

Ecology is the branch of biology which mainly involves the study about the interactions among organisms and their environment. Basically, there are four levels of biological organization.

- Organisms.
- Populations.
- Communities.
- Biomes.

Let us discuss the first two levels of organizations, organisms and population.

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.

Organisms and Environment

All organisms possess the ability to adapt to different environmental conditions due to genetic variations. This increases their chances of survival. The polar bear has different characteristic traits that help them to adapt to extremely cold climate of Antarctica. The dense fur coats protect them from cold and predators. The waxy coat repels water and keeps the body warm. These features help them to adapt to the cold.

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.
- Death rates- Total number of deaths in a period of time.
- Sex Ratio- Total number of females and males per 1000 individuals.
- Age pyramid: A plot of age distribution.

Population Growth

Population growth refers to the increase in the number of individuals in a population. This depends on various factors such as weather, food availability, predator pressure, etc. The population density changes due to the following factors:

- **Natality:** The number of births in a population in a given time period.
- **Mortality:** The number of deaths in a population in a given time period.
- **Emigration:** The number of individuals who moved to some other habitat in a certain time period.
- **Immigration:** The number of individuals who have come into the habitat from elsewhere in a certain period of time.
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Factors That Affect Population Size

Populations of organisms must obtain food and other resources, or materials for living, within their ecosystem to survive. Factors that affect survival also affect population size.

Limiting Factors

Population density is a measure of the number of organisms per unit area. The size of any population in an ecosystem can be controlled by a number of limiting factors, or factors that set an upper limit on the growth rate of a population. Such factors include reproduction, natural resources, space and nesting sites, competition, and waste and disease.

Reproduction

The speed at which a population can grow is set by the species' reproductive cycle. Some species, such as whales, sharks, and humans, produce a single offspring after a long period of growth. These animals produce few young over their lifetimes. Other species, such as insects and small rodents, mature quickly and produce many young. This is because after only a short time, there will be many breeding members of the population.

A species' ability to reproduce also largely depends on the availability of resources. During periods when few resources are available, such as during a drought, many animals and plants produce fewer offspring. During periods of abundance, animals and plants produce more offspring.

Natural Resources

Natural resources, such as food and water, can be limiting factors. For example, the population size of an animal that eats only fruit will be limited by the amount of fruit available in the ecosystem. The population size of a predator will be limited by how many animals can be preyed on in the area.

Space and Nesting Sites

Living space and nesting sites can also be limiting factors. Some organisms live closer together than others. For example, millions of herb plants such as garlic mustard can exist in a square kilometer. Wolverines live very far apart with a population density of one individual per 100 square kilometers. Certain animals must have places in which to construct their nests. For instance, many species of birds have plenty of space in which to live but are limited by the number of suitable nesting sites, such as holes in dead trees.

Competition

Competition will occur when resources are limited. Competition is the interaction among living things for the resources they need to survive and to produce offspring. Competition can occur within a population or between individuals in different populations.

Wastes and Disease

As a population's density increases, its waste products can build up to unhealthy levels. Waste can poison an organism or spread diseases that can affect populations of animals that live close together in colonies, such as prairie dogs. It also can affect human population growth.

Carrying Capacity

The number of organisms of one species that an environment can support for a long time is called the environment's carrying capacity. In most cases, populations start small and grow until they are larger than the carrying capacity of their habitat. Limiting factors cause the population to drop below the carrying capacity for a period of time before growing once again. This graph shows how a population of sheep on the island of St. Kilda in Scotland has changed in size since 1985. The solid line shows how the population fluctuates dramatically each year.

Natural Events and Carrying Capacity

Researchers studying the sheep population found that the timing of storms was an important factor influencing population fluctuations. The time it takes a population to return to its carrying capacity depends on the organisms' reproductive abilities. Aphids, tiny insects that are born pregnant, can repopulate an area in a matter of weeks. Sharks, however, produce only a few young each year, starting when they are several years old. It may take decades for a shark population to recover.