CHAPTER 1

Introduction

The mother nature has always been very kind to human-beings in one or the other way. Every comfort endowed on the man since its appearance on the surface of earth. Bhagavat Gita has envisaged mutual cooperation and interdependence of environment and man. In the ancient times, the man used to understand the importance of environment. It is, however, evidenced in literature that the trees, space, and earth are also consumed with the merits of supreme revisit.

The socio-economic progress and development of a nation is usually linked very closely to its industrial progress, with that of the energy sector being the main driving force for achieving a sustainable development and overall progress, without drastically disrupting the environmental balance of nature, a challenging problem today.

Definitions: Environment is derived from the French word. 'Environment' which means to incircle or surround. It pertains to everything that surrounds. However, the environment is defined in several of ways, *viz*.,

1. Environment includes various organizating and their physical surroundings.
2. The seam of all external conditions affects the life, development and the survival of an organism.
3. The surroundings in which an organism usually operates, including water, air, land, natural resource flora and fauna, human and their inter-relation.
4. The totality of the surrounding conditions including biotic as well as abiotic factors.
5. The introduction of climate topography, soil and other plants and animals in any given area/region, an organism's environment usually influences its form, behaviour and survival.
6. According to UNESCO, the environment is, "The complex set of physical, biological, social, political and cultural conditions which surrounds an individual or organism and that ultimately determines its form and the nature of its survival."
7. The environment literally means, "The surrounding." However, the environment is, "the aggregate of all those intensities and the set of conditions that directly or indirectly influence not only the life of the organisms but also the communities at particular place."
8. Treshow (1970) defined environment as, "environment includes all the factors and forces prevailing internally and externally or around, and in the plants and animals."

Moreover, the environment usually includes the following:

1. Light;
2. Moisture;
3. Wind;
4. Temperature;
5. Organisms;
6. Soil;
7. Pollution;
8. Radio-isotopes;
9. Pesticides and
10. Man.

The Two Conditions

(a) Physical Environment: When the environment includes non-living things like water, wind, soil and temperature and the trees of native like solar isolation, gravity and molecular energy, it is called physical environment.

(b) Biotic environment: Which includes all living things that affect the organisms, it is called the environment biotic environment. Therefore, environment has been designative as a complex of many factors. These factors generally interact not only with the organisms but among themselves also.

Components of Environment

The components of environment can broadly be grouped into two categories, *viz*.,

1. **Abiotic:** They include non-living physical and the chemical factors, for example, air, water, light, soil, temperature, etc., and;
2. **Biotic:** They include living types of components, for example, plants, animals, microorganisms, etc.

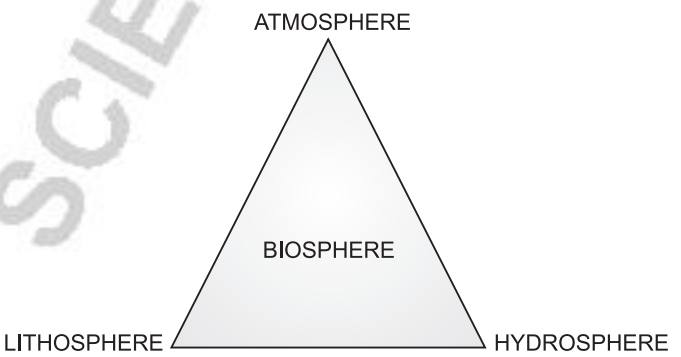
What is Biosphere?

The biosphere comprises of two words, *viz*.,

1. Bios = Life; and;
2. Sphere = Area.

However, Biosphere is the largest and major unit of environment and mostly, called as "Life zone of earth." In simple words, it defined as, "that part of the earth in which life exists." The term Biosphere was coined by the greatRussian scientist Vladimir Vermadsky (1929). However, there are generally three sub-divisions of biosphere, *viz*.,

1. Atmosphere;
2. Lithosphere; and
3. Hydrosphere.



1. Atmosphere: It is the blanket of gases/vapours which usually surrounds the earth and is held together by the gravity force. It extends 300 km above the surface of earth. About 95 percent of the total air is present upto the height of 20 km and remaining 5 percent in the 280 kms. The atmosphere also brings water from the sea due to the following two processes, *viz*.,

(*i*) Evaporation; and (*ii*) Precipitation

The proportion of various gases in the atmosphere is as follows:

	Gases		**% (by volume)**
1.	Nitrogen (N_2)	=	78.0841
2.	Oxygen (O_2)	=	20.9486
3.	Argon (Ar)	=	0.9340
4.	Carbon Dioxide (CO_2)	=	0.0318
5.	Neon (Ne)	=	0.00182
6.	Helium (He)	=	0.00052
7.	Krypton (Kr)	=	0.00011
8.	Xenon (Xe)	=	0.00009
9.	Hydrogen (H_2)	=	0.00006
10.	Methane (CH_4)	=	0.0002
11.	Gas (NO_3)	=	0.00005
12.	O_3	=	0.000004

However, Sutchlife (1966) divided atmosphere into 4 (four) zones, *viz*.,

(*i*) Troposphere; (*ii*) Stratosphere; (*iii*) Mesosphere; and (*iv*) Ionosphere.

(*i*) Troposphere: It is closest to the earth and nearly 80 percent of the atmospheric mass is contained with this zone. However, its thickness may be varies as:

(*i*) At the equator = 17.5 km;
(*ii*) At poles = 6.4 km.
(*iii*) Average (about) = 12 km.

(*ii*) Stratosphere: It lies generally above the troposphere. It usually stretches near about 50 km. Stretches upto 85 km, the upper boundary of this region is known as 'stratosphere'.

(*iii*) Mesosphere: It is characterized above the stratosphere zone with a drastic fall in temperature. Upto 85 kms from the surface of earth, the temperature is the lowest (–) 90°C.

(*iv*) Ionosphere: It extends upto 300 kms. The temperature rises to about 1200°C at an altitude beyond 300 kms.

Altitude (km)	Region	Temperature (°C)	Composition
1. 0 – 12	Troposphere	15 to –55	N_2, O_2, CO_2, H_2O
2. 15 – 50	Stratosphere	–55 to –2	O_3
3. 50 – 90	Mesosphere	–2 to –90	O_2, NO
4. 90 – 400	Thermosphere	–90 to 2000	O_2, O, NO
5. > 400	Exosphere	—NA—	Solar wind

Source: Tyagi, Anil and Single, Virendra (2013). Environmental science, Danika Pub.Co.

There five are the atmospheric regions whereas, above mentioned H-region and ionosphere.

2. Lithosphere: It refers to the layer of rock materials on the earth's surface, both on the;

(a) Continents; and (b) Ocean floors.

It usually forms a thin crust with a thickness of 50 – 100 kms. The soil fulfills a wide range of interrelated functions, *viz*.,

(*i*) Forms a very good link between the atmosphere geology, water resources and the construe;

(*ii*) Acts as a reservoir of carbon (C) which is a key factor in estimating concentration of gases of the green-house;

(*iii*) Regulates the flow of water from rainfall to the water bodies, vegetation, aquifers and the atmosphere;

(*iv*) As the medium for vegetation, forests and the users, and helps in determining the nature and distribution of life; and

(*v*) Frames the basis for terrestrial ecosystems.

The soil is usually composed of the following:

(1) Sand, (2) Silt, (3) Clay particles, (4) Humus, (5) Water, (6) Air space. However, the average composition of the earth's crust is as follows:

1. Air & water = 46.6%;
2. Silicon = 27.7%;
3. Aluminum = 8.3%;
4. Iron = 5.0%;
5. Calcium = 3.6%;
6. Magnesium = 2.1%;
7. Sodium = 2.8%; and
8. Potassium = 2.6%.

There are usually two types of humus found in lithosphere, *viz.*,

(a) Mild humus: This is dark is colour, saturated with bases like that of calcium, and;

(b) Raw humus: This is usually red in colour, less basic and very rich in fulvic acid.

3. Hydrosphere: It is the layer of water near or at the surface of earth. About 97 percent of water is in the vast oceans. The distribution of earth's water is as follows:

Source	Volume (X 10^6 km^3)	% of total
1. Oceans	1300.30	97.30
2. Ice	29.49	2.22
3. Ground water	6.73	0.50
4. Inland lakes	0.242	0.02
5. Soil moisture	0.074	0.005
6. Atmospheric water vapour	0.014	0.001
7. Rivers	0.007	0.001

The fresh water, required for human, animals and plant being form is provided only by the rain. The mean composition (approx.) of the rainwater is (ppm);

1. $Na^+ = 1.98$;
2. $K^+ = 0.30$;

3. $Mg^{2+} = 0.27$;
4. $Ca^{2+} = 0.09$;
5. $Cl^{-} = 3.79$;
6. $SO_4^{2+} = 0.58$; and
7. $HCO_3^{-} = 0.12$.

The average pH of hydrosphere is 5.7. However, in some extreme cases some regions on the globe might experience acid rains.

Geographical classification: The earth orbit around the sun usually determines the flow of solar energy which reaches to the surface of earth. The thermal environment of man provides a basis for dividing the globe into latitude zones which are as follows:

Name of zone	Latitude (North and South)
1. Equatorial zone	10°
2. North and South Tropical zone	10° to 25°
3. Sub-tropical zones	25° to 35°
4. Middle-latitude zones	35° to 55°
5. Subarctic zones	55° to 60°
6. Arctic zones	66½°
7. Polar zones	Between 75° latitude and poles

Environment cycles: There are two most important aspects of biosphere which are as follows:

1. The flow of energy; and
2. Cycling of materials.

The entire biosphere is a closed loop with inter-related environmental cycles. The major environmental cycles are as follows:

1. Carbon cycle;
2. Nitrogen cycle;
3. Oxygen cycle;
4. Sulphur cycle; and
5. Phosphorus cycle.

1. Carbon cycle: It is an environmental process which includes the following:

(1) Photosynthesis;
(2) Decomposition; and
(3) Respiration.

The life originated by the usual conversion of CO_2 (Carbon dioxide) into the carbon-based organic components of the living organisms. The release of CO (Carbon monoxide) is first due to incomplete burning of carbon-containing compounds. However, carbon monoxide (CO) has some harmful effects on animals as well as on humans.

$$2C + ¾\rightarrow 2CO \text{ (Carbon monoxide)}$$

$$CO_2 + C ¾\rightarrow 2CO \text{ (At high temperature)}$$

It is very much evident that more the CO_2 (Carbon dioxide) in the atmosphere, the more heat will be usually retained and thus the atmosphere becomes very hot. This phenomenon is called 'Greenhouse' effect.

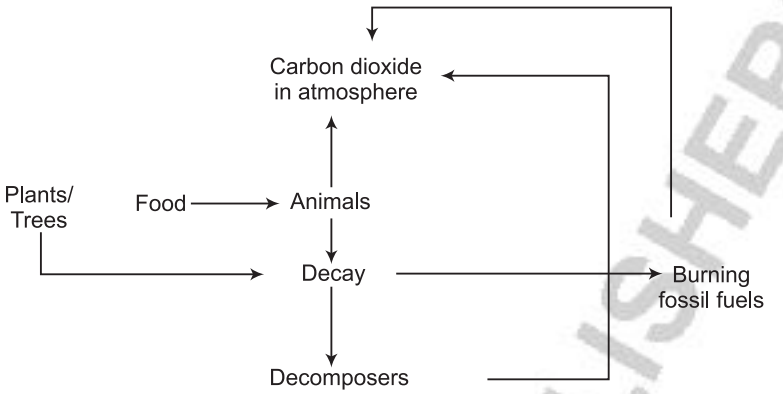


Fig. *Carbon cycle in atmosphere*

2. Nitrogen cycle: In usually consists of atmospheric nitrogen forming compounds and mostly nitrogen occurs in atmosphere as an inorganic gas (N_2). However, most of the plants cannot use nitrogen in its gaseous form. The nitrogen monoxide (NO) and nitrogen dioxide (NO_2) are the constituents of atmospheric nitrogen cycle.

$$N_2 + O_2 \text{ ¾→ } 2NO$$

$$2NO + O_2 \text{ ¾→ } 2NO_2$$

But, both NO (Nitrogen monoxide) and NO_2 (Nitrogen dioxide) are very toxic and are usually determental to the following:

1. Materials;
2. Vegetation;
3. Animals; and
4. Humans.

The nitrogen monoxide (NO) decreases the photosynthesis and NO_2 (nitrogen dioxide) usually causes the following disorders:

1. Necrosis of plant tissues; and
2. Nasal irritation and pulmonary edema in animals.

The atmospheric fixation comes about 2 percent of global nitrogen assimilation and the rest being cycled in non-gaseous forms.

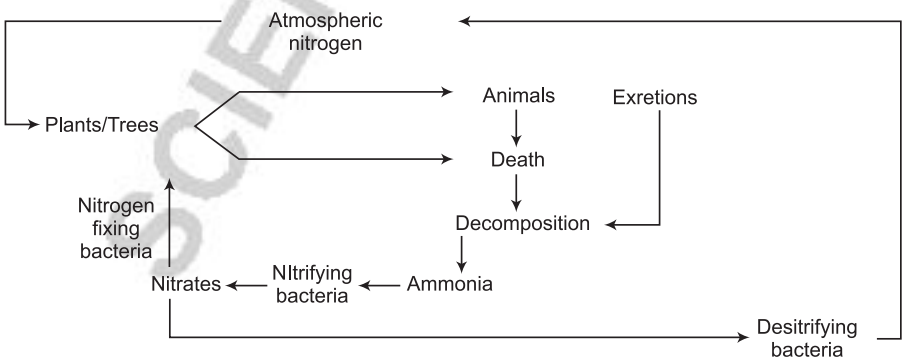


Fig. *Nitrogen Cycle in Atmosphere*