UNIT-I

ENVIRONMENTAL SCIENCE INTRODUCTION AND NATURAL RESOURCES

1.1 INTRODUCTION

The word Environment is derived from the French word "Environ" which means "surrounding". Our surrounding includes biotic factors like human beings, Plants, animals, microbes, etc and abiotic factors such as light, air, water, soil, etc. Environment is a complex of many variables, which surrounds man as well as the living organisms.

Environment includes water, air and land and the interrelation ships which exist among and between water, air and land and human beings and other living creatures such as plants, animals and micro organisms. She suggested that environment consists of an inseparable whole system constituted by physical, chemical, biological, social and cultural elements, which are interlinked individually and collectively in myriad ways. The natural environment consist of four interlinking systems namely, the atmosphere, the hydrosphere, the lithosphere and the biosphere. These four systems are in constant change and such changes are affected by human activities and vice versa.

Components of Environment

Environment has been classified into four major components:

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

Hydrosphere includes all water bodies such as lakes, ponds, rivers, streams and ocean etc. Hydrosphere functions in a cyclic nature, which is termed as hydrological cycle or water cycle. Lithosphere means the mantle of rocks constituting the earth's crust. The earth is a cold spherical solid planet of the solar system, which spins in its axis and revolves around the sun at a certain constant distance.

Lithosphere mainly, contains soil, earth rocks, mountain etc. Lithosphere is divided into three layers-crusts, mantle and core (outer and inner). Atmosphere The cover of the air, that envelope the earth is known as the atmosphere.

Atmosphere is a thin layer which contains gases like oxygen, carbon dioxide etc. and which protects the solid earth and human beings from the harmful radiations of the sun. There are five concentric layers within the atmosphere, which can be differentiated on the basis of temperature and each layer has its own characteristics. These include the troposphere, the stratosphere, the mesosphere, the thermosphere and the exosphere.

Biosphere it is otherwise known as the life layer, it refers to all organisms on the earth's surface and their interaction with water and air. It consists of plants, animals and micro-organisms, ranging from the tiniest microscopic organism to the largest whales in the sea. Biology is

concerned with how millions of species of animals, plants and other organisms grow, feed, move, reproduce and evolve over long periods of time in different environments. Its subject matter is useful to other sciences and professions that deal with life, such as agriculture, forestry and medicine. The richness of biosphere depends upon a number of factors like rainfall, temperature, geographical reference etc. Apart from the physical environmental factors, the man made environment includes human groups, the material infrastructures built by man, the production relationships and institutional systems that he has devised. The social environment shows the way in which human societies have organized themselves and how they function in order to satisfy their needs.

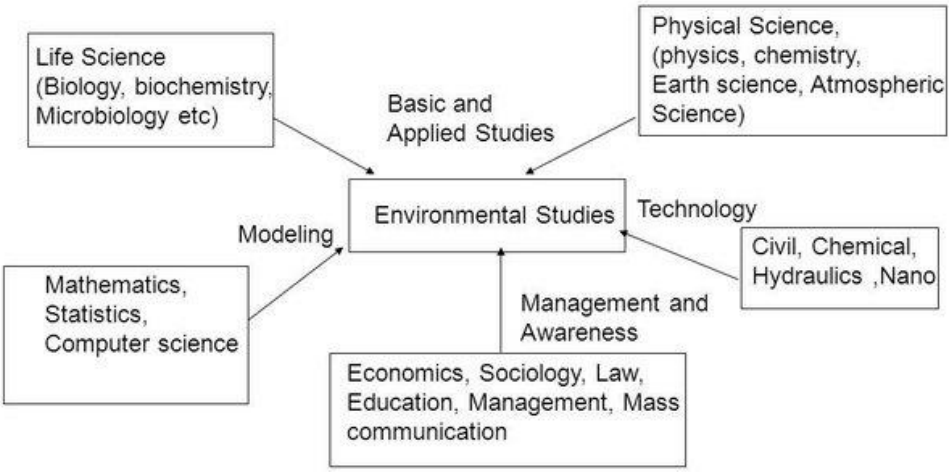
1.1.1 MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Environmental science is an interdisciplinary academic field that integrates physical and biological sciences, (including but not limited to Ecology, Physics, Chemistry, Biology, Soil Science, Geology, Atmospheric Science and Geography) to the study of the environment, and the solution of environmental problems. Environmental science provides an integrated, quantitative, and interdisciplinary approach to the study of environmental systems.

Related areas of study include environmental studies and environmental engineering. Environmental studies incorporate more of the social sciences for understanding human relationships, perceptions and policies towards the environment. Environmental engineering focuses on design and technology for improving environmental quality.

Environmental scientists work on subjects like the understanding of earth processes, evaluating alternative energy systems, pollution control and mitigation, natural resource management, and the effects of global climate change. Environmental issues almost always include an interaction of physical, chemical, and biological processes.

The multidisciplinary nature of environmental science is illustrated in following diagram



1.1.2 SCOPE OF ENVIRONMENTAL SCIENCE

Because of environmental studies has been seen to be multidisciplinary in nature so it is considered to be a subject with great scope. Environment is not limited to issues of sanitation and health but it is now concerned with pollution control, biodiversity conservation, waste management and conservation of natural resources. This requires expert eyes and hence is creating new job opportunities. The opportunities in this field are immense not only for scientists but also for engineers, biologists. There is a good chance of opportunity to find a job in this field as environmental journalists. Environmental science can be applied in the following spheres:

Ecosystem Structure and Function

The study of ecosystems mainly consists of the study of the processes that link the leaving organism or in other words biotic component to the non-living organism or a biotic component. So for the study of environment we should aware with biotic and a biotic components.

Natural Resource Conservation

For managing and maintenance of forests which are natural resources and for the maintenance of wildlife forms task under natural resource conservation. It is also a scope of environmental studies

Environmental Pollution Control

With the knowledge of environmental science everybody can control the pollution. He/she can handle the waste management and also look for ways to control pollution on the aspect of pollution control.

Environmental management

There are several independent environmental consultants who are working with Central and State pollution control Board. They offer advice to solve the problems of environment the optimum solution for the upcoming problems. They give direction for controlling pollution due to industrial development. There are several current consultants who are working with government pollution control boobs, involved in policy making, pollution control and maintenance of ecological balance.

The scope of environmental studies in industry

Environmental scientist's work towards maintenance of ecological balance, they also work towards conservation of biodiversity and regulation of natural resources as well as on preservation of natural resources. Most of the industries have a separate environmental research and development section. These sections govern the impact that their industry has on the environment. Our environment is being degraded by the rapid industrialization. To combat this

menace there is a growing trend towards manufacture of "green" goods and products. So we can say that there is a good scope in the field of industry from environmental studies.

Research and development

Research and development have tremendous scope due to increment in public awareness regarding the environment. Various universities and governmental organizations offer a scope for such research. These universities conduct research studies in order to develop the methods toward monitoring and controlling the source of environmental pollution. Due to an increasing threat from global warming, many steps are being undertaken for the reduction of greenhouse gases and the adoption of renewable energy resources. They generate awareness now regarding the use of solar energy for variety of purposes. This provides scope of environmental history in the field of research and development.

Social Development

NGO (Nongovernmental organizations) help in creating awareness regarding the protection of the environment and making the masses aware of various environmental issues . They also generate a public opinion in this field. They work towards disseminating information and in bringing about changes in political policies that are personally effect the environment. The social dimension of this profession includes controlling population explosion through organizing advisory awareness camps.

1.1.3 IMPORTANCE OF ENVIRONMENT SCIENCE

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

Environment science has become significant for the following reasons:

1.Environment Issues Being of International Importance

It has been well recognized 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, and 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 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.

5. Need for Wise Planning of Development

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

1.1.4 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 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, 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 are 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.

1.2 NATURAL RESOURCES

The word resource means a source of supply. The natural resources include water, air, soil, minerals, coal, forests, crops and wildlife are examples. All the resources are classified based on quantity, quality, re-usability, men's activity and availability.

Natural resources are naturally occurring substances that are considered valuable in their relatively unmodified (natural) form. A natural resource's value rests in the amount of the material available and the demand for it. The term was introduced to a broad audience by E.F. Schumacher in his 1970s book Small is Beautiful.

a) Renewable resource or inexhaustible resources

The renewable resources can maintain themselves or can be replaced if managed wisely. These resources are constantly renewed in nature. The renewable resources are therefore not likely to be lost due to excessive and unwise use.

b) Non-renewable resources or exhaustible resources

These resources once used are lost forever, as they are not restored. They include metallic minerals and fossil fuels. At current rates of usage, all the industrial metals may lose for less than a century and those of petroleum and natural gas may exhaust in 15-20 years.

Natural Resources and Associated Problems

Human population is growing day-by-day. Continuous increase in population caused an increasing demand for natural resources. Due to urban expansion, electricity need and industrialization, man started utilizing natural resources at a much larger scale. Non-renewable resources are limited. They cannot be replaced easily. After some time, these resources may come to an end. It is a matter of much concern and ensures a balance between population growth and utilization of resources. This overutilization creates many problems. In some regions there

are problems of water logging due to over irrigation. In some areas, there is no sufficient water for industry and agriculture. Thus, there is need for conservation of natural resources.

There are many problems associated with natural resources:

Forest resources and associated problems

1. Use and over-exploitation.
2. Deforestation.
3. Timber extraction.
4. Mining and its effects on forest.
5. Dams and their effects on forests and tribal people.

Water resources and associated problems

1. Use and overutilization of water.
2. Floods, droughts etc.
3. Conflicts over water.
4. Dams and problems.

Mineral resource and associated problems

1. Use and exploitation.
2. Environmental effects of extracting and using minerals.

Food resources and associated problems

1. World food problems.
2. Changes caused by agriculture and over grazing.
3. Effects of modern agriculture.
4. Fertilizer-pesticide problems.
5. Water logging and salinity.

Energy resources and associated problems

1. Growing energy needs.

Land resources and associated problems

1. Land degradation.
2. Man-induced landslides.
3. Soil erosion and desertification.

1.3 FOREST RESOURCES

Forests are one of the most important natural resources and a part of biosphere since these are natural assets on this earth. Forests predominantly composed of trees, shrubs, woody vegetation etc… Approximately 1/3rd of the earth's total land area is covered by forests. Forests are important ecologically and economically. Ecologically forests are to be considered as earth's lungs because they consume CO_2 and release O_2which is required for sustaining the life on this earth. The poisonous gas CO_2 is absorbed by the trees of forests and reduces the global warming and helps to continue hydrological cycle, reduce soil erosion. Forest ecosystems are extremely good & hold a good quantity of water.

Economically forests provide timber, fodder to grazing animals, firewood(conventional fuel), bamboos, rubbers, medicines, gums, resins, food items etc.

USES OF FOREST

1. Watershed protection:

• Reduce the rate of surface run-off of water.

• Prevent flash floods and soil erosion.

• Produces prolonged gradual run-off and thus prevent effects of drought.

2. Atmospheric regulation:

• Absorption of solar heat during evapo-transpiration.

• Maintaining carbon dioxide levels for plant growth.

• Maintaining the local climatic conditions.

3. Erosion control:

• Holding soil (by preventing rain from directly washing soil away).

4. Land bank:

• Maintenance of soil nutrients and structure.

5. Local use - Consumption of forest produce by local people who collect it for subsistence – (Consumptive use)

• Food - gathering plants, fishing, hunting from the forest. (In the past when wildlife was Plentiful, people could hunt and kill animals for food. Now those populations of most Wildlife species have diminished; continued hunting would lead to extinction.)

• Fodder - for cattle.

• Fuel wood and charcoal for cooking, heating.

• Poles - building homes especially in rural and wilderness areas.

• Timber – household articles and construction.

• Fiber - weaving of baskets, ropes, nets, string, etc.

• Sericulture – for silk.

• Apiculture - bees for honey, forest bees also pollinate crops.

• Medicinal plants - traditionally used medicines, investigating them as potential Source for new modern drugs.

6. Market use - (Productive use)

• Most of the above products used for consumptive purposes are also sold as source of income for supporting the livelihoods of forest dwelling people.

• Minor forest produce - (non-wood products): Fuel wood, fruit, gum, fiber, etc.which are Collected and sold in local markets as a source of income for forest dwellers.

• Major timber extraction - construction, industrial uses, paper pulp, etc. Timber extraction is done in India by the Forest Department, but illegal logging continues in many of the forests of India and the world.

OVER EXPLOITATION OF FORESTS

Forest has been known to possess huge potential for human use and they have been exploited since early times for their vast potential. Exploitation of forest has taken place to meet human demands in the following ways:

- Due to wood cutting and large scale logging for raw materials like timber, pulp wood, fuel wood etc
- Deforestation due to road construction
- Clearing of forest to create more agricultural lands to meet the food needs of growing population
- Encroachment of forests leading to destruction of about 19.57 lakh hectares (2013)of forest in the country
- About 78% of forest area is under heavy grazing
- Mining activities leads to clearing of forests
- Big hydro electric projects result in large scale destruction of forest

In India, **Joint forest management** has come up as innovative approach involving community participation so that the rural economy is strengthened as well as forest resources are conserved through public involvement

DEFORESTATION

Deforestation is the permanent destruction of indigenous forests and woodlands. The term does not include the removal of industrial forests such as plantations of gums or pines. Deforestation has resulted in the reduction of indigenous forests to four-fifths of their pre-agricultural area. Indigenous forests now cover 21% of the earth's land surface. Deforestation refers to the loss of forest cover (or) the aimless destruction of trees. The clearing of forests across the earth has been occurring on a large scale basis for many centuries. This process involves the cutting down, burning and damaging of forests. Currently 12 million hectares of forests are cleared annually and the current rate of deforestation continues, the world's forests will vanish within the next 100 years about 80% of the original forests on the earth have already been cleared.

Major causes of Deforestation:

a. **Shifting cultivation** : There are an estimated 300 million people living as shifting cultivators who practice slash and burn agriculture and are supported so clear more than 5 lakh ha of forests for shifting cultivation annually. In India, we have this practice of North-East and to some extent in Andhra Pradesh, Bihar and M.P. which contribute to nearly half of the forest clearing annually.

b. **Fuel requirements**: Increasing demands for fuel wood by the growing population in India alone has shooted up to 300-500 million tons in 2001 as compared to just 65 million tons during independence, thereby increasing the pressure on forests.

c. **Raw materials for industrial use**: Wood for making boxes, furniture, railway-sleepers, plywood, match boxes, pulp for paper industry etc. have exerted tremendous pressure on forests. Plywood