**Ecology**

**Dr. Rima Kumari: Date: 09/10/2020**

Online class and e- content for BSc IInd year students

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| Date and Time | Online class medium | E. content topic |
| 09/10/2020  01:00 p.m to 1.40 p.m | Via Google meet  Link: Meeting URL: https://meet.google.com/vqt-siqq-wti | **Ecology:**  **Ecological organization, classification** |

Ecology (from Greek: οἶκος, "house" or "living relations"; -logία, "study of") is the scientific study of the distributions, abundance and relations of organisms and their interactions with the environment. Ecology includes the study of plant and animal populations, plant and animal communities and ecosystems. Ecosystems describe the web or network of relations among organisms at different scales of organization. Since ecology refers to any form of biodiversity, ecologists research everything from tiny bacteria's role in nutrient recycling to the effects of tropical rain forest on the Earth's atmosphere. In other way, Ecology is the branch of science that deals with the relationship of organisms with one another and with their physical surroundings. Ecology may also be defined as study of interaction of biotic factor (living organisms) with abiotic factor (the environment ) and how the organisms interact with each other and their biotic and abiotic environment. It is studied at various levels, such as organism, population, community, biosphere, and ecosystem. The discipline of ecology emerged from the natural sciences in the late 19th century. Ecology is not synonymous with environment, environmentalism, or environmental science. Ecology is closely related to the disciplines of physiology, evolution, genetics and behaviour.

**Introduction and History of ecology**

The term ecology was first used by German zoologist Ernst Haeckel (1869), however, this science has its origins in other sciences such as biology, geology and evolution among others.

Lamarck with his theory of evolution, proposed that the environment is in constant transformation, by which agencies need change and make an effort to achieve this, and this is a mechanism of evolution, one of the main bases of ecology taking into account the relationships of organisms and their environment.

Modern ecology, actually had its principles with the development of the theory of Darwinian evolution. He noted that the environment is constantly changing which causes the agencies with best adaptations are those who survive by the mechanism of natural selection. Highlighting the importance of the interaction of organisms with their environment.

a conceptual understanding of ecology is found in the broader details of study, including:

* life processes explaining adaptations
* distribution and abundance of organisms
* the movement of materials and energy through living communities
* the successional development of ecosystems, and
* the abundance and distribution of biodiversity in context of the environment.

**Scopes:**

There are many practical applications of ecology in conservation biology, wetland management, natural resource management (agroecology, agriculture, forestry, agroforestry, fisheries), city planning (urban ecology), community health, economics, basic and applied science, and human social interaction (human ecology). Organisms and resources comprise ecosystems which, in turn, maintain biophysical feedback mechanisms that moderate processes acting on living (biotic) and nonliving (abiotic) components of the planet. Ecosystems sustain life-supporting functions and produce natural capital, such as biomass production (food, fuel, fiber and medicine), the regulation of climate, global biogeochemical cycles, water filtration, soil formation, erosion control, flood protection, and many other natural features of scientific, historical, economic, or intrinsic value.

There are also many subcategories of ecology, such as ecosystem ecology, animal ecology, and plant ecology, which look at the differences and similarities of various plants in various climates and habitats. In addition, physiological ecology, or ecophysiology, studies the responses of the individual organism to the environment, whil

**Levels of Ecological Organization**

**Ecological Organization** represent a hierarchy of progressively increasing level of complexity and Ecosystem represents a highly complex level of organization. Ecosystems can be studied at small levels or at large levels. The levels of organization are described below from the smallest to the largest:

#### ****Level # 1. Individual (organismal ecology)****

An individual can be any living organism that has the ability to function independently. It is a body made up of organs, organelles and other parts that work together to carry out various processes of life for e.g. a lion, an elephant, a tiger, a wolf etc.

**Level # 2. Species**

A **species** is a group of individuals that are genetically related and can breed to produce fertile young. Individuals are not members of the same species if their members cannot produce offspring that can also have children. The second word in the two word name given to every organism is the species name. For example, in Homo sapiens, sapiens is the species name.

#### ****Level #****3. Population ****(****Population ****ecology)****

#### A population is a group of organisms belonging to the same species that live in the same area and interact with one another.

In ecology, ‘a population is a group of potentially interbreeding individuals that occur together in space and time’. The individual comprising a population are members of the same species. Populations of plants and animals in the ecosystem do not function independently of each other. They are always influencing each other and organizing themselves into communities and have functional relationship with their external environment for e.g., a pride of lions, a herd of elephants, a school of fish, a flock of sheep etc. Population growth rate is the percentage variation between the numbers of individuals in a population at two different times.

#### ****Level #****4 Community:

Population of plants and animals exist in a habitat. In order to survive, individuals of one species interact with individuals of another species. A **community** is all of the populations of different species that live in the same area and interact with one another. Therefore, a community can be defined as the collection of different species of population (both plant and animal species) in a specific area at a given point of time. These species can vary vastly in number and size.

A Community in most instances is named after the dominant plant species. E.g., grasses dominate a grassland community, though it may contain herbs, shrubs, and trees along with associated animals of different species.

#### ****Level #****5 ecosystem:

An ecosystem is a community of living organisms in conjunction with the non-living components of their environment (things like air, water and mineral soil), interacting as a system. An **ecosystem** includes the living organisms (all the populations) in an area and the non-living aspects of the environment. An ecosystem is made of the biotic and abiotic factors in an area. These biotic and abiotic components are regarded as linked together through nutrient cycles and energy flows.

#### ****Level #****5 Biome:

It is a grouping of terrestrial ecosystem on a given continent that is similar in vegetation structure, physiognomy, environmental features and characteristics of their animal communities.

The climate determines the boundaries of a biome and the abundance of plants and animals found in each one of them. The most important climatic factors are temperature and precipitation.

The aquatic systems are not called as biome; they are divided into distinct life zones, with regions of relatively distinct plant and animal life.

The major difference between the various aquatic zones is due to salinity, level of dissolved nutrients, water, temperature and depth of sunlight penetration.

#### ****Level #****7. Biosphere:

The term ‘Biosphere’ was given by geologist Edward Suezz in 1875. Biosphere is a part of the earth where life can exist. It is a zone of life on earth where plants and animals, including ourselves, develop kinship with one another for life, food, water, shelter, mates etc. This discrete unit has living and non-living components, which are interdependent and interrelated in terms of their structure, components and functioning.

Biosphere represents a highly integrated and interacting zone comprising of atmosphere (air), hydrosphere (water), and lithosphere (land). It is the narrow layer around the surface of the earth. The **biosphere** is the part of the planet with living organisms (Figure below). The biosphere includes most of Earth, including part of the oceans and the atmosphere. Biosphere is absent at extremes of the north and south poles. Occasionally spores of fungi and bacteria do occur at heights beyond 8000mts, but they are not metabolically active and represent only the dormant life.

Based on types of Ecology

Global Ecology

It deals with interactions among earth’s ecosystems, land, atmosphere, and oceans. It helps to understand the large-scale interactions and their influence on the planet.

Landscape Ecology

It deals with the exchange of energy, materials, organisms, and other products of ecosystems. Landscape ecology throws light on the role of human impacts on the landscape structures and functions.

Ecosystem Ecology

It deals with the entire ecosystem, including the study of living and non-living components and their relationship with the environment. This science research how ecosystems work, their interactions, etc. Ecosystem ecology is an extension of organismal, population, and community ecology. The ecosystem is composed of all the biotic components (living things) in an area along with that area’s abiotic components (non-living things). Some of the abiotic components include air, water, and soil. Ecosystem biologists ask questions about how nutrients and energy are stored, along with how they move among organisms and the surrounding atmosphere, soil, and water. The availability of nutrients is an important factor in the distribution of the plants that live in this habitat.

Community Ecology

It deals with how community structure is modified by interactions among living organisms. Ecology community is made up of two or more populations of different species living in a particular geographic area. A biological community consists of the different species within an area, typically a three-dimensional space, and the interactions within and among these species. Community ecologists are interested in the processes driving these interactions and their consequences. Questions about conspecific interactions often focus on competition among members of the same species for a limited resource. Ecologists also study interactions among various species; members of different species are called heterospecifics. Examples of heterospecific interactions include predation, parasitism, herbivory, competition, and pollination. These interactions can have regulating effects on population sizes and can impact ecological and evolutionary processes affecting diversity.

Population Ecology

A population is a group of interbreeding organisms that are members of the same species living in the same area at the same time. In biology, a population can be defined as a set of individuals of the same species living in a given place at a given time. Births and immigration are the main factors that increase the population and death and emigration are the main factors that decrease the population.

Population ecology examines the population distribution and density. Population density is the number of individuals in a given volume or area. This helps in determining whether a particular species is in endanger or its number is to be controlled and resources to be replenished.

Organisms that are all members of the same species, a population, are called conspecifics. It deals with factors that alter and impact the genetic composition and the size of the population of organisms. Ecologists are interested in fluctuations in the size of a population, the growth of a population and any other interactions with the population. A population is identified, in part, by where it lives; its area of population may have natural or artificial boundaries. Natural boundaries might be rivers, mountains, or deserts, while examples of artificial boundaries include mowed grass or manmade structures such as roads. The study of population ecology focuses on the number of individuals in an area and how and why population size changes over time. Population ecologists are particularly interested in counting the Karner blue butterfly, for example, because it is classified as federally endangered. However, the distribution and density of this species is highly influenced by the distribution and abundance of wild lupine.

Organismal Ecology

Organismal ecology is the study of an individual organism’s behaviour, morphology, physiology, etc. in response to environmental challenges. It looks at how individual organisms interact with [biotic and abiotic](https://byjus.com/biology/biotic-and-abiotic/) components. Ecologists research how organisms are adapted to these non-living and living components of their surroundings.

Individual species are related to various adaptations like physiological adaptation,  morphological adaptation, and behavioural adaptation.

**Molecular Ecology**

The study of ecology focuses on the production of proteins and how these proteins affect the organisms and their environment. This happens at the molecular level.

DNA forms the proteins that interact with each other and the environment. These interactions give rise to some complex organisms.

**Importance of Ecology**

The following reasons explain the importance of ecology:

**Conservation of Environment**

Ecology helps us to understand how our actions affect the environment. It shows the individuals the extent of damage we cause to the environment.

Lack of understanding of ecology has led to the degradation of land and the environment. It has also led to the extinction and endangerment of certain species. For eg., dinosaurs, white shark, mammoths, etc. Thus, the study of the environment and organisms helps us to protect them from any damage and danger.

**Resource Allocation**

With the knowledge of ecology, we are able to know which resources are necessary for the survival of different organisms. Lack of ecological knowledge has led to scarcity and deprivation of these resources, leading to competition.

**Energy Conservation**

All organisms require energy for their growth and development. Lack of ecological understanding leads to the over-exploitation of energy resources such as light, nutrition, and radiation, leading to its depletion.

Proper knowledge of ecological requirements prevents the unnecessary wastage of energy resources, thereby, conserving energy for future purposes.

**Eco-Friendliness**

Ecology encourages harmonious living within the species and the adoption of a lifestyle that protects the ecology of life.

**Examples of Ecology**

Following are a few examples of ecology:

**Human Ecology**

It focuses on the relationship between humans and the environment. It emphasizes the impact human beings have on the environment and gives knowledge on how we can improve ourselves for the betterment of humans and the environment.

**Niche Construction**

It deals with the study of how organisms alter the environment for the benefit of themselves and other living beings. For eg, termites create a 6 feet tall mound and at the same time feed and protect their entire population.