6 .ORGANISMS AND POPULATIONS

13.1.3 ADAPTATIONS

- Adaptation is morphological, physiological and behavioral attribute of an organism that enables them to survive and reproduce in their habitat.

Adaptation of animals in desert

- In the absence of an external source of water, the kangaroo rat in North American deserts is capable of meeting all its water requirements through its internal fat oxidation
- It also has the ability to concentrate its urine so that minimal volume of water is used to remove excretory products.

Adaptation of plants in desert

- Thick cuticle and sunken stomata on the leaf surface of many desert plants prevents loss of water.
- CAM plants open their stomata during night to reduce the loss of water during photosynthesis.
- In some plants like Opuntia , leaves are modifies into spines to reduce transpiration and photosynthesis takes place in flat green stem called as **phylloclade**.

Adaptation of animals in cold climate

- 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.

Adaptation in high altitude

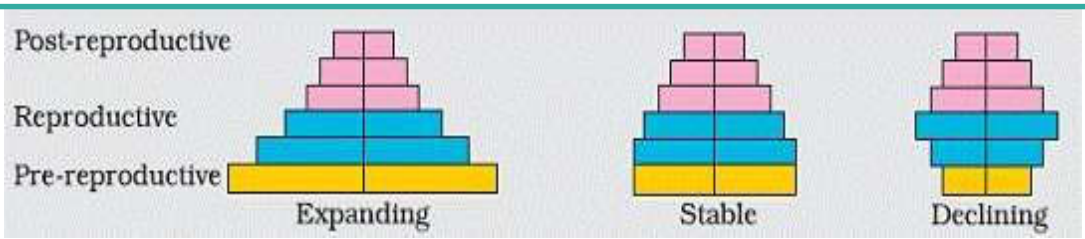
- When a person moves to high altitude place, develops altitude sickness because in the low atmospheric pressure of high altitudes, the body does not get enough oxygen.
- Symptoms include nausea, fatigue and heart palpitations.
- The body compensates low oxygen availability by increasing red blood cell production, decreasing the binding capacity of hemoglobin and by increasing breathing rate.
- The person gradually get acclimatized and stop experiencing altitude sickness. This is a type of physiological adaptation.

Behavioural adaptation

- Desert lizards deal with the high temperatures of their habitat, by managing to keep their body temperature fairly constant by behavioural adaptation.
- Desert lizards bask in the sun and absorb heat when their body temperature drops below the comfort zone and move into shade when the ambient temperature starts increasing.
- Some species are capable of burrowing into the soil to hide and escape from the above-ground heat

13.2.1 POPULATION ATTRIBUTES- AGE DISTRIBUTION

- Age distribution is also an important attribute of population.
- A population comprises different age groups such as pre-reproductive, reproductive and post-reproductive age groups.
- This age distribution is graphically represented by an age pyramid.
- The age pyramid indicates whether a population is growing, stable or declining.



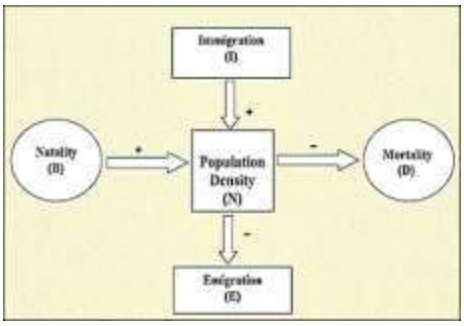
- It shows the size of the population. It is determined by counting the no.of individuals,or by biomass.
- The population size is more technically called as population density.
- Population density can be measured by
- Counting the number,by measuring percent cover or biomass, or Pug marks and faecal pellets for some animals.

13.2.2 POPULATION GROWTH

- The size of population is not static. It keeps changing with time, depending upon food availability, predation pressure and reduce weather.
- The density of a population in a given habitat during a given period, fluctuates due to changes in four basic processes which are
  - **1.Natality (B)** : Number of births during given period in the population that are added to the initial density
  - **2.Mortality (D)**:Number of deaths in the population during a given period.
  - **3.Immigration (I)** :It is the number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration
  - **Emigration (E)** : Emigration is the number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration
- If N is the population density at time t, then its density at time t +1 is

$$N_{t+1} = N_t + [(B + I) - (D + E)]$$

Where
N = Population Density
B = the number of births
I = the number of immigrants
D = the number of deaths
E = the number of Emigrants.



Growth model

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

Exponential Growth

- Any species grow exponentially under unlimited resources conditions and can reach enormous population densities in a short time.
- Population grows exponentially and after attaining the peak value ,the population shows sudden decrease.
- For example many insect populations show rapid increase during rainy season followed by their disappearance at the end of season .

- This type of growth is not so realistic.
- If in a population of size N, the birth rates as represented as 'b' and death rate as 'd'. Then increase and decrease in N during unit period time 't' will be

dN / dt = (b – d) × N
Let (b – d) = r, then
dN / dt = rN

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

- In nature, a given habitat has enough resources to support a maximum possible number, beyond which no further growth is possible. This is called **carrying capacity (K)** of a habitat.
- Due to competition between individuals for limited resources, the fittest individual will survive and reproduce.
- A population growing in a habitat with limited resources show initially a lag phase, followed by phases of acceleration and stationary phase, when the population density reaches the carrying capacity.
- The logistic growth shows sigmoid curve and this is also called Verhulst-Pearl logistic growth

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

Where N = Population density at time t
r = Intrinsic rate of natural increase
K = Carrying capacity

13.1.3 POPULATION INTERACTIONS

PARASITISM

- Parasitism is generally defined as a relationship between the two living species in which one organism is benefitted at the expense of the other.
- The organism that is benefitted is called the parasite, while the one that is harmed is called the host.
- Some parasites are host-specific (one parasite has a single host) in such a way that both host and parasite tend to co-evolve.
- Some of the parasitic adaptations are-
  - Loss of unnecessary sense organs
  - Presence of adhesive organs or suckers to cling on to the host.
  - Loss of digestive system.
  - High reproductive capacity.
- The life cycles of parasites are often complex, involving one or two intermediate hosts or vectors to facilitate parasitism on its primary host.
- The human liver fluke depends on two intermediate hosts, a snail and a fish to complete its life cycle.

Effects of parasites on the host

- Majority of the parasites harm the host.
- They may reduce the survival, growth and reproduction of the host and reduce its population density.
- They make the host more vulnerable to the predators, by making it physically weak.

Types of parasite

ECTOPARASITE:

- Feeds on the external surface of the host. Eg.Lice on human ,Ticks on dog, Cuscuta ,a parasitic plant grow on hedge plants.

ENDOPARASITE:

- Parasites that live inside the host body at different sites. Eg. Tape worm, liver fluke.

BROOD PARASITISM:

- Special type of parasitism found in birds.
- The parasitic birds lay its eggs in the nest of its host and let the host incubate them.
- The egg of the host is very similar with the egg of the parasite. Eg.Cuckoo lays eggs in the nest of the crow.

COMMENSALISM:

- This is the interaction in which one species benefits and the other is neither benefited nor harmed. Some examples are
- Orchids growing as an epiphyte on a mango branch. Barnacles on back of whales.
- Clown fish living among tentacles of sea anemone. Cattle Egret and grazing cattle.

MUTUALISM

- Mutualism is the interaction between two living organisms where both the organisms are equally benefitted and no one is harmed.
- Lichens represent an intimate mutualistic relationship between a fungus and photosynthetic algae.
- Mycorrhizae are associations between fungi and the roots of higher plants
- Plants provide nectar and pollen for pollinating agents and the pollinating agents in turn pollinate the flowers of plants.
- Animals disperse the seeds of plants and plants provide juicy fruits for seed dispersers.
- Mutualism exists between fig tree and a pollinator species,wasp.
- A fig species can be pollinated only by its partner wasp species.
- The wasp pollinates the fig flower while in search for egg lying site,in return fig offers the wasp the developing seeds for developing larvae.

Sexual deceit

- Mediterranean orchid Ophrys employs 'sexual deceit'.
- Petal of the flower resembles the female bee.
- The male bee attracted to what it perceives as a female, 'pseudocopulates' with the flower but does not get any benefits.