

ORGANISMS AND POPULATIONS



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Ecology:

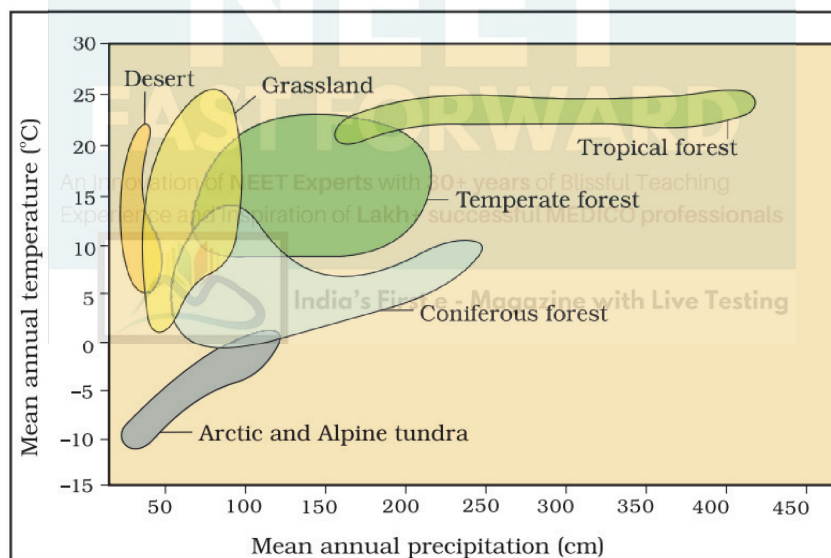
Ecology is the branch of biology that deals with the interactions among organisms and between the organism and its physical (abiotic) environment. Study of ecology is important to strike a balance between development and maintenance of natural environmental and biotic communities, use and conservation of resources, solve local, regional, and global environmental problems.

Organism and Its Environment:

The branch of science that studied the relationship between the organism and the environment is called ecology.

Various levels of the organization are:

- **Organism:** each individual belonging to the species.
- **Population:** The group of organisms that are capable of interbreeding.
- **Communities:** A combination of different populations combine together to form communities.
- **Biomes:** A large number of flora and fauna found in a climatic zone.



Major Abiotic Factor:

The most important biotic factor that affects the environment, as well as organisms, is the temperature. The temperature around the poles is lesser than the temperature found around the equator. The temperature of the polar region ranges from sub zero and increases up to >50°C in tropical deserts in summer. The temperature will affect the metabolism rate and physiology of the body as it affects enzyme kinetics. Those organisms that can tolerate a high range of temperature are called eurythermal. E.g., dog, cat, red algae, etc while a large number of organisms tolerate only a narrow range of temperature called

stenothermal. E.g., python, crocodile, penguin. The temperature tolerance of organisms depends upon the type of geographical area they are found.

The other important abiotic factor is water on which life depends. The area where the amount of water is less are called deserts where only organisms that have special adaptations will be able to survive. In the aquatic organism, the composition and pH of the water are very important. The range of salinity for some organisms is quite high called euryhaline, e.g., green crab and molly fish while in some organisms the salinity level tolerance is very low called stenohaline e.g., haddock, goldfish, etc. The organisms of seawater are found to be less adaptive to the marine water and vice versa due to their different osmotic environment.

The other important abiotic factor is light which is useful for the process of photosynthesis and can be observed in the case of autotrophs. The main source of light, well known, is the sun. The requirement of light intensity varies from organism to organism as some organisms require high light intensity while some organisms require low light intensity. There are various types of plants categorized on the basis of the light intensity required, the short-day plants and long-day plants. In animals, the small fluctuation of light will affect the various plant activities that include migration, reproduction, and foraging. The quality of the spectrum of solar radiation is quite important for life. The spectrum consists of ultraviolet radiation which is very harmful to the organisms while the different colors of the visible spectrums are not available for marine organisms found at various depths of the oceans.

The other important abiotic factor affecting organisms and their population is soil. The soil nature and features vary depending upon the type of climate, and the process of weathering, the development of soil, transportation of soil, or whether it is sedimentary. There are various parameters that affect the type of soil that are pH, minerals present in the soil, and the topography. Apart from this, other parameters such as pH, mineral composition, and topography depend upon the type of vegetation and animals present.

Organisms: An organism refers to a contiguous living system that lives in an environment and has the ability to adapt and retain certain structure and behaviour. It includes fungi, bacteria, plants, animals, and humans. An organism collectively forms a population. The population forms a community which operates the ecosystem. The ecosystem consists of both biotic and abiotic factors.

Major abiotic factors which lead to variation in the physical and chemical conditions of different habitat are temperature, water, light, and soil.

Responses to Abiotic Factors:

Various organisms respond differently towards various abiotic factors.

The various abiotic factor responses are:

- **Regulators:** They are those organisms that are capable of maintaining homeostasis and regulation resulting in constant body temperature, osmotic concentration, etc. This property can be observed in the case of the birds and mammals along with few vertebrates and invertebrate species. In the case of humans, the body temperature is maintained at 37°C resulting in homeostasis. In the summer season when the temperature is very high then

the body sweats profusely in order to maintain the body temperature which is similar to the process of evaporation resulting in cooling. In the winter season, the outer temperature is very low so the body saves continuously to maintain the inner body temperature making it warm. In the case of plants, this mechanism of maintaining the internal body temperature is absent.

- **Conformers:** They are those organisms that are unable to regulate their body temperature. Their body releases or absorbs heat that results in an increase or decrease in body temperature resulting in the process of thermoregulation which is an energetic process. In the case of small animals, the surface-to-volume ratio is larger so the heat of the body can be released quickly, thus, the animals are absent in the polar region. The process of evolution will result in various benefits.
- **Partial Regulators:** They are those species that are capable of regulation but only up to a certain limit depending upon the environmental conditions. The organisms simply undergo confirmation when they cross this limit.
- **Migration:** The movement of animals from one place to another depending upon their requirements. For example, the migratory birds that come every winter from Siberia to Keoladeo National Park (Bharatpur) in Rajasthan due to the stressful conditions in their habitat.
- **Spores:** There are certain microorganisms that include bacteria, fungi, etc to stop their growth during the unfavourable conditions of the environment. As in the winter season, the animals undergo winter sleep called hibernation while in summer they undergo summer sleep called aestivation.

Adaptations:

The feature that helps the organism to survive or to reproduce in their habitats is called adaptation. It is observed that the organisms usually adapt themselves according to the environment they live in. For example, in the case of the desert plants like Opuntia, they have thick cuticles, leaves modified into spines, and sunken stomata so as to reduce the rate of transpiration and undergo photosynthesis with the help of the CAM pathway. while in the case of the higher altitudes like mountains and hills, humans have shown altitude sickness resulting in nausea, short breaths, fatigue, heart palpitations, etc. But after some time they acclimatize themselves according to the environment and results in the higher production of red blood cells so that more oxygen can bind to them and increases the rate of respiration. There are certain behavioural responses that can be observed in various animals based on the environmental conditions.

Population:

Population is defined as a group of individuals or organisms of any species living in a well-defined geographical area, at a specific time with the capability of interbreeding. For example, population of deer in a forest.

Population Attributes:

- **Birth rate:** Total number of individuals born in a given period of time.



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