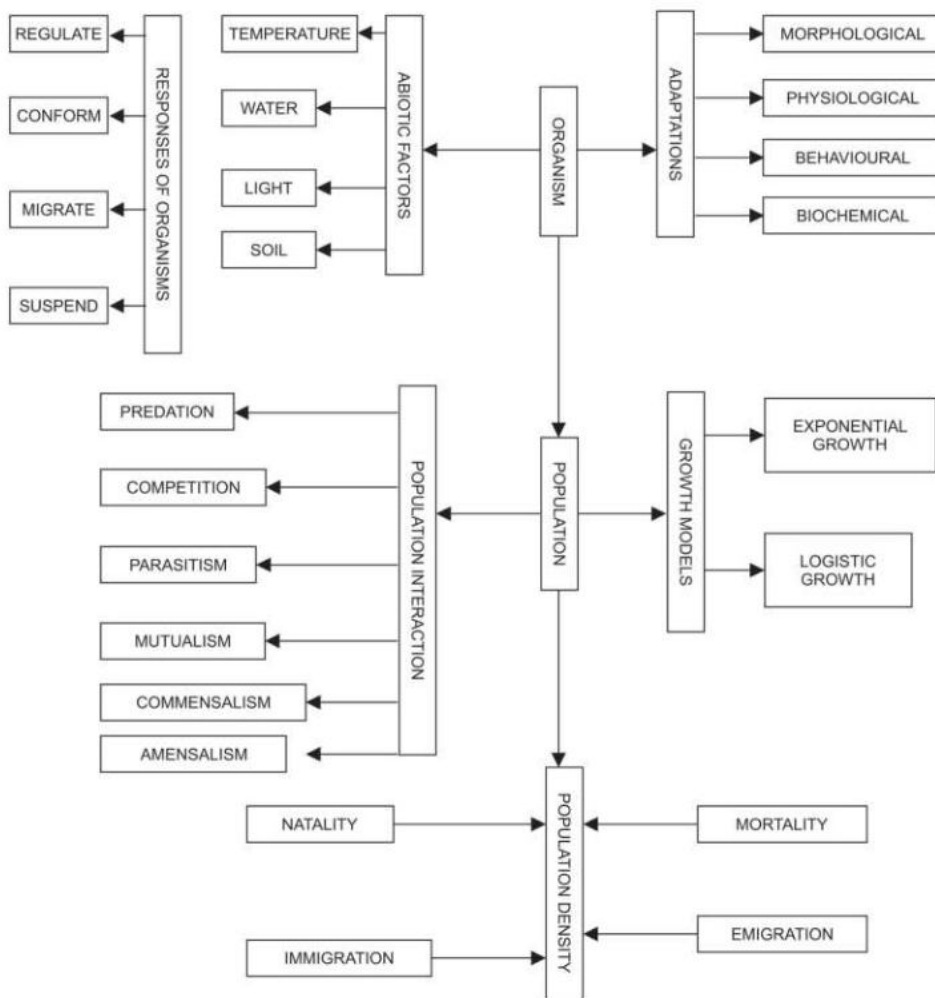


## Chapter - 11

# Organisms And Population



**Ecology** : A branch of science that studies interactions among organisms and their physical environment. Ecology is basically concerned with four levels of biological organisation— Organisms, population, communities and biomes.

Ramdeo Misra is called as the Father of Ecology in India.

**Organisms** : Organisms form the basic unit of study in ecology.

**Species** : Organisms with similar features and the potential to interbreed among themselves and produce fertile offspring, constitute a species.

**Populations** : Population is a group of individuals of the same species, inhabiting in a given area. Interspecific competition for basic needs operate among the individuals of population.

**Biological Community** : Biological community is constituted by an assemblage of the populations of all different species that live in an area and interact with each other. A biotic community has a distinct species composition and structure.

### Population Attributes :

A population has certain attributes that an individual does not possess. Important characteristics of a population are :

(i) **Population density** : Population density of a species is the number of individuals of a species per unit area or volume

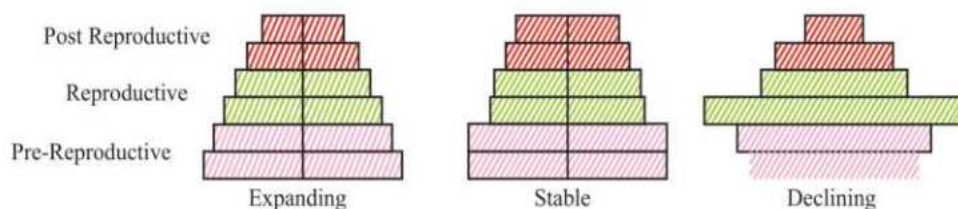
$$\text{Population density} = \frac{\text{Number of individual in a region (N)}}{\text{unit area in a region (S)}}$$

(ii) **Birth rate or Natality Rate** : It is expressed as the number of births per thousand individuals of a population per year

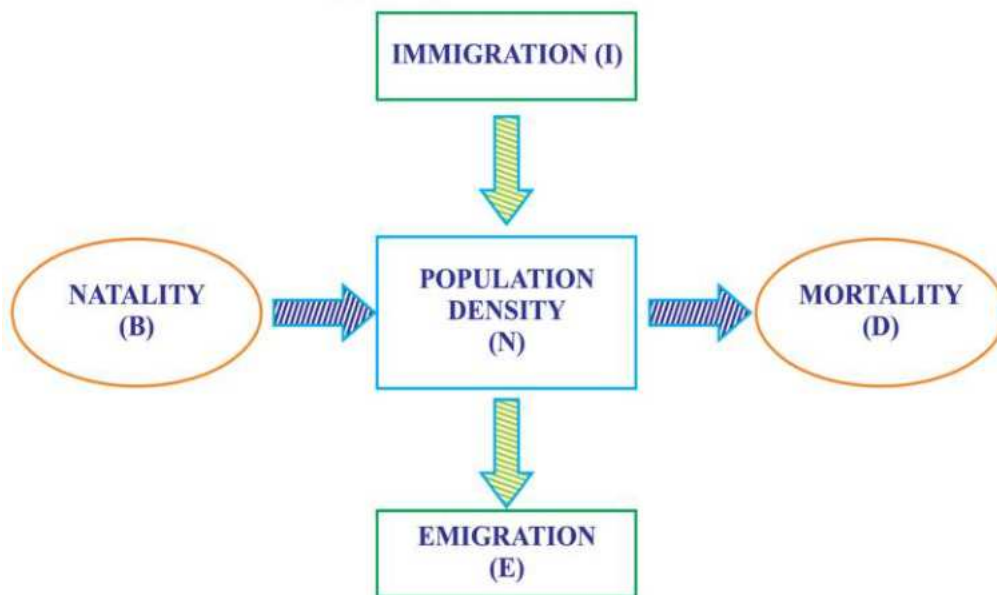
(iii) **Death rate or Mortality rate** : It is expressed as the number of deaths per thousand individual of a populations during a given period.

(iv) **Sex ratio** : It is expressed as the number of females per 1000 males of a population in given time.

**Age Pyramids of Populations :** A population at any given time is composed of individuals of different ages. If the age distribution is plotted for the population, the resulting structure is called an age pyramid. The shape of the pyramids reflects the growth status of the populations. Whether (a) it is growing (expanding) (b) Stable or (c) Declining. The pyramids for human population (males and females) are presented below :



**Population Growth :** If 'N' is the population density at time t' then its density at time t + 1 is :  $N_{t+1} = N_t + (B + I) - (D + E)$



**Immigration :** Number of individuals of the same species that have come into the habitat from elsewhere during a given period.

**Emigration** : Number of individuals of the population who have left the habitat and gone elsewhere during a given time period.

**Growth Models** : The two growth models are :

(i) **Exponential growth model** : If food and space for a population are unlimited and each species has the ability to grow, then the population grows in exponential or geometric fashion.

**Exponential Growth Equation** is  $N_t = N_0 e^{rt}$

Where,

$N_t$  = Population density after time t

$N_0$  = Population density at time zero

r = intrinsic rate of natural increase

e = the base of natural logarithms (2.71828)

**Exponential growth** : 'J' shape curve is obtained.

- When resources are not limiting the growth.
- Any species growth exponentially under unlimited resources conditions can reach enormous population densities in a short time.
- Growth is not so realistic.

(ii) **Logistic growth model** : A population growing in a habitat with limited resources (food and space) shows logistic growth :

*Verhulst-Pearl Logistic Growth* is described by the following equations :

$$dN/dt = rN (K-N / K)$$

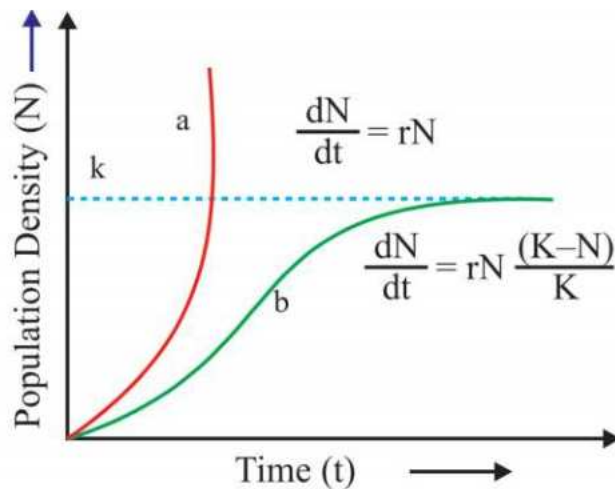
Where, N = Population density at time t

r = Intrinsic rate of natural increase

K = Carrying capacity

**Logistic Growth**: Sigmoid curve is obtained

- When resources are limiting the Growth.
- Resources for growth for most animal populations are finite and become limiting.
- The logistic growth model is a more realistic one



a-Exponential growth  
b- Logistic growth

k- Carrying capacity

### Population Interactions :

1. **Predation** : Interaction between species involving killing and consumption of prey is called predation. The species which eats the other is called the predator and the one consumed is termed as the prey. The predator keeps check on prey population. The reduction in predator population may lead to increase in prey population.

- Predators play important roles in ecosystem :
  - (a) Transfer of energy across trophic levels.
  - (b) Keep prey population under control : The invasive prickly pear cactus was brought under control by introduction of a cactus-feeding predator (moth) in Australia.
- Biological pest control methods : Used in agricultural are based on the ability of predator to regulate prey population.
- Maintain species diversity in a community.

### Examples of Predation :

- (i) Carnivorous animals like tiger eating deers, snake eating frog
- (ii) Insectivorous plants like *Nepenthes*, *Drosera*, *Utricularia*

2. **Competition** : In this fitness of one species is significantly lower in presence of another species.

**Gause's Competitive Exclusion Principle** : Two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated.

3. **Parasitism** : Parasitism is a kind of relationship between two species in which one derives its food from the other (host). Parasitism also involves shelter, in addition to food obtained by a parasite. Parasites may be ectoparasites or endoparasites. Ectoparasites live on the surface of their host while endoparasites live inside the body of the host.

### Examples of Parasitism

- (i) *Cuscuta* growing on hedge plant
- (ii) Head lice and humans
- (iii) *Ascaris*, *Taenia*, *Plasmodium* causing diseases in humans

### Example of Brood parasitism

- (i) Koel laying its eggs in crow's nest.

4. **Mutualism** : In mutualism both the interacting species are benefited mutually. It is also known as symbiosis.

### Examples of Mutualism

- (i) Mycorrhiza living in roots of higher plants
- (ii) *Rhizobium* in root nodules of legumes
- (iii) Algae and fungi in lichens
- (iv) Orchid *Ophrys* and bee for pollination (Sexual deceit-resemblance of flower to female bee)

**Co-evolution** : (1) Fig species and wasp. Female wasp uses the fruit as an Oviposition (egg-laying) and also uses the developing seeds within the fruits for nourishing its larvae. Wasp pollinates the fig inflorescence while searching for egg laying site, in return fig offers developing seeds as food for developing larvae. (2) Mediterranean orchid *Ophrys* and bee.

5. **Amensalism** : Interaction between two different species, in which one species is harmed and the other is neither benefited nor harmed.

### Example of Amensalism

- (i) *Penicillium* whose toxin kills many bacteria is neither benefitted nor harmed

6. **Commensalism** : This is the interaction in which one species is benefitted and the other is neither harmed nor benefitted under normal conditions.

### Examples of Commensalism

- (i) Clown fish living among tentacles of sea anemone
- (ii) Pilot fish (*Remora*) accompanies sharks
- (iii) Orchid growing on mango tree (epiphyte)
- (iv) Sea anemone on the shell of hermit crab
- (v) Barnacles on back of whales
- (vi) Egret and grazing cattle

## Questions

VSA

(1 Mark)

1. Name the two intermediate hosts of human liver fluke.
2. Calculate the death rate if 6 individuals in a laboratory population of 60 fruitflies died during a particular week.
3. An organism has to overcome stressful condition for a limited period of time. Which strategies can it adopt to do so ?
4. What do phytophagous insects feed on ?

### MULTIPLE CHOICE QUESTIONS

5. Which part of human body is a unique habitat for hundred of species of microbes?
  - a) Urinary bladder
  - b) Mouth
  - c) Intestine
  - d) Stomach

6. select the statement which explains best commensalism
- a) One organism is benefited
  - b) Both organisms are benefited
  - c) One organism is benefited, other is not affected
  - d) One organism is benefited, other is affected
7. Which of the following statement is not true for logistic growth.
- a) Resources are limited.
  - b) It is represented by sigmoid curve
  - c) Population density never reaches the carrying capacity.
  - d) The final phase is asymptote.
8. Select the incorrect match
- a) Predation-biological control
  - b) Competition-cuckoo bird
  - c) Commensalism- epiphyte
  - d) Mutualism-mycorrhizae
9. When a population grows in a habitat with limited resources then following phases of achievement are observed -
- a) Lag – Acceleration – Deceleration – Asymptote
  - b) Log – Deceleration – Acceleration – Asymptote
  - c) Log – Acceleration – Deceleration – Asymptote
  - d) Log – Acceleration – Asymptote – Deceleration

#### **Assertion And Reason Questions**

Read the assertion and reason carefully and work the correct option out of the options given below :

- a) If both assertion and the reason are true and the reason is a correct explanation of the assertion.
- b) If both the assertion and reason are true but reason is not a correct explanation of the assertion.
- c) If the assertion is true but the reason is false.



10. Assertion :– Female mosquito is not considered as parasite although it needs our blood for reproduction.

Reason : Parasitism is aimed to obtain either food or shelter.

11. Assertion : The monarch butterfly is highly distasteful to its predator

Reason : This is evolved to lessen the impact of its prey

**SA-I**

12. Differentiate between commensalism and amensalism **(2 Marks)**

13. Write any two adaptations evolved by parasites.

14. Why abingdon tortoise became extinct in Galapagos Islands after introduction of Goats.

15. Why do clown fish and sea anemone pair up? What is this relationship called?

**SA-II (3 Marks)**

16. How will you measure population density in following cases ?

- (i) fish in a lake
- (ii) tiger census in a national park
- (iii) single huge banyan tree with large canopy.

**LA (5 Marks)**

17. Orchid flower, Ophrys co-evolves to maintain resemblance of its petal to female bee. Explain how and why does it do so ?

**Answers**

**VSA (1 Mark)**

- 1. Snail and fish.
- 2.  $6/60 = 0.1$  individuals per fruitfly per week.
- 3. (i) Migration
- (ii) Suspension of active life by hibernation/aestivation/spore formation.

4. Plant sap and other parts of the plant.

**Answer**

5. c) 6. e) 7. c) 8. b) 9. a) 10. a) 11. c0

**SA-I**

**(2 Marks)**

12. **Commensalism:** interaction in which one species benefits and the other is neither harmed nor benefited. E.g cattle egret and grazing cattle.

**Amensalism:** Interaction in which one species is harmed and the other is neither harmed nor benefited. E.g Penicillium toxins kills many bacteria is neither benefited nor harmed.

13. Loss of unnecessary sense organs, presence of adhesive organs, suckers to cling host, loss of digestive system, high reproductive capacity (any2)

14. Due to greater browsing efficiency of goats.

15. Interaction-commensalism.

**SA-II**

**(3 Marks)**

16. (a) fish caught per trap.

(b) number per unit area

(c) percentage cover in biomass.

**LA**

17. • employs 'sexual deceit'

• one petal bears uncanny resemblance to female of the bee.

• Male bee is attracted to what it perceives as a female 'pseudo-copulates,' during which pollen dusted on male bee's body.

• Male bee transfers pollen to another flower when the same been pseudo-copulates with another flower.

• *Ophrys* does so because pollination success will be reduced unless it co-evolves with female bee.

