

CHAPTER
<b>1</b>

## **Environmental Science : Definition, Scope and Importance**

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### **INTRODUCTION**

The science of Environment studies is a multi-disciplinary science because it comprises various branches of studies like chemistry, physics, medical science, life science, agriculture, public health, sanitary engineering etc. It is the science of physical phenomena in the environment. It studies of the sources, reactions, transport, effect and fate of physical a biological species in the air, water and soil and the effect of from human activity upon these.

### **Environment Explained**

Literary environment means the surrounding external conditions influencing development or growth of people, animal or plants; living or working conditions etc. This involves three questions:

#### **1. What is Surrounded**

The answer to this question is living objects in general and man in particular.

#### **2. By what Surrounded**

The physical attributes are the answer to this question, which become environment. In fact, the concern of all education is the environment of man. However, man cannot exist or be understood in isolation from the other forms of life and from plant life. Hence, environment refers to the sum total of condition, which surround point in space and time. The scope of the term Environment has been changing and widening by the passage of time. In the primitive age, the environment consisted of only physical aspects of the planted earth' land, air and water as biological communities. As the time passed on man extended his environment through his social, economic and political functions.

#### **3. Where Surrounded**

The answer to this question. It is in nature that physical component of the plant earth, viz land, air, water etc., support and affect life in the biosphere. According to a Goudie environment is the representative of physical components of the earth where in man is

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an  
important factor affecting the environment.

(j) **Definitions of Environment** : Some important definitions of environment are as under:

1. **Boring**: 'A person's environment consists of the sum total of the stimulation which he receives from his conception until his death.'

It can be concluded from the above definition that Environment comprises various types of forces such as physical, intellectual, economic, political, cultural, social, moral and emotional. Environment is the sum total of all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturation of living organisms.

2. **Douglas and Holland**: 'The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms.'

(ii) **Scope of Environment**: The environment consists of four segments as under:

1. **Atmosphere**: The atmosphere implies the protective blanket of gases, surrounding the earth:

(a) It sustains life on the earth.

(b) It saves it from the hostile environment of outer space.

(c) It absorbs most of the cosmic rays from outer space and a major portion of the electromagnetic radiation from the sun.

(d) It transmits only here ultraviolet, visible, near infrared radiation (300 to 2500 nm) and radio waves. (0.14 to 40 m) while filtering out tissue-damaging ultraviolet waves below about 300 nm.

The atmosphere is composed of nitrogen and oxygen. Besides, argon, carbon dioxide, and trace gases.

2. **Hydrosphere**: The Hydrosphere comprises all types of water resources oceans, seas, lakes, rivers, streams, reservoir, polar icecaps, glaciers, and ground water.



- (i) Nature 97% of the earth's water supply is in the oceans,
- (ii) About 2% of the water resources is locked in the polar icecaps and glaciers.
- (iii) Only about 1% is available as fresh surface water-rivers, lakes streams, and ground water fit to be used for human consumption and other uses.

3. **Lithosphere:** Lithosphere is the outer mantle of the solid earth. It consists of minerals occurring in the earth's crusts and the soil *e.g.* minerals, organic matter, air and water.

4. **Biosphere:** Biosphere indicates the realm of living organisms and their interactions with environment, viz atmosphere, hydrosphere and lithosphere.

### **Element of Environment**

Environment is constituted by the interacting systems of physical, biological and cultural elements inter-related in various ways, individually as well as collectively. These elements may be explained as under:

#### (1) Physical elements

Physical elements are as space, landforms, water bodies, climate soils, rocks and minerals.

They determine the variable character of the human habitat, its opportunities as well as limitations.

#### (2) Biological elements

Biological elements such as plants, animals, microorganisms and men constitute the biosphere.

#### (3) Cultural elements

Cultural elements such as economic, social and political elements are essentially manmade features, which make cultural milieu.

### **ENVIRONMENT STUDIES: IMPORTANCE**

Importance of Environment Studies: The environment studies enlighten us, about the importance of protection and conservation of our indiscriminate release of pollution into the environment.



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At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. We study about these issues besides and effective suggestions in the Environment Studies. Environment studies have become significant for the following reasons:

### **1. Environment Issues Being of International Importance**

It has been well recognised that environment issues like global warming and ozone depletion, acid rain, marine pollution and biodiversity are not merely national issues but are global issues and hence must be tackled with international efforts and cooperation.

### **2. Problems Cropped in The Wake of Development**

Development, in its wake gave birth to Urbanization, Industrial Growth, Transportation Systems, Agriculture and Housing etc. However, it has become phased out in the developed world. The North, to cleanse their own environment has, fact fully, managed to move 'dirty' factories of South. When the West developed, it did so perhaps in ignorance of the environmental impact of its activities. Evidently such a path is neither practicable nor desirable, even if developing world follows that.

### **3. Explosively Increase in Pollution**

World census reflects that one in every seven persons in this planet lives in India. Evidently with 16 per cent of the world's population and only 2.4 per cent of its land area, there is a heavy pressure on the natural resources including land. Agricultural experts have recognized soils health problems like deficiency of micronutrients and organic matter, soil salinity and damage of soil structure.

### **4. Need for An Alternative Solution**

It is essential, specially for developing countries to find alternative paths to an alternative goal. We need a goal as under:

- (1) A goal, which ultimately is the true goal of development an environmentally sound and sustainable development.
- (2) A goal common to all citizens of our earth.
- (3) A goal distant from the developing world in the manner it is from the over-



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consuming  
wasteful societies of the “developed” world.

### **5. Need To Save Humanity From Extinction**

It is incumbent upon us to save the humanity from extinction. Consequent to our activities constricting the environment and depleting the biosphere, in the name of development.

### **6. Need For Wise Planning of Development**

Our survival and sustenance depend. Resources withdraw, processing and use of the product have all to be synchronised with the ecological cycles in any plan of development our actions should be planned ecologically for the sustenance of the environment and development.

## **NEED FOR PUBLIC AWARENESS**

It is essential to make the public aware of the formidable consequences of the Environmental Degradation, if not retorted and reformative measures undertaken, would result in the extinction of life. We are facing various environmental challenges. It is essential

to get the country acquainted with these challenges so that their acts may be eco-friendly.

Some of these challenges are as under:

### **1. Growing Population**

A population of over thousands of millions is growing at 2.11 per cent every year. Over 17 million people are added each year. It puts considerable pressure on its natural resources

and reduces the gains of development. Hence, the greatest challenge before us is to limit the

population growth. Although population control does not automatically lead to development, yet

the development leads to a decrease in population growth rates. For this development of the women is essential.

### **2. Poverty**

India has often been described a rich land with poor people. The poverty and environmental degradation have a nexus between them. The vast majority of our people are

directly dependent on the nature resources of the country for their basic needs of food,



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fuel

shelter and fodder. About 40% of our people are still below the poverty line. Environment degradation has adversely affected the poor who depend upon the resources of their immediate

surroundings. Thus, the challenge of poverty and the challenge environment degradation

are two facets of the same challenge. The population growth is essentially a function of poverty. Because, to the very poor, every child is an earner and helper and global concerns

have little relevance for him.

### **3. Agricultural Growth**

The people must be acquainted with the methods to sustain and increase agricultural growth with damaging the environment. High yielding varieties have caused soil salinity and

damage to physical structure of soil.

### **4. Need to Ground water**

It is essential of rationalizing the use of groundwater. Factors like community wastes, industrial effluents and chemical fertilizers and pesticides have polluted our surface water

and affected quality of the groundwater. It is essential to restore the water quality of our rivers and other water bodies as lakes is an important challenge. It so finding our suitable

strategies for consecration of water, provision of safe drinking water and keeping water bodies clean which are difficult challenges is essential.

### **5. Development And Forests**

Forests serve catchments for the rivers. With increasing demand of water, plan to harness the mighty river through large irrigation projects were made. Certainly, these would submerge forests; displace local people, damage flora and fauna. As such, the dams

on the river Narmada, Bhagirathi and elsewhere have become areas of political and scientific

debate. agriculture and other uses. Vast areas that were once green, stand today as wastelands.

These areas are to be brought back under vegetative cover. The tribal communities inhabiting

forests respects the trees and birds and animal that gives them sustenance. We must recognize

the role of these people in restoring and conserving forests. The modern knowledge and skills of the forest deptt. should be integrated with the traditional knowledge and experience



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of the local communities. The strategies for the joint management of forests should be evolved in a well planned way.

## **6. Degradation of Land**

At present out of the total 329 mha of land, only 266 mha possess any potential for production. Of this, 143 mha is agricultural land nearly and 85 suffers from varying degrees

of soil degradation. Of the remaining 123 mha, 40 are completely unproductive. The remaining

83 mha is classified as forest land, of which over half is denuded to various degrees.

Nearly

406 million head of livestock have to be supported on 13 mha, or less than 4 per cent of the

land classified as pasture land, most of which is overgrazed. Thus, out of 226 mha, about

175 mha or 66 per cent is degraded to varying degrees. Water and wind erosion causes further degradation of almost 150 mha This degradation is to be avoided.

## **7. Reorientation of Institutions**

The people should be roused to orient institutions, attitudes and infrastructures, to suit conditions and needs today. The change has to be brought in keeping in view India's traditions

for resources use managements and education etc. Change should be brought in education,

in attitudes, in administrative procedures and in institutions. Because it affects way people

view technology resources and development.

## **8. Reduction of Genetic Diversity**

Proper measures to conserve genetic diversity need to be taken. At present most wild genetic stocks have been disappearing from nature. Wilding including the Asiatic Lion are

facing problem of loss of genetic diversity. The protected areas network like sanctuaries,

national parks, biosphere reserves are isolating populations. So, they are decreasing changes

of one group breeding with another. Remedial steps are to be taken to check decreasing genetic diversity.

## **9. Evil Consequences of Urbanisation**

Nearly 27 per cent Indians live in urban areas. Urbanisation and industrialisation has given birth to a great number of environmental problem that need urgent attention. Over



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30 percent of urban Indians live in slums. Out of India's 3,245 towns and cities, only 21 have

partial or full sewerage and treatment facilities. Hence, coping with rapid urbanization is a major challenge.

### **10. Air and water Population**

Majority of our industrial plants are using outdated and population technologies and makeshift facilities devoid of any provision of treating their wastes. A great number of cities

and industrial areas that have been identified as the worst in terms of air and water pollution. Acts are enforced in the country, but their implement is not so easy. The reason

is their implementation needs great resources, technical expertise, political and social will.

Again the people are to be made aware of these rules. Their support is indispensable to implement these rules.

### **VARIOUS TYPES OF ENVIRONMENT**

According to Kurt Lewin, environment is of three types which influence the personality of an individual as under:

- (a) Physical Environment,
- (b) Social and Cultural Environment, and
- (c) Psychological Environment.

These may be explained as under:

#### **1. Physical Environment**

Physical environment, refers to geographical climate and weather or physical conditions wherein and individual lives. The human races are greatly influenced by the climate.

Some

examples are as under:

- (a) In the cold countries i.e. European countries the people are of white colour. Likewise, in Asian and African countries, that is, in hot countries people are of dark complexion.
- (b) The physique of an individual depends on climate conditions as the individual tries to adjust in his physical environment.
- (d) The human working efficiency also depends on the climatic conditions.

#### **2. Social Environment**

Social Environment includes an individual's social, economic and political condition wherein he lives. The moral, cultural and emotional forces influence the life and nature of

individual behaviour. Society may be classified into two categories as under:





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(i) An open society is very conducive for the individual development.

(ii) A closed society is not very conducive for the development.

### 3. Psychological Environment

Although physical and social environment are common to the individual in a specific situation. Yet every individual has his own psychological environment, in which he lives. Kurt Lewin has used the term 'life space' for explaining psychological environment. The Psychological environment enables us to understand the personality of an individual.

Both the

person and his goal form psychological environment.

If a person is unable to overcome the barriers, he can either get frustrated or completed to change his goal for a new psychological environment. But adopting this mechanism, the

individual is helped in his adjustment to the environment.

### STRUCTURE OF ENVIRONMENT

Environment is both physical and biological. It includes both living and non-living components.

#### (i) Physical Environment

The Physical Environment is classified into three broad categories viz.

(i) Solid,

(ii) Liquid

(iii) Gas.

These represent the following spheres:

(i) The lithosphere (solid earth)

(ii) The hydrosphere (water component) and

(iii) The atmosphere

As such, the three basic of physical environment may be termed as under:

(i) Lithospheric Environment

(ii) Hydrospheric Environment

(iii) Atmospheric Environment

The scientists have classified them into smaller units based on different spatial scales,

*e.g.*

(i) Mountain Environment

(ii) Glacier Environment

(iii) Plateau Environment

(iv) Coastal Environment



## **(ii) Biological Environment**

The biological of the environment consists of:

- (j) Plants (flora)
- (i) Animals (fauna).

Thus, the biotic environment further be divided into floral environment and faunal environment. All the organisms work to form their social groups and organizations at several levels. Thus, the social environment is formed. In this social environment the organisms work to derive matter from the physical environment for their sustenance and development.

This process gives birth to economic environment. Man claims to be most skilled and civilized of all the organisms. This is the reason why his social organisation is most systematic. The three aspects of man, *e.g.* physical, social and economic, function in the biotic environment as under:

### **(i) The Physical Man**

The 'Physical Man' is one of the organisms populations or biological community. He is in need of basic elements of the physical environment like habitat (space), air, water and food. Besides, like other biological populations, he releases wastes into the ecosystem.

### **(ii) The Social Man**

The 'Social Man' performs the following functions:

- (a) Establishing social institutions,
- (b) Forming social organisations,
- (c) Formulating laws, principles and policies,
- (d) Taking steps to safeguard his existence, interest and social welfare.

### **(iii) The Economic Man**

The economic man derives and utilises resources from the physical and biotic environment with his skills and technologies. The economic function makes the man an environment/geomorphic process as he transports matter and energy from one component of the ecosystem to the other. There may be any following two situations:

- (a) His exploitative functions may be in harmony with the natural environment. Such, functions do not necessarily involve change in the working of the ecosystem.



(b) These functions may exceed the critical limit. Consequently, the equilibrium of the environment/ecosystem is disturbed and a great number of environment and ecological problems crop up. These are detrimental to man him besides to whole population of human species in a given ecosystem.

## **Ecosystem**

### **INTRODUCTION**

No life exists in a vacuum. Materials and forces which constitutes its environment and from which it must derive its needs surround every living organism. Thus, for its survival, a plant, an animal, or a microbe cannot remain completely aloof in a shell. Instead, it requires from its environment a supply of energy, a supply of materials, and a removal of waste products.

For various basic requirements, each living organism has to depend and also to interact with different nonliving or abiotic and living or biotic components or the environment.

#### **1. Abiotic**

The abiotic environmental components include basic inorganic elements and compounds such as water and carbon dioxide, calcium and oxygen, carbonates and phosphates besides such physical factors as soil, rainfall, temperature, moisture, winds, currents, and solar radiation with its concomitants of light and heat.

#### **2. Biotic**

The biotic environmental factors comprise plants, animals, and microbes; They interact in a fundamentally energy-dependent fashion. In the words of Helena Curtis "The scientific study of the interactions of organisms with their physical environment and with each other, is called ecology". According to Herreid II "It mainly concerns with the directive influences of abiotic and biotic environmental factors over the growth, distribution behaviour and survival of organisms.

### **Ecology Defined**

(1) Ernst Haeckel (1866) defined ecology "as the body of knowledge concerning the

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economy of nature-the investigation of the total relations of animal to its inorganic and organic environment.

(2) Frederick Clements (1916) considered ecology to be "the science of community.

(3) British ecologist Charles Elton (1927) defined ecology as "the scientific natural history concerned with the sociology and economics of animals."

(4) Taylor (1936) defines ecology as "the science of the relations of all organisms to all their environments."

(5) Taylor (1936) defined ecology as "the science of the relations of all organisms to all their environments."

### **ECO-SYSTEM:**

At present ecological studies are made at Eco-system level. At this level the units of study are quite large. This approach has the view that living organisms and their non-living environment are inseparably interrelated and interact with each other. A.G. Tansley (in 1935) defined the Eco-system as 'the system resulting from the integrations of all the living and non-living actors of the environment'. Thus he regarded the Eco-systems as including not only the organism complex but also the whole complex of physical factors forming the environment.

### **ASPECTS OF ECO-SYSTEM**

The eco-system can be defined as any spatial or organizational unit including living organisms and non-living substances interacting to produce an exchange of materials between the living and non-living parts. The eco-system can be studied from either structural or



### **1. Structural Aspect**

The structural aspects of ecosystem include a description of the arrangement, types and numbers of species and their life histories, along with a description of the physical features of the environment.

### **2. Functional**

The functional aspects of the ecosystem include the flow of energy and the cycling of nutrients.

### **Habitat**

The non-living part of the eco-system includes different kinds of habitats such as air, water and land, and a variety of abiotic factors. Habitat can be defined as the natural abode or locality of an animal, plant or person. It includes all features of the environment in a given locality. For example, water is used as habitat by aquatic organisms and it comprises three major categories-marine, brackish and freshwater habitats. Each of these categories may be subdivided into smaller unit, such a freshwater habitat may exist as a large lake, a pond, a puddle, a river or a stream.

The land is used as a habitat for numerous terrestrial organisms. It includes many major categories of landmasses, which are called biomes. Biomes are distinct large areas of earth inclusive of flora and fauna, *e.g.* deserts, prairie, tropical forests, *etc.* Soil is also used as a habitat by a variety of microbes, plants and animals.

### **Abiotic Factors**

Among the main abiotic factors of the ecosystem are included the following:

- (1) The climatic factors as solar radiation, temperature, wind, water currents, rainfall.
- (2) The physical factors as light, fire, pressure, geomagnetism,
- (3) Chemical factors as acidity, salinity and the availability of inorganic nutrients needed by plants.

### **Biotic or Biological Factors**

The biological (biotic) factors of ecosystem include all the living organisms-plants, animals, bacteria and viruses. Each kind of living organism found in an ecosystem is given the name a species. A species includes individuals which have the following features:

- (1) They are genetically alike.

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(2) They are capable of freely inter-breeding and producing fertile off springs.

### Relationships

In an ecosystem, there exist various relationships between species. The relationship may be as under:

(1) Effects

Two species may have any of the following kind of effects:

(i) They may have a negative effect upon one another (competition).

(ii) They may have a neutral effect (neutralism).

(iii) They may have beneficial effect (protoco-operation and mutualism).

(2) Other kinds of Relationship

The species may aggregate, or separate, or show a random relationship to one another.

### Population

A population is a group of inter-acting individuals, usually of the same species, in a definable space. In this way we can speak of population of deer on an island, and the population of fishes in a pond. A balance between two aspects determines the size of a population of any given species:

(i) Its reproductive potential,

(ii) Its environmental resistance.

In this way population size is determined by the relative number of organisms added to or removed from the group as under:

(i) Addition

Recruitment into the population is a function of birth rate and immigration rate.

(ii) Removal

Loss from the population is a function of death rate and emigration.

### Factors Regulating Population

Following factors does population regulation:

(i) Physical attributes of the environment (*e.g.* climate),

(ii) Food (quantity and quality),

(iii) Disease (host-parasite relationships).

(iv) Predation,

(v) Competition (inter-specific and intra-specific).

An ecosystem contains numerous populations of different species of plants, animals and microbes; all of them interact with one another as a community and with the physical environment as well. A community or biotic community, thus, consists of the population



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of  
plants and animals living together in a particular place.

### **Division of Ecosystem**

The ecosystem can be divided, from the energetic view point into three types of organisms:

producers, consumers, and reducers. These can be explained as under:

#### (1) Producer

Photosynthetic algae, plants and bacteria are the producers of the ecosystem; all other organisms depend upon them directly or indirectly for food.

#### (2) Consumers

Consumers are herbivorous, carnivorous, and omnivorous animals; they eat the organic matter produced by other organisms.

#### (3) Reducers

Reducers are heterotrophic organisms like animals; they are fungi and bacterial that decompose dead organic matter.