

CHAPTER**1**

Introduction to Environment

1.1 ENVIRONMENT [G.T.U., Sept.-'09; Janu.-2010, 2011; March-'10; June-'10, June 2014, Jan.2016]

The word “Environment” is derived from the French word “Environner” that means to encircle or surround. All the biological and non-biological things surrounding an organism are thus included in environment.

Environment can be defined as:

External surroundings and conditions which directly or indirectly affects the living organism

It can be also defined as:

Environment is sum total of water, air and land, interrelationship among themselves and also with human beings, other living organisms and property

Environment is usually divided in to two parts

1. Biotic
2. Abiotic

Biotic environment is made up of all living organisms (plants, animals & microorganisms) including their reactions, interactions and interrelated actions. [G.T.U., Jan.2016]

Abiotic Environment or physical environment: It is composed of external physical factors like temperature, humidity, water, soil, minerals, gases etc. It provides both habitation and raw materials for the synthesis of organic food.

These biotic and abiotic components are in a dynamic state i.e they constantly affect each other and cannot be isolated from each other.

Any constituents of the environment which directly or indirectly affects the growth and development of an organism is called environmental or ecological factor. Example of environmental factors are climatic factors, topographic factors, biotic factors, fire, edaphic (related to soil) factors.

1.2 ECOLOGY :

[G.T.U., Sept.-2009, March-2010; Dece. 2010]

The word ecology is derived from two Greek words "oikos" meaning house, habitation or place of living and "logos" meaning 'study'

Definition :

Ecology is the study of the interrelationship between living organisms and their physical and biological environment. (The physical environment includes light and heat or solar radiation, moisture, wind, oxygen, carbon dioxide nutrients in soil, water and atmosphere. The biological environment includes organisms of all kind as well as plants and animals)

Ecology is covered in detail in the subsequent chapter.

1.3 ECOSYSTEM :

[G.T.U., Sept.-2009, Mar.-2010; Jan./Dec. 2011, May 2012]

Ecosystem is made up of two words "eco" and "system" eco means environment and system means an interacting and interdependent complex.

Definitions of ecosystem :

There are number of definitions of ecosystem

1. The organisms of any community besides interacting among themselves, always have functional relationship with the environment. This structural and functional system of communities and environment is called ecological system or ecosystem
2. It is a community of interdependent organisms together with the environment
3. Any unit that includes all of the organisms in a given area interacting with the physical environment, so that a flow of energy leads to clearly defined trophic structure, biotic diversity and material cycles within the system.

Ecosystem is covered in detail in the subsequent chapter.

1.4 ENVIRONMENTAL SCIENCE :

'Environmental science' is the scientific study of our environment and our place in it.

It can be also defined as

Environmental science is the study of earth, air, water, living organisms and the man with his impact on environment.

It is highly multidisciplinary integrating disciplines of physical, chemical and biological sciences, geology, mathematics, sociology etc.

Branches of biology like Botany, Zoology, Microbiology, Genetics Biochemistry and Biotechnology helps in understanding the biotic components and their interactions.

Basic concepts of physics, Chemistry, Geology, Atmospheric science, Oceanography help us to understand the physical and chemical structure of the abiotic components and energy transfer and its flow.

Mathematics, statistics and computer sciences serve as effective tools in environmental modeling and management.

Sociology and Economics helps us to understand socio-economics aspects associated with various developmental activities.

Environmental studies is therefore a multi disciplinary subject where different aspects are dealt with a holistic approach

1.4.1 SCOPE OF ENVIRONMENTAL STUDIES

Scope of environmental studies is very broad based and it includes a large number of areas and aspects. Few basic aspects are as follows :

1. Natural resources- their conservation and management
2. Ecology and biodiversity
3. Environmental pollution and control
4. Social issues in relation to development and environment
5. Human population and environment.

Environmental studies can be highly specialized also which may concentrate on more technical aspects like Environmental science, Environmental Engineering, Environmental Management etc.

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 by his or her deeds. Thus, environment is one subject that is actually global in nature.

Environmental studies is also very important since it deals with the most basic or routine issues like safe and clean drinking water, hygienic living conditions, clean and fresh air, fertile land, healthy food and development that is sustainable.

Environmental studies helps to solve biggest environmental problems like acid rain, global warming, ozone depletion and resources depletion.

1.5 COMPONENTS OF ENVIRONMENT [G.T.U., Dec. 2008, 2010, May 2012, Jan. 2016, May 2017]

Environment can be divided in to four components

1. Atmosphere
2. Hydrosphere
3. Lithosphere
4. Biosphere

(1) Atmosphere :

[G.T.U., Jan. 2010, July 2011, Dec. 2014, June 2016]

Atmosphere is the mixture of various gases and water vapour and subatomic particles that entirely covers the earth extending outward several thousand kilometers. The major gases in a pollution free dry air are Nitrogen (78%), Oxygen (21%) Argon (0.9-1.0%) and Carbon dioxide. The minor gases include Neon, Helium, Methane, Hydrogen, Carbon Monoxide Ozone etc.

Table 1.1 gives the composition of clean dry air.

| Constituent | Concentration |
|----------------|---------------|
| Nitrogen | 0.7808 |
| Oxygen | 0.2095 |
| Argon | 0.0093 |
| Carbon dioxide | 355 ppm |
| Neon | 18 ppm |
| Helium | 5.2 ppm |
| Methane | 1.8 ppm |
| Krypton | 1.1.ppm |
| Nitrous oxide | 0.3 ppm |
| Hydrogen | 0.5 ppm |
| Ozone | 0.01 ppm |

Table 1.1 Composition of clean dry air

Most of the above values remain practically unchanged with respect to time. However the concentration of carbon dioxide is increasing by about 1.5 ppm yearly as a result of deforestation and increased air pollution from automobiles and industries

Structure of atmosphere :

On the basis of temperature profile and other related phenomena, atmosphere is divided into five major layers.

(i) Troposphere : [G.T.U., June 2013]

Troposphere is the lower portion of the atmosphere which extends up to 8 km at the poles and 16 km at equator. On an average it extends up to 10-11 km from the earth surface. The temperature in this region decrease at the rate of $5-7^{\circ}\text{C}/\text{km}$. There are strong vertical air movements in this region which are responsible for the rapid and complete mixing.

Short term properties of the troposphere (temperature, wind, pressure, humidity, cloud, etc.) at a given place and time are called **weather**.

(ii) Stratosphere : It is above troposphere and extends up to 50-55 Km. Up to about 20 km temperature remains constant then increases with increase in height. Ozone layer is in this layer.

(iii) Mesosphere : It is the layer above stratosphere and extends up to 80 km. Here temperature decreases slowly with altitude but then sharply to about -75°C

(iv) Thermosphere : Temperature increases rapidly with increases in height. The heating of this layer is due to absorption of the solar energy. Within the thermosphere there is a layer of charged particles known as ionosphere.

(v) Exosphere : Very little is known about this layer. It exists above the ionosphere and extends up to 2000 km above the earth. This layer is almost airless and empty. It probably contains hydrogen gas in ionized state. It has very high temperature ($\geq 1200^{\circ}\text{C}$)

(2) Hydrosphere :

The hydrosphere is in fact the water environment. About 70% of earth is covered by water. Water is available in seas, oceans, lake, river, glaciers etc. It is estimated that the hydrosphere contains about 1360 million cubic km of water out of which 97% is in the oceans and sea, 2% in glaciers and ice caps while remaining 1% of fresh water is available for human consumption. Water is the main constituent in all the living organism and acts as an important resource for human life.

(3) Lithosphere :

The outer soil crust of the earth is lithosphere. The living organisms, plant and vegetation, are supported by the lithosphere. It also contains resources like minerals, organic as well as inorganic matter and to some extent air and water. Lithosphere plays an important role as it not only produces food for human beings and animals, but also the decomposition of organic wastes is carried out by a host of microorganisms in the soil.

[G.T.U., January-2010]

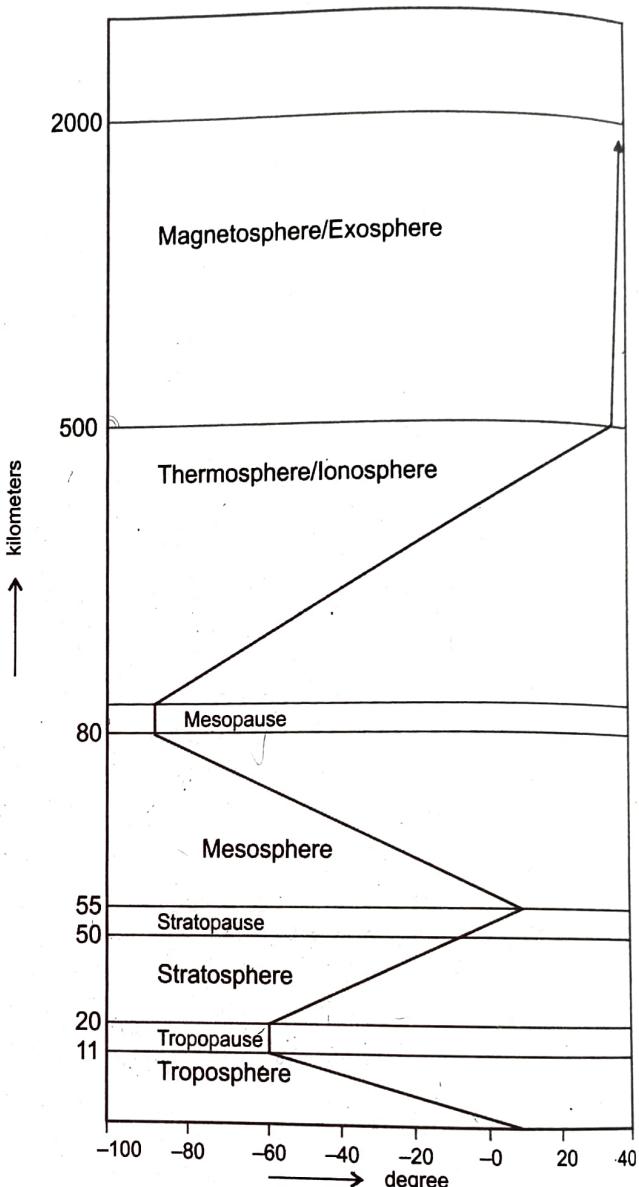
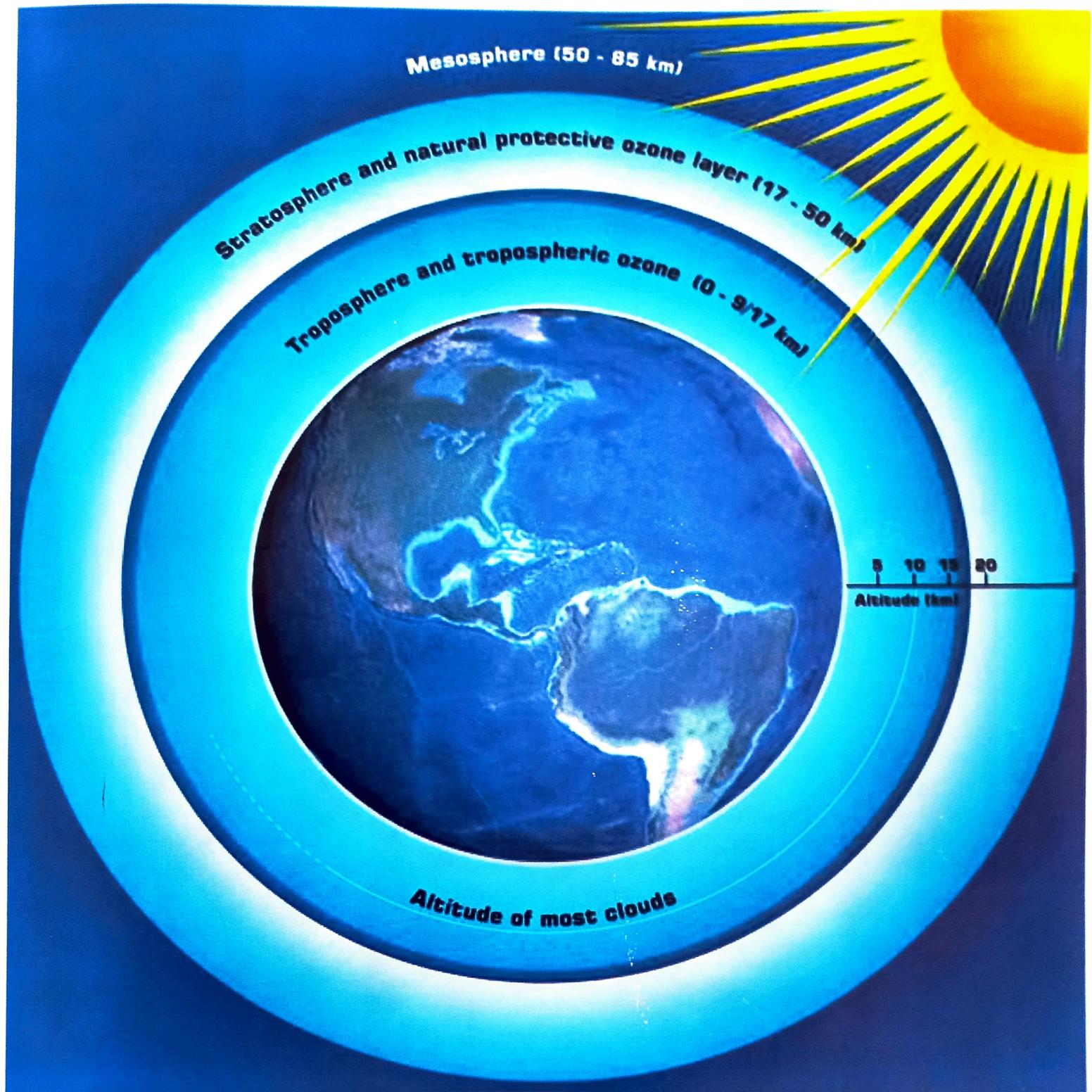


Fig 1.1 Temperature profile curve of atmosphere

It probably contains hydrogen gas in ionized state. It has very high temperature ($\geq 1200^{\circ}\text{C}$)



STRUCTURE OF ATMOSPHERE

Earth's environmental spheres



(4) Biosphere:

[G.T.U., January 2011]

Biosphere is the thin outer crust of the earth which includes all the living organisms and their environment. It extends from the lowest sea bed level to about 24 km of the atmosphere. Thus biosphere consists of lithosphere, atmosphere and hydrosphere. The living organisms interact with one another in biosphere and sustain their life. The life supporting resources are also available from the biosphere. The waste products in gaseous, liquid and solid waste forms are discharge in to biosphere. Though the sustaining and assimilative capacity of the biosphere is tremendous but it is not infinite. The system is in operation for millions of years but now it is showing stress, primarily due to impact of human upon environment.

1.6 INTERACTION BETWEEN DIFFERENT COMPONENTS OF ENVIRONMENT :

[G.T.U., Sept.-2009, June-2010, June 2014, Jan.2016]

There are four major environmental components or conceptual spheres :

Atmosphere, hydrosphere, lithosphere and biosphere.

A schematic representation of the four environmental components and their interrelationships is shown in the figure.

The circles represent the spheres and the curved arrows indicate the flow path of matter. There is closed, dynamic, inseparable, organic coupling or interrelationship among the environmental components. If one components or linkages changes, all other components respond. Every sphere has two way linkage to every other sphere including itself. The two way linkage signifies that matter may flow from one component to other in both directions. Some arrows show the transfer within a given component from one location to another indicating movement of the substance from one physical location to another without leaving the sphere. Since matter cannot be destroyed or created, the major objective is to find the location and chemical form of the substance at any given time.

The atmosphere may be considered as a transport component that moves substances from atmospheric sources to the receptors. Its storage capacity is small compared to the other spheres but it has an immense (great) capacity for spatially redistributing matter

The hydrosphere may be further classified in to two subcomponents;

One is conveyor that is a river system which collects the substances within the watershed and delivers them to the second subcomponent that is ocean

The lithosphere is the solid shell of inorganic materials on the surface of the earth. It is composed of soil particles and underlying rocks down to the depth of 50 km. Within the soil biochemical reactions by microorganisms are responsible for most of the chemical changes of matter. However, soil and rocks are mainly storage components for deposited matter.

The biosphere is the thin shell of organic matter on the earth surface comprising of all the living things. It occupies the least volume of all the spheres but it is the cause of majority of the flow of the matter across the nature. Weathering through hydrologic cycle, blowing wind and volcanic releases are some of the mobilizing agents. The biosphere is responsible for the grand scale recycling of energy and matter on the earth. The mobilization of matter is not restricted to a small area. For example burning of forest not only

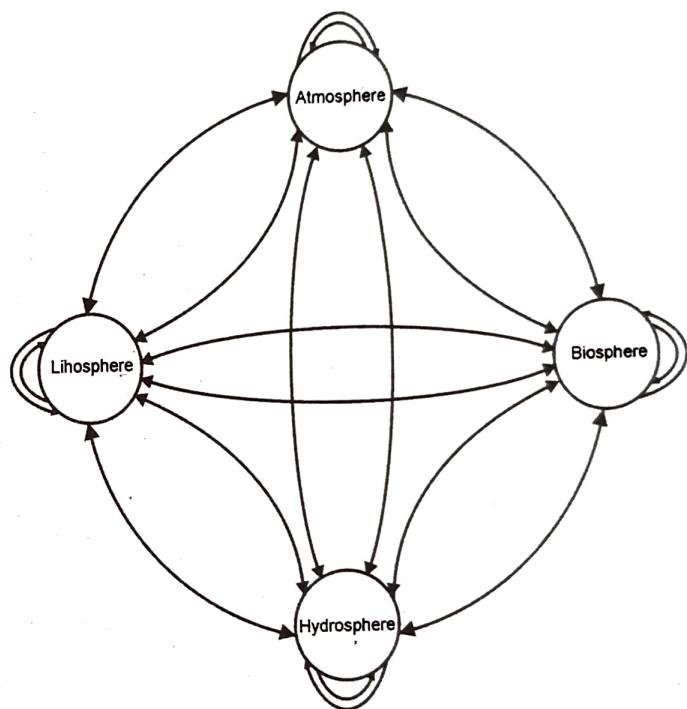


Fig 1.2 Interrelationship between various components and environment

changes chemical form of matter but also result in atmospheric transport and deposition. Some of the biologically released chemicals including carbon, nitrogen and sulphur have long atmospheric residence times, resulting in continental and global scale redistribution.

1.7 ENVIRONMENTAL POLLUTION :

[G.T.U., June/Sept. 2009; Jan. 2011, Dec. 2014]

For normal and healthy living a conducive environment is required by all the living beings. The favourable unpolluted or clean environment has a specific composition. When this composition gets changed by addition of harmful substances, the environment is called polluted environment and the substance polluting it is called **pollutant**.

Environmental pollution can therefore be define as "any undesirable change in the physical, chemical or biological characteristics of any components of the environment (air, water, soil) which can cause harmful effects on various forms of life or property.

Causes for Environmental pollution can be mainly classified as natural and man made

- (a) Natural (volcanic eruption, forest fire)
- (b) Man made

Causes of man made environmental pollution are :

- (1) Rapid Industrialization
- (2) Population growth
- (3) Unplanned urbanization

There are various types of pollution:

[G.T.U., July/Dec. 2011]

- | | |
|--------------------|----------------------|
| 1. Air pollution | 4. Land pollution |
| 2. Water pollution | 5. Thermal pollution |
| 3. Noise pollution | |

Different types of pollution will be covered in detail in the subsequent chapters

1.8 IMPACT OF HUMAN ON ENVIRONMENT [G.T.U., Dece.-2008, Mar.2010, Dec.2011, May 2012]

OR

IMPACT OF TECHNOLOGICAL DEVELOPMENT ON ENVIRONMENT.

[G.T.U., Jan.-2010, Mar.-2010, Jun.-2010; Jan. 2011, July 2011, Dec. 2013, June 2016, May 2017]

The biosphere has received and assimilated the waste generated by plants and animals for centuries. The sustaining and assimilative capacity of biosphere is tremendous, but it is not infinite. For every natural act of pollution, there are natural forces that restores the quality of environment. For example the natural systems or force have been ever active, dispersing smoke from forest fires or volcanic eruptions, diluting animal wastes by washing it into rivers and streams and converting wastes of past generations of plants and animals into soil by microbiological activities. For centuries biosphere has done the self purification as the quantity of waste or pollutants generated were within its assimilative capacity but now it is showing signs of stresses as quantity of pollutant have increased tremendously due to man's activity.

Man is the only living organism capable of modifying its surrounding environment according to the need. Other animals change according to the environment. First man started hunting animals and cutting trees for his basic needs, gradually with time he started cultivating food grains and for that he started cutting forests and converting them in to grass lands/agricultural fields. To increase his comforts he started disturbing each and every component of environment. Large scale deforestation, increasing in quantity of carbon dioxide due to burning of forest, grass, crop waste, endangering some of the species of organism etc are some of the examples of early causes of pollution and disturbance in food chain/food web. But up to that time amount of pollution was within the assimilative capacity of environment so the effects were not pronounced.

But with the start of industrial revolution the total scenario changed. Every thing changed, the use fossil fuel for generation of power, for running vehicles, many industries were started to produce the products which increased the living standard. Result of this was increasing in pollution of all type. Quantity of carbon dioxide emitted increased tremendously which has started showing effect in the form of global warming. Rivers are becoming increasingly polluted due to discharge of industrial waste and sewage. Major environmental issues arising due to human activities are global warming, acid rain, ozone depletion and population explosion.

Following table shows impacts of urbanization on the various components of environment.

Environmental component

| Atmosphere | Population (numbers and density) | Land use | Transportation | Services |
|-------------|---|---|--|--|
| | Increased release of CO ₂ , decreased O ₂ production, as plant colonies are destroyed | Increased average temperatures for most urbanized areas. | Air pollution from combustion of fuels creation of photochemical smog. | Particulate matter and toxic-gas fumes from incinerators, landfills and sewage treatment plants. |
| Hydrosphere | by spreading urban areas. Greater demand on water resources (both surface and ground | More intense use of hydrologic resources causing increased pollution. | Rain and surface waters polluted with lead. Drainage patterns altered by infrastructure. | Leaching of pollutants from landfills. Discharges from sewage outfalls pollution from boats. |
| Lithosphere | water). Increased transformation of uninhabited agricultural or unutilized land to urban uses. | Complete changes due to construction, landscaping, etc. | Disruption or disfiguration of landscape, etc. | Sanitary landfill of urban wastes and re-stallation repairs of services disrupt landscape. |

Table 1.2 Impacts of Urbanization on the various Components of Environment

Following is a quantified list of status of various components of the environment due to human interventions.

Emission of CO₂ and other gases in atmosphere from fossil fuel burning and other human activities may raise the temperature of the earth's lower atmosphere several degrees by 2150. This would disrupt food production and flooding of low-lying coastal cities and croplands.

Chlorofluorocarbons and halons released in to lower atmosphere are drifting into the upper atmosphere and reacting with and gradually depleting ozone faster than it is being formed. The thinner ozone layer will let in more ultraviolet radiation from the sun which will cause increase in skin cancer and eye cataracts, weakening of immune system. Levels of eye burning smog, damaging ozone gas and acid rain in the lower atmosphere will increase and yield of some important food crops will decrease.

An estimated 36,500 species of plants and animals become extinct each year, mostly because of human activates. If deforestation, desertification and destruction of wetlands and coral reefs continue at present rates, at least 500,000 and perhaps one million species will become extinct over the next 20 years.

About 8.1 million sq.km of once productive land (cropland, grass land, forest) have now become desert in the last 50 years. Each year about 61000 square kilometer of new desert are formed.

Topsoil is eroding faster than it forms on about 35% of the world cropland. Crop productivity on one third of the earth's irrigated area has been reduced by salt built-up in top soil.

Almost half of the world's original expanse of tropical forests are cleared.

There has been great reduction in biodiversity.

Between 25%–50% of the world's wetlands have been drained, built upon or seriously polluted. Worldwide millions of hectares of wet land are lost each year.

Most of the waste we dump in water and land eventually ends up in to oceans. Oil slicks, floating plastic debris, polluted estuaries and beaches and contaminated fish and shell fish are visible signs that we are using ocean as the world's largest dump trash.

In developing countries 61% of the people living in rural areas and 26% of urban dwellers do not have access to safe drinking water. Each year about 5 million people die from preventable water borne diseases.

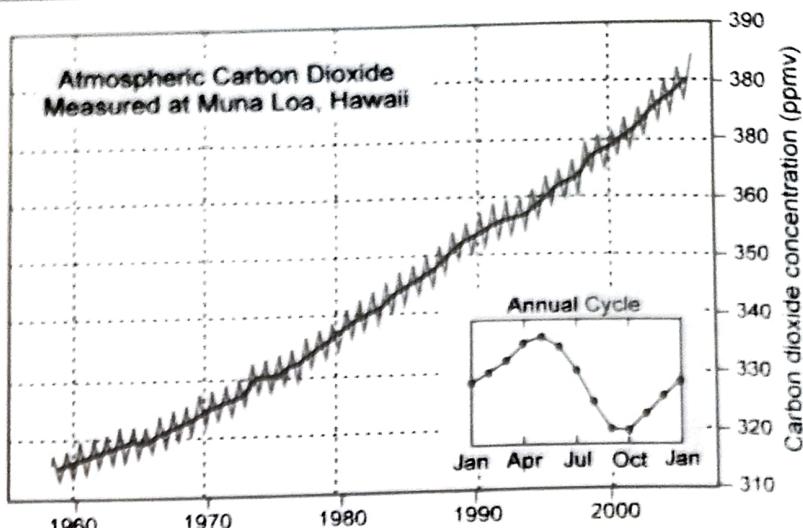


Fig. 1.3 Atmospheric Carbon Dioxide

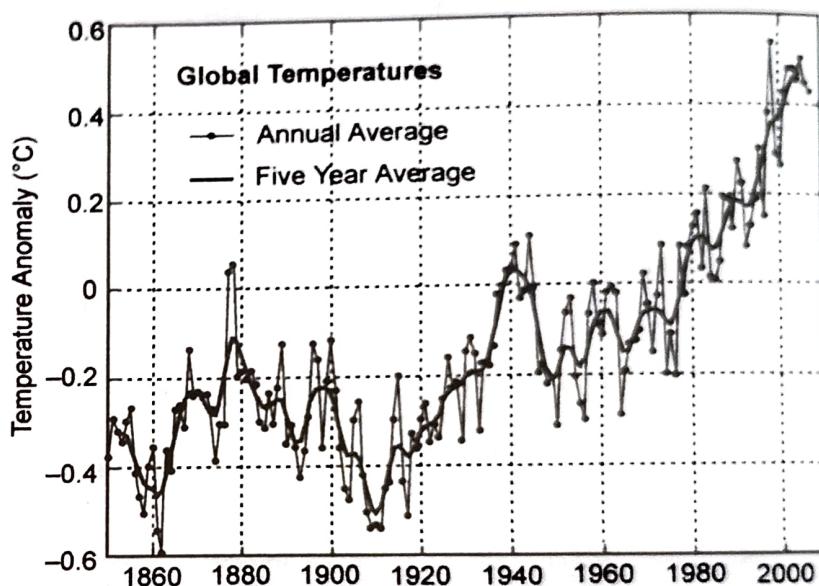


Fig. 1.4 Global Temperatures

1.9 ENVIRONMENTAL DEGRADATION :

[G.T.U., Janu.-2010, June-2010, March-2010, Jan. 2013, Jan.2016]

The alarming rate of population growth followed by the increasing standard of living has put excessive pressure on all of the natural resources. In order to meet the basics needs, there is rapid deforestation, industrialization and unplanned urbanization. All these human activities along with some natural occurrences have modified and even transformed the basic components of environment.

Some of these components have changed to such an extent that they cannot be set right by self regulatory mechanism of the environment. Consequently, the changed environmental conditions adversely affect the living organisms of the biosphere. Environmental degradation thus can be defined as 'the overall lowering of environmental qualities due to the damages caused by both natural events and human activities in the basic structure of the environment at local, regional and global levels adversely affecting all living organisms including man.'

The total environmental degradation and pollution arises mainly due to consumption of natural resources by over population of the developing countries and wasteful over consumption of resources by developed countries.

To explain the impact (I) the proposed three factor model in a given area comprises of :

[G.T.U., March 2009]

1. The population size (P)
2. Per capita consumption of resources (A)
3. Degradational pollution caused per unit of resources used (T)

$$\text{Hence } I = P \times A \times T$$

In developing countries three Ps or P3 i.e population, poverty and pollution are the key factors for rapid environmental degradation. Whereas in the developed countries it is the high rate per capita resource used which leads to such degradation. However there are many other factors which cause degradation of environment

Environmental degradation has led to the destruction of the environmental stability and ecological balance. Some of the natural events that cause Environmental degradation are volcanic eruption, forest fires, earthquakes, floods

Examples of human activities causing pollution and degradation of environment are nuclear explosion, deliberate forest fire, releases of toxic gases from automobiles, power plants and various industries etc.

1.9.1 SUSTAINABLE DEVELOPMENT

[G.T.U., Dec. 2014, June 2016]

Sustainable development is the development that meets the needs of the present without jeopardizing the needs of future generations.

In other words, every generation should leave air, water and soil as pure and unpolluted as possible. Although it is a difficult thing, it can be achieved through proper environmental management.

To meet the basic requirements of ever increasing population, industrialization is a must, but it results in pollution, environmental degradation and causes ecological imbalance. At the same time, industrial development cannot be sacrificed as it creates job opportunities, raises the standard of living and solves unemployment problems. In view of this, balance has to be struck so that development and environmental protection occurs simultaneously. To achieve this goal, sustainable development is the only answer.

Sustainable development can be done if the following concepts are taken care of :

Control of population.

Reduction in excessive usage of resources and enhancing resources conservation, i.e more and more use of renewable resources and judicious use of non-renewable resources.

Recycling and reuse of materials for waste minimization.

Concentrating more on social and economic development of the community.

Using cleaner fuel and technologies.

Development of good mass transportation facilities to reduce the number of vehicles plying on the road which will reduce the pollution.

By using effective environmental management tools like Environmental Impact Assessment (EIA), Environmental management systems (EMS) like ISO 14001 etc.

1.10 ENVIRONMENTAL EDUCATION

[G.T.U., Dec.'08, June '09, Jan.'10; Dec.'10, Dec.'11, June 2013, Dec. 2013, Dec. 214, May 2015, June 2016, May 2017]

Environmental education deals with man's relationship with his natural and man made surroundings, including the relation of population growth, pollution, resource allocation and depletion, conservation technology with the total human environment. Environmental education is the study of the factors influencing ecosystems, mental and physical health, living and working conditions and pollution

Environmental education has very important role to play in dealing with the global and local issues of environment. Environmental education is important in developing awareness about the consequences and the challenges which would arise due to man handling the environment. It also helps in improving the attitude towards environment and in understanding the environment in a better way. It also improves the skills pertaining to conservation of resources and maintaining ecological balance and sustainable development.

In short objectives of environmental education can be listed as;

- To Increase awareness and sensitivity to total environment
- To Increase the knowledge of environment
- To Improve attitude towards environment
- To Provide motivation for environmental protection
- To Increase participation and to develop a sense of responsibility and urgency regarding environmental problems and to ensure appropriate actions to solve the problems

Principles of environmental education :

- Environmental education considers environment in totality
- It is not a one shot learning process but it requires a holistic approach as it is multidisciplinary in nature
- Environmental hazards are controllable and every citizen has a moral obligation and responsibility towards this.
- Education must be given to all sections of the society
- Promote the value and necessity of cooperation at personal, local and National level in the prevention of environmental problems and solution for it.
- Help learner to discover the systems and causes of environmental problems
- Concerns of environment are concerns of several agencies and everybody should work together.

Realizing the importance environmental education the supreme court of India has directed all national organizations like UGC which regulates higher education in India to offer environmental education as a paper in the curriculum or syllabus of various degree courses. Also to increase the awarness among the common people 5th June is celebrated as World Environment Day.

1.11 ROLE OF ENVIRONMENTAL ENGINEER :

[G.T.U., July 2011]

Environmental engineers work in the industrial and research sectors to implement various solutions to control pollution and maximize the planet's energy resources. Other areas of environmental engineering include water and waste management, land cultivation, air quality control, and urban planning.

Environmental engineers work on finding new ways to solve problems in the environment, and have specialization in a variety of areas including :

- | | |
|------------------------|---|
| • Waste Management | • Toxic Material Control |
| • Water Supply | • Storm Water Management |
| • Solid Waste Disposal | • Public Health and Safely |
| • Land Management | • Radiation Protection |
| • Industrial Hygiene | • Air Pollution and Air Quality Control |

An environmental engineer may also be involved in working with a city's public health and safety board, construction management groups, and serving as advocates for environmental policies. Environmental engineering science and research projects provide comprehensive data, statistics, and reports for a variety of industry applications.

1.12 IMPORTANCE FOR DIFFERENT ENGINEERING DISCIPLINE

As discussed earlier environmental science is a multi disciplinary subject. Various aspects of environmental sciences are directly connected to various modes of life. With technological advances, application of different engineering solution/ principles in our day to day life is increasing. Every engineering solution will consume some sort of resources. It may cause different types of pollutions. All the engineering aspirants/engineers should have basic knowledge of environmental science, so that he/she is in position to know the impact of their activities on the environment. Knowledge of environment science will also help them motivate as well as take effective steps for conservation of resources and to develop the methods for pollution abatement/reduction. For example calculation of carbon foot print for any production activities will help to assess the pollution potential of that activity and will also help in identifying the ways to reduce the emissions of greenhouse gases by modifying the process/step which is responsible for maximum green house gas emission. Importance of environmental science for different branches has been highlighted by some examples given below:

1. **Mechanical Engineering :** Mechanical engineering deals with design and operation of many combustion processes. Any combustion process will require fuel. If a mechanical engineer is aware of the impact of use of different types of fuels on the environment, he would try to develop a process which uses greener fuel and thus reduce the pollution. He/she would also try to increase the efficiency of combustion processes, as incomplete combustion leads to production of carbon monoxide and other air pollutants. If they are aware of the positive impacts of renewable energy sources through the study of environmental science, they would try to develop new technologies to harvest wind energy, hydropower etc. Mechanical engineering also deals with the subject of refrigeration. Use of refrigerants which have higher global warming potential and which causes depletion of ozone layer should be discouraged and focused should be on developing technologies which may eliminate the use of these environmentally dangerous compounds.
2. **Automobiles Engineering :** They should be aware of different exhaust gases coming out of the vehicles and their impact on the environment. This will entice them to develop vehicles whose emissions are very less. Design can be focused on used of hybrid vehicles or vehicles running on electricity rather than fossil fuels.
3. **Civil Engineering :** Demolition and construction waste are produced in large quantity in various works related to civil engineering. If a civil engineer is aware of the problems caused in handling and disposing solid waste, he/she would try to reuse this waste as a construction material, benefit of which will be two fold, 1. Reduction of usage of new resources and 2. Reduction in the quantity of the waste that has to be disposed properly in order to minimize the risk on the environment. Construction/demolition waste can be used to replace aggregates in concrete. They can also develop methods/technologies which could be used to use plastic: a very dangerous pollutant, for bituminous road construction. They can also use different cleaner production techniques to reduce the SPM and other pollutant levels at the construction site.
4. **Electrical Engineering :** Production of energy by conventional sources causes depletion of the natural resources and large amount of pollution. Power sector is one of the largest contributors of green house gases. Reduction in the power consumption can reduce the amount of pollution to a great extent. Basic knowledge of different types of pollutants produced in power generation and their impacts on environment will inspire electrical engineers to develop energy efficient devices/equipment which will reduce the power consumption, which in turn will lead to resource conservation and pollution abatement.

5. **Computer/IT Engineering.** Environmental science include the study of e-waste, its sources and impact on the environment. Computer engineers with a sound knowledge of environmental science would try to develop technologies which can be used to upgrade existing computer and other IT gadgets easily thereby reducing the need of replacing the existing one. Thus there would be reduction in the generation rate of e-waste and problem related to disposal.

Similarly knowledge of environmental science will help other engineering disciplines also to achieve a broader goal of sustainable development.

EXERCISE

1. Define Environment, Ecology, Ecosystem, Pollution, Pollutant.
 2. Explain various components of environment.
 3. Explain the multidisciplinary nature of ecosystem.
 4. Write a short note on scopes of environmental studies.
 5. Explain the structure of atmosphere.
 6. Explain the interrelationship between various components of environment.
 7. Write a note on “Impact of man on Environment”.
 8. Write a note on “environmental degradation”.
 9. Justify the statement ‘we have not inherited the earth from our ancestors but we have borrowed it from our children’.
 10. Justify the statement ‘The earth provides enough to satisfy every person’s need but not every person’s greed’.
 11. Explain the need of sustainable development.
 12. Explain the importance of environmental education.
 13. What are the objectives and guiding principles of environmental education.
 14. Explain how environmental science is important for different disciplines of engineering.

MULTIPLE CHOICE QUESTION

7. Short term properties of the atmosphere at a given place and time is referred as [G.T.U., Jan 2013]
(a) Climate (b) Microclimate (c) Season (d) Weather

8. Ambient lapse rate is
(a) $-5.2^{\circ}\text{C}/\text{km}$ (b) $-2.2^{\circ}\text{C}/\text{km}$ (c) $-6.5^{\circ}\text{C}/\text{km}$ (d) $5.2^{\circ}\text{C}/\text{km}$

9. Environmental pollution is due to
(a) Rapid industrialization (b) Population growth
(c) Unplanned urbanization (d) All of the above

10. The component of the environment which is of utmost importance for study of environment
(a) Atmosphere (b) Hydrosphere (c) Biosphere (d) Lithosphere

11. The biggest pollutant receptor or sink of the earth is
(a) Biosphere (b) Lithosphere (c) Hydrosphere (d) Atmosphere

12. Earth day is celebrated on : [G.T.U., June 2014]
(a) 5th June (b) 12th May (c) 22nd April (d) 22nd May

13. Stratosphere contains an important species which protect life on earth is : [G.T.U., June 2014, Jan 2016]
(a) Oxygen (b) Ozone (c) Nitrogen (d) Hydrogen

14. A zone consisting of land, water and air which supports life on earth is : [G.T.U., June 2014]
(a) Biosphere (b) Atmosphere (c) Lithosphere (d) Hydrosphere

15. Which is not true? [G.T.U., Dec. 2014]
(a) Lithosphere includes the crust and the uppermost mantle
(b) Lithosphere is underlain by the stratosphere
(c) Lithosphere provides timber
(d) Lithosphere is broken into tectonic plates

16. Percentage of total water found as fresh water is [G.T.U., Dec. 2014]
(a) 87.5% (b) 2.5% (c) 97.5% (d) 75%

17. The range of temperature variation in mesosphere is [G.T.U., May 2015]
(a) 20°C to -56°C (b) -2°C to -90°C (c) -56°C to -2°C (d) -90°C to 120°C

18. In the atmosphere the layer above the troposphere is [G.T.U., May 2016]
(a) Stratosphere (b) Exosphere (c) Mesosphere (d) Thermosphere

19. The layer in which presence of ozone is treated as a pollutant is [G.T.U., May 2017]
(a) Stratosphere (b) Troposphere (c) Ionosphere (d) Exosphere

20. The least pollutant receptor or sink on the earth is [G.T.U., May 2017]
(a) Biosphere (b) Atmosphere (c) Lithosphere (d) Hydrosphere

• ANSWER •

- 1. (c) 2. (d) 3. (c) 4. (b) 5. (b) 6. (c) 7. (d) 8. (c) 9. (d) 10. (c) 11. (c) 12. (c)
13. (b) 14. (a) 15. (b) 16. (b) 17. (b) 18. (a) 19. (b) 20. (b)**

