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Environmental Studies—Scope and Importance

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INTRODUCTION

Nature consists of two very much complex, interdependent mutually reactive and interrelated entities—the **organisms** and the **environment**. The organisms can survive only in appropriate environments, interact with each other, and are influenced by the whole complex of environmental factors. The various principles that govern the relationships between the organisms and environment is called **ecology**. The term ‘ecology’ (Gk. *Oikos*—house or place to live, *logos*—study or discourse) was first introduced by a German biologist **Ernst Haeckel** (1869), and defined it as ‘*the study of reciprocal relationships between organisms and their environment*’. Ecology is the branch of biology that deals with the study of interactions between organisms and environment. An understanding of ecological principles is essential for the sustainable use of resources and to evolve strategies for the mitigation of environmental problems at local, regional and global levels.

ENVIRONMENT

The term ‘environment’ means surroundings, in which the organisms live. It is the sum total of all biotic (living) and abiotic (non-living) factors that surround and potentially influence an organism. Some components of the environment serve as resource (e.g. soil, water etc.) while others act as regulatory factor (e.g. temperature, light etc.). Different components of the environment are interlinked and interdependent. Environment creates favourable conditions

for the existence and development of living organisms. In context of human beings, environment can be defined in number of ways:

(i) "Environment is the sum of all social, economical, biological, physical or chemical factors which constitute the surroundings of man, who is both creator and moulder of his environment."

(ii) "Environment refers to the sum total of conditions which surround man at a given point in space and time."

(iii) "Environment is the representative of physical components of the earth wherein man is the important factor influencing his environment."

Spatial and Time Scale of Environment

The environment can be understood at both large and small scales. This is reflected in regional and global climatic patterns, as well as the local climatic conditions called the **microclimate**. The term 'spatial' refers to the physical space occupied by an organism. Most organisms interact with their environment at several spatial and time scales. For example, a single bacterium in soil, interacts with air and water within a fraction of a cubic centimetre space, while a tree interacts with a large volume of air, water and soil at a large spatial scale. The environment varies from place to place due to variation in climate, and topography. The activities of organisms influence the hydrosphere, the lower atmosphere and the near surface part of the lithosphere through exchanges of matter and energy. Organisms have to cope with the external environment over a range of time scales, varying from few minutes to days, seasons or over a much longer period of geological time scale. For example, the population of phytoplankton (i.e. microscopic photosynthetic organisms that float on water surface) may undergo change within a few days with the change in light conditions in aquatic systems. On the contrary, the variations in lithosphere occur very slowly and take a long period of time.

WEATHER AND CLIMATE

The term '**weather**' refers to the short term properties of the atmosphere (such as temperature, pressure, humidity, rainfall, sunshine, cloud cover and wind, etc.) at a given place and time. The average weather of an area including general patterns of atmospheric conditions, seasonal variations and weather extremes averaged over a long period of time is called **climate**. Thus, weather refers to the hourly, daily or weekly changes in the above properties, climate reflects longer periods, such as season or years. The climate is largely determined by the temperature and rainfall of an area. Differential input of solar radiation in different regions and redistribution of heat energy by winds and ocean currents results in global variations in temperature and rainfall. The variations in temperature, rainfall and humidity in different regions of globe determine global climate patterns which govern all life on earth.

Climatic Zones. The entire earth can be divided into four main climatic regions on the basis of mean temperature along latitude. These regions are:

1. Tropical region (0° – 20° latitude),
2. Subtropical region (20° – 40° latitude),
3. Temperate region (40° – 60° latitude), and
4. Arctic and Antarctic regions (60° – 80° latitude).

ENVIRONMENTAL STUDIES—SCOPE AND IMPORTANCE

Temperature varies with change in latitude and altitude. The mean temperature decreases as we move from tropical to arctic region. A similar climatic zonation occurs with increasing altitude in the mountains. The mountains which are located in tropical region will successively have tropical, subtropical, temperate and alpine zones with increasing altitude. Likewise, the high altitudes in temperate zone, will have alpine climatic conditions. Within each temperature based climatic zone, the annual precipitation (*i.e.* rainfall and/or snowfall) varies considerably. The two factors, temperature and precipitation, together determine the vegetation and soil type.

Microclimate. The climatic conditions that prevail in an area of limited size, such as the immediate surroundings of plants and animals, constitute **microclimate**. It generally differs from the prevailing regional climatic conditions. For example, in a forest, the ground vegetation receives less light due to dense foliage of tall trees. Tall trees also change the air temperature profile. During the daytime, air temperature inside the forest is lower than outside. Similarly, the interior of a forest is more humid than the surrounding non-forested area. Thus, the microclimate differs in different zones of a forest.

HABITAT

The place occupied by an organism, population or community which is exposed to a particular combination of environmental factors is called **habitat**. In this combination, no environmental factor acts independently but is also interacted by other factors. Habitat is, therefore, also defined as '*the sum total of environmental factors or conditions, which determine the existence of an individual organism, population or community in a particular locality*'. The term habitat is more specific than the environment because it corresponds to a particular combination of its factors. It may be as small as bark of a tree or a burrow or as large as ocean. Each habitat may have several minor variations due to minor change in one of the environmental factors. The habitats with minor variations are called **microhabitat** or **partial habitats**. For example, vertical stratification of temperature produces a number of microhabitats around different parts of a large plant.

Habitats are characterised by conspicuous physical features, which may include the dominant forms of plant and animal life. Plants and animals are influenced by the environmental conditions of a particular habitat, indicate some specific traits. For example, the characteristics of plants growing on saline soils differ from the plants found growing on normal non-saline soils.

COMPONENTS OF ENVIRONMENT

The environment is classified into two components : abiotic (non-living) and biotic (living) components.

Abiotic (Non-living) Components

The abiotic or non-living components include the **climatic** and **edaphic factors**. The climatic factors include temperature, humidity, rain and snowfall etc. The edaphic factors comprise the soil and substratum. The ability of organisms to utilise, tolerate or combat the various abiotic factors are different and it may limit their distribution, behaviour and

relationship with other organisms. Some of the most important abiotic factors are given below:

1. Temperature. Living organisms can survive only in a narrow range of temperature which allows their metabolism. The living organisms develop physiological and behavioural adaptations to withstand extremes of temperature. Many animals (such as some birds and mammals) migrate to warmer places in winter to avoid extreme cold. Some desert animals live inside burrows to avoid the intense heat of the desert.

2. Water. Water is an essential requirement of life. No life can exist without water. The requirement of water varies from organism to organism. The distribution of organisms depends upon the extent of the need and special adaptations for conserving water.

3. Light. Light is essential for photosynthetic organisms for the preparation of food on which the rest of the living world depends. Plants show various adaptations for obtaining optimum light. The activities of a large number of organisms are regulated by light. For example, cockroaches, moths and bats are active during the night.

4. Humidity. It is the amount of water vapours present in the atmosphere. Humidity regulates the rate at which water evaporates from the body surface of land organisms by transpiration, perspiration and other means. Different plants and animals show various adaptations to withstand dry conditions.

5. Wind. Wind determines the weather condition. It helps in the dispersal of seeds and fruits of many plants.

6. Mineral Elements. A large number of minerals are required by organisms for their proper growth. Deficiency or absence of any one results in abnormal growth which may lead to death. High concentration of minerals are equally harmful and can limit the distribution of organisms.

7. Background. The background of the habitat also determines the distribution of animals by enabling them to camouflage against the colour, general texture and pattern. For example, desert animals like the lion and the camel are sand coloured.

Biotic (Living) Components

The living organisms form the biotic component of the environment. All organisms require energy for their life processes and materials for the formation and maintenance of body structures. Food supplies both energy and materials for the sustenance of life. Green plants produce carbohydrates by photosynthesis and also synthesise proteins and fats. The green plants are, therefore, called **producers**. The animals that consume this energy as food are called **consumers**. The non-green organisms like the fungi and some bacteria which are incapable of producing their food, live on the dead and decaying plant or animal parts are called **decomposers**.

TYPES OF ENVIRONMENT

Environment can be conveniently divided into two categories: 1. Natural environment and 2. Man-made or anthropogenic environment.

1. Natural Environment. The environment that comes into existence without interference of man is called natural environment. It operates through self-regulating mechanism called homoeostatic environment mechanism i.e., any change in the natural

ecosystem brought about by natural process is counter balanced by changes in other components of the environment.

2. Man-made or Anthropogenic Environment. The environment which has been modified by human activities is called man-made environment. Man is the highest of all the creatures on this earth. He is modifying the environment according to his own needs and ways without taking into account its consequences. Increase in the scientific technologies which are the product of human brain is now deteriorating the environment.

HUMAN INTERFERENCE WITH THE ENVIRONMENT

Every living species of plants or animals influences its environment and in turn gets influenced by it. The magnitude of such influences is not usually high in these species because of the fact that due to natural checks their population cannot rise beyond certain limits and they can also not modify their own way of life. However, man is an exception. With increasing scientific knowledge, man is able to modify the environment to suit his immediate needs much more than any other organism. This enables man to improve the quality of his life.

Since the very beginning of human civilization, some thousand years ago, man started interfering with the environment. He devastated forests by cutting trees for the wood and for other household needs. He removed stretches of forests for bringing land under cultivation. He killed animals—the gentle ones, for food and the fierce ones, for safety. He had polluted the rivers with chemicals from factories, thereby making the water unfit for his needs. All these activities, however did not affect the environment too seriously upto a fairly long time, because the population was not too high and the life style was not so complex. The natural self-purifying and self-cleansing capacity of the environment was undeteriorated.

However, with the scientific and industrial revolution in the recent past, there has been immense impact of man on his environment. Man has failed to realise that any change upsets the balance of the ecosystem as a whole. All the devastating effects of man's effect to control nature have occurred because he has upset the balance relationship of the organisms that make up the environment. Huge industrial installations every year, introduction of faster mode of transport and sprouting up of large crowded cities (urbanization) are the main outcomes of the modern civilization. These and a large number of many others are contributing to what is called environmental pollution. An example of which is also the widespread use of insecticides. The immediate effect was a reduction in the population of pests and an increase in the yield of crops. But these insecticides also poisoned and killed birds which feed on insects. As a result, the next generation of pests multiplied even faster in the absence of their natural enemies, and damage to crops was much more. Increasing industrialization is also causing much danger to man's life by polluting the environment.

NEED FOR PUBLIC AWARENESS

With the advancement in technology, explosive increase in human population, scarcity of space and food, deterioration of hygienic conditions, depletion of natural resources and socio-economic problems, one needs extensive and exhaustive study of the environment, particularly in relation to human survival and benefit. The subject is gaining more popularity with its name as **environmental biology** or **environmental studies**. However, the environmental biology is not a new discipline but simply an extension of ecological approach which stresses upon the study of environment in its totality with special emphasis on the welfare of man.

Environment is not merely the atmosphere and other physical factors, surrounding us, but is the complex of all factors which not only affect one organism one time, but all organisms all the time. In a larger sense, environment constitutes the various physical, mental, social, spiritual, educational, economic and intellectual aspects of whole humanity and when kept healthy and inspiring, it promotes the progress and development of mankind. The understanding of the subject needs an adequate knowledge of geography, climatology, pedology (soil science), microbiology (science of micro-organisms), biochemistry, biophysics, sociology, economics etc. The environmental problems with which now we are concerned embrace diverse aspects ranging from the economic, social and psychological problems of human settlements to the management and use of natural resources and habitats. Since time immemorial, man has been and will always be exploiting nature without taking into consideration of environmental deterioration. In fact, the so called progress, in reality, is disturbing the environmental balance seriously, leading to breakdown of life support system on the earth. The thoughtless exploitation is mainly due to the ignorance about environment and ecosystem, lack of concern amongst planners and ecologists about the side effects of the developmental projects, gap in information and in training personal, absence of multidisciplinary approach to developmental projects and lack of systematic information, data and feed back system. This calls for making proper environmental strategies for maintaining the ecological balance not only by making preservation of nature an integral part of developmental planning, but also by adopting alternative means of livelihood for those dependent upon nature for survival.

There is a Chinese proverb:

"If you plan for one year, plant rice, if you plan for 10 years plant trees and if you plan for 100 years, educate people".

Therefore, if we want to manage our earth, we must make people environmentally educated.

ENVIRONMENTAL ETHICS

The environmental ethics or Dharma of Ecology teaches us how to treat nature. It includes cultures and traditions that have influenced human relationship with nature, the place of man in nature, rights and duties of individuals, the moral standings of humans and duties of future generations. The basic principles underlying environmental ethics or Dharma of ecology are described as follows:

1. Protection of renewable natural resources.
2. Conservation of non-renewable resources.
3. Optimum resource use by nations.
4. Avoid consumerism.
5. Adopt sustainability as a way of life.
6. Joining environment and economics to eradicate poverty.
7. Link environment with peace and security.

There is an urgent need to treat the entire world as Global family (Vasudaeva-kutumbakam). Man should not try to conquer nature but work with it in close harmony.

ENVIRONMENTAL EDUCATION

Environmental education is the education through environment, about environment and for the environment. It is the process of recognising value and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness of man, his culture and his biophysical surroundings. Also it entails practice in decision making and self formulation of a code of behaviour, about issues concerning environment quality.

Now most countries, including India, have realised the need of environmental education. The aim of environmental education is that the individual and social groups should acquire awareness and knowledge, develop skills and abilities and participate in solving real environmental problems. The perspective should be integrated, inter-disciplinary and holistic in character.

(According to UNESCO, the goals of environmental education are to develop a world population that is aware of and concerned about total environment and its associated problems and commitment to work individually and collectively towards solution of current problems and the prevention of new ones. Consequently, UNESCO launched the international programme in Environmental Education in January 1975.)

- To facilitate the coordination, joint planning, pre-programming activities essential to teach development of an international programme of environmental education.
- To promote the international exchange of ideas and information, pertaining to environmental education.
- To coordinate research to understand better the various phenomena involved in teaching and learning about environment.
- To formulate and evaluate new methods, materials and programmes (both in school and out-of-school for youths and adults) in environmental education.
- To train and retrain personnels and staff for the environmental education programmes
- To prepare advisory services to member-States relating to environmental education.

Objectives of Environmental Education

The intergovernmental conference on environmental education held in Tbilisi, USSR (1977) listed six objectives. These are as follows:

1. **Awareness.** To help people acquire an awareness of and a sensitivity to the total environment and its allied problems.
2. **Knowledge.** To help people acquire basic understanding of the total environment and associated problems.
3. **Attitudes.** To help people acquire social values, strong feelings of concern for the environment and the motivation to act in protecting and improving it.
4. **Skills.** To help people acquire the skills for solving such problems.
5. **Evaluation Ability.** To help people evaluate environmental measures and education programmes in terms of ecological, political, economical, social, aesthetic and educational factors; and
6. **Participation.** To help people develop a sense of responsibility and urgency regarding environmental problems and solutions.

This conference also stressed that environmental education should consider the environment in its totality—natural and man-made, audit should be a life-long process and be interdisciplinary in the approach.

In order to achieve these objectives, the environmental education should be a continuous process and should be provided for all age groups at all levels, both in and out of school education.

Principles of Environmental Education

The principles of environmental education are as follows:

1. To appreciate the gifts of the nature.
2. To help acquire knowledge of the immediate environment.
3. To help understand the biotic and abiotic environment.
4. To help understand the inter-dependence of life at different trophic levels.
5. To help develop interest in flora and fauna of the environment.
6. To help develop interest in the community and the problem of the people and society.
7. To develop tolerance towards different casts, creeds, races, religions and cultures.
8. To help understand the effect of unchecked population growth or unplanned resource utilization of the world.
9. To love the neighbours and mankind as a whole.
10. To value equality, liberty, fraternity, truth and justice.
11. To examine trends in the growth of population and interpret them for the socio-economic development of the country.
12. To evaluate the utilization of physical and human resources and to suggest remedial measures.
13. To help diagnose the different causes of environmental pollution and to suggest remedial measures.
14. To help diagnose the causes of social tensions and to suggest methods for avoiding them.
15. To promote the value and necessity of local, national and international cooperation in the prevention and solution of environmental problems.

Stages of Environmental Education

Environmental education can be divided into two major categories : formal and non-formal.

1. Formal Environmental Education

It includes teaching and training of students of primary, secondary, higher secondary and university levels as well as teachers and environmental professionals.

(i) At **primary school stage**, students are sensitized about the environment through audio-visual and field visits.

(ii) At **lower secondary stage**, stress is on real life situations conservation and sustainable development. Teaching strategy includes those used at primary level along with general science, teaching, practicals and field work.

(iii) At **higher secondary school stage**, conservation knowledge, problem identification and action skills are highlighted. Emphasis is given on teaching, practicals and field work.

(iv) At **college stage**, maximum stress should be on knowledge regarding sustainable development. Students should be taught about conservation, real life situations and awareness contents should include science based teachings, practicals and field work.

(v) At **university stage**, stress is given on teaching research and extension. Some research institutions, engineering colleges and IIT's offer courses in environmental studies. At university stage, there are four major areas of environmental education *viz.* environmental engineering, conservation and management, environmental health and social ecology.

2. Non-Formal Environmental Education

It deals with youths and adults from all segments of the society such as family, factory workers, managers, decision makers in environmental as well as non-environmental fields.

The non-formal environmental education is being imparted in our country in the following ways:

(i) By celebrating the world environment day (*i.e.* on 5th of June).

(ii) By organising eco-development camps for youth to create awareness about basic ecological problems.

(iii) By imparting in service and pre service training to the professionals, technical persons and legal experts.

(iv) By arranging regular courses for senior executives and administrators.

(v) Tribals are being educated about their environment by involving their leaders, women and youth.

(vi) Adult education programmes also include education on the environment and its conservation.

(vii) There are foundation courses for probationers, IAS, IPS, IFS and Armed forces.

(viii) There are forums for public representatives *i.e.*, for M.P's and M.L.A.'s to discuss environmental problems.

(ix) Many NGO's (Non-government organisations) are actively involved in the programmes like environmental education, conservation of nature, pollution control and afforestation.

Importance of Environmental Education

Environment belongs to all and is thus important for all, whatever be the occupation or age of a person, he or she will be affected by environment and will also affect the environment by his or her deeds. The main importance of environmental education are as follows:

1. Environmental education is important for the economy and welfare of human society.
2. It helps us in careful handling the issues like pollution menace, over exploitation of natural resources, food security and sustainable development.
3. In this age of science and technology, eco-friendly technology or eco-technology is the need of hour, because it promotes blending of the traditional knowledge and technology with modern technologies. It can be achieved only through proper environmental education.
4. Reckless use of agrochemicals has degraded the environment and has disturbed the ecological balance. Environmental education helps us to find ways and means to maintain the ecological balance.
5. Environmental education demonstrates how man can derive benefits from the environment without destroying it.
6. Environmental education trains us to conserve our fast depleting natural resources.
7. Environment has been a source of happiness for man and time has come to preserve this happiness for man by imparting environmental education.

8. Environmental education helps in inculcating attitudes and values, conducive to environment protection and understanding of inter-dependence of nature and man.
9. It creates an increased civic sense and an awareness of the economic, political and ecological inter-dependence of the modern world.
10. It helps to understand different food chains and the ecological balance in nature.
11. It directs attentions towards the problem of population explosion, depletion of natural resources and the pollution of environment and the methods of solving such problem.

Scope of Environmental Education

Environmental studies is very important and has following scopes:

1. There is a need for trained manpower at every level to deal with environmental issues like safe and clean drinking water, hygienic living conditions, clean and fresh air, fertile land, healthy food and sustainable development.
2. Environment protection and management, environmental laws, business administration and environmental engineering are emerging as new carrier opportunities.
3. Since the pollution control laws becoming more stringent, industries need environment experts to control pollution and disposal of wastes.
4. Environmental experts are now in great demand in industries for adopting green technologies to reduce pollution and to cut down the costs of effluent treatment.
5. These days, there is huge market world over for waste disposal and pollution control technologists and environmental experts.
6. If we want to live in a clean, healthy, aesthetically beautiful, safe and secure environment for a long time and wish to hand over a clean and safe earth to our children, we will have to include environmental experts in all developmental and policy making committees.

IMPORTANT TERMS

1. **Adaptation.** Structural and functional characteristics of organisms which enable them to survive and reproduce in a particular environment.
2. **Anthropogenic.** Human generated ; caused by humans.
3. **Atmosphere.** The gaseous mantle that envelops the earth surface.
4. **Climate.** Average weather of an area including general pattern of atmospheric seasonal variations and weather extremes.
5. **Ecology.** The study of reciprocal relationship between organisms and their environment.
6. **Edaphic.** Related to soil.
7. **Environment.** Surroundings in which organisms live.
8. **Habitat.** Place occupied by an organism/population/community which is exposed to particular combination of environmental factors.
9. **Microclimate.** Represents to climatic conditions in the areas of limited size.
10. **Sustainable Development.** Increase in standard of life that can be maintained over a long term without degrading the environment or compromising the ability of future generations to meet their own needs.
11. **Weather.** Refers to the short term properties of the atmosphere at a given place and time.