NBKR INSTITUTE OF SCIENCE AND TECHNOLOGY::VIDYANAGAR
(AUTONOMOUS)

LECTURE NOTES

II B.TECH. I SEMESTER
(2020-2021)

Subject Name:ENVIRONMENTAL SCIENCE **Code:19MC2101**

Teacher:Dr.U.CHANDRABHASKARA REDDY
Asst.Professor,
Department of Civil Engineering,
NBKRIST,
Vidyanagar.

CONTENTS

UNIT-I
ENVIRONMENTAL SCIENCES (A Multidisciplinary Subject)

1.0.ENVIRONMENT:

'Environment' is derived from the French word Environner which means to encircle or surround. Therefore all the biological and abiological things surrounding an organism are included in environment.

Thus environment is sum total of water, air and land, inter-relationships among themselves and also with the human beings, other living organ-isms and property. The above definition given in **Environment (Protection) Act, 1986** clearly indicates that environment includes all the physical and biological surroundings and their interactions.

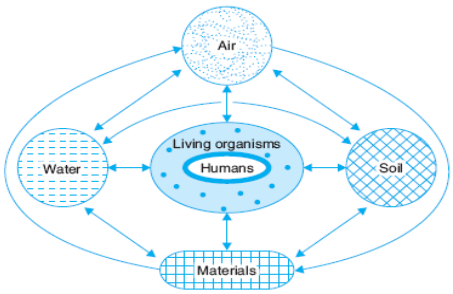
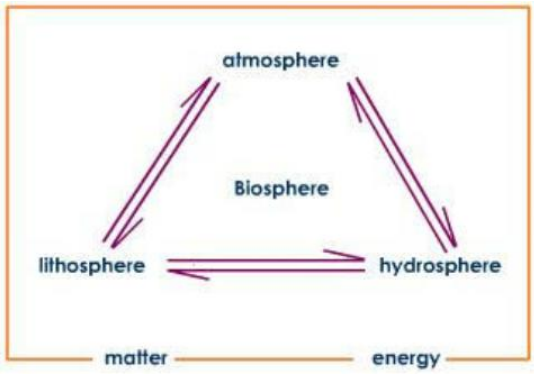


Fig. 1.1 Concept of Environment: air, water, land, living organisms and materials surrounding us and their interactions together constitute environment.



Science is the careful study about processes.So environmental science deals with the

Types of environment :

1. Natural environment
2. Man-made environment

1. Natural environment :

- It includes components such as air,water,soil,land,forest,wildlife,flora,fauna….
- This environment operates through a self-regulating mechanism.
- It is never static,so that the changes may be negligible or drastic.
- These changes may be either beneficial or harmful to the living organisms in the environment.
- The Natural environment on the earth is devided into four realms.

A. Atmosphere :

The layer of gases surrounding earth is called the atmosphere.
The atmosphere of earth is composed of several distinct layers such as troposphere, stratosphere, mesosphere,and ionosphere.

1) Troposphere

- ✓ It is the lower portion of the atmosphere and extends from 0-18 kms.
- ✓ It contains 75% of the atmospheric air mass.
- ✓ The temperature of the troposphere changes from 15°C to -56°C.
- ✓ The chemical constituents are O_2, CO_2, N_2 water.

2) Stratosphere:

- ➢ It lies above the troposphere and extends from 18-50 kms.
- ➢ The temperature of which changes from -2°C to -56°C.
- ➢ The main chemical constituent is ozone.

3) Mesosphere:

- ❖ It lies above the stratosphere and extends from 50-85 kms.
- ❖ The temperature of which drops to about -95°C.
- ❖ The main chemical constituents are N_2, O_2, O_2^+, NO^+.

4) Ionosphere:

- ✓ It lies above the mesosphere and extends upto 500 kms above the earth surface.
- ✓ The temperature of which raises upto 1200°C.
- ✓ It contains the charged particles like O_2^+, O^+, NO^+.

B. <u>Hydrosphere:</u>

The Hydrosphere comprises all types of water resources oceans, seas, lakes, rivers, streams, reserviour, 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.

(iv) The presence of water on earth gives it the name " blue planet"

(v) Due to the range of surface temparatures and presusures, water exists in all three states; solid(ice), liquid(water), and gas(water vapour) on earth.

C. <u>Biosphere :</u>

- ✓ The biosphere is that part of earth which includes air, land, surface rocks, water, and all components within which life occurs.
- ✓ It is the life-zone of the earth and includes all living organisms. The biosphere can be devided into distinct ecosystems that represent interactions between different groups of organisms.

D. Lithosphere :

- The lithosphere includes the solid part of earth's crust.
- It has two parts, the crust and upper mantle.
- The crust includes rocks, minerals, and soil.
- Directly below the crust is called mantle.

2. Man-made environment :

Humanbeings are the most powerful environment agents and are capable of modifying the environment to a great extent according to their needs by the application of modern technology.

It is classified further as physical, chemical, and biological environments.

1.Physical environment :

- ✓ It includes all the matter which the universe is made of and excludes the biotic components.
- ✓ It includes radiation, temperature, humidity, rain, soil and other physical factors which directly influence the organisms and determine the existence of life on earth.

Ex: solar energy

2.Chemical environment :

- ✓ It includes all the chemical components of earth.
- ✓ It include gases, acids, water, inorganic elements and organic substances.
- ✓ The chemical environment may be different for different group of organisms.

3.Biological environment :

- ✓ It includes all life on earth.
- ✓ It covers all living organisms found on earth.
- ✓ These can be bacteria, virus, microbes, algae, shrubs, mammals……
- ✓ All these are influence factors and act as reservoirs for various infectious diseases.

Components of Environment :

All major components of the environment namely, air, water, land, energy, living beings including humans, are inter related and inter-connected in many ways.

The components of environments are broadly classified as abiotic and biotic components.

1. Abiotic / Non-living components :

The way in which plants and animals grow and carryout their activities is a result of several abiotic factors. They include all the physical and chemical factors that influence living organisms.

Ex : air, water, rocks, soil…..

Abiotic components are essential for living world, as life cannot exist without factors such as sunlight, water, air and minerals. The quality of abiotic environment is a critical factor for life.

It is believed that primitive organisms drastically changed the abiotic components of the planet and affected. Human activities are currently resulting in considerable changes in the abiotic environment hence causing harmful effects such as global warming.

2. Biotic / Living components :

These are living components of environment such as microbes, plants, animals and human beings. They are classified as either producers or consumers depending their food habits.

a) <u>Producers/Autotrophs :</u>

- These include green plants and algae which manufacture their own food.
- Green plants capture solar energy with the help of chlorophyll pigment present in their leaves, make their own food in the form of sugars.
- This process is known as photosynthesis and the plants are known as photo-autotrophs.
- Bacteria that utilize the oxidation of inorganic compounds such as hydrogen sulphide, ammonia as energy source to manufacture their food by the process of chemosynthesis and are known as chemo-autotrophs.

b) <u>Consumers/Heterotrophs :</u>

- The organisms of this group are not capable of manufacturing food.
- They depend upon autotrophs to meet their food requirements.
- They depend upon autotrophs for both energy and raw materials to make complex organic molecules.
- These are further classified depending on their food habits.
- Based on the food habits they are
    1. Herbivores
    2. Carnivores
    3. Omnivores
    4. decomposers

Scope of environmental studies:

The scope of environmental studies is broad based and it encompasses a large number of areas and aspects .

- Natural Resources—their conservation and management
- Ecology and biodiversity
- Environmental pollution and control
- Social issues in relation to development and environment
- Human population and environment

These are the basic aspects of Environmental Studies which have a direct relevance to every section of the society. Environmental studies can be highly specialized also which may concentrate on more technical aspects like Environmental Science, Environmental Engineering, Environmental Management, Environmental Biotechnology 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 and will also affect the environment by his or her deeds. Thus, environment is one subject that is actually global in nature.

For example, atmosphere has no boundaries and the pollutants produced at one place can be dispersed and transported to another place. The river water polluted by industrial or municipal discharge at one point would seriously affect the downstream aquatic life.

There are some environmental problems which may be of localized importance but there are some major issues like global warming, depletion of ozone layer, dwindling forests and energy resources, loss of global biodiversity etc. that are going to affect the mankind as a whole and for that we have to think globally. For dealing with local environmental issues, e.g. the impacts of mining or hydro-electric projects, solid waste management etc. we have to think and act locally. In order to make the people aware about those aspects of environment with which they are so intimately associated, it is very important to make every one environmentally educated.

Importance of environmental studies:

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

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 planted 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:

A goal, which ultimately is the true goal of development an environmentally sound and sustainable development.

A goal common to all citizens of our earth.

A goal distant from the developing world in the manner it is from the over-consuming wasteful societies of the "developed" world.

Need To Save Humanity from Extinction

It is incumbent upon us to save the humanity from exinction. 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 by synchronised with the ecological cycles in any plan of development our actions should be planned ecologically for the sustenance of the environment and development.

- **<u>Need for Public Awareness:</u>**

As the earth's natural resources are dwindling and our environment is being increasingly degraded by human activities, it is evident that something needs to be done. We often feel that managing all this is something that the Government should do. But if we go on endangering our environment, there is no way in which the Government can perform all these clean-up functions. It is the prevention of environment degradation in which we must all take part that must become a part of all our lives. Just as for any disease, prevention is better than cure. To prevent ill-effects on our environment by our actions, is economically more viable

than cleaning up the environment once it is damaged. Individually we can play a major role in environment management. We can reduce wasting natural resources and we can act as watchdogs that inform the Government about sources that lead to pollution and degradation of our environment.

This can only be made possible through mass public awareness. Mass media such as newspapers, radio, television, strongly influence public opinion. However, someone has to bring this about. If each of us feels strongly about the environment, the press and media will add to our efforts. Politicians in a democracy always respond positively to a strong publicly supported movement. Thus if you join an NGO that sup-ports conservation, politicians will make green policies. We are living on spaceship earth with a limited supply of resources. Each of us is responsible for spreading this message to as many people as possible.

Suggested further activities for concerned students:

- Join a group to study nature, such as WWF-I or BNHS, or another environmental group.
- Begin reading newspaper articles and periodicals such as 'Down to Earth',WWF-I newsletter, BNHS Hornbill, Sanctuary magazine, etc. that will tell you more about our environment. There are also several environmental websites.
- Lobby for conserving resources by taking up the cause of environmental issues during discussions with friends and relatives. Practice and promote issues such as saving paper, saving water, reducing use of plastics, practicing the 3Rs principle of reduce, reuse, recycle, and proper waste disposal.
- Join local movements that support activities such as saving trees in your area, go on nature treks, recycle waste, buy environmental friendly products.
- Practice and promote good civic sense such as no spitting or tobacco chewing, no throwing garbage on the road, no smoking in public places, no urinating or defecating in public places.
- Take part in events organized on World Environment Day, Wildlife Week, etc.
- Visit a National Park or Sanctuary, or spend time in whatever nature you have near your home.

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES :

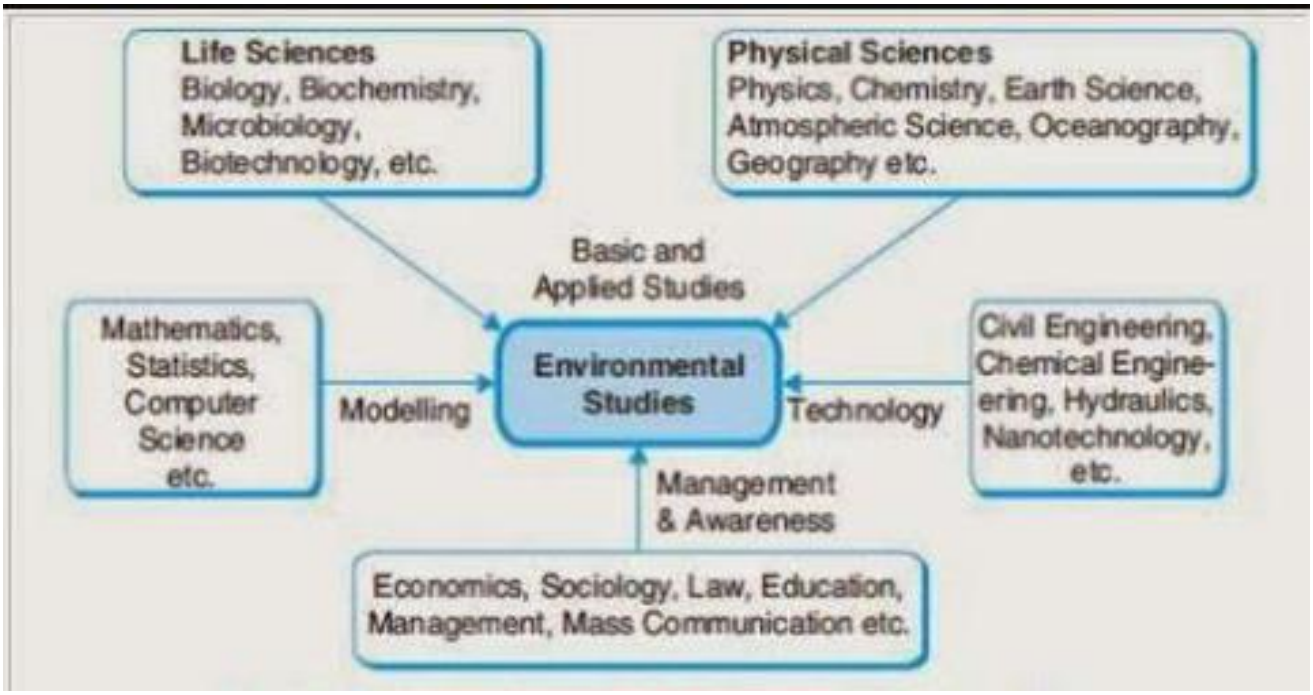
Environment is complex and has multifarious aspects.

Keeping in view the complex nature of the environment, knowledge and information from various disciplines os science, social science, law and engineering have to be included in environmental studies to understand it completely.

- ✓ Life sciences including botony, zoology, microbiology, genetics and biochemistry help in understanding the biotic components and their interactions.
- ✓ For understanding the physical and chemical structure of abiotic components of environment along with mass and energy transfers we have to make use of basic concepts of physics, chemistry,geology, atmospheric science and geography.
- ✓ Mathematics, statistics and computer science serve as effective tools in environmental modeling.
- ✓ Subjects like economics, management and sociology provide the inputs for dealing with socio-economic aspects associated with various development activities.

- ✓ A synthesis of civil engineering, hydraulics, chemical engg, nano- technology provide the technical solutions to environmental pollution control and waste treatment.
- ✓ Environmental education and mass communication are two important subjects that are instrumental in disseminating environmental awareness.
- ✓ Environmental ethics provide the guidelines for a sustainable lifestyle.

Environmental sciences, therefore is a multidisciplinary subject where we deal with different aspects using a holistic approach.



Institutions in Environment:

- **Bombay Natural History Society (BNHS),Mumbai:**

The BNHS began as a small society of six members in 1883. It grew from a group of shikaris and people from all walks of life into a major research organization that substantially influenced conservation policy in the country. The influence on wildlife policy building, re-search, popular publications and peoples action have been unique features of the multi-faceted society. Undoubtedly its major contribution has been in the field of wildlife research. It is India's oldest conservation research based NGO and one that has acted at the forefront of the battle for species and ecosystems. The BNHS publishes a popular magazine called Hornbill and also an internationally well-known Journal on Natural History. The BNHS has over the years helped Government to frame wildlife related laws and has taken up battles such as the 'Save the Silent Valley' campaign.

- **World Wide Fund for Nature (WWF-I), New Delhi**:

The WWF-I was initiated in 1969 in Mumbai after which the headquarters were shifted to Delhi with several branch offices all over India. The early years focused attention on wildlife education and awareness. It runs several programs including the Nature Clubs of India program for school children and works as a think tank and lobby force for environment and development issues.

- **Center for Science and Environment (CSE),New Delhi**:

Activities of this Center include organizing campaigns, holding workshops and conferences, and producing environment related publications. It published a major document on the 'State of India's Environment', the first of its kind to be produced as a Citizen's Report on the Environment. The CSE also publishes a popular magazine, 'Down to Earth', which is a Science and Environment fortnightly. It is involved in the publication of material in the form of books, posters, video films and also conducts workshops and seminars on biodiversity related issues.

- **Botanical Survey of India (BSI)**:

The Botanical Survey of India (BSI) was established in 1890 at the Royal Botanic Gardens, Calcutta. How-ever it closed down for several years after 1939 and was reopened in 1954. In 1952 plans were made to reorganize the BSI and formulate its objectives. By 1955 the BSI had its headquarters in Calcutta with Circle Offices at Coimbatore, Shillong, Pune and Dehra Dun. Between 1962 and 1979, offices were established in Allahbad, Jodhpur, Port Blair, Itanagar and Gangtok. The BSI currently has nine regional centres. It carries out surveys of plant resources in different regions.

- **Zoological Survey of India (ZSI)**:

The ZSI was established in1916. Its mandate was to do a systematic survey of fauna in India. It has over the years collected 'type specimens' on the bases of which our animal life has been studied over the years. Today it has over a million specimens! This makes it one of the largest collections in Asia. It has done an enormous amount of work on taxonomy and ecology. It currently operates from 16 regional centers.

- **Centre for Environment Education (CEE),Ahmedabad:**

The Centre for Environment Education, Ahmedabad was initiated in 1989. It has a wide range of programs on the environment and produces a variety of educational material. CEE's Training in Environment Education {TEE} program has trained many environment educators.

- **Wildlife Institute of India (WII), Dehradun**:

This Institution was established in 1982, as a major training establishment for Forest Officials and Research in Wildlife Management. Its most significant publication has been 'Planning A Wildlife Protected Area Network for India' (Rodgers and Panwar, 1988). The organisation has over the years added an enormous amount of information on India's biological wealth. It has trained a large number of Forest Department Officials and Staff as Wildlife Managers. Its M.Sc. Program has trained excellent wildlife scientists. It also has an Environment Impact Assessment (EIA) cell. It trains personnel in eco-development, wildlife biology, habitat management and Nature interpretation.