

## CHAPTER 1 - INTRODUCTION TO ENVIRONMENTAL STUDIES

### 1.1 DEFINITIONS

Environment is derived from the French word Environ which means to encircle or surround. Environment is sum total of water, air, and land, inter-relationships among themselves and also with the human beings, other living organisms and property.

The above definition given in Environment Act, 1986 clearly indicates that environment includes all the physical and biological surroundings and their interactions.

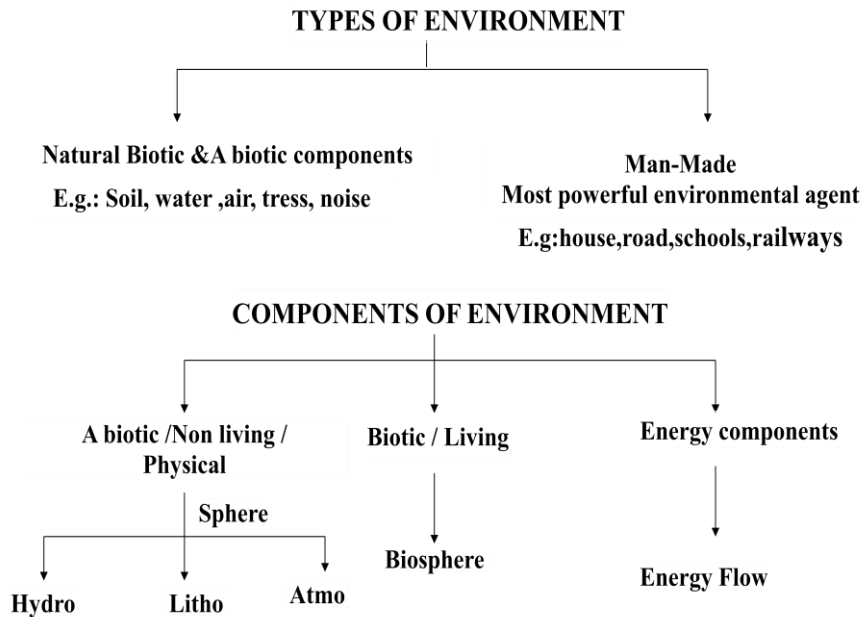
➤ **ENVIRONMENT:** Living+ Non-living things  
Influencing one another

➤ **ENVIRONMENTAL SCIENCE:** Study of biotic(biological) and a biotic (non-biological)  
components & relationships

➤ **ENVIRONMENTAL ENGG:** Protection Enhancement=Quality,  
Public health, welfare environment

➤ **ENVIRONMENTAL EDU/STUDIES:** Educating people=Preserving quality environment

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 and biological species in the air, water and soil and the effect of from human activity upon these.



## 1.2 SCOPE

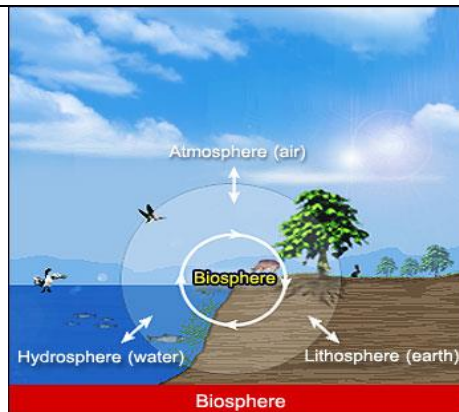
Scope of environmental science is broad. Some of the aspects of scope of environmental science are:

- Studying the interrelationships among biotic and abiotic components for sustainable human ecosystem
- Carrying out impact analysis and environmental auditing for the further catastrophic activities
- Developing and curbing the pollution from existing and new industries
- Stopping the use of biological and nuclear weapons for destruction of human race
- Managing the unpredictable disasters and so on.

## 1.3 COMPONENTS OF ENVIRONMENT

The main composition of the Earth / Environment consists of:

- **Biosphere**
- **Lithosphere**
- **Hydrosphere**
- **Atmosphere.**



### 1.4.1 Biosphere - The Bio-Organism

Biosphere is the regions of the surface and atmosphere of the Earth or other planets where living organisms exist. So basically, it is where ever a living organism can live, be it sky, or ocean or land. They are all biosphere. In 1875 geologist Eduard Suess coined the word, Biosphere. He defined it as follow:

"The place on Earth's surface where life dwells."

Biosphere overlaps with the other 'spheres' which are:

- Hydrosphere
- Lithosphere
- Atmosphere

### 1.4.2 Lithosphere : Earth's crust & minerals

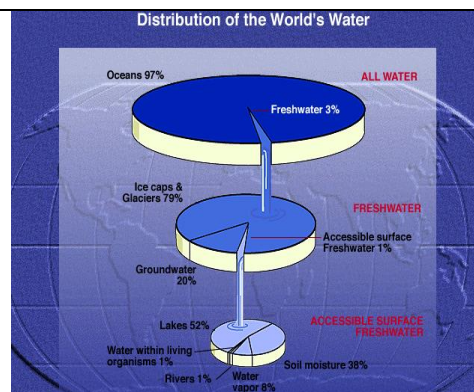
Lithosphere is the Earth's crust or the layer from the upper mantle. It consists of rock materials, soil or other minerals found from underground. Nevertheless, the surface we are walking on everyday is actually the lithosphere. Lithosphere is important to preserve soil fertility, farming, developments, waste disposal and even the conservation of forests.

Without lithosphere, water and nutrients cannot be absorbed for plantations and underground water supplies. In fact, there will be no formation of fossil fuels. Lithosphere becomes the home for many luxurious minerals like diamonds, crystal, ore and other underground secreted materials.

### 1.4.3 Hydrosphere : Water on Earth

Hydrosphere is water that compliments either on or surrounds our Earth. Recently researchers have detected a great pollution of hydrosphere which is caused by our own doings. Hydrosphere can be found in various forms:

- In Biosphere - plants, animals, humans etc.
- Under the Earth's sediments, crust and rocks.
- Water that covers the Earth's surface (3/4) in liquid plus solid forms such as ice and snow.
- Water vapour and atmospheric water in the air.



#### 1.4.4 Atmosphere - Air that surrounds us

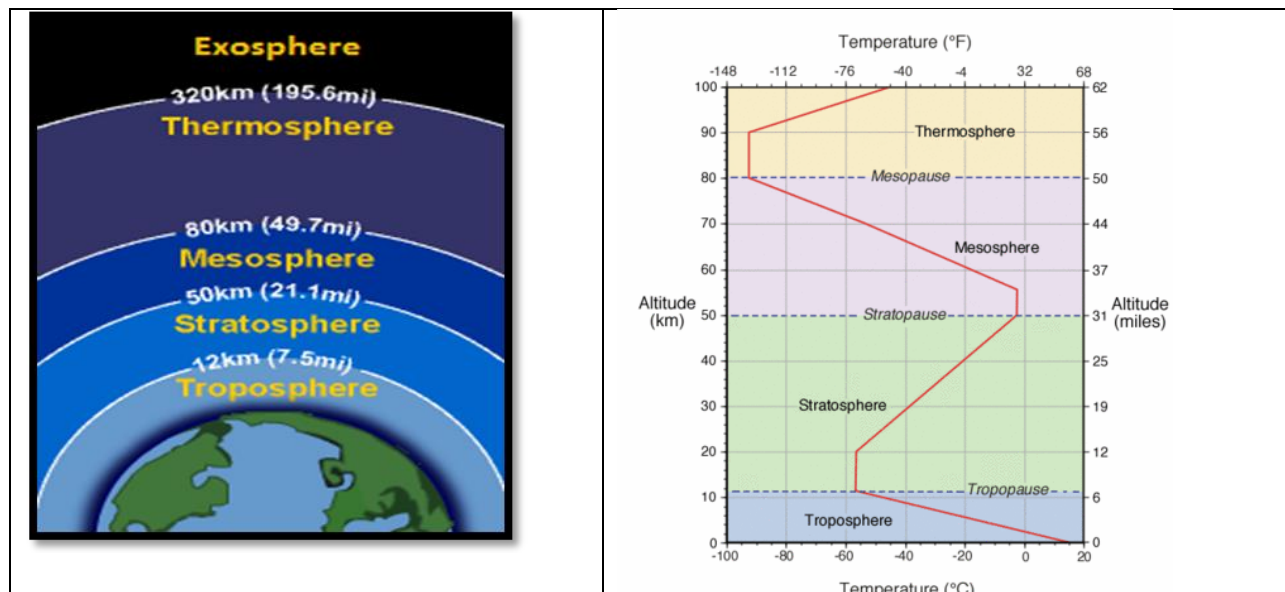
Without our atmosphere, there would be no life on earth. The Earth's atmosphere is a layer of gases that are retained by the Earth's gravity. The Earth's atmosphere extends from surface level to a towering 10 000 km above surface level. Two gases make up the bulk of the earth's atmosphere: nitrogen (78%), and oxygen (21%). Next is Argon which makes up 0.9% of the atmosphere, and then of course, there is Carbon Dioxide which makes up 0.04% of the atmosphere. The remaining is made up of water vapour and other trace gases.

The atmosphere implies the protective blanket of gases, surrounding the earth:

- It sustains life on the earth.
- It saves it from the hostile environment of outer space.
- It absorbs most of the cosmic rays from outer space and a major portion of the electromagnetic radiation from the sun.
- It transmits 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.

#### 1.4.5. Atmospheric – Layers

The Earth's atmosphere contains several different layers that can be defined according to air temperature. The image displays these layers in an average atmosphere. According to temperature, the atmosphere contains four different layers namely Troposphere, Stratosphere, Mesosphere, Thermosphere and Exosphere. The temperature drops as we go up through the troposphere, but it rises as we move through the next layer, the stratosphere. The farther away from earth, the thinner the atmosphere gets.



Vertical change in average global atmospheric temperature. Variations in the way temperature changes with height indicates the atmosphere is composed of a number of different layers (labeled above). These variations are due to changes in the chemical and physical characteristics of the atmosphere with altitude.

### **Troposphere :**

The first layer is called the troposphere. The depth of this layer varies from about 8 to 16 kilometers. This layer is where weather occurs. About 75 % of the total mass of the atmosphere is contained in troposphere. It is also the layer where the majority of our weather occurs. Maximum air temperature also occurs near the Earth's surface in this layer. With increasing height, air temperature drops uniformly with altitude at a rate of approximately 6.5° Celsius per 1000 meters. This phenomenon is commonly called the Environmental Lapse Rate. At an average temperature of -56.5° Celsius, the top of the troposphere is reached. Temperature and pressure drops as you go higher up the troposphere.

Greatest depths occur at the tropics where warm temperatures causes vertical expansion of the lower atmosphere. From the tropics to the Earth's polar regions the troposphere becomes gradually thinner. The depth of this layer at the poles is roughly half as thick when compared to the tropics. Average depth of the troposphere is approximately 12 kilometers.

At the upper edge of the troposphere is a narrow transition zone known as the tropopause.

### **STRATOSPHERE**

Above the tropopause is the stratosphere.

This layer extends from an average altitude of 12 to 50 kilometers above the Earth's surface. This stratosphere contains about 19.9 % of the total mass found in the atmosphere. Very little weather occurs in the stratosphere. Occasionally, the top portions of thunderstorms breach this layer.

The lower portion of the stratosphere is also influenced by the polar jet stream and subtropical jet stream. In the first 9 kilometers of the stratosphere, temperature remains constant with height. A zone with constant temperature in the atmosphere is called an isothermal layer. From an altitude of 21 to 50 kilometers, temperature increases with an increase in altitude.

The higher temperatures found in this region of the stratosphere occurs because of a localized concentration of ozone gas molecules. These molecules absorb ultraviolet sunlight creating heat energy that warms the stratosphere.

Ozone is primarily found in the atmosphere at varying concentrations between the altitudes of 10 to 50 kilometers. This layer of ozone is also called the **ozone layer**. The ozone layer is important to organisms at the Earth's surface as it protects them from the harmful effects of the sun's ultraviolet radiation. Without the ozone layer life could not exist on the Earth's surface.

Separating the mesosphere from the stratosphere is a transition zone called the stratopause.

## Mesosphere

In the mesosphere, the atmosphere reaches its coldest temperatures (about  $-90^{\circ}$  Celsius) at a height of approximately 80 kilometers.

At the top of the mesosphere is another transition zone known as the mesopause.

## Thermosphere

The last atmospheric layer has an altitude greater than 80 kilometers and is called the thermosphere. Temperatures in this layer can be as high as  $1200^{\circ}\text{C}$ . These high temperatures are generated from the absorption of intense solar radiation by oxygen molecules ( $\text{O}_2$ ). While these temperatures seem extreme, the amount of heat energy involved is very small. The amount of heat stored in a substance is controlled in part by its mass. The air in the thermosphere is extremely thin with individual gas molecules being separated from each other by large distances. Consequently, measuring the temperature of thermosphere with a thermometer is a very difficult process. Thermometers measure the temperature of bodies via the movement of heat energy. Normally, this process takes a few minutes for the conductive transfer of kinetic energy from countless molecules in the body of a substance to the expanding liquid inside the thermometer. In the thermosphere, our thermometer would lose more heat energy from radiative emission than what it would gain from making occasional contact with extremely hot gas molecules.

This layer contains:

**Ionosphere** - This is the lower part of the thermosphere. It extends from about 80 to 550 km. Gas particles absorb ultraviolet and X-ray radiation from the sun. The particles of gas become electrically charged (ions). Radio waves are bounced off the ions and reflect waves back to earth. This generally helps radio communication. However, solar flares can increase the number of ions and can interfere with the transmission of some radio waves.

## Exosphere –

This is the upper part of the Atmosphere. It extends from about 550 km to thousands of kilometers. Air is very thin here. This is the area where satellites orbit the earth.

## 1.5 ENVIRONMENT STUDIES: IMPORTANCE

Weather cycles erratic, rising temperatures, towns flooded and depletion of natural resources. With unorganized growing and uncontrolled development, environment science has become an important channel of studies for students today.

“In recent years, the environment science as an important discipline, offer solutions to environmental problems,”. Several scientific disciplines as biochemistry, physics, mathematics, biotechnology, chemistry, botany, toxicology, remote sensing and engineering have an interface with the scientific environment.

Environmental science is important for economy and welfare of human society.

It helps us in careful handling of the issues like pollution, overexploitation of natural resources, food security and sustainable development.

Excessive use of agrochemicals has degraded the environment and has disturbed the ecological balance. Environmental science helps us to find ways and means to maintain the ecological balance.

It demonstrates how man can derive benefits from environment without destroying it.

It trains us to conserve our fast depleting natural resources.

It helps to understand different food chain and ecological balance in nature.

It directs attention towards the problems of population explosion, depletion of natural resources and pollution and the methods of solving such problems.

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.

Environmental studies helps to maintain ecological balance by providing a basic knowledge of environmental systems and their processes. By giving information regarding the changes that take place due to anthropogenic factors environmental study helps us.

It also helps to gain a skill in using techniques to analyze various environmental systems and the effect of human activities on that system.

Environmental studies applies economical methods and concepts to issues of the environment, management, environmental policy analysis.

Environmental study includes diverse area such as property rights, economic instruments for pollution control, cost benefit analysis management applications with environmental policy.

Concepts from environmental studies can be applied to the study of agriculture and the design of sustainable production systems.

We need to study physical, biological, chemical and social processes that form the basic of the problem of environment. Environmental studies provide skills necessary to raise the questions and too often obtain answers to some of the environmental problems from which our planet is facing today.

Environment is responsible for creating conditions suitable for the existence of a healthy biosphere on this planet. The load of pollutant discharged is also diluted and chemically

modified. It regulates the temperature on earth where life activities are possible. Harmful ultraviolet radiations are absorbed in the stratosphere by the vital ozone layer.

These rays can severely damage the terrestrial life. The atmosphere of our environment is a quick and effective media for transfer, transport and dissemination of gaseous wastes.

There are some natural and spontaneous process in our environments, by which we get plentiful supply of clean, air, fresh water and fertile soils, which rerate endlessly by biogeochemical cycles. Our planet which is rich in biodiversity have millions of species including beautiful, intriguing, towering trees and other coral nets where all types of animals live together.

All animals depend on plants for their food & plants on animals. Insects, bacteria, virus and other organisms are one hand harmful somewhere but very helpful on the other. For example, pollination, regeneration etc. are some examples.

Since life is dependable upon the environment, its absence causes many adverse and harmful effects. Many countries are facing the problems of environmental pollutions. Without sustainable environment and natural resources, one cannot survive.

Over-exploitation of natural resources and pollution of environment are corroding the vital life support systems on which all life depends.

Air, water, soil, noise, marine pollutions, food adulterations, decreasing agricultural land, extinction of various plants, mammals , global warming etc. are some factors which are making our life more and more difficult. The future of entire humanity is at stake.

Instead of these, some environmental problems are also there like, solid waste management ,mining impact, impacts of hydro-electric projects ,effects of nuclear hazards and effects of industrial effluents. These problems should also have some solutions, because their effects are very dangerous.

Therefore, environmental aspect should be in mind while planning for industries, township and other research institutions/health centers. Modern technologies should be developed to reduce the pollution at every step.

Modern technologies for effluent treatment and cleaning/washing should be used. Environmental studies is very important for getting clean drinking water, hygienic living conditions, clean and fresh air, fertile land, healthy food etc.

## **1.6 NEED FOR PUBLIC AWARENESS**

Environment includes all living and non-living objects. We live in the environment and use the environmental resources like air, land and water to meet our needs. Development also means meeting the needs of the people. While meeting the ever-growing needs, we put pressure on the environment. When the pressure exceeds the carrying capacity of the environment to repair or replace itself, it creates a serious problem of environmental degradation. If we use any



environmental resource such as ground water beyond its limit of replacement, we may lose it forever. Therefore, there is a need to create 'awareness' about Environmental protection. While efforts are being made at the national and international level to protect our environment, it is also the responsibility of every citizen to use our environmental resources with care and protect them from degradation.