

## ORGANISMS AND POPULATIONS

Ecology is the branch of biology that deals with the inter-relationship amongst the organisms and their environment.

- Applied ecology is the study of specialized field of ecology which are concerned with conservation and economic exploitation of organisms. Example - agronomy, wildlife management etc.
- System *ecology* deals with interpretation of ecological concepts and processes in terms of mathematical models of formulae.
- Genecology is the study of genetic composition and changes in relation to the origin of emits, ecotypes, new species etc.

Individual (Organism)

Population

Biotic community

Ecosystem

Land

Biome

Biosphere

### Organism and Its Environment

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- \* The variation in the intensity and duration of temperature along with annual variations in precipitation results in formation of major biomes like desert, rain forest and tundra.
- Regional and local variations within each biome lead to the formation of different kinds of habitats like tropical rain forest, deciduous forest, semi-arid etc.

#### Major abiotic Factors

- a) **Temperature** - The organisms that can tolerate wide range of temperature are called eurythermal and those organism restricted to a narrow range of temperatures are called stenotherm.
- b) **Water** - Some organisms are tolerant to wide range of salinities are called eurhaline and others are restricted to a narrow range are called stenohaline.
- c) **Light** - Flowering in some plants occurs only in presence of critical day light called Photoperiod
- (1) **Soil composition**, grain size and aggregation determine the percolation and water holding capacity of the soils along with pH, mineral, composition and topography determine the vegetation in any area.

#### Responses of Abiotic Factor

**Regulate** - All birds and animals are capable of maintaining homeostasis by physiological means Which ensures constant body temperature, constant osmotic concentration etc.

**Conform** - Most of animals and plants, their body temperature change with ambient temperature. In aquatic animals osmotic concentration of the body fluid change with that of the ambient water osmotic concentration. These animals are called conformer.

**Migrate** - The organism move away for time being from the stressful unfavorable habitat to more suitable habitat and return back when stressful period is over. Siberia birds migrate to Keolado National Park. Sharatpur, India.

**Suspend** - In microorganisms like bacteria, fungi and lower plants a thick wall is formed which help them to survive unfavorable conditions.

**Adaptation** is the attribute of organism morphological, physiological and behavioral changes that enables the organism to survive and reproduce in its habitat.

Mammals from colder climates have shorter ears and limbs to minimize heat loss. This is called Allen's Rule. In polar seas aquatic mammals like seals have a thick layer of fat called blubber, below their skin that acts as an insulator and reduces loss of body heat

#### Populations

Individuals of any species live in groups in well-defined geographical area share or compete for similar resources, potentially interbreed and constitute a population,

#### Population Attributes

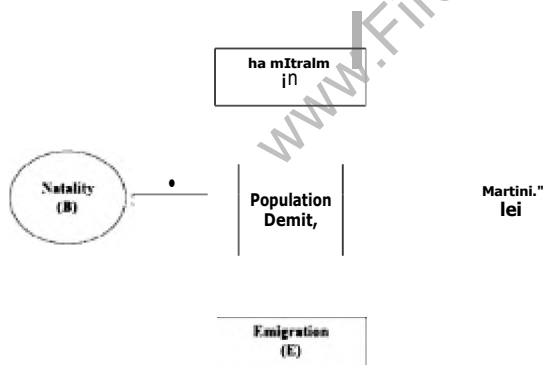
- The birth and death rates
- Sex Ratio

- A population at given time composed of different individual of different ages. If the age distribution is plotted for the population, the resulting structure is called age pyramids.
- The shape of pyramids reflects the shape of growth status of population\_ Which may be
  - Expanding
  - Stable
  - Declining

#### Population Growth

The main factors that determine the population growth are-

- Natality (number of birth)
- Mortality (number of death)
- Immigration (individual came into habitat)
- Emigration (Individual leaves the habitat)



If  $t_0$  is the population density at a time  $t_0$  then its density at  $t+1$  is

#### Growth model

Growth of population takes place according to availability of food, habitat condition and presence of other biotic and abiotic factors. There are two main types of models-

1. Exponential Growth. In this kind of growth occurs when food and space is available in sufficient amount. The population grows in an exponential or geometric fashion. If in a population of size  $N$ , the birth rate is represented as  $b$  and death rate as  $d$ . Then increase and decrease in 1% during unit period time  $t$  will be

$$\frac{dN}{dt} = rN$$

Let  $\frac{dN}{dt} = rN$  then

$$\frac{dN}{N} = r dt$$

Then, the  $r$  in this equation is called **intrinsic rate of natural increase**.

**Logistic Growth**- there is a competition between the individuals of a population for food and space. The fittest organism survives and reproduces. In this type of growth initially shows a lag phase followed by phases of acceleration and deceleration.

$$\frac{dN}{dt} = rN \left( 1 - \frac{N}{K} \right)$$

Where  $N$  = Population density at time  $t$

$r$  = Intrinsic rate of natural increase

$K$  = Carrying capacity

**Population interaction**

Following types of interaction are seen -

1. Competition
2. Parasitism
3. Commensalism
4. Mutualism

Species A	Species B	Name of Interaction
+	+	Mutualism
+	0	Commensalism
+	-	Parasitism
-	-	Competition
-	0	Amensalism