11. ORGANISMS AND POPULATIONS

ECOLOGY

Ecology is th study of interaction of organisms among themselves and between the organism and its physical (abiotic) environment.

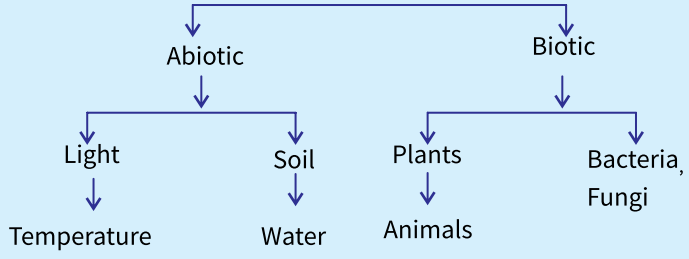
Four Levels of Biological Oranization

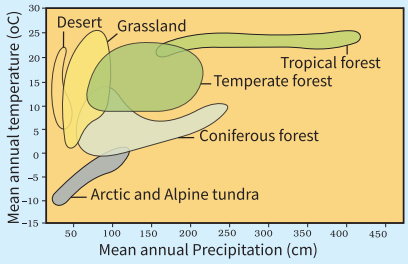
- Organisms
- Population
- Communities
- Biomes

ORGANISM AND ITS ENVIRONMENT

Ecology at the organismic level is essentially physiological ecology which tries to understand how different organisms are adapted to their environments in terms of not only survival but also reproduction.

Factor Affecting Environment





Biome distribution with respect to annual temperature and precipitation

Response to Abiotic Factors

Regulate: maintaining homeostasis.

Conform: constant internal environment.

Migrate: moving to hospitable environment.

Suspend: suspend growth during unfavorable environment.

Hibernation: winter sleep by bears

Aestivation: summer sleep

ADAPTATIONS

- Adaptation of desert plants (Opuntia).
- Adaptation of kangaroo rat in North American Deserts.
- Adaptation of mammals for colder climates short ears & limbs, it is called Allen's rule.

i) Physiological: Ability to survive in low oxygen condition at high altitude.

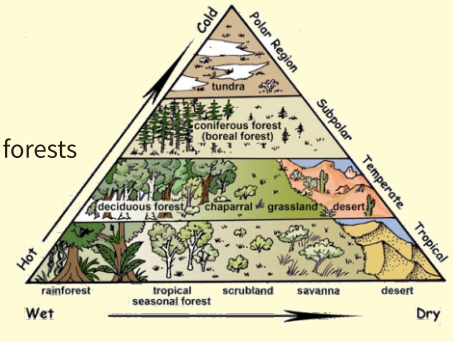
ii) Biochemical adaptations: Ability of fishes to survive in high pressure in deep Oceans.

iii) Behavioral adaptations: Small desert animals live in burrows to escape high heat.

To reduce water loss in xerophytes, leaves are reduced to spines and stems become thicker, green and show photosynthesis.

Major Biomes are

- Deserts,
- Rain forests
- Tundra
- Coastal area
- Tropical deciduous forests



Kangaroo rat inhabiting the Arizona Desert never drinks water in its life and has the potential to concentrate its urine to conserve water.

Desert lizards maintain their body temperature by basking in the sun and moving into shade when temperatures increase.

POPULATION

Group of individuals of same species that can interbreed & live in same geographical area.

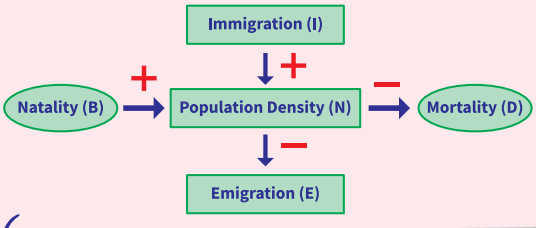
POPULATION GROWTH

- Change in population density reflects size of population
- Factors affecting population density

i) Natality - Number of births during a given period in the population that are added to the initial density.
ii) Mortality - Number of deaths in the population during a given period.
iii) Immigration - Number of individuals of same species that have come into the habitat from elsewhere during the time period under consideration.
iv) Emigration - Number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration.

- Population density can be

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



GROWTH MODELS

EXPONENTIAL GROWTH

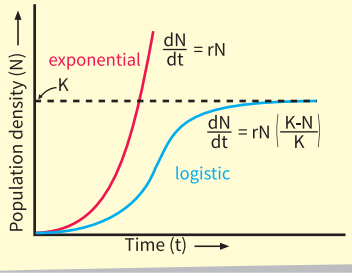
$(N_t = N_o e^{rt})$

(J-shaped growth)

LOGISTIC GROWTH

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

(S-shaped growth)



POPULATION ATTRIBUTES

Birth Rate | **Death Rate** | **Sex ratio** | **Age pyramids** | **Population Density**

Population Attributes: Shows age distribution of population & shape of pyramid reflects the growth status of the population.

Expanding | **Stable** | **Declining**

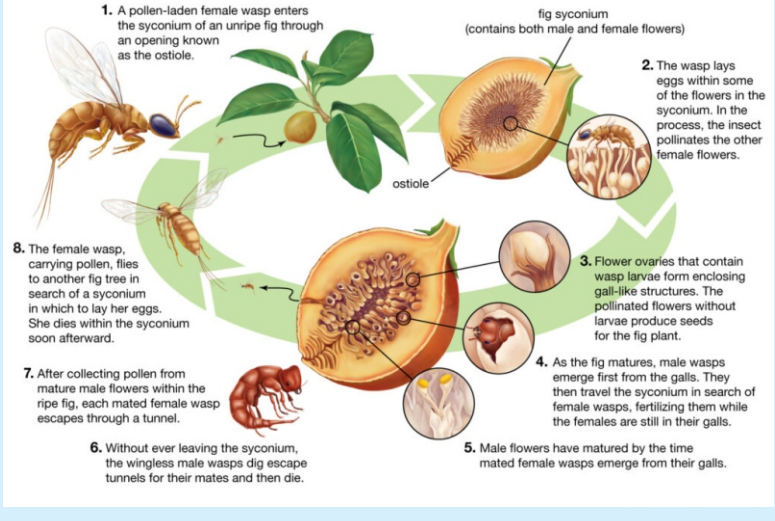
Triangular pyramid | **Bell-shape pyramid** | **Urn-shaped pyramid**

Population Interactions

Species A	Species B	Name of interaction
+	+	Mutualism
–	–	Competition
+	–	Predation
+	–	Parasitism
+	0	Commenssalism
–	0	Amensalism

+ = Benefifed
– = affected
0 = Neutral

Both the species benefit in **mutualism** and both lose in **competition** in their interactions with each other. In both **parasitism** and **predation** only one species benefits (parasite and predator, respectively) and the interaction is detrimental to the other species (host and prey, respectively). The interaction where one species is benefitted and the other is neither benefitted nor harmed is called **commensalism**. In **amensalism** on the other hand one species is harmed whereas the other is unaffected. Predation, parasitism and commensalism share a common characteristic– the interacting species live closely together.



Mutualism between fig tree and wasp

Mutualism: Pseudocopulation in ophrys

Commensalism - clown fish and sea anemone