TOPIC
1

ECOLOGY

ORIGIN OF ECOLOGICAL STUDIES

The term ecology is derived from the Greek word 'oikos' meaning 'house', combined with the word 'logy' meaning the 'science of' or 'the study of '. Literally, ecology is the study of the earth as a 'household', of plants, human beings, animals and micro-organisms. They all live together as interdependent components. A German zoologist Ernst Haeckel, who used the term as 'oekologie' in 1869, became the first person to use the term 'ecology'. Hence, ecology can be defined as a scientific study of the interactions of organisms with their physical environment and with each other.

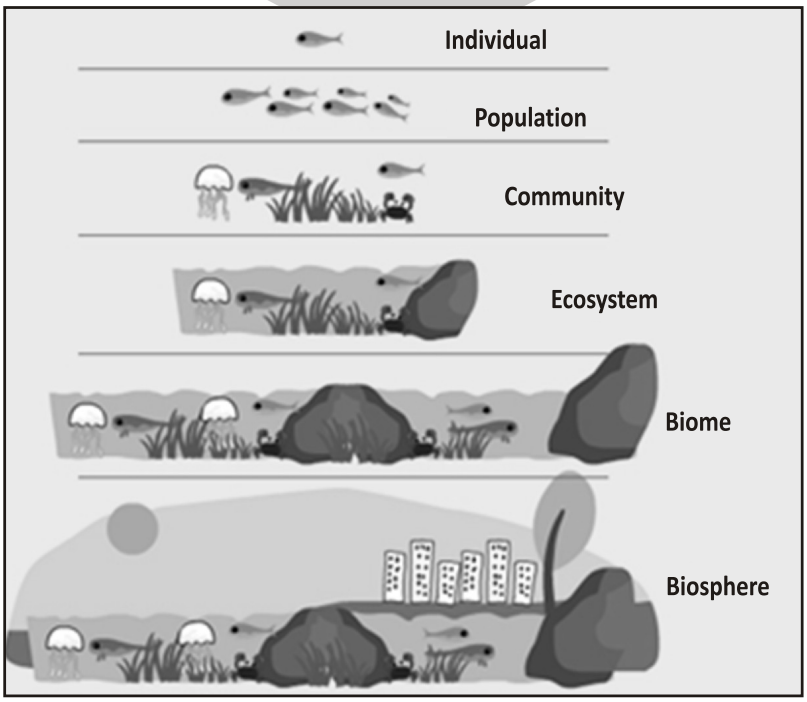
It would be interesting to understand how the diversity of life-forms is maintained to bring a kind of balance. This balance is maintained in a particular proportion so that a healthy interaction between the biotic and the abiotic components goes on. The interactions of a particular group of organisms with abiotic factors within a particular habitat resulting in clearly defined energy flows and material cycles on land, water and air, are called ecological systems.

ON THE EVE OF THE EXAM

- Ecology is the study of the earth as a 'household', of plants, human beings, animals and micro-organisms.
- A German zoologist Ernst Haeckel became the first person to use the term 'ecology' in 1869.
- Ecology can be defined as a scientific study of the interactions of organisms with their physical environment and with each other.

SCOPE OF ECOLOGICAL STUDIES

Ecology not only deals with the study of the relationship of individual organisms with their environment, but also with the study of organisms, populations, communities, ecosystems, biomes and biosphere as a whole.



Organism (Individual)

It is a basic unit of study. This study includes the Study of the form, physiology, behaviour, distribution and adaptation of organism in relation to environment. An individual is any living thing or organism. Individuals do not breed with individuals from other groups. In the diagram above, you will notice that Gill, the goldfish, is interacting with its environment, and will only crossbreed with other gold fishes just like her.

Population

A group of individuals of a given species that live in a specific geographic area at a given time. Example is Gill and his family and friends and other fishes of Gill's species. Note that populations include individuals of the same species, but may have different genetic makeup such as hair/eye/skin colour and size between themselves and other populations. Their Study includes the study of interaction between populations and intraspecific relationships.

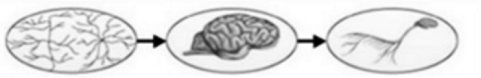
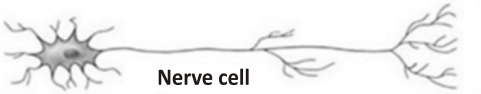
Community

This includes all the populations in a specific area at a given time. A community includes populations of organisms of different species. In the diagram above, note how populations of gold fishes, salmons, crabs and herrings coexist in a defined location. A great community usually includes biodiversity.Their Study includes the Study of structure and composition of community and interspecific interactions between members of community.

Ecosystem

The Ecosystem includes more than a community of living organisms (biotic) interacting with the environment (abiotic). Their Study includes the Study of the community in relation to the structure of its ecosystem-nutrients cycling, climate, energy flow etc.

LEVELS OF ORGANIZATION IN AN ECOSYSTEM

Biosphere	The part of Earth that contains all ecosystems	
Ecosystem	Community and its nonliving surroundings	
Community	Populations that live together in a defined area	
Population	Group of organisms of one type that live in the same area	 Bison herd
Organism	Individual living thing	 Bison
Groups of Cells	Tissues, organs and organ system	 Nervous tissue Brain Nervous system
Cells	Smallest functional unit of life	 Nerve cell
Molecules	Groups of atoms smallest unit of most chemical compounds	 Water DNA

Biome

A biome, in simple terms, is a set of ecosystems sharing similar characteristics with their abiotic factors adapted to their environments. It is a large community unit, characterized by a major vegetation type and associated fauna found in a specific climatic region. Their Study includes the Study of physical and biological features of a particular biome and study of human activities affecting the biome.

Biosphere

The biosphere is the sum of all the ecosystems established on the Earth. The biosphere includes all the living components of the earth. It consists of all plants and animals, including all the micro-organisms that live on the planet earth and their interactions with the surrounding environment. The study of Biosphere includes the study of human activities affecting the earth as a whole like global climate change, ozone hole etc.

ON THE EVE OF THE EXAM

- Ecology deals with the study of organisms, populations, communities, ecosystems, biomes, and biosphere.
- Scope of Ecology includes:
  - Organism : individual, it is a basic unit of study.
  - Population : A group of individuals of a given species.
  - Community : This includes all the populations in a specific area.
  - Ecosystem : Includes living organisms (biotic) interacting with the environment (abiotic).
  - Biome : A set of ecosystems sharing similar characteristics with their abiotic factors.
  - Biosphere : The sum of all the ecosystems established on the Earth.

ATTRIBUTES OF AN ORGANISM

HABITAT

Habitat is the physical environment in which an organism lives. Each organism has particular requirements for its survival and lives where the environment provides for those needs.

The features of the habitat can be represented by its structural components namely

1. space 2. food 3. water 4. cover or shelter.

Earth has four major habitats-

1. Terrestrial
2. Freshwater
3. Estuarine (Where rivers meet the ocean)
4. Ocean.

The human gut is also a habitat for a tapeworm and the rotting log a habitat of a fungus.

NICHE

In nature, many species occupy the same habitat but they perform different functions. The functional characteristics of a species in its habitat are referred to as “niche” in that common habitat. Habitat of a species is like its ‘address’ (i.e. where it lives) whereas niche can be thought of as its “profession” (i.e. activities and responses specific to the species). The term niche means the sum of all the activities and relationships of a species by which it uses the resources in its habitat for its survival and reproduction.

A niche is unique for a species while many species share the habitat. No two species in a habitat can have the same niche. This is because if two species occupy the same niche they will compete with one another until one is displaced.

ON THE EVE OF THE EXAM

- Habitat and Niche are some of the ecological attributes of an Organism.
  - Habitat - Physical environment in which an organism lives.
  - Niche - The functional characteristics of a species in its habitat.
- Habitat of an organism is like its ‘address’ (i.e. where it lives) whereas niche is like its “profession” (i.e. activities and responses specific to the species).

BIOTIC INTERACTIONS

The biological community of an area or ecosystem is a complex network of interactions. The interaction that occurs among different individuals of the same species is called intraspecific interaction while the interaction among individuals of different species in a community is termed as interspecific interaction.

TYPES OF INTERACTIONS

Negative Interactions
- Amensalism
- Predation
- Parasitism
- Competition

Positive Interactions
- Commensalism
- Mutualism

Neutral Interactions

TABLE : SUMMARY OF INTERACTIONS

Interaction	Species 1	Species 2	Effects of interaction
Negative Interaction			
Amensalism	0	-	One species is unaffected while the other species is inhibited
Predation	+	-	One species (predator) benefits while the second species (prey) is harmed and inhibited.
Parasitism	+	-	Beneficial to one species (parasite) and harmful to the other species (host).
Competition	-	-	Adversely affects both species
Positive Interaction			
Commensalism	+	0	One species (the commensal) benefits, while the other species (the host) is neither harmed nor inhibited
Mutualism	+	+	Interaction is favourable to both species
Neutral Interaction			
Neutralism	0	0	Neither species affects the other

Amensalism

This is a negative association between two species in which one species harms or restricts the other species without itself being adversely affected or harmed by the presence of the other species. Organisms that secrete antibiotics and the species that get inhibited by the antibiotics are examples of amensalism. For example the **bread mould fungi Pencillium** produce penicillin an antibiotic substance which inhibits the growth of a variety of bacteria. Pencillium benefits apparently by having greater availability of food when the competition because of the bacteria is removed.

Predation

In this type of interaction predator captures, kills and eats an animal of another species called the prey. The predator naturally benefits from this relationship; while the prey is harmed. Predators like leopards, tigers and cheetahs use speed, teeth and claws to hunt and kill their prey.

Parasitism

In this type of interaction, one species is harmed and the other benefits. Parasitism involves parasite usually a small size organism living in or on another living species called the host from which the parasite gets its