- **The interactions between populations of species in a community are broadly divided into two categories:**
- (i) Positive (beneficial) and
- (ii) Negative (inhibition) interactions.
- This depends upon the nature of effect on the interacting organisms of different species

POPULATION INTERACTIONS

- Population interactions are the effects organism in a community have on one another.

- An organisms interaction with its environment are fundamental to the survival of that organism and the functioning of the ecosystem as a whole

- Populations do not exist alone in nature, The way organisms interact is important for the survival of a species. There are two types of interaction: **intraspecific interactions** and **interspecific interactions**. Intraspecific interactions are those that take place among organisms of the same species while interspecific interactions are those which happen among individuals of different species.

IMPORTANT INTERACTIONS BETWEEN TWO SPECIES

By comparing populations living alone and together, several types of interactions can be identified.

- COMMENSALISM (+/o)
- MUTUALISM (+/+)
- COMPETITION (-/-)
- PARASITISM (+/-)
- PREDATION (+/-)
- ALLELOPATHY(+/-)

POPULATION INTERACTIONS INFLUENCE ABUNDANCE

- When populations of different species interact, the effects on one on the other may be positive (+), negative (-) or neutral (o).

Table 1 . : Population Interactions

Species A	Species B	Name of Interaction
+	+	*Mutualism*
–	–	*Competition*
+	–	*Predation*
+	–	*Parasitism*
+	*0*	*Commensalism*
–	*0*	*Amensalism*

MUTUALISM

- Mutualism is a type of symbiosis in which populations interact to the benefit of both species.

- Mutualism may be obligate (necessary for survival of one or both species) or facultative (one species may survive in the absence of other).

MUTUALISM

POLLINATION PROCESS

- One of the most commonly observed mutualism is the pollination of flowering plants by an insect or humming bird.
- The pollinator benefits from the interaction by receiving nectar.
- The plant gets its pollen transferred from one plant to another.

MUTUALISM

SYMBIOTIC NITROGEN FIXERS

- Although free nitrogen is about 80% of the atmosphere, plants are unable to use it until it is "fixed" into ammonia and converted to nitrates by bacteria.

- A common example of this mutualism between plants and nitrogen fixing bacteria is found in the roots of leguminous plants.

LEGUMES/NITROGEN FIXING BACTERIA

- Nitrogen fixing bacteria enter the root hairs of legumes in the seedling stage. The bacteria causes the plant to produce **nodules.**
- The host plant in return supplies carbohydrates, amino acids and other nutrients that sustain their bacterial partners (bacteriods).

The *Rhizobium*/Soybean Connection

- The mutualism between *Rhizobium* and soybeans is an important source of **nitrogen fixation**
- *Rhizobium*, a bacterial genus, can convert atmospheric nitrogen (N_2) into ammonia (NH_3). Thus, making this essential nutrient available to these legumes.
- In turn legumes, such as soybeans , supply *Rhizobium* with carbohydrates and other nutrients for growth and reproduction.

MUTUALISM

LICHEN

- The lichen is a mutualistic association between a species of algae and a species of fungus. Algal partner is known as phycobiont and fungal partner is known as mycobiont
- The fungus retains water and takes up minerals.
- The algae provides carbohydrates and other organic nutrients as the result of photosynthesis.

COMMENSALISM

- Commensalism is an association between two organisms in which one benefits and the other derives neither benefit nor harm

- In commensalism species involved live together without entering into any kind of physiological exchange

COMMENSALISM

LIANAS

- These are vascular plants rooted in the ground and maintain erectness of their stem by making use of other objects for support
- They maintain no direct nutritional relationship with the trees upon which they grow
- E.g. : Grapes

COMMENSALISM

EPIPHYTE

- An epiphyte is a plant that grows upon another plant. Growing on another plant gives the epiphyte better access to sunlight and moisture.
- They differ from lianas in that they are not rooted into the soil
- They have specialized roots to absorb moisture and nutrients from humid air to prepare food so, they are not dependent on the supporting species
- E.g. : Orchid species

COMMENSALISM

EGRETS FORAGING IN FIELDS AMONG CATTLE

- As cattle, graze on the field, they cause movements that stir up various insects. As the insects are stirred up, the egrets following the livestock catch and feed upon them. The egrets benefit from this relationship because the livestock have helped them find their meals, while the livestock are typically unaffected by it

ALLELOPATHY

- Allelopathy is a biological phenomenon by which an organism produces one or more biochemical's that influence the growth, survival, and reproduction of other organisms.

- These biochemical's are known as allelochemicals and can have beneficial (positive allelopathy) or detrimental (negative allelopathy) effects on the target organisms.

- plant allelopathy is used as a means of survival in nature, reducing competition from plants nearby.

COMPETITION

- Mutual use of a limited resource by populations of two or more species.
- Each individual adversely affect another in the quest for food (nutrients), living space, or other common needs.
- Individuals harm one another is attempting to gain a resource.

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COMPETITION

May be:	• interspecific • intraspecific
Due to:	• exploitation, or • interference
Result in:	• exclusion of one, or • coexistence

Outcomes of Competition

PREDATION

It is a kind of interaction in which one organism(predator) kills another organism(prey) for food

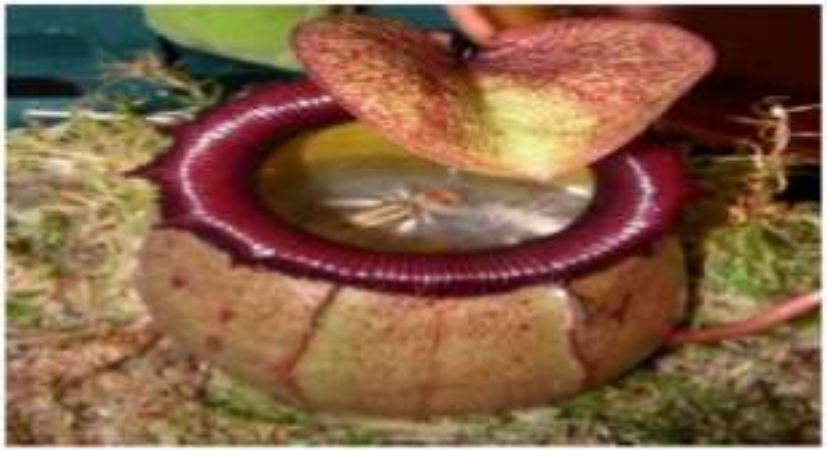
PREDATION

Predation comprises of organism which are;

- **Classic or "true" predators** : most commonly thought of predators including, sharks, cheetahs, bears etc.
These predators kill their prey soon after catching it, normally consuming it all.
- **Grazers**: can be considered a predator by the same definition but consume only part of a prey organism.

PREDATION

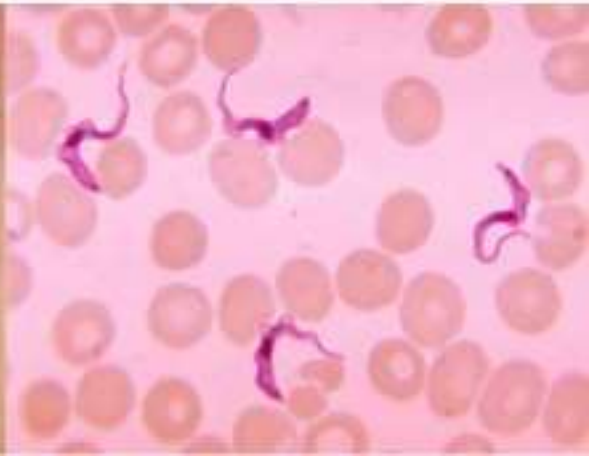
- Most of the predatory organism are animals but there are some plants, like Nephenthes,Drosera etc. which consume insects for their food.They are also known as Insectivorous plants
- These plants are adapted in remarkable ways to attract,catch and digest their victims. Their foliar appendage produce proteolytic enzymes for digestion of insects



PARASITISM

- The association between a parasite and a host is known as parasitism and it occurs when a member of one species (parasite) consumes tissues or nutrients of another species (host).
- Parasites live on or in their hosts; often for long periods of time
- Parasites are most often much smaller than their hosts.
- It is not necessarily fatal to the host.





PARASITISM

- Parasites are divided into two groups: endoparasites and ectoparasites.
- Endoparasites are parasites that live inside the body of the host e.g. Trypanosoma
- Ectoparasites are parasites that live on the outer surface of the host and generally attach themselves during feeding e.g. Ticks, Mites

PARASITISM

- Ectoparasites develop some clinging organs like hooks, suckers to get attached with the body of host.
- Some plants like cuscuta have certain specialized absorbing structures called haustoria to attain food.

Allee's Law

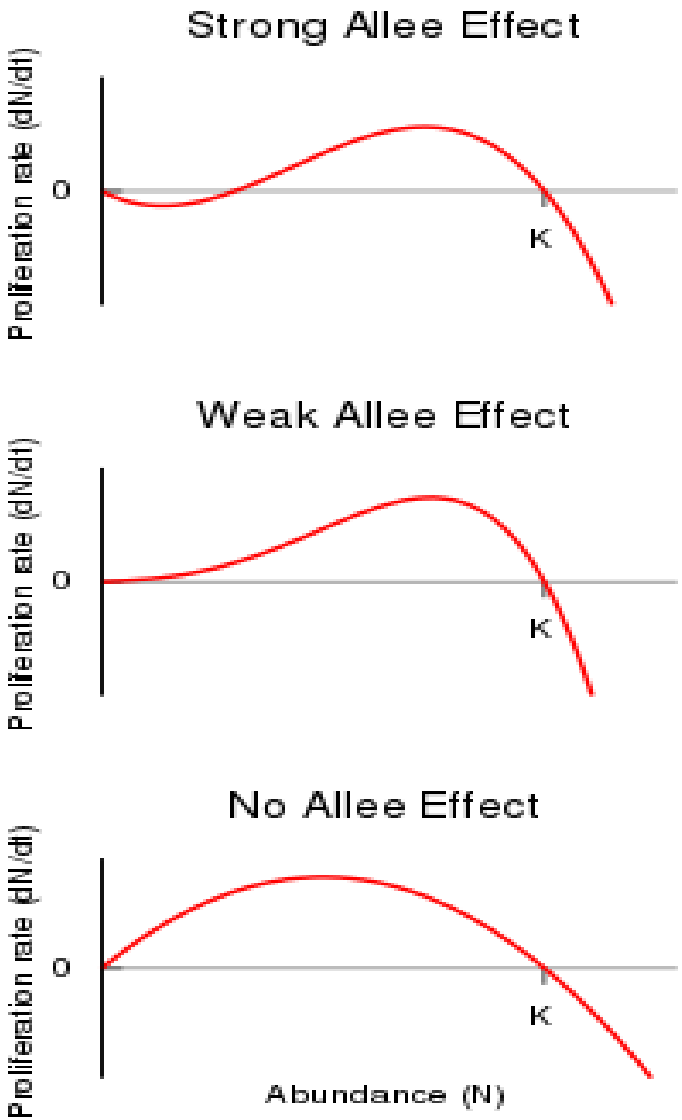
- Allee's Law says that there is a positive relationship between individual fitness and either the numbers or density of conspecifics (conspecifics are other individuals of the same species).
- In other words, as the number of individuals in a population increases, or as population density increases, survival and reproduction also increase (Berryman 1999).
- A good example occurs when animals aggregate in groups for protection and thereby dilute the threat that each individual faces from a predator: For example, an individual sparrow in a flock of 4 sparrows that is attacked by a successful predator has a 75% chance of survival, while an individual sparrow in a flock of 100 has a 99% chance of survival.

Increased numbers of conspecifics benefit a population because they

- increase predator dilution or saturation;
- increase antipredator vigilance or aggression;
- enhance cooperative defense of resources and cooperative defense against predators;
- increase social thermoregulation;
- increase collective modification or amelioration of the environment;
- increase the availability of mates;
- increase the success of pollination or fertilization success, enhance reproduction and reduce inbreeding, genetic drift, or loss of integrity by hybridization

- According to Allee's Law, there is reduced reproduction or reduced survival at low population densities or low population sizes.
- For example, when the population size of an insect-pollinated plant becomes low, or if a low number of individuals flower during a year, fewer seeds will be produced per plant because insect pollinators will have a harder time finding few flowers than many flowers (Forsyth 2003).
- Because small populations have lowered reproduction or survival, **Allee's Law is of special interest to ecologists that work with endangered species.**

- The **strong Allee effect** is a demographic Allee effect with a critical population size or density. The **weak Allee effect** is a demographic Allee effect without a critical population size or density.
- The distinction between the two terms is based on whether or not the population in question exhibits a critical population size or density.
- A population exhibiting a weak Allee effect will possess a reduced per capita growth rate (directly related to individual fitness of the population) at lower population density or size. However, even at this low population size or density, the population will always exhibit a positive per capita growth rate.
- Meanwhile, a population exhibiting a strong Allee effect will have a critical population size or density under which the population growth rate becomes negative. Therefore, when the population density or size hits a number below this threshold, the population will be destined for extinction without any further aid. A strong Allee effect is often easier to demonstrate empirically using time series data, as one can pinpoint the population size or density at which per capita growth rate becomes negative


Strong Allee Effect
Proliferation rate (dN/dt)
0
K
Weak Allee Effect
Proliferation rate (dN/dt)
0
K
No Allee Effect
Proliferation rate (dN/dt)
0
K
Abundance (N)