Concept of Environment

Generally, environment, atmosphere, climate, weather, season, nature are the words interchangeably used. With reference to the distinction cited by NASA, the difference between weather and climate is a measure of time. Weather is what conditions of the atmosphere are over a short period of time, and climate is how the atmosphere "behaves" over relatively long periods of time.

Weather is basically the way the atmosphere is behaving, mainly with respect to its effects upon life and human activities. The difference between weather and climate is that weather consists of the short-term (minutes to months) changes in the atmosphere. Most people think of weather in terms of temperature, humidity, precipitation, cloudiness, brightness, visibility, wind, and atmospheric pressure, as in high and low pressure.

Whereas, the climate is the description of the long-term pattern of weather in a particular area.

Some scientists define climate as the average weather for a particular region and time period, usually taken over 30-years. It's really an average pattern of weather for a particular region.

When scientists talk about climate, they're looking at averages of precipitation, temperature, humidity, sunshine, wind velocity, phenomena such as fog, frost, and hail storms, and other measures of the weather that occur over a long period in a particular place.

For example, after looking at rain gauge data, lake and reservoir levels, and satellite data, scientists can tell if during a summer, an area was drier than average. If it continues to be drier than normal over the course of many summers, than it would likely indicate a change in the climate.

There is very thin line of understanding between all these concept. The key difference between Atmosphere and Environment is that, Atmosphere is the layer of gases around the Earth and Environment is the living or non-living things around us.

- All the things around us makes our environment like all the living things and non-living things around us. For examples – Water, Animal, Human, All other objects
- Atmosphere is the last layer of ecosystem whereas environment is our own system around us.
- It comprises the set of natural, social and cultural values existing in a place and at a particular time, that influence in the life of the human being and in the generations to come. I.e., it is not only the space in which life develops, but it also includes living beings, objects, water, soil, air and the relations between them as well as intangibles like culture
- **Environment is a set of physical, chemical, biological and social components that, in a short or long term, cause direct or indirect adverse effects on living beings and human activities.**

- **The term environment is derived from French word "environs" meaning around, encircle or encompass. And hence the term environment in short can be used for surrounding.**
- Environment can also be referred as the totality of all the externalities that affect human life. In broader perspective environment consists of human, social, political, economic and physical environment.
- **Webster**‟s ninth new college dictionary defines environment as the "circumstances, objects or conditions by which one is surrounded".
- The **Encyclopedia Britannica** defines environment as the entire range of external influence acting on an organism both physical and biological".

COMPONENTS OF ENVIRONMENT:

Broadly speaking, components of environment can be classified in to two -

a) Natural : Lithosphere (land), Hydrosphere (water), Atmosphere (air), Biosphere (flora/fauna/microbes)

b) Human (manmade)

NATURAL ENVIRONMENT

1. Lithosphere: It is the solid rocky crust covering the entire planet. It is inorganic and composed of minerals. It consists of continents, mountains and ocean floor, which makes up 29% of the earth‟s surface.

2. Hydrosphere: It is composed of all the water on and around the earth. It includes all the oceans, lakes, rivers, ponds and streams on the earth. It covers 71% of the earth‟s surface of which 97% is in the oceans. Only 3% is fresh water which includes the solid ice sheets as well as liquid form in the rivers and ponds.

3. Atmosphere: The atmosphere is the layer of gases surrounding the earth‟s surface. It consists of 78% of Nitrogen, 21% of Oxygen, 0.03%carbon dioxide and other gases. The atmosphere helps to maintain the temperature near the surface by absorbing the dangerous ultraviolet rays coming from solar radiation. This mass of air—extending over a vertical distance of about 10,000 Kms. Every single layer of the Earth's atmosphere plays a crucial role in supporting life on the planet. The mass of all the atmospheric layers combined adds up to 0.5×10^{-19} kgs; approximately 80 percent of which can be attributed to the troposphere alone. Each of these layers have some unique characteristics. Following are the layers of atmosphere impacting upon or significant component of environment –

a. Troposphere:

It is the first layer of the Earth's atmosphere. It starts from the surface of the planet and vertically extends 12 Kms. The temperature of troposphere decreases with altitude. Troposphere is separated from stratosphere by the atmospheric boundary referred to as the tropopause.

b. Stratosphere

Stratosphere extends from tropopause to the 51 kms. The temperature in this layer remains constant with altitude for the first 5.59 miles, but increases for next 12.42 to 31.06 miles. The ozone layer, which is very crucial for lifeforms on the Earth, also lies in this zone. Stratosphere is separated from mesosphere by the atmospheric boundary referred to as the stratopause.

c. Mesosphere

It extends from stratopause to a vertical distance of around 50 - 80 kms. It terminates by the mesopause, which is also the coldest part of the Earth, with a temperature of around **-100°C** (-148.0°F). Mesosphere is the layer wherein most of the meteors burn when they enter the atmosphere.

d. Thermosphere

It is the largest layer of atmosphere extending from 50 to 700 Kms. In this layer, the temperature increases with altitude and can reach up to **1200°C at times**. The oxygen molecules in this zone contributes to the rising temperature by absorbing intense solar radiation. Located within the thermosphere is ionosphere, a layer which contains electrically charged gas particles that help in transmission of radio signals. The highest point of thermosphere, thermopause, and the lowest point of the exosphere, exobase, combine to form an atmospheric boundary between the two layers.

e. Exosphere

The outermost layer of the atmosphere, exosphere extends from thermospause into the space. This layer is mainly made up of hydrogen and helium. Though the definite boundary of this layer is not known, scientists believe that it extends for a vertical distance of 700 to 10,000 kms. That, however, is not supported by substantial evidence, so thermosphere is referred to as the biggest among all these layers of the planet's atmosphere.

4. Biosphere: This component comprise of living or non living organisms, flora and fauna, plants and animal species including one-cell organisms. They all are vital to maintain the energy flow via eco-cycles, food webs and food chains and thus maintain the balance in nature.

MAN-MADE ENVIRONMENT-:

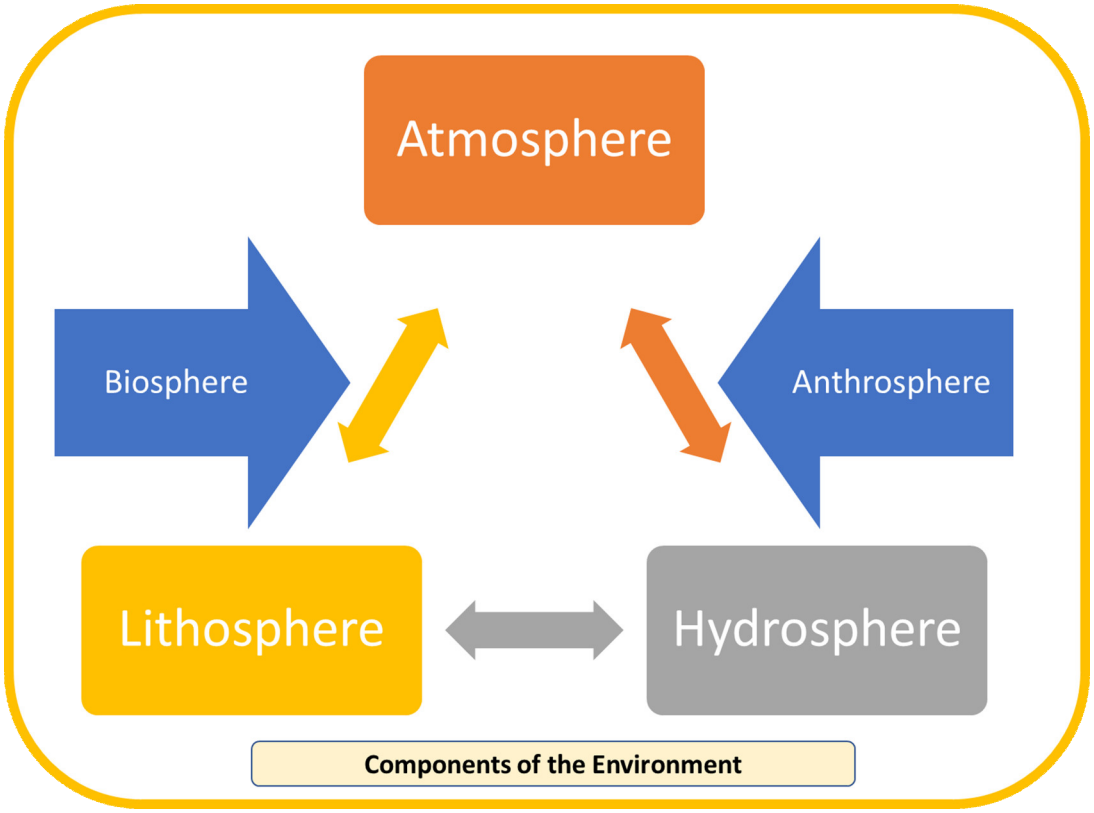
Anthrosphere:

It is sometimes referred as technosphere. The environment that is made or modified by humans for use in human activities and human habitats. The term was first used by Eduard Suess. The contemporary concept of the technosphere was first proposed as a concept by American geologist and engineer Peter Haff. It has been estimated that as of 2016 the total weight of the anthroposphere - that is, human generated structures and systems - was 30 trillion tons.

The anthroposphere can be viewed as a human-generated equivalent to the biosphere. While the biosphere is the total biomass of the Earth and its interaction with its systems, the anthroposphere is the total mass of human-generated systems and materials, including the human population, and its interaction with the Earth's systems.

As human technology becomes more evolved, such as the greater ability to launch objects into orbit or to cause deforestation, the impact of human activities on the environment potentially increases. The anthroposphere is the youngest of all the Earth's spheres, yet has made an enormous impact on the Earth and its systems in a very short time.

Aspects of the anthroposphere include: mines; agriculture; oil and gas fields; computer-based systems including the Internet; educational systems; landfills; factories; atmospheric pollution; space junk; forestry and deforestation; urban development; transportation systems including roads, highways, and subways; nuclear installations; warfare.



SCOPE AND CONCEPT OF ECOLOGY

Human beings are always trying to upgrade their living conditions. He want his surrounding very dynamic, ever changing, but if the same thing happens with the environmental conditions them this may affect living conditions very drastically. The relationships or interactions between the organisms and their surrounding need to understand in depth for further line of action in development.

The term Ecology was coined by German Biologist Ernest Hackel in 1866. The term Ecology is coined from two Greek words **"Oikos"** that means **house**, a place to live and "logos" means **the study of.** In this sense, Ecology is the study of the habitation of living organisms (**oikos**=habitation, **logos**=discourse). Some prefer to define it as **"scientific natural history"** or **"the science of community population"** or the **"the study of biotic communities".**

The most comprehensive definition of ecology will be "a study of animals and plants in their relation to each other and to their environment".

It may be considered as, the scientific study of the interactions that determine the distribution and abundance of organisms.

E. Hackel defined ecology as "the science of relation between organisms and their environment".

In earlier trends of the studies plant and animal ecology were separate branches, but later the understanding of the biotic community concept, the food chain, material cycling concept etc., helped to establish the basic theory for a unified field of **General Ecology**.

Ecology till recently was considered in academic circles to be a branch of biology, which, along with molecular biology, genetics, developmental biology, evolution etc. was by no means always considered as one of the subjects of **Biological Sciences** only.

However, presently the emphasis has shifted to the study of environmental systems of the entire 'household', which in fact relates to its core meaning. **Thus, ecology has grown from a subdivision of biological sciences to a major interdisciplinary science that links together the biological, physical and social sciences.**

SCOPE OF ECOLOGY

The science of ecology after undergoing a several hundreds of years gestation period has emerged today as a matured, honoured and scholarly discipline in biological science.

Ecological studies focus on how various organisms interact with their environment. There are a number of fields within ecology, either focusing on specific areas of interest or using particular approaches to address ecological problems.

Study of Ecology:

Ecology is studied with particular reference to plants or to animals and microbes. Since plants and animals are intimately interrelated, study of plant ecology or animal ecology alone is bound to be imperfect and inadequate.

So plant and animal ecology are to be given equal emphasis and it is better to study them under the term Bio-ecology. The term Synecology denotes ecological studies at the community level while the term Autecology denotes ecological studies at the species level. The hierarchical studies under ecology are conducted as follows –

i. Autecology – Study of an individual species

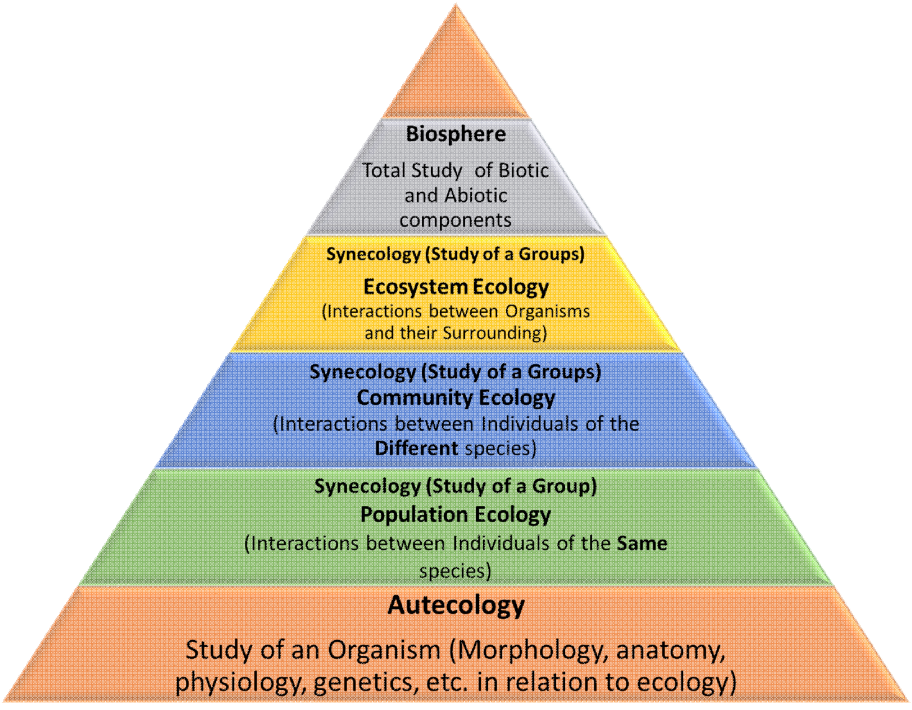
ii. Synecology – Study of the groups of species

iii. Population – Study of the group of same specie

iv. Community – Study of the groups of different species in a specific area

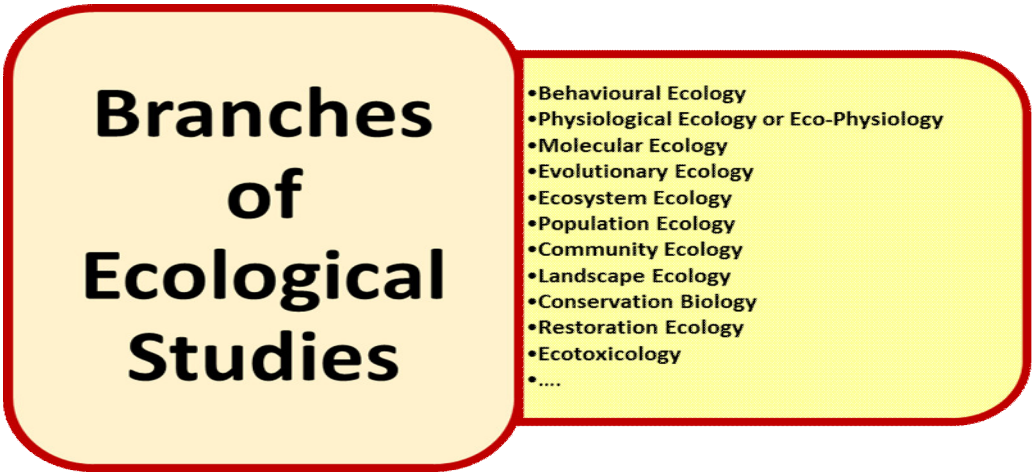
v. Ecosystem – Study of the specific area for interaction between all biotic and abiotic components

vi. Biosphere – Study of the major area like Hydrosphere, Xerosphere, or Biosphere (Globe)



BRANCHES OF ECOLOGY:

Ecological studies focus on how various organisms interact with their environment. There are a number of fields within ecology, either focusing on specific areas of interest or using particular approaches to address ecological problems –



i. Behavioural Ecology: Behavioural ecology emerged from ethology. It is concerned with explaining the patterns of behaviour in animals. It includes kinship, prey predator, parental care, sexuality, etc.

ii. Physiological Ecology or Eco-Physiology: It deals with how organisms are adapted to respond to temperature, maintain proper water and salt balance, balance levels of oxygen and carbon dioxide, or deals with other factors of their physical environment. Studies of eco-physiology play an important role in agriculture since crop yield is very much dependent on the performance of individual plants.

iii. Molecular Ecology: The use of molecular biology to directly tackle ecological problems is the focus of molecular biology. The molecular clock hypothesis states that DNA sequences roughly evolve at the same rate and because of this the dissimilarity between two sequences can be used to tell how long ago they diverged from one another. Phylogenies are the evolutionary history of an organism, also known as **Phylogeography**. A Phylogenetic tree is a tree that shows evolutionary relationships between different species based on similarities/differences among genetic or physical traits.

iv. Evolutionary Ecology: Evolutionary ecology emphasises the impact of evolution on current patterns and human induced changes. It relates to how animals choose mates, determine the sex of their off-spring, forage for food and live in groups, or how plants attract pollinators, disperse seeds, or allocate resources between growth and reproduction. Evolutionary ecologists are particularly interested in how form and func-tion adapt organisms to their environment.

v. Ecosystem Ecology: Organisms obtain energy either through photosynthesis or by consuming other organisms. These energy transformations are associated with the movements of materials within and between organisms and the physical environment. Thus, the interaction between the biotic and abiotic components called an ecosystem is the

sub-field of ecology called ecosystem ecology. Issues of interest at this level is how human activities affect food webs, energy flow and global cycling of nutrients.

vi. Population Ecology: Population ecology constitutes organisms of the same species living in the same place and same time. It may comprise of the dynamics of a single population of any living thing (earth-worm, fox, whale, pine tree etc.) or may focus on how two populations (predator and its prey or parasite and its host) interact with each other.

At the level of population, evolutionary changes take place. It is also related directly to the management of fish and game populations, forestry and agriculture. Population ecology is also fundamental to our understanding of the dynamics of disease.

vii. Community Ecology: Populations of many different organisms in a particular place are tied to one another by feeding relationships and other interactions. These rela-tionships of interacting populations are called ecological communities and their study is under the purview of community ecology.

Community studies is principally on how biotic interactions such as predation, herbivory and competition influence the numbers and distributions of organisms. It has particular relevance in our understand-ing of the nature of biological diversity.

viii. Landscape Ecology: These are of ecological fields whose study requires the synthesis of several other sub-fields of ecology. Landscape ecology is one that emphasizes the inter-connections among ecosystems of a region.

ix. Conservation Biology: This sub-field of ecology blends the concepts of gene-tics with population and community ecology. It takes a landscape approach and is related to the maintenance of biodiversity and the preservation of endangered species.

x. Restoration Ecology: It relates to the re-establishing of the integrity of natural sys-tems that have been damaged by human activity.

xi. Ecotoxicology: It is the study of the fate and action of human-made substances, such as pesticides and detergents, in the natural world. Ecotoxicology focuses on the way in which human-made substances affect human health. Eco-toxicologists often use other animals, such as fish or small invertebrates, as models for the action of the particular toxic substance under study.

Environmentalism, conservationism and preservationism are social or political movements and not branches of ecology. Roadside trash pickups and city tree planting drives are well-intentioned public beautification and cleanup activities, but such activities are not science. Although everyone applauds such civic responsibilities, they however, do not increase our understanding of the natural world.

The subfields of ecological studies provide ways to think about the various approaches in ecology. However, in many cases, individual ecologists conduct work that crosses boundaries of these subfields. The natural curiosity of most ecologists, along with the complexity of nature, often encourages broad approaches. Ecological study, thus, is an integrative science, one that requires great innovation, breadth and curiosity.

ECOLOGICAL FACTORS

An environmental factor, ecological factor or eco factor is any factor, abiotic or biotic, that influences living organisms. Abiotic factors like ambient temperature, amount of sunlight, pH of the water soil in which an organism lives

The ecological factors that affect the growth of plants and determine the nature of plant communities are divided into three types.

The three types of ecological factors are: (1) Climatic factors which include rainfall, atmospheric humidity, wind, atmospheric gases, temperature and light (2) Physiographic factors which include altitude, effect of steepness and sunlight on vegetation and direction of slopes (3) Biotic factors which include interrelationship between different plants of a particular area, interrelationship between plants and animals occupying the same area and interrelationship between soil microorganisms and plants.