanding the field of different subjects in a better and more realistic manner
- Solving various problems of the human society in an effective manner
- Providing awareness of key concepts and general ideas that have emerged in different subjects

In the implementation of this type of curriculum, some problems are faced as it is totally based on skills. Therefore,

- Team teaching programmes are needed during teaching. The team teaching programme is only restricted to micro teaching and the method of teaching classes for pre service teachers.

- Trained and experienced staff is not available for some subj ects.
- Lack of coordination can hinder the effectiveness of this programme.
- College and university never provides such opportunities.

If we want to live in harmony with our environment and want to utilize different areas of specialization then we have to adopt a team teaching approach. In order to achieve this goal, colleges, universities and institutions have to provide such opportunities to scientists, social scientists and trainers to plan techniques and material for the implementation of total approach.

The interdisciplinary approach supports and is based on the subject-centered pattern of the curriculum. In this type of curriculum, different subjects like history, language and mathematics are included according to the level of various stages. Economics, psychology and sociology are introduced at the secondary and senior secondary stages of schooling. The content which is considered to be included in different subjects is kept with an idea that lays emphasis on:

- Details of cultural heritage
- Cognitive functioning of the child
- Expansion of knowledge
- Internal order of subjects may be presented in a particular sequence
- Presentation in suitable units or branches.

Every discipline has a basic structure. This structure is reflected in the organization of the content and the interrelationship among its various components.

- Every discipline supplies its concepts, skills, rules as well as principles
- Subject knowledge is on priority
- Changes occur only when subject matter changes and content is reorganized
- Content and learning outcomes decide the methods of teaching
- Organization of content is based on the logic of the structure of the discipline.The classroom curriculum models can be distinguished in two general categories: the topical unit model and the integrated model.

Table 4.1 *Interdisciplinary vs Multidisciplinary Approach*

S.No	Basis	Interdisciplinary	Multidisciplinary
1.	Implementation	Easy to implement.	Comparatively difficult to implement
2.	Teacher	No especially trained teachers are required.	More training is required to teachers to teach the content to the students.
3.	Coordination	Coordination is not required as it is a single subject.	Greater coordination is required among teachers.
4.	Time	Time is required to complete the course content.	Less time is required to complete the course content.
5.	Curriculum load	There is an additional load on environmental education curriculum.	There is minimum load on environmental education curriculum.
6	Curriculum development	Components are easily identified and arranged in sequence.	Components can be identified and accommodated in the existing curriculum.

7.	Evaluation	A comprehensive evaluation is easier to apply.	Comprehensive evaluation is difficult due to different variables.
8.	Class Level	More appropriate at the secondary level rather than the elementary level.	Appropriate at all levels of classes.
9.	Goals	Some goals of environmental education may be achieved at secondary and tertiary levels.	The goals of environmental education are achieved at every level.

CHECK YOUR PROGRESS

3. What was the contribution of the first international environmental conference at Stockholm in 1972?
4. What are the major environmental issues which need to be addressed through the curriculum at different levels ?

4.4 TOPICAL UNITS AND INTEGRATED UNITS

Topical Approach

Topical arrangement means that a topic should be finished entirely at one stage. It takes the topic as a unit. Topical arrangement requires that easy and difficult portions of a topic should be dealt with at one stage only.

In this system the topic which is dealt with earlier receives no attention later and so there is every chance of being forgotten. The main defect in the topical method is that it introduces in the curriculum a large amount of irrelevant material for which the students have no time and no immediate need or the use at that particular stage. They are introduced with a view to make the teaching of the topic complete and thorough. Hence, topical method demands that a topic once taken should be finished in its entirety.

Integrated Approach

Before knowing this approach, we have to understand conceptual approach. In activities a child gets the opportunity to touch, feel, taste, handle, smell and so on. These result in percepts. Percepts develop from impressions of awareness of sensations caused by an environmental stimulus which requires little interpretation. Percepts are primary factors in thinking which often initiate train of thought.

When percepts are recalled at some later time without the presence of the external stimuli, the memories and images are already formed. The percepts in the form of images and memories develop into greater abstractions called concepts. The concepts are usually formed as a result of many related sensations, percepts and images. For example, if a child has distinguished apple from other fruits, that means that the child has applied the word apple to a group of ideas which include the image and then the memories in the form of shape, colour, size etc. of the apple and has developed a concept. The concepts are usually organized as a result of many related sensations percepts and images.

In case of teaching Science, it is important to teach concepts and process both. For example if the concept of temperature is being taught then the child has to be taught to measure temperature using a thermometer or when a child is taught to find out weight I of a body by spring balance, then it is imperative to teach the child to record weight using ; a spring balance or reading scale of the spring balance.

Here weight is a concept and process. Hence we use both the approaches \ conceptual approach and process approach together i.e. at primary level teaching through] integrated approach is more effective. Conceptual Approach involves Child Centred Approach and Process Approach involves Teacher Centred Approach. Thus, using both the approaches together is Integrated Approach.

4.4.1 NCERT Approach to Teaching Environmental Education

A comprehensive consultation strategy was evolved by the NCERT keeping in view the paramount urgency of introducing Environmental Education (EE) as a compulsory subject in schools. The experts, environmentahsts, educationists and organizations working in the field of environment and EE were approached to give their comments and suggestions on the seven specific issues identified as being critical to development of syllabus for EE.

An issue wise analysis of comments and suggestions received is given below:

1. Scope and dimensions of environmental education at elementary, secondary and higher secondary levels of school education

EE has generally been visualized as a multidisciplinary area of study. The scope is broad based and encompasses physical, chemical, biological, social, cultural and human dimensions of study. All the dimensions are closely interrelated and influence one another. The themes, which emerge prominently, include interdependence of man and nature, ecologically and socially sustainable development, pollution and the problems it creates md the preservation and conservation of natural resources. The other themes that find i prominent place are population, human health, impact of science and technology, ndustrialization, culture, ethics, agriculture and economics.

The main focus of EE is to expose students to the actual world they live in. They have to be acquainted with the environment related issues and problems. They must also be able to look at the environmental problems and concerns, analyse, evaluate, draw inferences and equip themselves to resolve them. To achieve this, the curriculum could 1 be based on the three common aspects:

- Learning *about* the environment
- Learning *through* the environment— exploration through a variety of activities
- Learning/or the environment by developing a genuine concern for and sensitivity towards its protection and preservation

In order to realize the above, the objectives of EE need to focus not only on ; knowledge but more importantly on generating awareness, developing attitudes, values / and skills, and promoting participation and action among children at all levels of school / education. By implication, learning opportunities would not remain limited to the classroom j alone but extend much beyond it.

On the issue of viewing EE as a compulsory subject with reference to the different stages of school education, i.e., elementary, secondary and higher secondary, the common consensus on the scope and dimension at each stage, as it emerged, is as follows:

- Elementary: Coverage to be related to the child's surroundings, health and hygiene along with suitable field activities and observations
- Secondary: Moderate exposure to various environmental concepts, plant and animal life, their interaction with the environment, pollution and other problems

- Higher secondary: Greater exposure to all the topics covered at the previous levels, in addition, some other topics could also be included

Integration of topics, not only at the elementary level but also at the secondary and higher secondary levels could also be done. To facilitate this process, the basic inputs and ideas about the environment along with concrete examples could be given through components in the physical sciences and life sciences.

In addition to the above approaches, another view could be that of a mixed approach.

The underlying philosophy in determining the scope and dimensions of the syllabus could also be highlighted in a variety of ways. Gandhiji's concept of correlation in three spheres, i.e., *self, society* and *nature,* focuses on the *inner man.* The holistic framework focusing on 'man in nature' and education correlated to life and the total environment is to be thought of. At the same time, nature having its own value, regardless of its value to human beings, is important too.

The main purpose of EE is to acquaint and sensitize the young minds to the environmental problems and concerns, to inculcate in them healthy personal and social attitudes and behaviour towards environment. This will enable them to initiate work for its sustainability individually and collectively taking together peers and community.

2. Significant elements of the content and process including projects and activities for EE

EE as an interdisciplinary subject has not only to lay emphasis on content but also on the development of awareness, attitudes and skills, leading to action. The content and process including projects and activities arc to be geared towards creating a sustainable world.

Themes: There is a nationwide commonality of perception regarding the major concerns and issues of EE. These include:

- Concept and meaning of environment
- Components of environment
- Natural resources
- Pollution and related problems
- Current environmental concerns and interdependence between man and nature
- Energy management
- Toxicology
- Health hazards
- Agriculture and environment
- Ecology/ecosystem
- Bio-technology and environment
- Sustainable development
- Population and development and the quality of life
- Environmental policies and legal provisions

The topics suggested for inclusion in the syllabi are as given below.

- Natural resources (flora, fauna, air, water, land, minerals)
- Biological diversity
- Marine life
- Inter-dependence of man and environment
- Environmental degradation
- Environmental problems and hazards

- Environmental pollution _ air, water, soil, noise
- Waste management
- Disaster management
- Protection of human health conditions and quality of life
- Conservation of energy, soil, wildlife, forests, water
- Renewable resources
- Eco-friendly and indigenous technologies
- Water resources management
- Sustainable development
- Sustainable agriculture
- Environmentally sound management of biotechnology
- Environmental policies and programmes
- Environmental information resources
- Acts, laws and regulations
- Role of government and non-governmental agencies.

Pollution in its various aspects emerges as a very important concern and a critical area of attention. Equally prominent are the local indigenous methods and traditional practices to bring solutions and changes in the local context.

In order to make the content of EE relevant to the students' life, it should reflect local environmental concerns, problems and local specific needs and be responsive to local specific challenges.

Considering the environmental components like (1) Real life situation (2) awareness (3) conservation and preservation of natural resources (4) sustainable development; National Curriculum Framework (2006), has suggested consideration of the following aspects in the curriculum at different stages.

Elementary Stage: Emphasis must be given on topics like-

- 75 per cent on building awareness
- 20 per cent on real life situation
- 5 per cent on conservation of natural resources

Lower Secondary Stage: The topics are arranged in such a manner that more weightage is given to real life situations than awareness.

- Real life situation
- Awareness
- Problems and their solutions

Higher Secondary Stage: Emphasis is on the following topics-

- Conservation
- Assimilation of knowledge
- Problem identification
- Activities and skill

4.5 MODELS—INFUSION AND INFUSED

Multidisciplinary and Interdisciplinary approaches symbolize the whole of environmental education curriculum framework through a range of disciplines. There is a thin line dividing the two

approaches and much depends on the matter of the curriculum.

A multidisciplinary approach presents environmental matters through a range of disciplines infused in various subjects.

In the interdisciplinary approach the content of teaching becomes unified by using matter from various disciplines simultaneously and forming a single subject.

CHECK YOUR PROGRESS

5. State any five topics which are considered necessary to be integrated in the curriculum by NCERT.
6. What are the different aspects that need to be considered in the curriculum at different stages by the National Curriculum Framework (2006)?

DID YOU KNOW

The UESCO's Training Workshop on Environment Education (1980) suggested the two models-fused and infusion.

4.6 SUMMARY

In this unit, you have learnt that:

- The definition of curriculum has changed with the new trend being set in the system of education and its process is continuous, therefore, the new definition of curriculum is very broad.
- The four components of curriculum are: (i) objectives (ii) subject matter (iii) methods and organization (iv) evaluation.
- Curriculum development is a specialized task which needs effective thinking, experience and skill. It is tri polar process in which every element is interrelated.
- The National Curriculum framework (NCF) 2005, has prepared a fresh curriculum of environmental education for different class levels.
- The first international environmental conference at Stockholm in 1972 made some decisions about environmental education.
- In 1986, the National policy on education felt the importance and need of environmental education.
- Infusion means the component of environmental education (EE) is instilled into the various existing disciplines like Biology, Chemistry, Physics, Geography, Economics, Political Science, English and Hindi.
- In the Insertion approach, relevant component of many disciplines are drawn to create a unit of environmental education.
- The interdisciplinary approach in curriculum helps in (i) Understanding the field of different subjects in a better and more realistic manner (ii) Solving various problems of the human society in an effective manner.
- Every discipline has a basic structure. This structure is reflected in the organization of the content and the interrelationship among its various components.
- The classroom curriculum models can be distinguished in two general categories: the topical unit model arid the integrated model.

- Multidisciplinary and Interdisciplinary approaches symbolize the whole of environmental education curriculum framework through a range of disciplines.
- In the interdisciplinary approach the content of teaching becomes unified by using matter from various disciplines simultaneously and forming a single subject.

4.7 KEY TERMS

- **Pedagogy:** It is the art or science of teaching.
- **Infusion:** It implies that the component of environmental education (EE) is instilled into the various existing disciplines like Biology, Chemistry, etc.
- **Cognitive function:** It is an intellectual process by which one becomes aware of, perceives, or comprehends ideas. It involves all aspects of perception, thinking, reasoning and remembering.

4.8 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Environmental Education aims at bringing awareness about the relationship between human beings and environment and the environmental problems/issues we are facing today because of our negative impact. It also provides the basic knowledge about how indigenous tradition and cultural practices are related to the environment. It inculcates habits, values, emotions and attitudes required to maintain and promote quality environment for the survival of mankind. EE aims at developing a sense of responsibility and eagerness to ensure appropriate actions to solve environmental problems.
2. The scope of EE at the school level may be summarized as enabling children to:

    - Connect with their natural and man-made environment understanding our dependence on the various components of environment (biotic, abiotic and man-made)
    - Develop a holistic understanding of their environment
    - Develop a multidisciplinary perspective to understanding of our environmental issues/ problems and appreciate the impact/s of our daily activities on its integrity
    - Develop favourable attitudes and habits to protect and preserve our environment

3. The first international environmental conference at Stockholm in 1972 made some decisions about environmental education. It was felt that to solve the problems created by man's activity within the environment, environment oriented education is required.
4. The major concerns and environmental issues which need to be addressed through the curriculum at different levels are:

    - The concept and meaning of environment
    - Components of environment
    - Natural Resources
    - Pollution and related problems
    - Current environmental concerns and interdependence between man and nature.
    - Energy Management
    - Toxicology
    - Health Hazards
    - Agricultural Environment

- Ecology or Ecosystem

5. The topics which are considered necessary to be integrated in the curriculum byNCERTare:
   - Natural resources
   - Biological diversity
   - Marine life
   - Environmental degradation
   - Waste Management

6. National Curriculum Framework (2006), has suggested consideration of the following aspects in the curriculum at different stages.

   Elementary Stage: Emphasis must be given on topics:
   - 75 per cent building up awareness
   - 20 per cent real life situation
   - 5 per cent conservation of natural resources

   Lower Secondary Stage: The topics are arranged in such a manner that more weightage is given to real life situations than awareness:
   - Real life situation
   - Awareness
   - Problems and their solutions

   Higher Secondary Stage: The emphasis on the following topics:
   - Conservation
   - Assimilation of knowledge
   - Problem identification
   - Activities and skill

4.9 QUESTIONS AND EXERCISES

Short-Answer Questions

1. What do you understand by curriculum development?
2. Write a short note on the two approaches for environmental education.
3. Briefly describe the topics that should be integrated in the curriculum as per NCERT

Long-Answer Questions

1. Explain the relationship between the four components of curriculum.
2. Describe the process of curriculum development.
3. Explain in detail the various objectives related to knowledge, skill and attitudes for effective teaching of environmental education.
4. Explain in brief the course content designed for different stages by the National Curriculum Framework (NCF), 2005.
5. Explain through a diagram the multidisciplinary and interdisciplinary approach.

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