Lectures

In

Environmental education

Content

Chapter 1

Meaning, Definitions

and Characteristics of Environmental Education

Introduction

Dear student, in the past few decades, concerns have been expressed all over the world on the way our Environment is getting degraded and its effect on the life support systems. Never before in the human history has so much been talked and written about the problems of the environment as it has been done today. As you are aware, both the developed and the developing countries are facing innumerable environmental problems resulting out of human greed and quest for progress and development. Just think for a while. What would happen if the present rate of environmental destruction continues unchecked? It is predicted that the results would be catastrophic, threatening the very existence of life on earth. Although the severity of the problem and its magnitude has been realized all over the world, much needs to be done to overcome the mounting problem.

There is a growing awareness in the country that it is only through education that people could be made aware of the various environmental problems and find solution to overcome them. As a result of this, Environmental Education has become a part of our school, college, professional and technical education curricula. Knowledge of Environmental Education is vital to teachers as it helps them in planning Environmental Education programmers and activities in their schools for training the youth to think and act for the environment.

Meaning of Environmental Education

Before we make an effort to understand the meaning of Environmental Education, it is better if we have some idea about environment itself. What is environment according to you? Environment is the sum-total of physical and biotic conditions influencing the response of the organism. All of the external physical and biological factors that directly influence the survival, growth, development and reproduction of organisms depicted as environment. It comprises of biotic or living environment which refers to the relationships between different organisms and the physical or abiotic or non-living environment controlled by physical factors such as temperature, soil and light. The life-supporting environment of planet earth is composed of three components mainly air, soil and water. Life cannot be imagined without these components of the earth.

Man's environment is all that surrounds him wherever he lives. It has natural, physical, social and cultural dimensions. Man not only adopts himself intelligently to his environment but seeks to control, modify and regulate it to his advantage. He also tries to understand and master it and utilize its immense potential for his benefits. While man has the nature given right to utilize all natural resources moderately, even maximally, for his benefits he has no right to exploit them beyond reasonable limits and upset the balance, harmony and rhythm in natural systems. He has to realize that this would cause serious threat and harm to his own life on this earth. What is true of the natural environment is true of the man-made

environment too. Both should be sustained, enriched and utilized in wholesome ways.

How do we understand environment more precisely in terms of its various elements and our interaction with it? Some of the commonly referred definitions of environment are given below. Examine these definitions critically and analyses them keeping the following questions in mind.

1. What are some of the key terms referred in the definition?
2. Do they reflect any particular element of nature or view point?
3. Are they comprehensive in portraying the various elements that constitute our environment?

1. “Environment includes a complex of natural, built and social components in the life of the humanity and that the social components constitute a set of cultural, moral, personal values and interventions”.
2. “Environment includes water, air and land and the interrelationship which exists among and between water, air and land and human beings, other living creatures, plants, micro-organisms and property”.
3. “Environment is simply the world around us. It starts with the skin of our body and reaches out in all directions, in ever widening circles, until it embraces even the universe”.
4. “Environment is not only the sum of all the material things that constantly interact with each other and which make up the mosaic of the country side landscape. It is much more than this. It also includes the economic structures and the outlook and habits of people in different parts of the world”.

5. “Environment is the sum of all the external conditions and influences affecting organisms. The environment consists of abiotic (non-living) and biotic (living) components. The abiotic components include soil, water, air, sunlight etc. and the biotic component includes all the living organisms. The environmental components act as a whole”.

6. “Environment includes all that is “within” and “without” us. Etymologically, environment means „surroundings“. It includes all the living and non-living objects as well as situations and factors, which affect the organism directly or indirectly and includes substances (soil, water), conditions (temperature, light), forces (wind, gravity), organisms (plants, animals) and time. It is well said that „with every breath you draw in, a part of the environment becomes part of you“. Similarly, „with every breath you give out, a part of you becomes a part of the environment“.

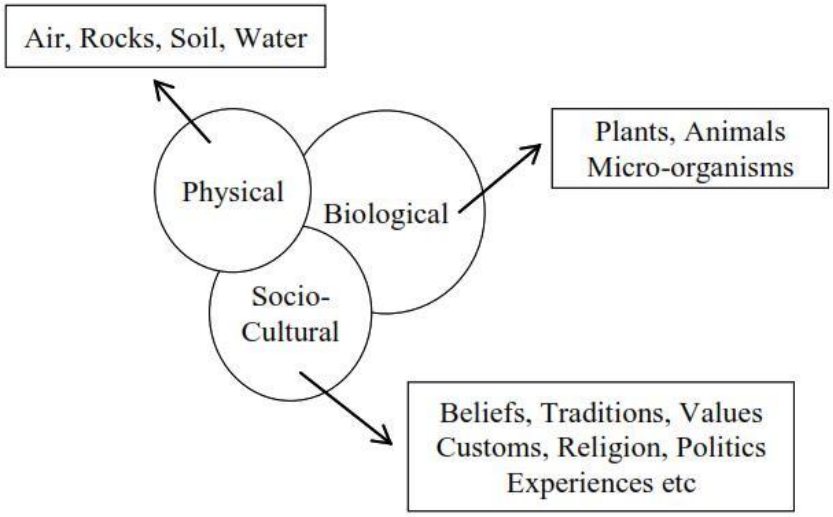
7. “The environment is the complex of climatic, edaphic and biotic factors that act upon on organism or an ecological community and ultimately determine its form and survival. It is also an aggregate of social and cultural conditions that influence the life of an individual or a community”.

What observations have you made after analyzing the above given definitions of environment? A careful analysis of these definitions would reveal that environment involves elements and factors of nature and human interactions. You would notice, from a comparison of the definitions that they are very broad and include not only physical or biological, but also socio-cultural aspects of the environment. The socio-cultural aspects of environment include man-made things that are products of civilization, technological development and progress. The socio-cultural environment specifically refers to the social, cultural, economic, political and religious

aspects of the environment. All these aspects constantly influence the interaction between living and non-living organisms.

Thus, environment could be visualized as the sum total of all the physical, chemical, biological, economic, social and cultural aspects influencing and interacting with the organisms. It is the whole set of natural and social systems in which people and other organisms live and draw their sustenance from. This interaction has been presented in the following diagram.

Diagram: Interaction of various components of environment.



As mentioned earlier, in nature, everything is connected with one another, be it biotic (living) or abiotic (non-living), directly or indirectly. They are interconnected, inter related and interdependent. Human beings are only a part of this complex web of life. If human actions/ behaviors do not respect this cosmic reality, then it violates the integrity of Earth's

wholeness. To avert the impounding disasters, we need to become aware of our critical role in maintaining the balance on the planet Earth and strive for its maintenance. This is very critical because we, the modern generation, have always taken environment for granted and have lived apart from it, rather being a part of it. Unfortunately, it is this concept and the resulting behaviors that have led to all of our environmental disasters and problems which we are facing today.

Now let us understand what Environmental Education is, Environmental Education is education about the environment, for the environment and through the environment. Its purpose is to protect, conserve and sustain the environment and to regulate its utilization in wholesome ways. It calls for human beings to live in harmony with their natural world, embracing all plants and animals, on which they depend for their survival and well-being.

All human beings have to recognize that it is we who are responsible for creating the present environmental crisis and it is only we who can check further degradation. Since our survival depends on a healthy environment, we need to evaluate carefully the effects of our actions on the environment. We can no longer be complacent with the thinking that environment exists only to serve our needs and wants. We must realize that much of our so called “Progress and Development” has resulted in the depletion and degradation of the environment. Protection and preservation of the environment must be integrated for the benefits of further generation. To achieve this, an environmentally enlightened community with sound, environmental knowledge, attitudes, values and skills is necessary. Environmental Education is expected to play this critical role.

Environmental Education enables us to:

- Understand that human beings are an inseparable part of the environment. We are part of a complex web of systems that links individuals, their culture and the biotic and abiotic elements of nature.
- Recognize that it is „we" who are responsible for creating the present environmental crisis and it is „we" who have the ability to mitigate the problems of environment, strengthen and maintain the health of this planet Earth.
- Recognize that each one of us has a moral responsibility to develop and maintain high quality natural and social systems which will advance human well-being and maintain ecological stability.
- Recognize that the bio-physical world contains a range of renewable and finite resources, which human beings can develop to satisfy their needs and wants. However, we need to limit our needs and wants with due consideration for the generations to come.
- Understand that our environment is getting degraded day-by-day due to unwise use of natural resources. We need to modify our life styles in order to ensure ecologically sustainable development.

Environmental Education is a continuous activity and a life-long process. It should be extended to all people, in different age groups and places with appropriate aims and contents, methods and strategies. It should adopt a combination of formal, non-formal and informal approaches. It would essentially be multi-disciplinary as it includes contents from Geography, Geology, and Biology and even other physical and social sciences. It should aim to develop appropriate awareness, knowledge, attitudes and skills.

Definitions of Environmental Education

After having understood the meaning of environment and environment education, let us now consider some of the definitions of Environmental Education.

Below are given a few of the definitions of the term Environmental Education as defined by various International and National Commissions and Individuals. Read the definitions and analyse them critically for the different perspectives, objectives and outcomes which each one of them highlights. What do they share in common? You can record your observations in the space provided.

1. The purpose of Environmental Education is to create an awareness and understanding of the evolving social and physical environment as a whole, its natural, man-made, cultural and spiritual resources, together with the rational use and conservation of these resources for development.

2. Environmental Education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter relatedness among man, his culture and his bio-physical surroundings. Environmental Education also entails practice in decision-making and self-evaluation of a code of behavior about issues concerning environmental quality.

3. Environmental Education aims at developing a citizenry which is aware of and concerned about the total environment and its associated problems and that has the knowledge, attitudes, motivation, commitment and the skills to work individually and collectively towards solution of current problems and prevention of new ones.

4. Environmental Education is a process of developing a world population that is aware of and concerned about the total environment and its

associated problems and which has the knowledge, skills, attitudes, motivation and commitment to work individually and collectively towards solution of current problems and the prevention of the new ones.

5. Environmental Education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems and motivated to work towards their solution.

6. Environmental Education is an across the curriculum approach to learning which helps individuals and groups to understand the environment with the ultimate aim of developing caring and committed attitudes that will foster the desire to and ability to act responsibly in the environment. Environmental Education is also concerned not only with knowledge but also with the feelings, attitudes, skills and social action.

7. Environmental Education is the interdisciplinary process of developing a citizenry that is knowledgeable about the total environment – including both its natural and built aspects – that has the capacity and the commitment to engage in inquiry, problem-solving, decision making and action that will assure environment quality.

8. Environmental Education is a life-long process that involves all of us as learners and educators; is interdisciplinary, integrates the historical, political, social, economic and cultural contexts; covers a wide learning spectrum from awareness, understanding to action; values indigenous and local knowledge; recognizes the role of both women and men in environmental protection, while contributing to the empowerment of women; is contextualized to the local and global realities and explores participatory and creative learning methods that are culturally appropriate.

You might have noticed one thing in common in all the definitions, that is, all of them consider environment in its totality and highlight the need for developing favorable behaviors – knowledge, attitudes and skills for protecting and preserving the environment.

Characteristics of Environmental Education

What makes Environmental Education? Environmental Education has been often confused with nature camping, trekking in forests, wild life education etc. It has been most of the times taken to mean as understanding about the environment. However, with the increasing awareness of the environmental problems and the need to equip people with the necessary knowledge, attitudes, values and skills to solve them, today, Environmental Education is expanded to include not only education about the environment, but also education in and education for the environment. These three prongs of Environmental Education have been described briefly in the following paragraphs.

1. Education about the environment

a) Provides understanding of how natural systems work.

b) Provides understanding of the impact of human activities upon them.

c) Develops environmental investigation and thinking skills.

2. Education in the environment

a) Gives reality, relevance and practical experience to learn through direct contact with the environment.

b) Develops skills for data gathering and analysis.

c) Develops aesthetic appreciation.

d) Fosters environmental awareness and concern.

3. Education for the environment

a) Develops concern and responsibility for the environment.

b) Develops an environmental ethics

c) Develops the motivation and skills to participate in environmental improvement.

d) Promotes a willingness and ability to make life style choices compatible with the wise use of environmental resources.

While education in the environment and education about the environment aim at creating an awareness and understanding of the complexities of the environment (relationships factors), education for environment aims at helping students to develop appropriate behaviors – attitudes, values and convictions – required for effectively participating in activities of environmental protection and conservation. Thus Environmental Education should not be confused with that of any narrowly defined discipline. It is a life-long education.

Through a study of several reports on Environmental Education has listed 25 important characteristics of Environmental Education. These have been reproduced below.

1. **Interdisciplinary and multidisciplinary:** Environmental Education should be a part of every subject taught.

2. **Multilevel:** Environmental Education should be taught at all grade levels.

3. **Global views:** Environmental Education involves development of an integrated environmental ethics.

4. **Concepts:** Environmental Education involves development of awareness and understanding of basic environmental concepts (Ex: limiting factors, carrying capacity)

5. **Process development:** Environmental Education involves development of cognitive, affective and skill behavior processes.

6. **Problem solving**: Environmental Education involves helping students develop processes of thinking which could be more effective in resolving complex environmental problems.

7. **Values clarifying**: Environmental Education involves exploring personal Assumptions, values and feelings towards self and society as well as relationship of these to the natural world.

8. **Systems thinking**: Environmental Education implies that one must learn to think in terms of systems of interacting factors that is to think not only rationally about the parts of a complex system but to develop an intuitive feeling for the dynamic behavior of such a system as a whole.

9. **First-hand experiences and activities**: Environmental Education requires situations where learning can be best nurtured through first-hand experiences and activities which foster a deep respect and love for the natural world.

10. **Environmental issues oriented**: Environmental Education involves use of local environmental issues as well as case studies, role playing and games which provide opportunities to examine and participate in the complexities of decision making, understanding of personal and alternative values and the actual operation of systems – natural and man-made.

11. **Present and future orientation**: Environmental Education continually assesses the present and promotes an ideology which examines desirable images of the future.

12. **Active participation**: Environmental Education emphasizes active participation in preventing and solving environmental problems.

13. **Individual learning**: Environmental Education involves certain degrees of independent study of a diverse number of interdisciplinary environmental problems.

14. **Team approach to teaching/learning**: Environmental Education involves teacher participation in environmental problem solving learning situations as team member.

15. **Productive student-teacher relationships**: Environmental Education emphasizes problem solving including recognition of the values and biases of oneself and others and responsibility for working individually and collectively in a process of informed environmental decision making.

16. **Community oriented**: Environmental Education involves entire community as a learning environment in the achievement of Environmental Education objectives.

17. **Field studies**: Environmental Education includes provision of field experiences which are first-hand experiences.

18. **Communication networking**: Environmental Education involves communication skills as a process which can provide complete and accurate images about environmental problems.

19. **Co-ordination and co-operation**: Environmental Education promotes the values of and necessity for local to international co-operation in the solution of environmental problems.

20. **Flexible administrative patterns**: Environmental Education requires institutional flexibility to cope with evaluation and provide adequate instruction because of its interdisciplinary nature.

21. **Reform of educational processes and systems**: Environmental Education requires modification of existing educational structures.

22. **Curriculum development base**: Environmental Education requires development of new curricula according to needed content and strategies.

23. **Curriculum evaluation base:** Environmental Education involves evaluation of processes that lead toward achievement of intended outcomes for effective programme development.

24. **Research base:** Environmental Education requires a sound research base to identify its strengths and weaknesses.

25. **Teacher education:** Environmental Education is part of teacher education programme aiming at improvement in professional development through pre-service and in-service programmes.

Chapter 2

Importance, Objectives, Scope and Guiding Principles of Environmental Education

Introduction

Man's appearance was a crucial event in organic evolution. He has evolved through many stages of civilization stretching over thousands of years. In the process he has increasingly used environmental resources, made innumerable discoveries and inventions, and adopted a variety of activities and processes, all meant to improve his living conditions. He has, at the same time, corrupted the natural environment, disturbed its equilibrium and upset its balance without taking adequate corrective measures.

In the recent past, a few hundred years ago came the industrial revolution. It resulted in knowledge explosion in almost every field leading to various discoveries and inventions. The needs and wants of an ever-growing population have multiplied the demands. Life-styles have been changing rapidly especially in respect of food, clothing, shelter and comforts. To meet the ever growing demands man has had to harness more and new sources of energy-steam, electricity, gas and oil, coal, solar energy, wind energy and atomic energy. His activities have led to pollution of air, soil and water. Deforestation is taking place at a rapid rate. These have upset the natural systems and seasons, apart from affecting health and life of human beings.

You have observed that man has increasingly moved away from natural habitats to man-made villages, towns and cities and from ways of living close to nature towards artificial comforts and luxuries. Urbanization has led to growth in population, alarming density of population, overcrowded dwellings, concrete jungles and high-rise structures. Modernization has been achieved at the cost of destruction of environment. Even modern agriculture is affected by chemical fertilizers and insecticides.

All these factors are threatening the very survival of man and other forms of life.

You will agree that protection and conservation of environment and its proper management is one of the biggest challenges that today's world in facing. Environmental problems are not restricted to any one country or region. Environmental problems such as global warming, ozone depletion, greenhouse effect, acid rain, loss of forests and biodiversity, pollution of oceans and seas have all become international problems involving more than one country in terms of being responsible for the problem, dealing with its impact and ultimately for providing solutions.

Recognizing the role of education in solving environmental problems, several national and international committees and conferences have asserted that education is the only hope and the most effective means that the society possess for confronting the challenges of the future. It is strongly believed that it is only education that can shape the world of tomorrow.

Importance of Environmental Education

Environmental Education relates to every one of us. It is not a subject of only environmentalists. With a view to increasing public awareness on the mounting environmental problems and generate necessary actions for mitigating them, Environmental Education is being introduced at all levels of education, from primary to post graduate and technical and vocational levels. Environmental Education at all levels and for all people is crucial because the more knowledge the public has about the environment, the better, the more rapid and the more effective decision – makers they can be. Furthermore, Environmental Education is the corner – stone of long – term environmental strategies for (1) Preventing

environmental problems (2) Solving those which arise or have occurred and (3) Assuring environmentally sound, sustainable development.

As Environmental Education is about the environment, its protection and conservation, we need to educate our younger generation about the problems and perspectives on environment and prepare them to face them and find solutions to many of them. This demands incorporating real life situations into our educational transactions and providing learners with opportunities to think and act for the environment.

The following points highlight the importance of Environmental Education.

1. Nature is man's greatest protector, provider and promoter. The more he understands and appreciates nature's provisions and systems the better for his safety and survival.

2. Man is a part of nature and is bound by its basic laws. The more he crosses his limits and flouts natural laws and tendencies the more does he invite danger.

3. Nature is man's largest reservoir of resources. While he can draw from these for meeting his needs and purposes he has to prevent their depletion and destruction beyond safe limits.

4. Nature's components and systems work in co-ordination resulting in balance and harmony. Man should understand this and see that they are not seriously disturbed.

5. Nature has its own forms and sources of energy. The more man unravels, understands and utilizes these, the better for the enrichment of his environment and his life.

6. Man with his superior capacities is the greatest consumer of natural resources and also the most prolific builder of artificial components and

systems in his environment. This can disturb the equilibrium and health of the environment.

7. Uncontrolled deforestation, ill-planned construction of dams, production and use of nuclear energy also pose grave threat to the balance and rhythm in nature.

8. Rapid growth of population, crowded urban settlements, ever-expanding industrialization, increasing use of chemicals in agriculture, uncontrolled output of industrial effluents and biological wastes, continuous expansion of modern means of transportation and communication etc. pollute the environment and create hazards in the bio-sphere, hydrosphere and atmosphere.

Environmental Education promotes the use of interdisciplinary and multidisciplinary knowledge as solving many of the environmental problems calls for knowledge of science and social science subjects. Since environment forms a foundation for learning these Disciplines, students" learning would become more meaningful, focused and interesting. It also promotes group dynamics and collective effort which would be instrumental in solving future problems. Another advantage of Environmental Education is that it involves value education. It gives students an opportunity to examine our thinking and practices, develop new ideas and frame opinions of what is good and what is bad for the environment, evaluate the options and adopt those that are environmentally friendly.

Objectives of Environmental Education

You are aware that education is a highly purposeful activity. Any purposeful programme ought to have carefully selected and well-defined objectives. Objectives give a clear sense of direction and guide the planning, implementation and monitoring of the programme. The

effectiveness and success of the programme would depend on the realization of the objectives set forth.

The following objectives of Environmental Education have been identified on the basis of statements and suggestions of different educationists, environmentalists, scientists and other thinkers.

The Environmental Education programme must aim at developing the following in each individual and group.

1. Knowledge about the eco-systems in one's environment and their existence, functioning and contributions.
2. Awareness and understanding of the components, processes and their interrelationships in the natural environment.
3. Sensitivity to events and changes in the physical, biological and socio-cultural systems in the environment and problems relating to them.
4. Appreciation of the beauty, balance and harmony in nature and the gifts of nature to man.
5. Desire to utilize the gifts and provisions of nature on the one hand and maintain its richness and balance on the other.
6. Readiness to devise and pursue ways and programmes for sustaining and enriching the environment.
7. Eagerness to identify and solve problems relating to the environment and communities living in the environment.
8. Urge to control and avoid activities that tend to disturb the equilibrium and activities that damage valuable components / systems in the environment.
9. Realization of the need to regulate utilization of environmental resources and prevent their depletion.

10. Eagerness to take measures to curb excessive disturbance, depletion, pollution that spoil the environment.

11. Perception of the importance of controlling population growth, settlements, human activities in such a way so as to maintain and improve the quality of life in a healthy and rich environment.

12. Sense of responsibility and commitment in protecting and conserving the environment, maintaining its health for man's benefits.

The objectives of Environmental Education as stated by UNESCO"s Tbilisi Conference are summarized below:

1. **Awareness**: To help individuals and social groups acquire an awareness of and sensitivity to the environment and its problems.

2. **Knowledge**: To help individuals and social groups gain a variety of experiences and acquire basic understanding of the environment and associated problems.

3. **Attitudes**: To help individuals and social groups acquire a set of values and feelings of concern for the environment and motivation to protect and improve environment.

4. **Skills**: To help individuals and social groups acquire the skills for identifying and solving environmental problems.

5. **Participation**: To help individuals and social groups to get actively involved at different levels in working towards the resolution of environmental problems.

Scope of Environmental Education

In view of the ever increasing magnitude, intensity and above all the urgency of today's environmental problems, educationists, all over the world, have argued for incorporating Environmental Education into formal educational setting. By virtue of its objectives and underlying principles,

Environmental Education is considered as a form of good educational practice harmonizing the life of the society. This can become possible only if all members of the society – students, teachers, scientists, specialists, technologists, administrators and law makers etc. Participate in the complex task of solving environmental problems. This can be achieved only with an environmentally enlightened society which is aware of its responsibilities.

Schools have an important role in impating Environmental Education in the younger generation. We need to realize that Environmental Education is a permanent investment in creating a sustainable society and hence it should not be treated as an additional subject in school curriculum. On the contrary it should be viewed as a fundamental educational reform aiming at creating environmentally literate society. Thus the scope of Environmental Education includes not only in imparting knowledge about environment but also in (1) developing positive attitudes, values and practices in students. (2) Generating positive actions that will help improve the quality of the environment. (3) Promoting a conservation ethic and encourage adoption of environmentally responsible life styles. (4) Creating drive for greater involvement in the community oriented environmental programmes.

Environmental Education is education in, about and for environment. Therefore its scope is very large. It begins from using environment as a medium of learning to actions that can be taken for conserving our natural resources and maintaining its health for this as well as forth-coming generations. Thus it relates to a wide range of concepts, issues and values pertaining to the protection and conservation of environment and all life support systems such as air, water, soil etc. Environmental Education

will not only open our eyes to the disasters we have been causing to the environment but will enable us to think of the ways and means by which we can halt further deterioration of the environment.

Environment is full of exciting things. It exhibits a wide variety of phenomena, processes and diversity. How many of us have really concentrated on the flight of a bird and try to understand the laws of Aerodynamics? All the disciplines such as physics, chemistry, geology, geography have evolved from the observations made by people in the environment. To this extent, our environment is a wonderful laboratory to introduce students to the laws and principles of science and make them understand how they work.

Environmental Education creates an awareness of the economic, social, political and ecological interdependence of the modern world so as to enhance a spirit of responsibility and solidarity among nations. Such awareness forms a pre-requisite for solving serious environmental problems.

The scope of Environmental Education is therefore not limited to students alone. It encompasses all sections of the society. Hence, it should be aimed at all members of the community, in ways corresponding to the needs, interests and motivations of the different age groups and socio – economic categories. Environmental Education should also take into consideration different socio-economic and cultural contexts and also living conditions of the people of different communities in the society.

Guiding Principles of Environmental Education

The Tbilisi Conference (1977) was instrumental in giving Environmental Education a comprehensive frame work. In this Conference many details of Environmental Education such as its goals, objectives, principles, content

outlines etc. were discussed and spelt out. These details are considered valid even today by the Environmental Education practitioners.

The conference recommended several principles to help guide efforts in developing and promoting Environmental Education at the national, regional and international levels. The International Conference on Environmental Education at Tbilisi in 1977 has made the following description of Environmental Education which has received wide acceptance internationally and it has proved to be useful for guiding environmental efforts and actions.

1. Environment should include all aspects of natural and man-made environments. It is a complex of natural, built and social components of the life of man. The social components constitute a set of cultural, moral, religious and personal values.

2. Environment should be viewed in its totality blurring political, cultural and physical boundaries since each affects others.

3. Interdisciplinary approach is best suitable for the study of environment and its interacting and inter-dependent parts.

4. Environmental Education should be a life long process.

5. Environmental Education should help individuals work for the development and utilization of natural resources with least destruction and pollution.

6. Environmental Education should help individuals to seek improvement of the quality of life for everyone by eradicating poverty, hunger, illiteracy, human exploitation and dominance.

7. It should help individuals utilize technology not only for self gain and a life of luxury in the short term but also for the survival of man – kind in the long term.

8. Environmental Education should begin with the local, current and most relevant environmental situations and issues and should move on to issues and situations that are national, regional and global in scope.

9. Experience through participation in real environmental situations makes greater impact. Hence local environmental problems are a good starting point for learning environmental attitudes and values.

10. Environmental Education should be regarded as a continuing process which involves constant renewal of the approach, content and methods resulting in knowledge appropriate to the changing conditions of the environment.

11. Environmental Education should cater to all ages and socio-professional groups of the population. It should be addressed to (a)the general non-specialist public groups of young people and adults whose daily conduct has a decisive influence on the preservation and improvement of the environment. (b) to particular social groups whose professional activities affect the quality of the environment and (c) to scientists whose specialized research and work provide knowledge based on which education, training and efficient management of environment should be based.

12. For providing effective Environmental Education, both public and private facilities available in the society must be utilized to the maximum extent possible.

In brief, the following are the guiding principles of Environmental Education.

Environmental Education should:

1. Consider the environment in its totality – natural and built, technological and social.

2. Focus on current environmental situations.

3. Examine the environmental issues form local, national, regional and international points of view.

4. Seek and promote local, national and international co-operation in solving environmental problems.

5. Consider environmental aspects in various projects for development and growth.

6. Ensure learners‟ role in planning their learning experiences about the environment.

7. Relate environmental sensitivity, knowledge, values and problem solving skills to every stage of learning.

8. Help students to identity or discover the real causes of environmental problems.

9. Emphasize the complexity of environmental problems and hence the need to develop critical thinking and problem solving skills, in all individuals.

10. Utilize a wide variety of educational approaches in the teaching and learning process regarding environmental issues.

Chapter 3

Factors of Degradation of Environment

Introduction

Environmental Degradation is a process through which the natural environment is compromised in some way, reducing biological diversity and the general health of the environment. This process can be entirely natural in origin or it can be accelerated or caused by human activities. Many international organizations recognize environmental degradation as one of the major threats facing our planet and if the environment becomes irreparably compromised, it could mean the end of human existence on our planet.

Degradation of Environment is one of the most serious challenges that human beings are facing in today's world. Human beings are facing a wide range of problems arising out of Degradation of Environment. Not only the number of problems arising out of Environmental Degradation is increasing but also their intensity is growing with time. Changes in the environment take place due to multiplicity of a number of natural as well as human factors. All of them together bring about a change in the environment. Natural forces like forest fire, volcanic eruption, earthquake, tsunami, floods, and cloud burst etc. which occur from time to time cause serious damage to the environment. Similarly human activities like deforestation can also generate severe negative impact on earth systems resulting in Environmental Degradation. The truth is that human factors are causing many times more damages to the environment than the natural factors.

Problems started to grow with human population and associated diversification of the economic activities. Industrial revolution has made these problems more and more acute. Industrialization, wide spread deforestation and population explosion have been considered as major causes of Degradation of Environment. Manufacturing of goods through the

utilization of natural resources is causing Degradation of Environment in two ways – environmental pollution through industrialization and damage to natural environment of various life forms through the exploitation of natural resources. Environmental Degradation caused by unsuitable land use is a worldwide problem that has affected sustainability.

Meaning of Degradation of Environment

Let us now understand the meaning of the term Degradation of Environment. Environmental Degradation is the deterioration of the environment through depletion of resources such as air, water and soil, the destruction of ecosystems and the extinction of wildlife. It is defined as any change or disturbance to the environment perceived to be undesirable. Environmental Degradation is caused by the combination of an already very large and increasing human population, continually increasing economic growth and the application of resource depleting and polluting technology. Environmental Degradation is one of the ten threats officially cautioned by the High Level Threat Panel of the United Nations. The United Nations International Strategy for Disaster Reduction defines Environmental Degradation as “The reduction of the capacity of the environment to meet social and ecological objectives and needs”. According to Business Dictionary Environmental Degradation refers to “Erosion of the quality of natural environment caused directly or indirectly by human activities”.

When the environment becomes less valuable or damaged, we can say that Degradation has occurred. There are many forms of Environmental Degradation. When habitats are destroyed, biodiversity is lost or natural resources are depleted, the environment is hurt. Environmental Degradation can occur naturally or through human

processes. The largest areas of concern at present are the loss of rain forests, air pollution and smog, ozone depletion, and the destruction of marine environment. Pollution is occurring all over the world and poisoning the planet's seas and oceans. Degradation can be mainly grouped into (a) eco – system imbalance (b) deforestation (c) fresh water degradation (d) soil degradation (e) marine degradation (f) air pollution (g) ozone depletion (h) global warming (i) solid and hazardous wastes.

Over the past 50 years, over one tenth of the earth's vegetated soils have become so degraded that their natural functions have been damaged to the point where restoration becomes extremely difficult. In the developing countries, more than 95% of urban sewage is released untreated into surface waters which poses a serious threat to human health. Urbanization is encroaching on more and more arable land, reducing the available land for farming. Countries throughout the world are being forced to look at the effects of their activities are having on the natural resources on which they depend. Everyone has a responsibility to prevent Environmental Degradation from the individual picking up litter to stop an area looking dirty to a country that must stop its waste from poisoning its water resources. Though Environmental Degradation is a global problem that requires global solutions, every citizen of this world has a definite role to play in preventing it.

Factors of Degradation of Environment

You have already understood the meaning of Degradation of Environment. Environmental Degradation refers to the deterioration of the environment. It is the result of exploitation of earth's natural resources. It is threatening the basic existence of life on our planet. Studies also reveal that the deterioration of environment is occurring at an alarming rate.

Environmental Degradation can be attributed to various human activities and also some natural processes. Most of the natural resources on the planet earth are vulnerable to depletion and the rate at which we are exploiting them has already brought some of them to the brink of exhaustion. Exploitation of fossil fuels is the best example for this phenomenon. Large – scale exploitation of fossil fuels has depleted the reserves across the world leaving us with no option but to find an alternative source of energy. Other human activities that have contributed to Environmental Degradation are urbanization, over population, deforestation, pollution, etc.

The hazardous wastes produced by industries contaminate the water bodies leaving the water unfit for drinking. In the same way green house gases that are released to the atmosphere such as chlorofluro carbons and carbon – dioxide have a devastating effect on the environment, making the planet vulnerable to a range of problems including global warming and climate change. Excessive deforestation to accommodate growing population has resulted in degradation of air and water.

After a point of time, the damage caused to the environment reaches a stage where in it cannot attain the required balance on its own. In such a situation, we humans need to step in and ensure that the damage is curbed and balance in attained. Environmentalists all over the world are trying their level best to save the environment. On our part, we need to do our bit to make sure that they succeed in their efforts. The need of the hour is to identity the factors or the causes of Environmental Degradation and eliminates them one by one as early as possible.

Let us now consider some of the important factors of Degradation of Environment.

1. High quantity of exhaust gases: One of the important reasons for Degradation of environment is the exorbitant amount of gases released by various industries. Important amongst these gases are co2, so2 and NH3. These and many other gases are responsible for ozone holes and global warming.

2. Deforestation: Deforestation is taking place all over the world. It decreases the number of trees, which clean the environment, provide oxygen and also affect rain patterns. This is why tree plantation is given much importance to make up for this loss.

3. Mining: Mining releases particulate matter. This particulate matter enters our lungs and causes harm to respiratory system. Particulate matter can also be due to indoor pollution resulting from cooking on traditional „Choolahs" and cottage industries like „bangle making".

4. Chemical effluents: Effluents are by – products of industries and these pose a serious threat to the environment. Leather and tanning industries, petroleum industries and chemical manufacturing industries create major waste products. These are directly released into nearby streams without treatment resulting in river pollution and causing harm to aquatic life.

5. Transport: The number of vehicles on the roads is increasing rapidly every day as the spending power of the population is also increasing. Smog is a nuisance that is created because of vehicular pollution. Hydrocarbons released from engines are the causes of creation of lower level ozone that is harmful to humans.

6. Construction: Unprecedented construction activities that are being carried out have resulted in Urban Heat Island. Urban Heat Island is an

effect caused due to trapping of solar radiation by concrete and cement which trap heat extremely well. Construction also causes removal of vegetative cover which usually allows for better exchange of heat. Heat island effect causes constricted circulation of air which traps pollutants released in urban areas decreasing the air quality.

7. **Secondary pollutants**: These are not directly emitted but get created when primary pollutants react amongst themselves. For example ozone is created from reaction between non – burnt hydrocarbons and nitrous oxides. Stratospheric clouds are the main reaction sites for such pollutants.

8. **Agricultural policies**: Over loading the land with fertilizers and over grazing are ruinous agricultural policies that degrade land, creating soil erosion that leads to silting in major rivers and reservoirs. Soil degradation leads to desertification and degradation of land quality.

9. **Population explosion**: The global population has experienced an unprecedented growth from 1 billion in 1800 to 7 billion in 2012. Life expectancy has increased due to advanced medical science. Hence population is expected to grow rapidly. Experts have predicted that world population would be 8.4 billion by mid-2030. Population explosion has resulted in a number of environmental issues including that of food and shelter. There is also alarming increase in the amount of waste generated every day.

10. **Arbitrary land – use policies**: Failure to execute land management policies can lead to land pollution. For example mining leaves land resources unusable for habitation and cultivation. Exhaustive mining has resulted in depletion of natural resources.

Socio – Economic Impact of Degradation of Environment

One of the greatest challenges facing humanity is environmental Degradation including deforestation, desertification, pollution and climate change. Environmental degradation increases the vulnerability of the societies and contributes to the scarcity of resources. Climate change leads to an increase in the intensity and frequency of weather extremes such as heat waves, floods, droughts and tropical cyclones. People living in the coastal areas are heavily hit by climate and Environmental Degradation. Environmental Degradation also leads to scarcity of resources such as water and farmable land.

Let us now see how Degradation of Environment affects human lives both socially and economically.

1. **Impact on human health:** Human health is heavily impacted by Degradation of environment. Reduction in water quality is responsible for more than two million deaths and billions of people with illness are reported annually across the globe. Similarly reduction in air quality is responsible for more than 3, 00, 000 deaths annually and large number of chronic diseases all over the world. The toxic wastes and harmful chemicals from factories, agriculture and automobiles cause illness and death in children and adults.

2. **Poverty:** In the majority of developing countries, poverty is attributed to poor crop harvests and lack of quality natural resources that are needed to satisfy basic survival needs. Water shortages, climate change and poor crop yields in the developing countries are mainly due to Environmental Degradation. Lack of access to adequate basic needs such as water and food directly leads to poverty.

3. **Atmospheric Changes**: Environmental Degradation can change some of the natural processes such as water cycle and normal processes of animal and plant activities. Deforestation and mining destroy the natural land cover. These together with air, water and land pollution pose several atmospheric alteration threats. The alterations include global warming and climate change which can increase the risks of natural disasters. Depletion of ozone layer increases the risk of skin cancer and eye diseases.

4. **Loss of Biodiversity**: Degradation of Environment has resulted in destruction of wild forests and the damage of natural ecosystems. This has led to mass extinction of species. This is because of the human activities such as acidifying water systems, over exploitation of natural resources, over population and the destruction of natural systems necessary for the survival of different species. These human activities alter the natural process thereby destroying the natural ecosystems supporting biodiversity.

5. **Loss for Tourism Industry**: The deterioration of environment can be a huge setback for tourism industry. Environmental damage in the form of loss of green cover, loss of biodiversity, increased air and water pollution can be a threat for tourism.

6. **Economic impact**: The huge cost that a country may have to spend due to Environmental Degradation can have big economic impact in terms of restoration of green cover, cleaning up of landfills and protection of endangered species. The economic impact can also be in terms of loss of tourism industry.

We need to take action to stop Degradation of Environment and take care of the world that we live in by providing Environmental Education to the people. It helps them to have familiarity with their surroundings that

will enable to take care of environmental concerns thus making it more useful and protected for our children and other future generations.

Prevention of Degradation of Environment

You have already understood that Environmental Degradation is the deterioration of the environment through depletion of resources such as air, water and soil, the destruction of ecosystems, habitat destruction, the extinction of wildlife and pollution.

Our planet is the most important thing in our lives. Preventing Environmental Degradation is a movement that we should all take part in. Keeping our planet clean for future generations is one of the most important things we can do. Air, soil and water are our most precious resources and we simply cannot afford to lose them. We would perish without these three resources.

The following measures can be taken for preventing Environmental Degradation.

1. **Reducing our consumption of resources:** Our natural resources are limited. Hence we should try to reduce the consumption of natural resources as far as possible. This includes cutting down trees to make paper and other materials that we need as well as fossil fuels like petrol and diesel to fuel our vehicles. Our wildlife and flora rely on their natural environment and if we keep consuming all the natural resources we will be left with nothing.

2. **Reusing resources and materials:** Once a resource runs out, we will never be able to get that resource back. If people start reusing specific things, Environmental Degradation can be greatly reduced.

3. Recycling Resources: Recycling is the best way to slow down Environmental Degradation. If we want to save our planet recycling of resources is to be given utmost importance. This will definitely reduce the rate of consumption of natural resources. For example waste paper and plastic can be recycled effectively.

4. Using mass transportation: In urban areas we commonly observe people using their own vehicles like scooters and cars to go to their work place and to move from one place to another. This consumes lot of fuel and results in air pollution. This can be avoided by resorting to the use of mass transportation like buses and trains. People should also be encouraged to use bicycles especially when it comes to travelling short distances.

5. Giving back to the environment: The best possible way to help prevent Environmental Degradation is to give back to the environment. This can be done successfully by planting three trees for every one that is cut down. Trees give us clean air to breathe and we cannot survive without them. Keeping our forests alive is not only important to our ecosystem but also to the wildlife system. When the food chain is affected, we human beings are also affected.

6. Creating social awareness: It is the need of the hour to spread social awareness about the dangers of environmental pollution. For this to happen Environmental Education should be made part and parcel of curriculum at all levels of education system.

Chapter 4

Environmental Hazards

Introduction

An Environmental Hazard is a threat posed by the natural or built environment to humans and the things that are valued in human society. An Environmental Hazard becomes a disaster when the threat is realized and causes significant human loss. Death, injury and psychological harm are considered to be more serious than economic or property loss.

Environmental Hazards are categorized as either natural or technological though multiple hazards may be linked to one another. Natural hazards include geologic events like Earthquakes, landslides and volcanic eruptions; hydrologic events like floods and drought; Meteorological events such as tornadoes and hurricanes and biologic events like wild fires and diseases. Technological hazards arise from within human systems and are usually accidental in nature. They include industrial failures that release toxic materials into the environment, structural collapses of buildings and bridges, and transportation disasters like plane crashes and train accidents.

Disaster is an undesirable occurrence resulting from forces that are largely outside human control. It strikes quickly with little or no warning which causes or threatens serious disruption of life and property including death and injury to a large number of people.

Hazards and disasters are closely related or sometimes used as synonymous to each other. Hazards are a threat, while disaster is an event. Disaster is a calamity or tragedy or a consequence of a hazard. Hazards are the processes which cause an accident or extreme event or danger whereas disaster is a sudden adverse or unfortunate extreme event which causes great damage to human beings as well as plants and animals. Disasters occur rapidly and indiscriminately. Thus, Environmental

Hazards are the processes where as environmental disasters are the results or responses of Environmental Hazards.

Meaning of Environmental Hazards

An Environmental Hazard is a substance, a state or an event which has the potential to threaten the surrounding natural environment or adversely affect people's health including pollution and natural disasters.

A hazard is an agent which has the potential to cause harm to vulnerable target. The terms 'hazard' and 'risk' are often used interchangeably. However, they are two very distinct terms. A hazard is any agent that can cause harm or damage to humans, property or the environment. Risk is defined as the probability that exposure to a hazard will lead to a negative consequence or a hazard poses no risk if there is no exposure to that hazard.

Kates defines Environmental Hazard as “the threat potential posed to man or nature by events originating in, or transmitted by, the natural or built environmental”. This definition includes a broader range of hazards ranging from long term environmental deterioration such as acidification of soil and build-up of atmospheric carbon-di-oxide to communal and social hazards such as crime and terrorism.

Environmental Hazards usually have common characteristics including their tendency to be rapid onset events meaning they occur with a short warning time, they have a clear source of origin which is easily identified, impact will be swift and losses suffered quickly during or shortly after on-set of the event.

Natural hazards may be defined as “extreme events that originate in the biosphere, hydrosphere, lithosphere or atmosphere” or “a potential threat to human and their welfare”. Technological and man-made hazards include explosions, release of toxic materials, structural collapses and transportation, construction and manufacturing accidents.

Types of Environmental Hazards

Every day we face a number of Environmental Hazards. These hazards can be classified into four categories namely physical, chemical, biological and socio-cultural.

1. **Physical hazards**: These are physical processes that occur naturally in the environment. They include natural disaster events such as earthquakes, volcanoes, land-slides, floods, droughts and Tsunami ot Pandemic diseases Covid-19 caused by Novel Corona Virus. Some physical hazards are on going like ultraviolet radiation. Ultraviolet radiation is considered a hazard because it damages DNA and can cause human health issues like skin cancer and cataracts.

2. **Chemical hazards**: These can be both natural and human made chemicals in the environment. Some chemical hazards occur naturally in the environment like the heavy metals like lead and mercury. Human made chemical hazards include many of the synthetic chemicals we produce like disinfectants, pesticides and plastics.

3. **Biological Hazards**: These come from ecological interactions between organisms. Some of the examples for biological hazards are viruses, bacterial infections, malaria and tuberculosis. When these pathogens and diseases are transferred between organisms, it is called an infectious disease. We suffer from these diseases and pathogens because we are being parasitized by another organism which is a natural process.

4. Socio-cultural hazards: These result from your location, socioeconomic status, occupation and behavioral choices. For example, smoking is hazardous to health and it is a behavioral choice. If you live in a neighborhood with lots of crime, it is a hazard based on your location. Similarly, your diet, exercise habits and primary mode of transportation all influence your health and the health of the environment around you.

Causes of Environmental Hazards

There has been a constant debate on the topic of natural hazards and the role played by the humans in the same. A lot of human practices as well as rapidly growing developmental activities have been blamed for the rise of these natural hazards like floods, droughts, land- slides, forest fires etc. The reality at present is that we are experiencing an increasing number of natural hazards. Hence, there is a need to keep a check on developmental activities so that we could have a sustained environment.

There are different types of natural hazards and depending upon different types of natural hazards, the causes are also different. For example, the causes of an earthquake cannot be the same as that of forest-fire. Natural hazards are caused due to different reasons like soil erosion, seismic activity, air pressure and ocean currents etc. Natural hazard is not a new phenomenon. These natural hazards have occurred since the earth began forming and continue to cause serious damage and loss of life all over the world. The root causes of most of the natural hazards that occur on earth can be attributed to the imbalance created in our environment. This imbalance may be in the form of soil pollution, air pollution or water pollution.

Natural activities taking place in the earth's crust as well as surface are the main causes for natural hazards. Seismic activity caused by earthquakes result in volcanoes. Tectonic movements in the earth's crust are responsible for earthquakes which are sometimes very dangerous and may lead to heavy loss of life and property.

The activity of the moon determines the ocean waves which can result in high tides during the full moon and sometimes these tidal waves can be really dangerous. The deadly December 2004 Tsunami also occurred on a full moon night. Tsunamis along the coasts of landmasses bordering the Indian ocean killed over 2,30,000 people in fourteen countries and destroying coastal communities with waves up to 30 meters high.

Changing ocean currents are dangerous and they can result in changes in water temperature which could result in global food shortage by killing fish and ocean plant life. These changing ocean currents could also adversely affect the intensity as well as frequency of storms. Tornadoes are also dangerous and are formed by the interaction of high- and low-pressure air. Flooding and high winds are caused by crashing together of low and high-pressure air.

The natural hazards have their root causes in the normal activities of the earth. However, during the past few decades, we have witnessed some rapid modernization and growth. Man's increased knowledge and technology have served to trigger for some natural hazards. Mining and deforestation can lead to floods and erosion. Global warming which could affect the ocean currents has its roots in modern man's over use of fossil

fuels. Earthquakes occurring as a result of tectonic movements inside the earth's crust can also be triggered by the activities like drilling, bombing, mining and construction.

Impact of Human Activities on Environmental Hazards

Today we are progressing at a rapid rate neglecting the harm that we are causing to our environment. Global warming as well as poor human management in the field of land and water resources has contributed to natural hazards. Humans have created a situation where natural hazards like earthquakes and tsunamis result in heavy losses in terms of human life and property.

Global warming is increasing the temperatures of Earth's oceans and atmosphere leading to more intense storms of all types including floods due to the melting of these oceans. There are a lot of constructions in flood-prone regions which have increased the likelihood that the towns and villages are affected by flash floods.

Rapidly growing industrialization has led to a lot of air and water pollution. Though there are environmental laws that the industries need to follow to treat the waste before disposing of into the environment, most of the times industries neglect these laws for personal gain. Authorities need to take severe action against such industries.

There are many societies and groups of people who are working in the field of environmental awareness to make people aware of the harmful effects of the growing pollution and other practices that are harmful to our environment. Several NGOs have taken up the issue of pollution and global warming by taking out rallies and organizing various campaigns to save the environment. Such initiatives are to be appreciated and encouraged.

Effects of Environmental Hazards

Environmental Hazards such as cyclones, earthquakes, landslides, floods, wild fire, and volcanic eruptions are increasing due to climate change. These natural hazards bring with them a host of issues including humanitarian crisis, public health issues, environmental and infrastructural problems, food scarcity and emotional shocks.

1 Humanitarian Crises: Climate change and accompanying natural hazards have created a large migrant population. These people are forced out of their homes by a natural hazard like flood, landslide, earthquake etc. The area where they lived is no longer habitable for one reason or the other. It is predicted that by the end of the century there will be 2 billion climate refugees and environmental migrants out of a projected population of 11 billion by 2100.

2. Public Health Issues: Natural hazards have resulted in health issues. Due to natural hazards facilities for water and toilet hygiene are heavily damaged. Safe disposal of human waste becomes a public health hazard. During floods standing water can be a breeding ground for pathogenic bacteria and mosquitoes, survivors of natural hazards can be cut off from life saving medications and be isolated from emergency health care services.

3. Environmental Problems: In March 2011, Tsunami following earthquake in Japan caused Fukushima Daiichi nuclear disaster where radioactive material was released into the Pacific Ocean. This was the largest nuclear disaster since Chernobyl and it caused a number of issues in the ecosystem and surrounding waters spreading radio active material through ocean currents. Natural hazards like Tsunami and wildfire can cause wide-ranging and long term consequences for ecosystems.

4. Infrastructural Damage: Natural hazards cause damage to both public and private infrastructure. In the wake of natural hazards, people can end up losing all of their assets with no opportunity for restitution. Natural hazards can have long-term consequences beyond the immediate loss of life and demolition of infrastructure. The area impacted by a natural hazard will show scars for years to come.

5. Food Scarcity: Natural hazards result often in food scarcity. Thousands of people around the world go hungry as a result of destroyed crops and loss of agricultural supplies whether it happens suddenly in a flood or gradually in a drought. As a result of this food prices raise reducing people's purchasing power and increasing the risk of malnutrition. The impact of hunger following an earthquake or flood can be tremendous causing life-long damage to children's development.

6. Emotional shocks: Natural hazards can be particularly traumatic for young children. Confronted with scenes of destruction and the deaths of relatives and friends, many children develop Post-Traumatic Stress Disorder (PTSD), a serious psychological condition resulting from extreme trauma. Children suffering from PTSD can be prone to psychological damage and emotional distress.

Prevention of Environmental Hazards

Natural hazards are inevitable, even if we have the technology to predict hazards, we cannot stop them from occurring. The best that we can do is to stop the practices that are harmful to our environment and leading to Environmental Degradation. We should be prepared for a disaster with our disaster management plan. Disaster can lead to out breaks of infectious diseases. Once a disaster strikes it leaves behind a lot of destruction and loss of life. In the case of disasters like floods,

earthquakes etc. where a large number of people are displaced, there are a lot of deaths also. This is a time when emergency preparedness comes into effect giving first aid to injured and providing rescue and relief operation.

Majority of deaths immediately after a natural disaster is directly associated with trauma and injuries. After a disaster strikes, there is a great risk of epidemic and hence it is very important to control the causalities as well as it is required to dispose of the dead animals and human bodies properly before an epidemic outbreak.

The risk factors for increased infectious diseases transmission and outbreaks are mainly associated with the after effects of the disasters. It is very important to deal with these problems which in turn can pose a greater threat. The after effects include displacement of populations and environmental changes. Unplanned and overcrowded shelters, poor water and sanitation conditions, poor nutritional status or insufficient personal hygiene may cause diarrhea and other water borne diseases. Hence it is very important to be prepared with a proper disaster management team which can take charge soon after a disaster strike.

Humans always had to deal with natural hazards whether through preparing for them or responding when a disaster occurs. One of the most important ways humans respond to natural hazards is by preparing for their occurrence. Technology has helped us to prepare, predict and forecast future natural hazards.

1. **Hazard Assessment:** Scientists study natural hazards to determine characteristics of various hazards. Hazard assessment generally determines the location and timing of past hazards, probable effects

depending upon magnitude of hazard and organizing the information into a usable form for policy makers.

2. **Risk Assessment:** It includes possible socio-economic effects. It covers locations of buildings and infrastructure in hazardous areas and potential exposure to natural hazard.

3. **Prediction:** In terms of natural hazards, predictions are made through various scientific observations. A common observation that could lead to a prediction is the identification of a precursor event. A precursor event is a smaller event that usually precedes a larger event such as small earthquakes around a volcano indicating volcanic eruption.

4. **Forecasting:** The term forecast is usually used as a short-term prediction of the severity, location and timing of weather-related events.

Chapter 5

Environmental Pollution

Introduction

Pollution is the effect of undesirable changes in our surroundings. These undesirable changes in the environment have harmful effects on plants, animals and human beings. During the last few centuries we have contaminated with a variety of waste product sour air, water and land on which life depends.

Environmental pollutants include solid, liquid and gaseous substances produced due to human activity. The nature and concentration of a pollutant determine the severity of its detrimental effects on human health. For example, an average human being requires about 12 kg of air each day which is nearly 12 to 15 times greater than the amount of food we eat. So, even a small concentration of pollutants in the air becomes more significant in comparison to similar levels present in food. Pollutants that enter water have the ability to spread to distant places. Degradable pollutants can be rapidly broken down by natural processes; e.g., domestic sewage, discarded vegetables etc. Slowly degradable pollutants remain in the environment for many years in an unchanged condition and take decades to degrade; e.g., DDT (pesticides). Non – degradable pollutants cannot be degraded by natural processes. Once they are released into the environment they are difficult to eradicate; e.g., toxic elements like lead or mercury and nuclear wastes.

There are many sources of pollution. On the basis of sources of pollution, pollution can be of two types namely natural and manmade. Natural sources of pollution include volcanic eruption (smoke, ash, gases and dust), forest fires, floods, cyclones etc. Manmade sources of pollution include industries, agriculture, domestic sewage, automobiles, nuclear explosions etc. Industries are the major sources of pollution. Industries

discharge several pollutants such as gaseous matter, solid matter, waste water that contains many chemical ingredients. Sources of urban pollution include sewage water, solid waste, gaseous exhaust and liquid effluents. The use of chemical fertilizers, pesticides and insecticides results in pollution of soil.

Meaning of Environmental Pollution

Environmental Pollution is one of the most serious problems facing humanity and other life forms on our planet today. Environmental Pollution is the contamination of the physical and geological components of the earth / atmosphere system to such an extent that normal environmental processes are adversely affected. Any use of natural resources at a rate higher than nature's capacity to restore itself can result in pollution of air, water and soil.

Environmental Pollution is a global problem and is common to both developed as well as developing countries. This has attracted the attention of human beings for its severe long – term consequences. The decline in environmental quality as a consequence of pollution is evidenced by loss of vegetation, biological diversity, excessive amounts of harmful chemicals in the atmosphere and in food grains and growing risks of environmental accidents and threats to life support systems.

Pollution is viewed from different angles by different people but is commonly agreed to be the outcome of urban – industrial and technological revolution and speedy exploitation of natural resources, increased rate of exchange of matter and energy and ever – increasing industrial wastes and urban effluents.

Singh (1991) has defined pollution in a very simple manner, i.e., “disequilibrium condition from equilibrium condition in any system”. This definition may be applied to all types of pollution ranging from physical to economic, political, social and religious.

According to Natural Environmental Research Council (NERC) pollution is viewed as “the release of substance and energy as waste products by human activities which result in changes, usually harmful, within the natural environment”.

Pollution is “any undesirable change in the physical, chemical or biological characteristics of air, water and soil that may create a hazard or potential hazard to the health, safety or welfare of any living species”.

Types of Environmental Pollution

Pollution refers to the addition of contaminating substances to the natural environment resulting in an adverse impact on the environment. Pollution can be of different types depending on the part of the environment that is getting polluted.

The word Pollution comes from the Latin word 'Polluere' that means contamination. Hence pollution is something that contaminates the environment. The presence of harmful substances in the air, land and water, which can have an adverse effect on living beings and on the environment, is pollution. Pollution poses a threat to the sustainability of the environment.

Let us now try to understand the different types of Environmental Pollution.

1. Air Pollution: Air pollution refers to the release of pollutants like toxic gases, biological molecules and particulate matter into the atmosphere. The pollutants can be derived from several sources including both natural

processes and human activities. Volcanic eruptions, automobile and industrial effluents etc., are some examples of air pollution sources. Carbon monoxide, carbon dioxide, chlorofluoro carbons etc., are some examples of air pollutants. Air pollution can be highly detrimental to the health and well – being of all life forms on earth.

2. **Water Pollution**: The contamination of water bodies like lakes, rivers, ponds etc. by pollutants is called water pollution. Water pollution is one of the most harmful types of pollution. It can have extremely disastrous consequences for all living beings using the contaminated water. A major volume of all the pollutants produced on land end up in water bodies. Toxic wastes released by industries, pathogens released in sewage, harmful chemicals present in agricultural land are some of the water pollutants. The contamination of water can lead to epidemics that can wipe out the population of an entire species. Thus water pollution has a highly adverse impact on the environment, society and economy of a place.

3. **Soil Pollution**: Soil pollution occurs when the soil of an area is contaminated. The soil is essential to the growth of all plants including crops. Degradation in the soil quality results in lower yields and poor health of crops grown on such soil. Industrial and agricultural chemicals are the common pollutants contaminating the soil.

4. **Noise Pollution**: When the environment is filled with unnecessary or unpleasant sounds that are harmful to human beings, animals and plants, it is called noise pollution. Transport vehicles, machinery, industries, loud music etc. are some of the most common sources of noise pollution. Noise pollution can give rise to chronic diseases like cardiovascular diseases. It can also severely affect psychological health of people.

5. **Radioactive Pollution:** When radioactive substances are present in areas where their presence is undesirable, it results in radioactive pollution. Such substances are highly toxic to all life forms on earth. Radioactive substances trigger mutations in the genetic material of living organisms leading to different types of cancer. Exposure to such toxins can also adversely impact the different systems of the body.

6. **Thermal Pollution:** An induced change in the temperature of large volumes of water causes thermal pollution. This type of pollution leads to degradation of water quality as the warm water does not provide ideal living conditions for aquatic flora and fauna. Higher temperatures also alter the composition of dissolved elements in water. The flora and fauna living in the area can be killed by this abrupt change in the water temperature.

7. **Plastic Pollution:** Plastic pollution is caused by plastic accumulation in the environment. Plastic which is a non – biodegradable substance is extremely harmful to all life forms on earth. Every year, thousands of animals die due to plastic pollution. Ingestion of plastics kills these animals. Most of the plastic waste generated in the world end up in the oceans where they cause great harm to the marine ecosystem.

8. **Light Pollution:** Recently another kind of pollution known as Light Pollition has been identified. In big cities artificial light sources such as advertisement boards and others light sources which emit bright light have polluted the serene moon light during nights. It is disrupting ecosystems and spoiling aesthetic environment. It is adversely affecting human health and psychology and disrupting ecosystems. Astronomers have said that it has become difficult to watch celestial bodies clearly during night in big cities due to this Light Pollution.

Causes, Effects and Prevention of Environmental Pollution

1. Air Pollution

Air is the most vital constituent of environment for the sustenance of life on earth. In pure air, the proportion of different constituents like oxygen, nitrogen and other gases is fixed and definite. Air is polluted when its natural composition is disturbed either by natural or by man-made sources.

Causes of Air Pollution:

1. Sulphur dioxide is emitted from the combustion of fossil fuels like coal and petroleum. Carbon monoxide is produced due to incomplete burning of fossil fuels. Nitrogen oxides are produced mainly by automobiles, aircraft, thermal power stations and factories.

2. Carbon dioxide is largely released into atmosphere by burning of fossil fuels. It is also emitted by volcanic eruptions.

3. Ammonia is a common by product from agriculture related activities. Use of insecticides, pesticides and fertilizers in agricultural activities emit harmful chemicals into the air.

4. Industries release large amount of carbon monoxide, hydro carbons, organic compounds and chemicals into the air depleting the quality of air.

5. During mining process dust and chemicals are released into the air causing air pollution.

6. Chlorofluro carbons are emitted from industries, refrigerators, air conditioners, cosmetic goods etc.

Effects of Air Pollution:

1. Toxic gases like sulphur dioxide and carbon monoxide affect the respiratory system and cause bronchitis, asthma and lung cancer. Sudden leakage of toxic gases from chemical and gas plants causes loss of life.

2. Air pollution severely affects weather and climatic conditions of a region. Air pollutants have impact on humidity, clouds and rainfall.

3. Global warming is caused due to the increase in concentration of certain gases like carbon dioxide, nitrogen oxides, and methane and chlorofluro carbons in the air.

4. Harmful gases like nitrogen oxides and sulphur oxides released into atmosphere during the burning of fossil fuels combine with water droplets. Then they fall on the ground in the form of acid rain.

5. Ozone exists in earth's stratosphere and is responsible for protecting humans from harmful ultraviolet rays. Earth's ozone layer is depleting due to the presence of chlorofluro carbons and hydro chlorofluro carbons in the atmosphere.

6. Toxic chemicals present in the air can force wildlife species to move to new place and change their habitat. The toxic pollutants deposited over the surface of water can also affect sea animals.

Prevention of Air Pollution:

1. People must be encouraged to use more and more public modes of transportation to reduce pollution.

2. Gaseous pollutants can be removed by spraying water, filtration or absorption.

3. Burning of fossil fuels is to be reduced as far as possible.

4. Engines of automobiles are to be redesigned to reduce emission of toxic gases. Emission test for vehicles is to be made compulsory.

5. The industrial areas should be located at certain safe distance from the residential areas.

6. There should be green belt around town ships, industrial areas and villages.

7. Steps should be taken to prevent forest fires. It is also important to check deforestation.

8. The height of smoke chimneys should be high enough to dilute the smoke.

9. Electrical energy is to be efficiently used because large amount of fossil fuels is used to produce electricity.

10. Use of alternate sources of energy like solar and wind energy must be encouraged.

2. Water Pollution

Water is the essential element that makes life on earth possible. Without water there would be no life. 71% of the earth's surface is covered by water. About 97% of the total water available on earth is found in the oceans and is too salty for drinking or irrigation. The remaining 3% is fresh water. Water has self-purifying capacity during water cycle. But it gets polluted when undesirable substances are added by man to water beyond the tolerance level.

Causes of Water Pollution:

1. Natural sources of water pollution are soil erosion, landslides, volcanic eruptions and decomposition of plants and animals. The brown and dirty water is the result of mud mixed in the water due to soil erosion.

2. Urban sources of water pollution include domestic effluents and sewage water. Sometimes sewage water flows into nearby rivers, tanks or lakes.

3. Industrial sources of water pollution include the effluents generated from industries such as paper, chemicals and petro chemicals, oil refineries, metal works, distilleries, textiles etc.

4. Agricultural sources of water pollution include excessive use of fertilizers, pesticides and insecticides.

5. When the acid rain falls it contaminates water bodies including streams, rivers and lakes.

6. Thermal Power Plants discharge large quantities of heated water into nearby rivers, lakes or ponds and cause thermal pollution of water.

7. The oil spill in the sea causes pollution of sea water. If there is accident or leakage of oil spreads on the water surface and cause serious problem to marine animals.

Effects of Water Pollution:

1. Consumption of highly contaminated water can cause injury to the heart and kidneys.

2. Polluted water is greatly responsible for several water borne diseases like cholera, typhoid, diarrhoea, dysentery etc.

3. Toxins within water can harm aquatic organisms breaking a link in the food chain.

4. Use of polluted water from rivers, lakes and ponds for irrigation affects food quality.

5. Highly polluted water decreases the fertility of the soil and also kills useful micro – organisms.

6. Polluted water obstructs the process of photosynthesis which affects the growth of vegetation.

7. Polluted water changes the physical and chemical nature of water.

Birds that get into oil – contaminated water die from exposure to cold water.

Prevention of Water Pollution:

1. The drinking water sources must be kept clean.

2. Provision must be made to establish sewage treatment plant.

3. Industries should not be allowed to discharge their effluents into the water bodies without treatment.

4. There should be a ban on the disposal of dead bodies into water bodies.

5. Use of pesticides in agriculture is to be minimized.

6. Use of plastic bags is to be strictly banned.

7. Awareness is to be created among people regarding water pollution. They need to be educated about water borne diseases.

3. Soil Pollution

Soil pollution has become a major challenge that we need to overcome for establishing a healthy environment. Soil is the home for a large part of microscopic and macroscopic living organisms. Soil pollution refers to anything that causes contamination of soil and degrades the soil quality. Soil contamination or soil pollution can occur either because of human activities or because of natural processes. However, mostly it is due to human activities.

Causes of Soil Pollution:

1. Human activities have led to acidification of soil and contamination due to the disposal of industrial waste like heavy metals, toxic chemicals, dumping oil etc.

2. Lack of crop rotation and intensive farming gradually decreases the quality of soil causing degradation of land.

3. Disposal of plastics, cans, electrical goods like batteries cause an adverse effect on the soil due to the presence of harmful chemicals.

4. Use of chemical fertilizers, inorganic fertilizers, pesticides will decrease the fertility of the soil and alter the structure of the soil.

5. The storage of waste products may leak into ground water.

6. Garbage that cannot be recycled is disposed of carelessly leading to pollution of land. Some of this waste can take thousands of years to decompose.

7. Acid rain makes the soil acidic which is harmful for crops.

8. The biological agents like pathogenic organisms are also responsible for soil contamination.

Effects of Soil Pollution:

1. Soil pollutants can cause cancer, skin diseases and central nervous system disorders in human beings. For example, high concentration of lead or mercury in the soil can affect functioning of kidneys and liver.

2. Crops and plants grown on polluted soils can accumulate poison and become unfit for human consumption.

3. Soil pollution contributes to air pollution by emitting toxic particles and foul gases into the atmosphere. It can also lead to water pollution if the toxic chemicals and materials reach the ground water.

4. When soil is contaminated with poisonous materials and chemicals, it cannot support plant life.

5. Fertility of the soil decreases once the soil is contaminated with chemicals and heavy metals or degraded due to human activities such as mining.

6. Acidification, diminished soil fertility and death of soil organisms in the soil can lead to changes in soil structure.

7. The level of pesticide residues like DDT in fruits, milk, eggs, vegetables beyond the permissible levels is responsible for causing diseases like cancer, sterility and even death.

Prevention of Soil Pollution:

1. It should be mandatory for industrial units not to dump their wastes on to the land. As far as possible the waste products should be recycled or used to make useful products.

2. Materials like paper, glass, metal scraps and some types of plastics can be recycled.

3. The domestic and urban garbage wastes should be properly managed by municipal corporations.

4. Animal wastes and agricultural wastes can be utilized as manure and for the production of biogas.

5. Biological methods of pest control can reduce use of pesticides to minimize soil pollution.

6. Use dustbin to throw the garbage at home as well as in public places.

7. Plant more and more plants to prevent soil erosion.

8. General public should be given information about the ill effects of soil pollution.

4. Noise Pollution

Every day we hear different kinds of sounds. Some of them are pleasant but others cause irritation. Imagine a world without sound. It would be very difficult to live in such a world. Sound is a medium for communication. We share our thoughts, feelings and information with others using sound. Noise Pollution may not seem as harmful as the contamination of air or water. But it is a pollution problem that affects human health and can contribute to a general deterioration of environmental quality. Noise is not a substance that can accumulate in the environment like other pollutants. Sound is measured in a unit called 'decibel' (dB).

Causes of Noise Pollution:

1. Various industries such as iron and steel, automobiles, power plants, textiles, petroleum, fertilizers etc. involve different operations that produce noise.

2. Household gadgets like T.V., radio, music systems, coolers, washing machine, and food processors generate noise.

3. Surface transport is one of the major sources of noise pollution in big cities. The horns from cars, buses, trucks, bikes and two wheelers cause a lot of noise.

4. Festivals and religious activities where public address systems are used often generate a lot of noise.

5. Construction activities where machinery is used also contribute to noise pollution.

6. Market places, malls, fairs and exhibitions also contribute remarkably to noise pollution.

Effects of Noise Pollution:

1. The most direct harmful effect of excessive noise is physical damage to the ear and the temporary or permanent hearing loss.

2. Excessive sound levels can cause harmful effects on the circulatory system by raising blood pressure and altering pulse rates.

3. Noise Pollution can affect biological functioning of the body and result in anxiety, insomnia, hypertension and giddiness, loss of physical control etc.

4. Chronic noise may also lead to abortions and congenital defects.

5. Noise Pollution can cause psychological effects such as irritability, stress, lack of concentration and mental fatigue.

6. Severe Noise interferes with normal auditory communication and hence increases the rate of accidents especially in industries.

7. Excessive Noise can have adverse effects on domestic animals also.

Prevention of Noise Pollution:

1. Factories which mainly produce noise should be established for away from residential areas.

2. Airports should be located atleast 20 kilometers away from residential areas.

3. Vehicles are to be properly maintained. There should be restriction on high sound horns. Advanced technology silencer must be used.

4. Use of horns near public places like hospitals and educational institutions should be banned.

5. The use of sound amplifiers of high power should be banned in religious, social and political events.

6. Planting green trees along the road side reduces the intensity of noise pollution.

7. Construction of sound proof rooms for noisy machines in industries must be encouraged.

8. Use of ear plugs can bring down loud noises to manageable level.

5. Radioactive Pollution

Radioactive pollution is the physical pollution of living organisms and their environment as a result of release of radioactive substances into the environment during nuclear explosions and testing of nuclear weapons, nuclear weapon production, mining of radioactive ores, handling and disposal of radioactive waste and accidents at nuclear power plants. Nuclear tests are carried out to determine the effectiveness, yield and explosive capability of nuclear weapons. The destruction caused by the

radioactive materials is because of the emissions of hazardous ionizing radiation like beta or alpha particles, gamma rays or neurons in the environment where they exist.

Causes of Radioactive Pollution:

1. Nuclear is considered to be the most potent source of energy due to its high latent power. Nuclear accidents in nuclear energy generation plants like Fukushima Daiichi nuclear disaster, Chernobyl disaster left many dead and even many more affected by the radiation released.

2. The use of nuclear missiles and atomic bombs during wars causes radioactive pollution.

3. Radio isotopes are used to make detectors and in industrial activities. Isotopes such as uranium have high concentrations of radiation in them.

4. Mining involves the excavation of mineral ores. For example radium, uranium, thorium, plutonium are highly radioactive materials.

5. Chemotherapy, a cancer treatment uses radiation to prevent further growth of cancer cells. Scientists have been exposed to radiation leading to their deaths or to complications.

6. Cosmic rays that come from outer space to our planet with intense radiation cause radioactive pollution. For example Gamma rays are said to have the highest level of radiation.

Effects of Radioactive Pollution:

1. Radiation has adverse effects when it comes to genetics. It leads to damage of DNA strands leading to genetic break up. The resulting mutation makes one highly susceptible to cancer.

2. Radiation causes diseases such as cancer, leukemia, anemia, hemorrhage and premature aging and premature deaths. Leukemia, for example, is caused by radiation in the bone marrow.

3. Radioactive substances in the soil react together with the various nutrients leading to destruction of these nutrients rendering soil infertile and highly toxic.

4. Radiation distorts the cells present in living organisms leading to permanent damage of the various organs and organ systems.

5. Burns, red lesions and sores are caused by radiation which can lead to skin cancer.

Prevention of Radioactive Pollution:

1. Proper methods are to be used for disposing radioactive waste. For example it should be stored in heavy and thick concrete containers.

2. It is necessary for any material with radioactive content to be labeled and the necessary precautions advised on the content of the label.

3. There should be a banning of nuclear tests which contribute greatly to the overall presence of radioactive substances.

4. We need to focus on alternative and environmentally friendly energy sources namely solar, hydroelectric and wind power.

5. Radioactive materials are to be stored in radiation proof containers to ensure no leakage during handling.

Chapter 6

Environmental Management and Protection

Introduction

Environmental Management is concerned with the understanding of the structure and function of the earth system. It is also concerned with description and monitoring of environmental changes, predicting future changes and attempts to maximize human benefit and to minimize Environmental Degradation due to human activities. Environmental Management also pertains to process of decision making in relation to the use of natural resources. It is more concerned with the management of human activities and their impact on the environment than with the management of natural environment itself.

Environmental managers attempt deliberately to increase the process of development, attempt to ensure that critical environmental limits are not exceeded, work to reduce and mitigate environmental issues and they are concerned with increasing the adaptability of human societies in the face of environmental change, variability, unpredictability and hazards. From this point of view, Environmental Management may be defined as the system that anticipates and avoids or solves environmental and resource conservation issues. From another point of view, Environmental Management may be defined as a process concerned with human – environment interactions which seek to identify

- What are environmentally desirable outcomes?
- What are the physical, economic, social, cultural, political and technological constraints to achieving those outcomes?
- What are the most feasible options for achieving those outcomes?

From another point of view, Environmental Management is concerned with meeting and improving provision for human needs and demands on a sustainable basis with minimal damage to natural habitats and ecosystems.

Thus the concept of Environmental Management is closely related to another important concept that of sustainable development.

The components of Environmental Management are based on five fundamental aspects. They are:

1. Environmental perception and public awareness which includes (a) sources of environmental perception and public awareness (b) level of environmental perception (c) role of environmental perception in environmental planning and management.

2. Environment Education and training to be given at school, college and university levels by professionals.

3. Resource management which includes (a) classification of natural resources (b) survey and evaluation of ecological resources (c) preservation of resources (d) conservation of resources.

4. Control of Environmental Degradation and pollution which includes (a) adopting suitable preventive mechanisms to reduce natural hazards and disasters (b) regeneration of degraded environment.

5. Environmental impact assessment which includes (a) appraisal of existing environmental conditions (b) appraisal of existing and proposed production methods (c) probable impacts of existing and proposed project (d) review of technology and required improvement.

6. Educating the general public about the urgent need for conservation and preservation of the environment.

Need for Management of Environment

Environmental Management is required for development without destruction or overuse of natural resources and to reduce pollution and degradation of nature. Considering the welfare of future generations, proper decisions regarding use of environment are necessary.

Environmental Management is essential for the following reasons.

1. **For use of resources:** You are aware that resources are limited. If these resources are not properly used, they will get exhausted very soon. For appropriate and reasonable use of resources management of environment is necessary.

2. **To overcome environment and ecology crisis:** Proper management of environment is necessary because the present development has reached a point where environment and ecology are in crucial crisis. If the same continues, it will have disastrous effect on the environment. The whole earth will be destroyed.

3. **For sustainable development:** Environmental Management is required for development without destruction or overuse of natural resources and to reduce pollution and degradation of nature.

4. **For economic need and values:** Environmental Management is required to give new directions to our economic needs and values and to maintain at the same time clean environment.

5. **To reduce disasters:** Proper Environmental Management reduces the risk of disasters like floods, forest fires, earthquakes, desertification, transport accidents, global warming etc. Appropriate measures are to be taken to avoid man-made disasters.

6. **To decide the limiting line between development and environment:** Environmental Management is essential to draw a line of limit between development and environment. For example, if we find that some of our developmental activities are responsible for global warming or depletion of the ozone layer, then we must have control over such activities. Further we may adopt the policy of afforestation.

Objectives and Characteristics of Environmental Management

Environmental Management is the process of allocating natural and man-made resources so as to make optimum use of the environment in satisfying not only the present basic human needs but of the future generations also. This management implies an element of conscious choice form a variety of alternative proposals and such a choice involves purposeful commitment to recognized and desired objectives.

Environmental Management involves environmental planning, conservation of resources, environmental status evaluation, and environmental legislation and administration. It is a field of study dedicated to understanding human-environment interactions and the application of science and common – sense to solving environmental problems.

The main objectives of Environmental Management are

1. To prevent and solve environmental problems.
2. To establish limits in respect of use of natural resources.
3. To develop Environmental Research Institutions and Monitoring Systems.
4. To warn about environmental threats.
5. To suggest measures for resource conservation.
6. To develop strategies for the improvement of quality of life.
7. To suggest long – term and short – term policies for sustainable development.
8. To identify new technologies for sustainable development.
9. To provide every person with opportunities to acquire the knowledge, values, attitudes and skills needed to protect and improve the environment.
10. To create new patterns of behavior of individuals, groups and society towards the environment.

Characteristics of Environmental Management

During the last three decades much awareness has been developed regarding environmental protection and quality of life. New terminologies like clean technology, environmental auditing, environment friendly products, environmental impact assessment, and environmental resource conservation have come into existence. All these aspects have been converged when the wider concept of Environmental Management has been emerged and also accepted as a tool for sustainable development.

Time has now come when our policy makers as well as society should aim to protect, conserve and regulate the development in such a way that it will not create any adverse effect on ecosystem and needs of the people can also be fulfilled. Throughout the world, particularly in developing countries, there is an urgent need for the management of total environment.

The Characteristic features of Environmental Management are:

1. It deals with a world affected by humans.
2. It supports sustainable development.
3. It demands a multidisciplinary approach.
4. It has to integrate different development view points.
5. It concerns with short – term and long – term planning as well as from local to global scale.
6. It seeks to integrate natural and social science, policy making and planning.

Thus, Environmental Management is an approach which integrates ecology, policy making, planning and social development.

Protection of Environment

Environmental Protection is the practice of protecting the natural environment by individuals, organizations and governments. Its objectives are to conserve natural resources and the existing natural environment and to repair damage caused to the environment.

Due to the pressure of consumption, population growth and technology, the biophysical environment is being degraded. This has been recognized and governments have begun placing restraints on activities that cause Environmental Degradation. Since the 1960s environmental movements have created more awareness of the various environmental problems.

Environmental Protection can be defined as the prevention of unwanted changes to ecosystems and their constituent parts. This includes (a) the protection of ecosystems and their constituent parts from changes associated with human activities and (b) the prevention of unwanted natural changes to ecosystems and their constituent parts.

An important issue is whether Environmental Protection relates to preservation, conservation or both. Preservation refers to the protection of an ecosystem or natural environment from change while conservation is generally associated with the sustainable use of natural resources. The objective of conservation is to ensure the maintenance of a stock of renewable resources that is being exploited for human purposes rather than the protection of the natural environment from any anthropogenic modifications. Measures that are put in place to prevent over exploitation of natural resources do constitute Environmental Protection.

The need for protecting the environment has become a basic living need. Today, when we look at our surroundings, we see buildings,

vehicles, multiplexes etc. The human needs are limitless and when it comes to urbanization, they are never satisfied. We as humans compromise the nature according to our convenience. But we often forget about the role that the environment plays in our lives. The green environment that we live in consists of air, water, soil, trees, sunlight etc. Everything that the environment consists of is important to us. There are many reasons which affect the environment. For example deforestation, pollution and over population have affected our environment to a greater extent.

We may not all be environmentalists, but there are simple measures which we can take to reduce consumption of resources to avoid depletion. The following measures can be adopted to protect the environment:

1. **Plant trees**: Trees may take long time to grow. But they serve the future generations. Plants not only provide shade but also absorb carbon-di-oxide reducing pollution.

2. **Conserve water**: Water conservation is vital since we cannot survive without water. Avoid using shower for bath. Turn off the tap while brushing teeth. Leakage of water is to be avoided.

3. **Limit car use**: Use of car is to be limited because they emit lot of carbon-di-oxide. Alternate way is using public transport. Carpooling is also useful to reduce gas emissions.

4. **Minimize food wastage**: Wasting food results in wastage of energy and water used to prepare the food. Research shows that annually food that gets lost globally is sufficient to feed almost a billion hungry people across the world.

5. **Switch off**: Turn off lights, computer, television etc. when they are not in use. This helps in saving lot of electrical energy. Also consider using LED bulbs to save electricity.

6. **Using second – hand products**: New products need resources for their manufacturing and production. Most of these productions use natural resources. Thus you can protect the environment by choosing second – hand products.

7. **Reuse and recycle**: Use an eco-friendly water bottle instead of bottled water or take your own reusable bag to the grocery store. Reusing and recycling can reduce pollution.

8. **Go paperless**: Select paperless as the mode of communication. This is to be implemented in all government offices.

9. **Buy local products**: If possible buy local products. This saves all the pollution incurred by transporting goods from long distance.

10. **Work from home**: If your employer permits you to work from home, it helps in the reduction of pollution and also saves money.

Chapter 7

Natural Resources, Problems and Solutions

Natural Resources

Definition of Natural resources

A Natural resource may be defined as any material given to us by nature, which can be transformed in a way that it becomes more valuable and useful.

Land Resources

Land instead of being one thing, is in fact a complex made up of several components. The nature of each of the components, which make the soil complex, is studied under land resources.

Soil is one of the most important ecological factors, because upon it the plants depend for their nutrients, water supply and anchorage. It is important even for the free-floating aquatic plants, which drive their nutrients dissolved in the water medium around them as a chief storage of all the nutrients, which are made available to the water medium.

It provides support to all plants and animals. Land is connected to atmosphere from where it receives different gases; it is having many water bodies through rain and sufficient underground water to support plant life on earth. Besides, the land receives solar radiation, which is essential for the plants to prepare their food.

Land is also the place where different types of animals are found and different types of ecosystems function. Land, however, is not uniform throughout but marked with great diversity of forms and structure and accordingly the ecosystems differ in their characteristics.

Land is the most important resource of a nation. Soil is a dynamic natural substance over the Earth's crust in which plants strike root and grow. It is composed of mineral and organic materials and living forms.

Prevention of Soil Erosion

1. Forest Management should be given top priority to check illegal felling of trees. Control measures should be taken to check forest soil erosion.

2. Steps should be taken to check shifting cultivation, which is very much seen in our area. People dependent on shifting cultivation should be provided with alternative methods of living. For example, they may be employed to plantation in a massive scale to check soil erosion in hill slopes.

3. Many studies should go before implementation of various developmental activities like urbanization, mining, construction of dams, canals, roads, railways airport, industries etc.

Forest Resources

Forests and wildlife are essential to maintain ecological balance of an area. They are an important renewable natural resource. Forest ecosystem is dominated by tress, their species content varieties in different parts of the world. It is contributes to the economic development of the country because they provide goods and services to the people and industries. It is enhance the quality of environment by influencing the life supporting system.

Forests check air pollution and soil erosion. Thus, they exercise safeguard pollution. It save the hill slopes from landslide. In deserts, trees reduce wind erosion by checking wind velocity. The forests check strong gates and keep the soil intact beneath the roots of trees and thus check extension of desert. Forests check pollution of air through increasing oxygen content of the air.

By causing condensation of water vapour in clouds, forests attract rains. Floods are controlled because forests dry up rainwater like sponge.

They are linked with our culture and civilization. It supply of raw materials. It provides Rs 400 crore per year as revenue to the government and it provides fodder to cattle. Minor forests products are canes, gums, resins, dyes, flocks, medicines, tannins, lac, fibres, katha etc. it gives employment opportunities and foreign exchange earners.

Deforestation

Deforestation involves the conversion of forested regions to non-forest land for the use of pastures for livestock, logging, companies, industrial gain, urban use, or simply to become a wasteland.

Prevention of Deforestation

a) Use recycled items

To, a consumer can purchase a variety of recycled items, including notebook paper, books, toilet paper and shopping bags. When people use recycled products and make a conscious effort not to waste, the demand for new raw material to replace these items can decrease.

b) Tree Care

When cutting down trees single out full-grown specimens and spare younger varieties. In the event that use must remove a tree for a legitimate reason (for safety issues or poor line interference), make sure that for every tree lost another is planted in its place.

c) Farming Practices

Those who plant crops at a farm can participate in putting a dent in deforestation by rotating crops. It is suggested to place the habit of using different portions of land each year with using the same portion of land to plant different crops. This practice has proven effective in maintaining soil fertility. Farmers may also embrace many another options, such as high

yield hybrid crops and hydroponics, which relies on a method of growing plants using mineral nutrient solutions instead of soil.

d) Cut back on palm oil

In Malaysia and Indonesia, an increasing amount of trees is cut down in order to generate the palm oil used in the production of some breads, chocolates and Shampoos. As a result, the native orangutans are losing their habitat. You can spread awareness and limit your consumption of products containing this type of oil.

e) Coals

As the chill of the winter takes over the autumn season, try using coals instead of firewood in your fireplace. While it only takes a couple of hours to consume a few logs here and there, keep in mind that it takes years for one tree to fully grow.

f) Reforestation

Take a page from the People's Republic of China, where the government has in the past set a requirement that every able-bodied citizen between the ages of eleven and sixty is responsible for planting three to five trees per year or complete an equal amount of work in other areas of forestry. Since 1982, the Government claims that at least one billion trees have been planted in china because of the program.

g) Become an Advocate

Become an advocate of reforestation. Learn how you can spread the world. For instance, a middle school in Washington took to the streets asking people for just one penny. They explained that the money would go towards purchasing acres of Amazonian rainforest. If successful, this move ensures that no deforestation can take place on the bought land. The effort was twofold spreading information and collecting money for a good cause.

h) Arbor day foundation's Rain forest rescue

Support programs, such as this Arbor Day foundation gem, which assist in the prevention of deforestation. Donated money is used to purchase and preserve rainforest space before lumber companies can get a hold of the land. As a result, the Arbor Day Foundation is able to protect the land from Deforestation.

i) Support Conservation Organizations

Lend your support through donations of your time, money, or actions to organizations that run programs concentrating on the prevention of forest habitats, such as Green peas, worldwide fund for nature, community forestry international and Conservation International.

More Points

1. Begin by hugging a tree.
2. Start planting trees.
3. When shopping, move towards buying recycled products mainly.
4. Stop printing and go paperless.
5. When at home, recycle as much as possible.
6. In the kitchen, cut down on your meat intake and eat as many vegetarian meals as possible.
7. Speaking of meat, do not buy meat products sources from land where forests have been cleared.
8. Simply buying organic products instead.
9. Do not buy palm oil at all.
10. Do not use firewood to heat up your fireplaces.
11. Encourage people to live in a way that does not hurt environment.

12. Do not buy anything from large, multinationals that are actively or indirectly involved or responsible for the clearing of forestland.

13. Support companies that produce products by causing minimal harm to the environment.

14. In the process, you also need to practice what you preach

15. Work with NGO's to establish parks to protect rainforests and wildlife.

Water Resources

Water claims to be an important resource. An important use of water in our country is for irrigation. Besides, water is also required in large amounts for industrial and domestic consumption.

Water resources are revealed by the history of human civilization that water supply and civilization are almost synonymous. Several cities and civilization have disappeared due to water shortages originating from climatic changes. Millions of people all over the world, particularly in the developing countries, are losing their every year from waterborne diseases.

An understanding of water chemistry is the basis of knowledge of the multi-dimensional aspects of aquatic environmental chemistry, which involve the sources, composition, reactions and transport of water. About 97 per cent of the earth's water supply is in the ocean, which is unfit for human consumption and other uses because of its high salt content. Of the remaining 3-2 percent is locked in the polar ice caps and only 1 percent as available as freshwater in rivers, lakes, streams, reservoirs and groundwater that is suitable for human consumption.

Prevention of Water Scarcity

The apparent abundance of water is deceptive and we tend to take it for granted. We tend to abuse and overuse it. This has led to water scarcity.

1. Improve the utilization of created irrigation potential.

2. Optimize agriculture production and productivity from irrigated lands on a sustainable basis.

3. Integrate all functions related to irrigated agriculture through a multi-disciplinary team under an area development authority.

4. Major and medium Irrigation Projects started.

5. Groundwater development, which constitutes bulk of the minor irrigation programme, is essentially a people's programme implemented primarily through individual and cooperative efforts with finance obtained mainly from institutional sources. To encourage use of water-saving devices such as sprinklers, drip system, hydrams, water turbines and hand pumps, the government subsidies are made available to small and marginal farmers for their purchase.

6. National Commission for Integrated Water Resources Development Plan are mainly for development of water resources for drinking, irrigation, industrial, flood control, transfer of surplus water to deficit areas etc.

7. The Central Water Commission's (CWC) work are divided into four functional wings, namely, water planning, design and research, river management and planning and progress

8. Water should not be wasted. Leaky taps must be

Mineral Resources

A '**Mineral Resource**' is a concentration or occurrence of material of intrinsic economic interest in or on the earth's crust in such form, quality and quantity that there are reasonable prospects for eventual economic extraction.

The economic development of a country depends, largely, on the availability of minerals, got as ores from the earth by mining. Coal and iron are the basic minerals, which humans need to develop iron and steel industry. Minerals such as mica, copper, lead and zinc are of vast economic importance. Thorium and uranium are atomic energy minerals.

A mineral is a naturally occurring substance, represent able by a chemical formula that is usually solid and inorganic, and has a crystal structure.

A mineral is a pure inorganic substance that occurs naturally in the earth's crust. More than two-thousand minerals have been identified and most of these are inorganic, which are formed by the various combinations of elements. However, a small proportion of the earth's crust contains organic materials consist of single elements such as gold, silver, diamond, and sulfur.

Categories of Mineral Resources

Mineral resources can be divided into two major categories.

• Metallic Mineral Resources

• Non-metallic Mineral Resources

Metallic Minerals are metals that are hard substance and conduct heat and electricity with characteristics of lustre or shine. For example Gold, Silver, Tin, Copper, Lead, Zinc, Iron, Nickel, Chromium, and Aluminium.

Characteristics of Metallic Minerals

- Metallic Minerals present a metallic shine in their appearance.
- Contains metals in their chemical composition.
- Potential source of the metal that can be got through mining.
- Metallic minerals contain metal in raw form.

Metallic minerals are further classified into Ferrous and Non-ferrous metallic minerals.

Ferrous Minerals are those minerals that contain iron, for example, Iron ore, manganese, and Chromites.

Non-Ferrous Minerals are those minerals which do not contain iron, for example, gold, silver, copper, and lead.

Nonmetallic minerals are a special group of chemical elements from which no new product can be generated if they are melted. For example sand, gravel, gypsum, halite, Uranium, dimension stone.

Characteristics of Non-metallic Mineral Resources

- Non-metallic minerals are minerals which are either present a non-metallic shine or bluster in their appearance.
- These minerals do not contain extractable metals in their chemical composition.

Use of Minerals

The use of minerals depends upon its deposits. Some countries are rich in mineral deposits, while others have no deposits. The greatest use of minerals depends on its properties. For instance, Aluminum is light, strong and durable in nature, so it is used for aircraft, shipping, and car industries.

Minerals are used in almost all industries. Gold, silver, and platinum are used in the jewelry industry. Copper is used in coin industry and for making pipes and wire. Silicon obtained from quartz is used in the computer industry.

Conservation of Mineral Resources

The total volume of consumable minerals resources is just 1% of all the minerals present in the earth's crust. However, the consumption rate is so high that these mineral resources which are non-renewable will get

exhausted very soon. Here are some of the measures to conserve minerals:

- Use of minerals in a planned and sustainable manner.
- Recycling of metals
- Use of alternative renewable substitutes.
- Technology should be improved to use the low-grade ores profitably.

Prevention of Exploitation of Minerals

A National mineral policy has been adopted which encompasses the various policy guidelines which have been issued from time to time. The policy also emphasizes certain new aspects and elements as follows:

1. Development of proper inventory.
2. Proper linkage between the exploitation of minerals and the development of mineral industry.
3. Preference to members of the scheduled Tribes for the development of small deposits in scheduled areas.
4. Production of forest, environment and ecology from the adverse effects of mining.
5. Enforcement of mining plan for adaptation of proper mining methods.
6. Optimum utilizations of minerals, export of minerals in value added form and recycling of metallic scrap and mineral waste.

Under the Constitution, Mineral rights and administration of mining laws are vested in state governments. The Central Government, however, regulates development of minerals under the MMRD Act 1957, and the rules and regulations framed under it. The statute empowers the Central Government to formulate rules for the following:

- The grant of prospecting licenses and mining leases.
- The conservation and development of minerals.

- The modification of old leases.

The MMRD Act, 1957, was amended in 1972 and major amendments were made in February 1987. The Mineral concession Rules, 1960, was also amended in February 1987 and 1988. The Mineral Conservation and Development Rules 1958, was replaced by rules that are more comprehensive in 1988.

The guidelines refer the environmental components to be kept in view during the site selection. For cost benefit analysis, the following has been suggested in the guidelines. The cost for environmental protection and mitigate measures should also be included in the overall estimates.

These should be also including the measure as follows:

1. Compensatory afforestation.
2. Restoration of land in areas under extraction.
3. Control of extracted weed.
4. Control of noise, air and soil pollution caused by the process of extraction and mining.
5. Rehabilitation of project ousters.

Energy Resources

Energy is an important input for development .It aims at human welfare covering household, agriculture, transport and industrial complexes.

Kinds of Energy Resources

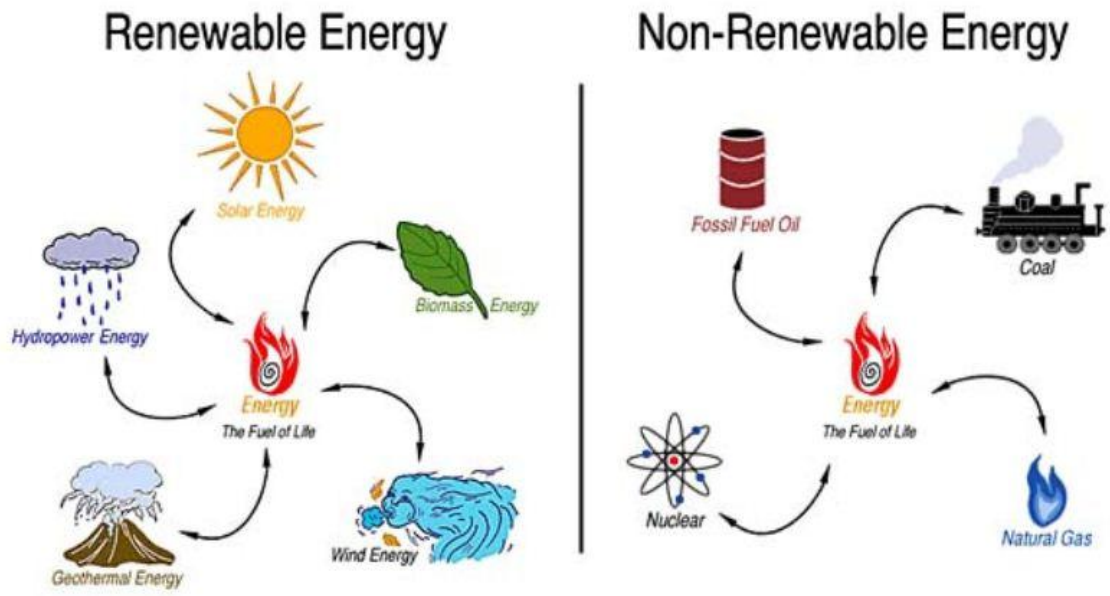
1. Renewable Energy Resources:

These resources are mostly biomass based and available in unlimited amount in nature since these can be renewed over relatively short period. These include firewood (or fuel wood) obtained from forests, petro plants, plant biomass (agricultural wastes such as biogases), animal dung, solar energy, wind energy, water energy (hydroelectric and tidal

energy), geothermal and dendrothermal energy. These are called renewable energy because they can reproduce themselves in nature and can be harvested continuously through a sustained proper planning and management.

2. Non –Renewable Energy Resources:

These energy resources are available in limited amount and develop over a longer period. Consequent to unlimited use, they are likely to be exhausted one day. These energy resources include coal, mineral oil, natural gas and nuclear power. Coal, petroleum and natural gas, the common sources of energy are organic (biotic) in their origin. They are also



called fossil fuels.

Alternative energy resources

Energy resources are well recognized that the development and utilization of renewable sources of energy along with conventional energy sources is necessary to meet the growing demand for energy in our urban

and rural areas. The techno-economic viability of a number of systems and devices based on renewable energy sources has been demonstrated successfully in the domestic, commercial and industrial sectors.

Reasons for use of alternative resources

1. Coal, mineral oil, natural gas and nuclear minerals are non-renewable and are to last one day.

2. The use of conventional resources is invariably associated with environmental pollution problems.

3. Large-scale utilization of wood may lead to deforestation.

4. Centralized system in a conventional source of energy, involves much expenditure on setting up infrastructure and management. There is now a trend towards decentralization which is likely to provide greater initiative to local people who could assess their needs and resources and plan a strategy that suits them best.

5. The energy crisis during the 1970s forced scientists to develop alternative sources of energy that should be renewable and pollution free.

6. Due to the rapid depletion of conventional energy sources, countries all over the world are forced to concentrate over tapping the vast potential of non-conventional energy sources. These sources include dendrothermal, solar, wind, ocean (tidal) geothermal heat, biomass, farm and animal waste including human excreta.

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