Ecology

Study of interaction between living organisms (Biotic components)

and its environment (abiotic factors)

levels of organisation

Biosphere → Largest unit → Hydrosphere ✓
Lithosphere ✓
Atmosphere ✓

↑
Biome ✓
↑
Landscapes ✓
↑
Ecosystem ✓
↑
Community ✓
↑
Population ✓
↑
Organism

Levels of Organisms in Ecology

Four Main Levels

Biome → Very large area with specific vegetation (flora) and wildlife (fauna)

↑

Community → Group of different populations

↑

Population → Group of individuals of same species

↑

Organism → Basic unit in Ecology

└→ Represents single individual

Organism

↓

Single individual

↓

Ecology at organism level is PHYSIOLOGICAL Ecology

↓

How an organism functions
to survive in it's environment.

Population

- It is a group of members of same species.
- Population Ecology → Help to understand Genetics and evolution

↓

Many forces work on population like Natural Selection

Population Attributes

Many factors which can be explained only at Population level and not at organisms level.

Population Attributes :

- Birth Rate
- Death Rate
- Age of population - Age pyramids
- Population density

Birth Rate

Number of Births per capita individuals in a population over a period of time.

$$\text{Birth Rate} = \frac{\Delta N}{N \Delta T}$$

ΔN = Final Population − Initial population.

N = Initial Population Size

T = Time

Ques: In a Pond Population increases to 28 from 20 in a year. Calculate Birth rate?

Ans: Last year = 20 (Initial Population)

Final population = (28)

$\Delta N = 28 - 20$

$= (8)$

$$\text{Birth Rate} = \frac{8}{20}$$

$$= 0.4$$

Conclusion:

Every lotus plant added 0.4 new individuals in the Population.

Death Rate

Number of deaths per capita per unit time in a population.

$$\text{Death Rate} = \frac{\Delta N}{N \Delta T}$$

Ques: In a lab, 4 fruit flies die in a week out of 40 fruit flies? Calculate death rate?

Ans: $\Delta N = 4$

$$\text{Death rate} = \frac{4}{40 \times 1}$$

$$= 0.1$$

Conclusion:

0.1 individuals die per capita in a population.

Sex Ratio

Number of females over males in a population of 1000 individuals.

Population = 600 males
400 females

600 : 400

6 : 4

Age Pyramids → Graphical Representation

Predict the age of population.

Types of Individuals

Pre-reproductive Individuals

Children → who haven't reached age of puberty

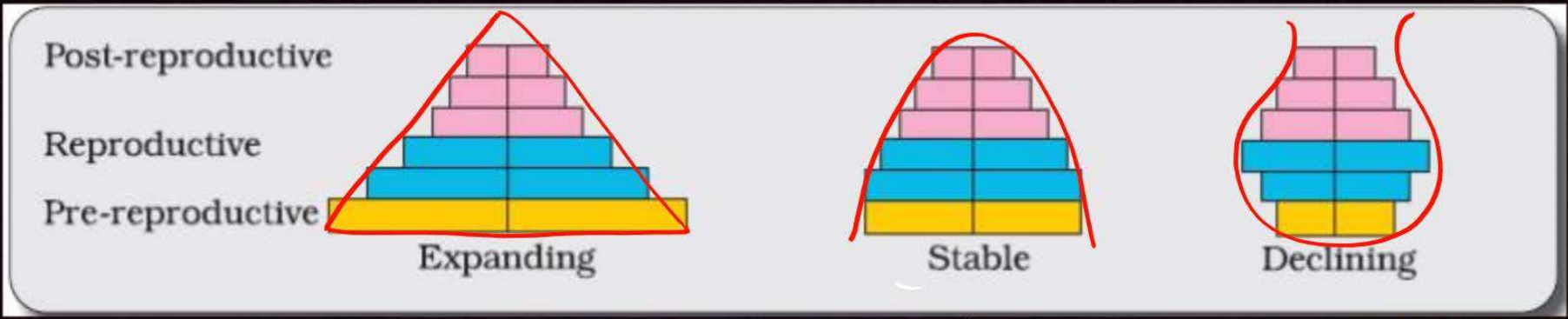
Reproductive individuals

Youth → Attained puberty and can reproduce.

Post-reproductive Individuals

Old individuals → which cannot reproduce.

Age Pyramids



Triangular age pyramid

Expanding population

* Pre-reproductive individuals are "maximum"

Bell-shaped pyramid

Stable population

Pre-reproductive individuals are slightly more than Reproductive individuals

Urn-shaped pyramid

Declining population

Pre-reproductive individuals are lesser than Reproductive individuals

Triangular pyramid → Positive growth in population

Bell shaped pyramid → Zero growth in population

Urn-shaped pyramid → Negative growth in population.

Population Density

Number of individuals per unit area.

Tell us about various ecological process like competition and resources etc.

Four ways to measure population density:

1. Total number
2. Biomass cover
3. Relative density
4. Indirect count

(a) Total number

Actual count of individuals in an area

- [Most accurate method]
- Not always possible

(b) Relative density

- In a case of fishes in pond or chlymydomonas in pond. → unicellular green algae.
- Give average value of fish population or the basis of fishes per trap.

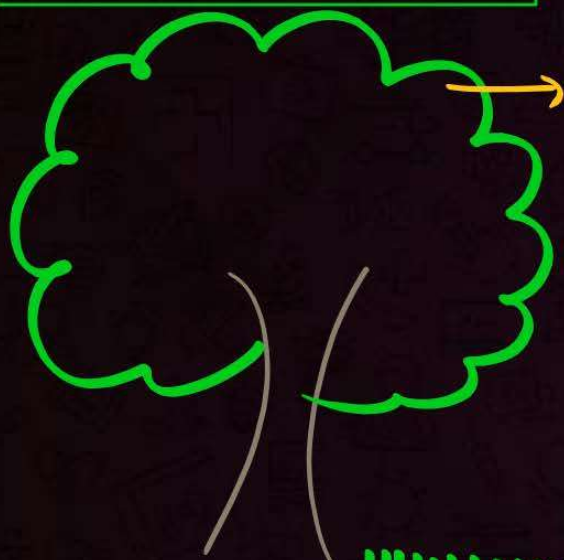
(c) Indirect count

Exp: Calculating tiger population

by **pugmarks**

by Faecal pellet

Biomass cover



① Banyan Tree

200 Parthenium grass (Carrot grass)

Population density of Banyan Tree is "More"

Biomass → Organic matter present in an organism.

Biomass of Banyan Tree >>> Biomass of Parthenium grass

Population Growth

Controlled by **4 factors**

Natality

- Number of Births in an area
- Tend to increase population growth

Mortality

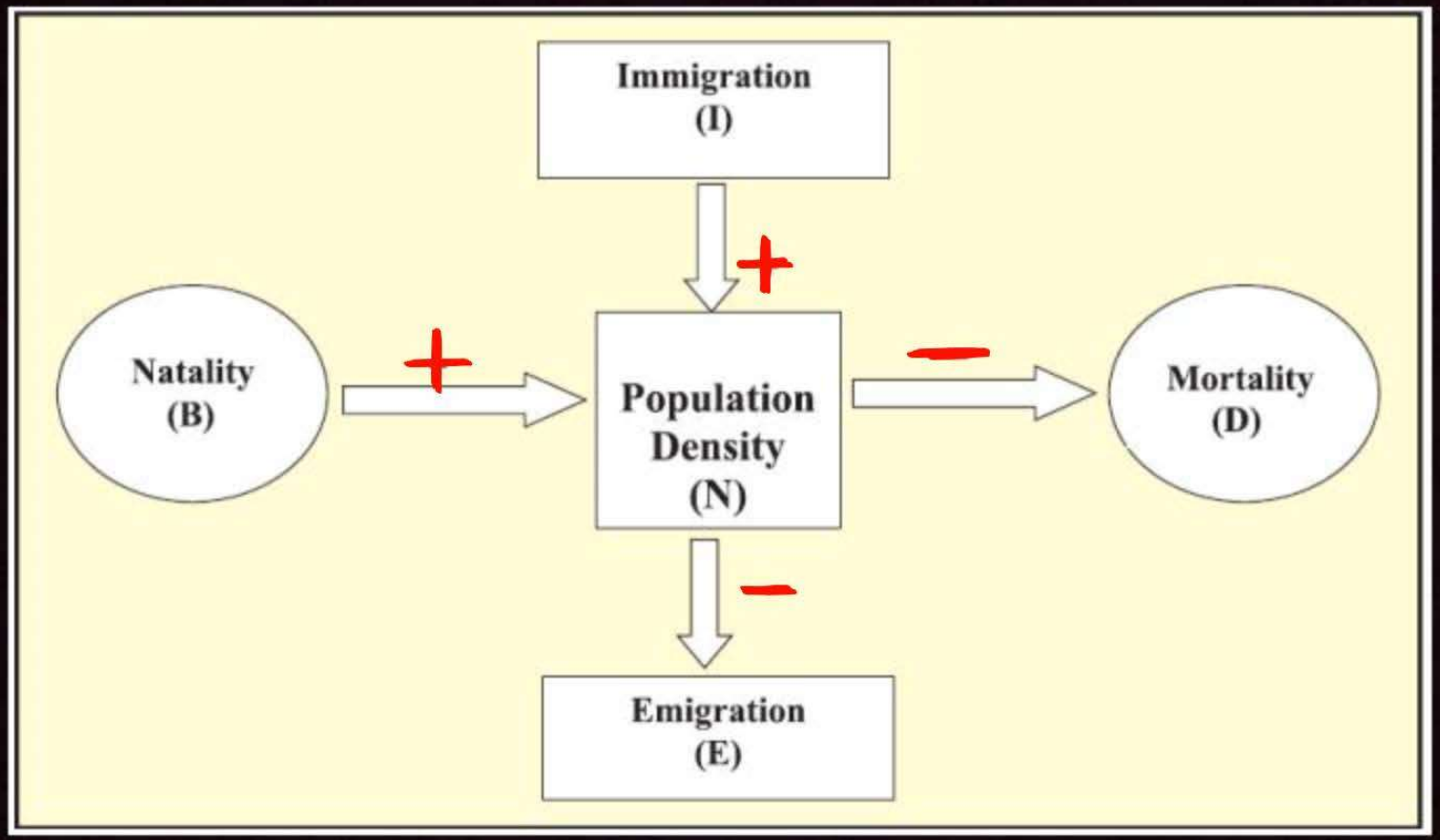
- Number of Deaths in an area
- Tend to decrease population growth

Immigration (Entry)

- Number of migrants entering into a population
- Tend to increase the population growth.

Emigration (Exit)

- Number of migrants going out of population
- .
- Tend to decrease the population growth


Immigration
(I)
+
Natality
(B)
+
Population
Density
(N)
−
Mortality
(D)
−
Emigration
(E)

Equation

Population Growth:

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

- N_{t+1}: Population size at time (t+1) (current)
- N_t: Initial Population density/size
- B: Natality
- I: Immigration
- D: Mortality
- E: Emigration

Cases:

(a) B + I > D + E → Population growth → Positive

(b) B + I = D + E → Population growth → 0 (Population size stable)

(c) B + I < D + E → Population growth → Negative

In normal Conditions

Natality & Mortality

are the most important factors to control population growth

In newly colonized area

Immigration

is the most important factors

Growth Model

Terminology

(a) r - value → The intrinsic rate of natural increase.

→ Reproductive fitness | Darwinian fitness | Biotic potential

→ Every organism wants to achieve high r-value

Growth Model

(b) Carrying capacity (K)

Every Ecosystem can support a limited number of individuals & can provide resources. This limit of Ecosystem is Carrying Capacity.

Ques: Suppose Ecosystem, K = 100 PYQ

[N = Population size of ecosystem]

- N = 70 — Population growth = Positive
- N = 100 — Population growth = 0
- N = 140 — Population growth = Negative

Growth Model

(c) Environmental Resistance

Sum total of all the factors, which together limits the population size

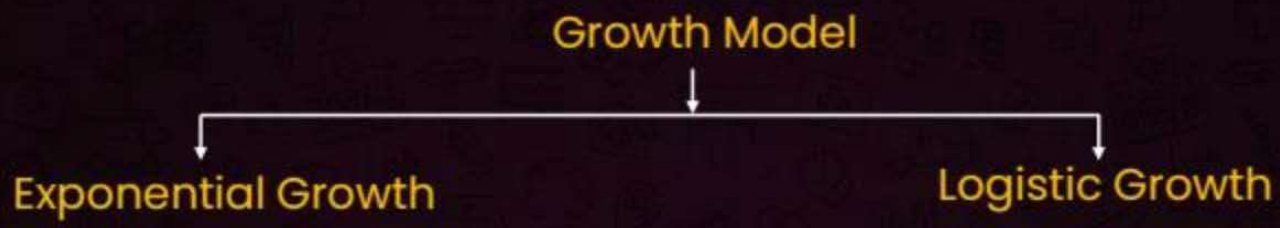
Factors:

a) Competition
b) Parasitism
c) Predation
d) Limited resources

Environmental Resistance $= \frac{K-N}{K}$

or

$= 1 - \frac{N}{K}$


Growth Model
Exponential Growth
Logistic Growth

Exponential Growth

- Seen under conditions of "Unlimited" resources.
- Examples (a) Moquito Population in Rainy season.
  (b) "ALGAL BLOOM" → uncontrolled increase in Population of Algae in Polluted water.
- Population size increases exponentially.

Equation

Differential form

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

N = Population size

"r-value"

Integral form

$$N_t = N_0 e^{rt}$$

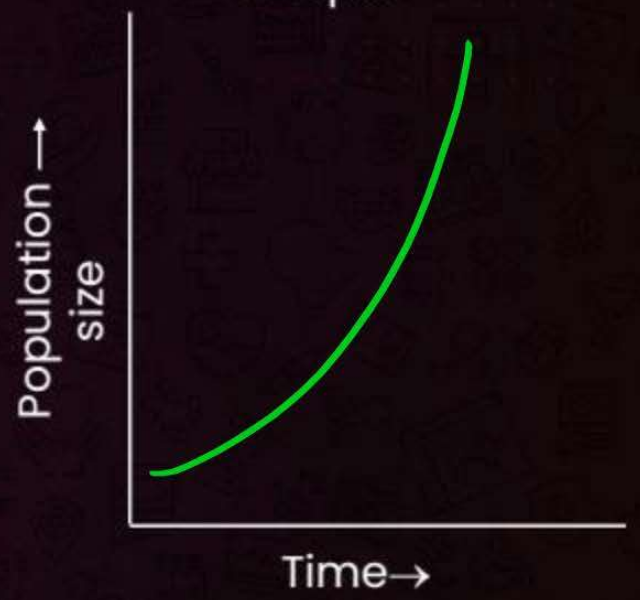
$$r = b - d$$

b = birth rate

d = death rate

$$\frac{dN}{dt} = (b-d)N$$

Graph



J-shaped curve

Logistic Growth

- Seen under condition of Limited resources
- Is the more realistic growth curve
- Most common in nature

Ex- Growth of Bacteria in Culture medium in Lab.

Equation

Differential form

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

"Environmental resistance"

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

Integral form

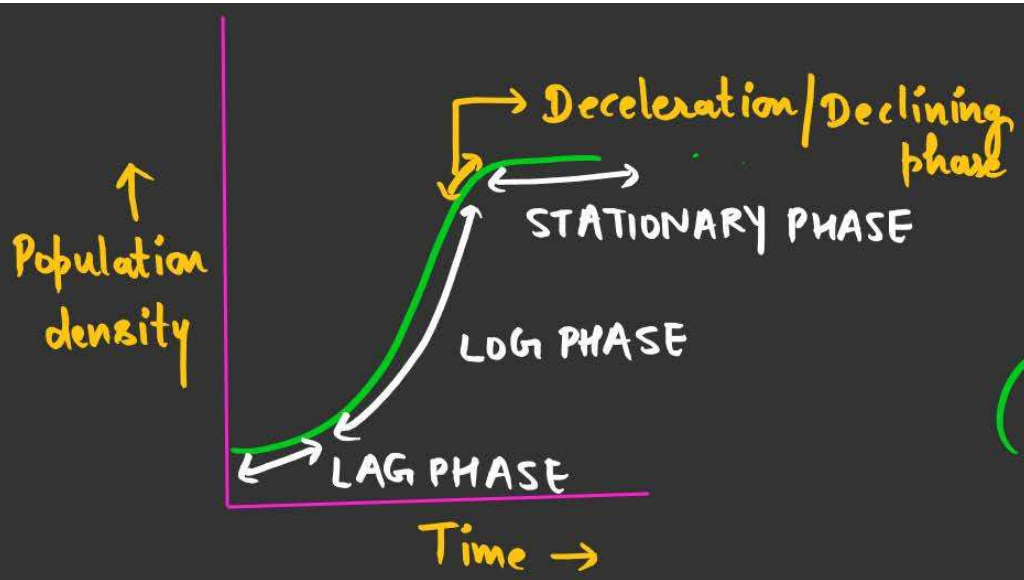
$$N_t = N_0 e^{rt}\left(\frac{K-N}{K}\right)$$

OR

$$N_t = N_0 e^{rt}\left(1-\frac{N}{K}\right)$$

$$N_t = N_0 e^{rt\left(\frac{K-N}{K}\right)}$$

$$N_t = N_0 e^{rt\left(1-\frac{N}{K}\right)}$$



Sigmoid curve | S-shaped Curve

LAG-Phase

Initial slow growth

LOG-Phase

Acceleration | Exponential phase

(Growth → Fast)

Decleration phase → Resources about to end

Stationary phase | Asymptote

↓ Resources → Used

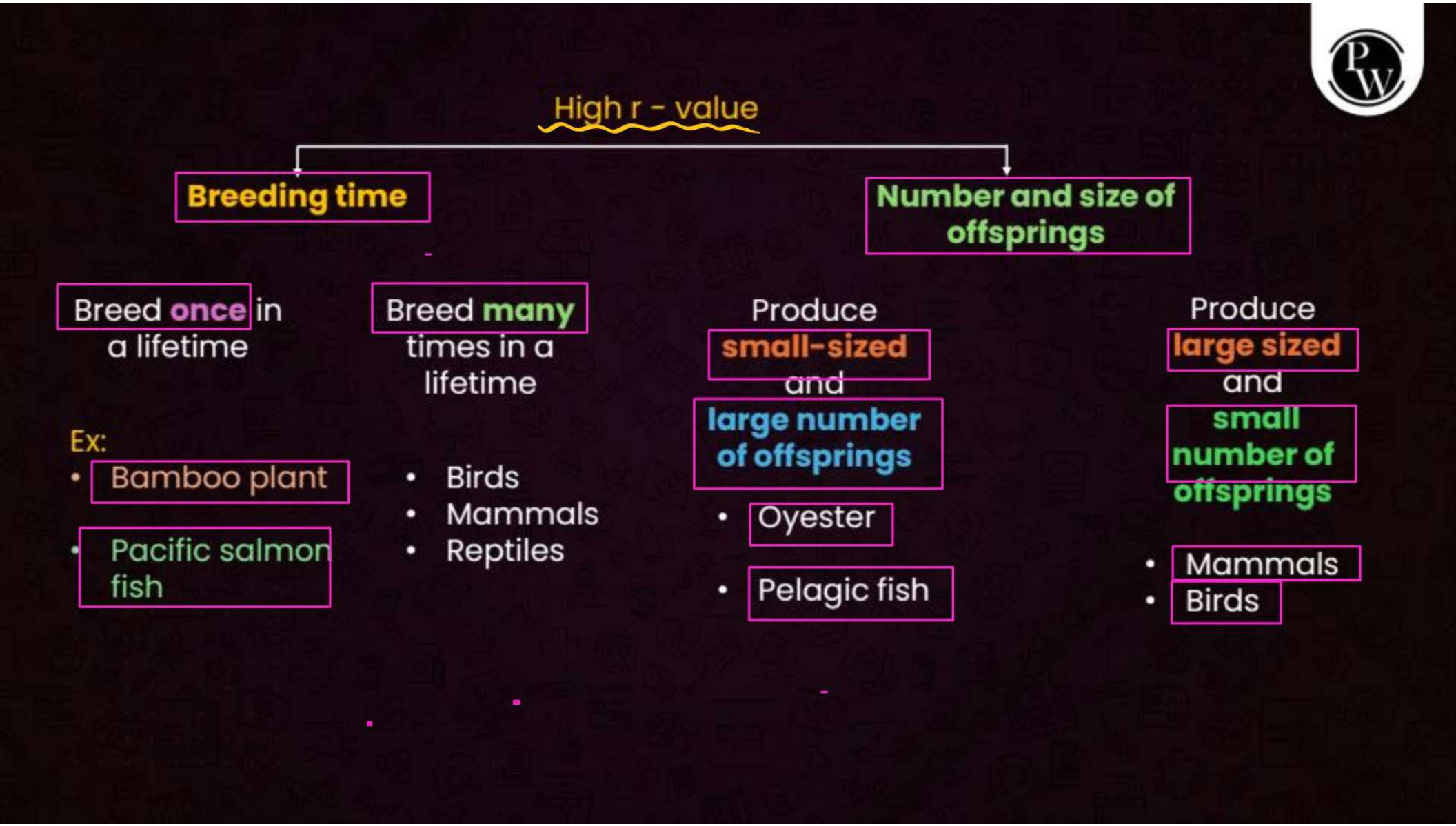
Growth → 0

Population size → Constant

To give you some idea about the magnitude of r values, for the "Norway rat" the r is "0.015," and for the "flour beetle" it is "0.12." In 1981, the r value for human population in India was "0.0205." *Find out what the current r value is. For calculating it, you need to know the birth rates and death rates.*

Life History Variation

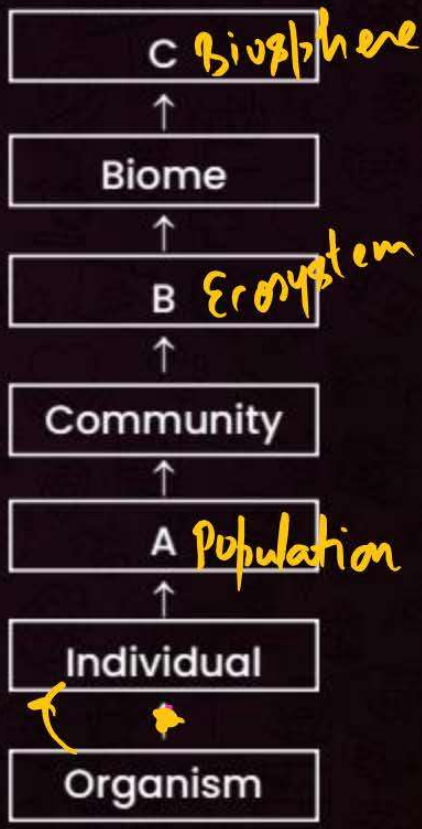
Every population and organisms has different strategies to maximize reproductive fitness (high r - value)


High r - value
Breeding time
Number and size of offsprings
Breed once in a lifetime
Ex:
Bamboo plant
Pacific salmon fish
Breed many times in a lifetime
Birds
Mammals
Reptiles
Produce small-sized and large number of offsprings
Oyester
Pelagic fish
Produce large sized and small number of offsprings
Mammals
Birds

QUESTION

Identify A, B and C in the ecological hierarchy.

	A	B	C
A	Population	Biosphere	Landscape
B	Ecosystem	Population	Ecosphere
C	Population	Ecosystem	Biosphere
D	Ecosphere	Population	Ecosystem



QUESTION

Which of the following is not possessed by an individual organism but by a population?

(A) Birth rate and death rate

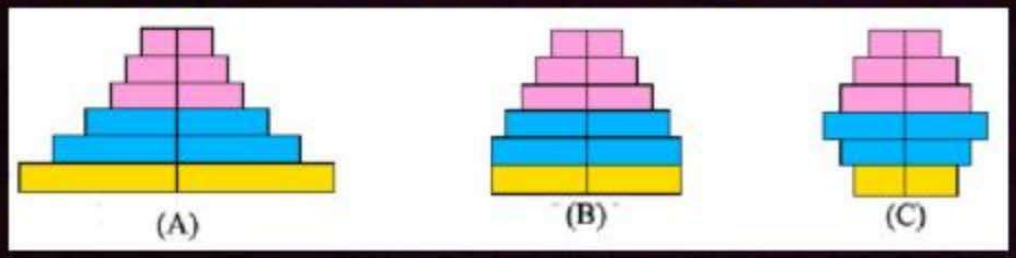
(B) Sex ratio

(C) Both (A) and (B)

(D) Birth and death

QUESTION

Study the age pyramid shown below and choose the correct option?



	A	B	C
A	Triangular pyramid	Urn-shaped pyramid	Bell shaped pyramid
B	Expanding population	Pyramid showing negative growth	Bell shaped pyramid
C	Expanding population	Bell-shaped pyramid	Pyramid showing negative growth
D	Bell shaped pyramid	Triangular pyramid	Urn-shaped pyramid

QUESTION

The integral form of exponential growth equation is

A $N_t = N_0 e^{rt}$

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

C $N_0 = N_0 + e^{rt}$

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

Population Interactions

Table 11.1 : Population Interactions

Species A	Species B	Name of Interaction
+	+	*Mutualism*
−	−	*Competition*
+ (Predator)	− (Prey)	*Predation*
+ (Parasite)	− (Host)	*Parasitism*
+ (commensal)	0	*Commensalism*
−	0 (Ammensal)	*Amensalism*

Competition (–, –)

Fight for use of resources

Competition

Intraspecific

- Competition between members of Same species

Interspecific

- Competition between members of Different species

Note : "Intraspecific" competition is more severe than Interspecific competition

Darwin - Survival of the fittest (Natural selection)

- "Interspecific" competition is more potent (important) for Evolution

"θ"

Forms of Competition

- Competitive Exclusion
- Competitive Co-existence

Competitive Exclusion

Principle / concept was given by **Gausse**

Concept : Two closely related species in an area

One is _Superior

other is _Inferior

with time, the superior species excludes/eliminates inferior species from that area.

Galapagos Island

"Abingdon Tortoise"
(Herbivore)

(Inferior species)

GOAT (Herbivore)

Eliminates Tortoise

superior species

(Grazing capacity better than Tortoise).

Barnacle → Arthropods (Inverterbrates)
on rocky island of Scotland

BALANUS (superior Barnacle)

↳ eliminates cathamalus

CATHAMALUS (Inferior Barnacle)

Competition Co-existence

Or

Resource partitioning

→ Given by Mac Arthur

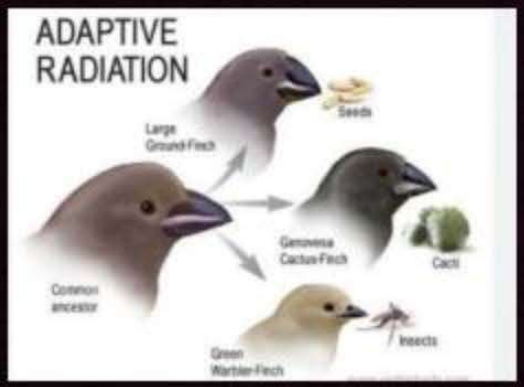
- **Two-closely related species** can **co-exist** by distributing their resources and by changing their **foraging pattern** and **usage of resources.**

Examples → Co-existence

(1) Galapagos island

Co-existence of

14 Darwin finches → Birds



(2) Warblers (Birds)

Five closely related species of warblers were co-existing

Competition occurs between

"two-closely related species"

Note : **Competition can be seen between**

totally unrelated species

Exp:

In **south America Lake**

Competition Release

If superior species is removed experimentally from an area, then inferior species grows well

This is competition release.

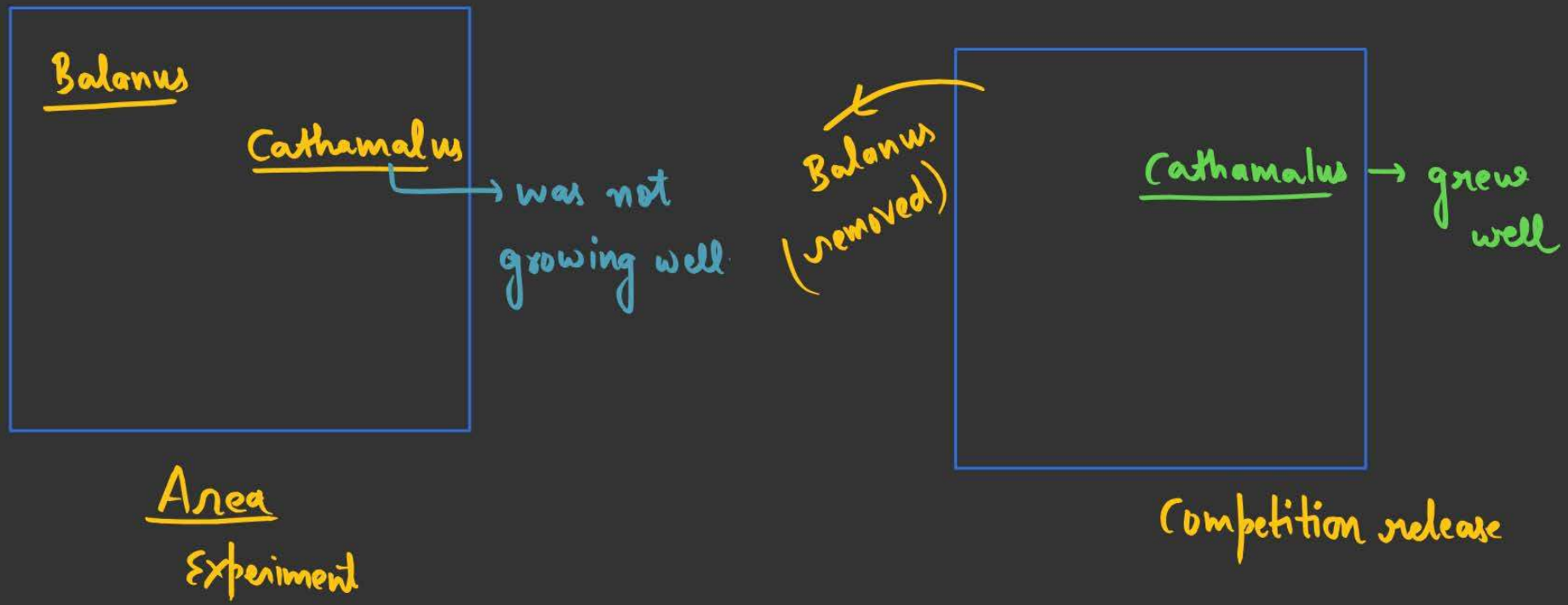
Given by

Connell Elegant

Experiment → Connel's Elegant Field Experiment.

"Provides evidence for Competition"

(Naturally evidence of competition is not found easily).


Balanus
Cathamalus
was not growing well
Area Experiment
Balanus (removed)
Cathamalus
grew well
Competition release

Do competition occurs only in conditions of Limited resources? → No

Or

Can also occur under condition of Unlimited resources? → Yes

Interference Competition

↓

Dominant species

Inhibits the feeding efficiency of other species.

even in the conditions of unlimited resources.

Imp

Summarise : Competition

(a) Can occur under limited resources and unlimited resources

(b) Can occur between closely related species and Totally unrelated species

(c) Exist in 2 forms

Exclusion

Co-existence

Note: Plants are most affected by competition

Reason: Plants cannot move.

Therefore, competition is best defined as a process in which the fitness of one species (measured in terms of its 'r' the intrinsic rate of increase) is significantly lower in the presence of another species.

Commensalism

⊕

Commensal
(Organism who is benefitted)

O
(organisms is neither benefitted nor harmed)

	⊕ Commensal		O (Mango)
1.	Orchid	and	Mango
2.	Cattle egrets	and	Cattle
3.	Clown fish	and	Sea anemone
4.	Barnacle	and	Whale

Monocots

Orchid and Mango

Orchid (Angiosperm)

(Epiphyte)

(space parasite)

Present on mango plant just for support and space.

Cattle egrets and Cattle

Cattle egrets (Birds) when cattle's move in grass, that removes insect from grass and egrets feed on them.

Sea anemone and clown fish

Barnacles on Whales

Clown fish

Because of sea anemone

Predators stay away from clown fish

Ammensalism

Organism who is harmed (−)

Ammensal organism in whose presence other organism is harmed (0)

- Allelopathy
  - Plants
    - Black walnut (0)
    - Apple Plant (−)
- Antibiosis → Against life
  - * Penicillium (Fungi) (0) (Penicillin) (Antibiotic)
    - Bacteria (−)
  - * Streptomyces (Bacteria) (0) (Antibiotics)
    - Other Bacteria (−)

QUESTION

Connell conducted experiments on the rocky coast of Scotland on barnacles to prove:

A. Resource portioning

B. Competitive exclusion

C. Competitive release

D. All of these

QUESTION

The principle of competitive exclusion states that

(A) Two species that have exactly the same niche cannot coexist in community

(B) Two species will stop reproducing until one species leaves the habitat

(C) Competition in a population promotes survival

(D) Two species cannot coexist in the same habitat

QUESTION

The interaction between clown fish and sea-anemone is a type of

A Commensalism

B Protocoperation

C Mutualism

D Amensalism

QUESTION

J-shape growth can be observed for

A. Algal bloom

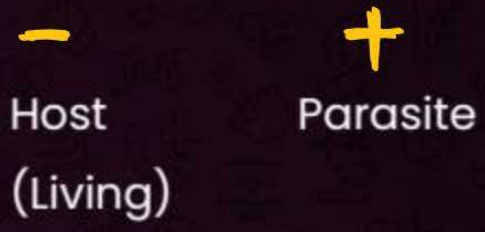
B. Insect population

C. Both (A) and (B)

D. All plant species

Parasitism

- Parasite Derive nourishment from Living Host.
- Parasitism has been evolved in all taxonomic groups.



Adaptations in Parasites:

(a) Loss of digestive system

(b) Loss of unnecessary sensory organs.

(c) Development of adhesive organs and sucking organs.

(d) High reproductive capacity (high r-value)

(e) Complex-life cycle Some of them has 2 hosts

Liver fluke – Fish

Snail

Impact on Host

(a) Makes host physically weak

- Reduced growth rate
- Reduced Reproductive rate

(b) Reduces the survival rate and population density of Hosts.

Note : An ideal parasite does not kill it's Host.

Cuscuta
(Parasitic plant)
(Amarbel)

Types of Parasitism

Ectoparasitism

Parasite present on surface

- Lices
- Ticks
- Termites

Endoparasitism

Present inside organism.

- Viruses
- Bacteria
- Fungi

Brood Parasitism

In Cuckoo Bird

lay it's eggs in "Crow's Nest"

Predation

Predators		Prey
Tiger	→	Deer
Sparrow	→	Seed
Herbivores	→	Plant

− (Prey)

+ (Predators)

Importance of Predators

(1) Predators → Maintain Prey population (Keep a check on prey population)

Ex → **In Australia (In 1920s)**

Prickly pear Cactus
(Problematic Weed)

Introduction of **Prickly pear moth** (Natural Predators of Prickly Pear Cactus)
controls the population of Cactus.

Importance of Predators

(2) Predators → maintain Species diversity in a community / Ecosystem

and maintain Ecological balance.

Examples :

Pisaster fish
(Natural Predator) in **American pacific coast.**

When it was removed experimentally.
Effect : **10 invertebrate species** were **extinct**.

Importance of Predators

(3) Responsible for **Energy flow** across different trophic levels
or
Energy transfer.

(4) **Predators**

↓

Are Prudent

- Predators do not over exploit their prey.

Defensive mechanisms in Prey.

1. **Camouflage** (Grasshopper → Praying Mantis)
2. Chemical defense Insects Monarch Butterfly (Produces distasteful toxic chemical)
3. Mimicry

Plants → Most affected by Predator

* Calotropis

Chemical → Cardiac Glycosides

Harm to Grazing animals

* Cactus

Opuntia Euphorbia

Have spines

Plants → Secrete → defensive chemical

- Nicotine
- Caffeine
- Strychinine
- Quinine
- Opium

Mutualism

+, + Symbiotic Association

① Lichen (Algae + Fungi)

- Phycobiont (photosynthesis)
- Mycobiont → Absorptⁿ of H_2O & minerals. → Reproduction.

② Mycorrhiza (Fungi + Roots of Higher Plants)

③ Animal-Plant Relationship

- Zoochory: Animals responsible seed dispersal.
- Zoophilly: Animals helps in Pollination.

Co-evolution

Ophrys (Orchid)

Sexual deceit / Pseudocopulation

Bee (Colpa)

Flower has resemblance with the female bee.

Organism and it's Environment

Abiotic factors
(Non-living factors)

- Water
- Soil
- Temperature
- Light

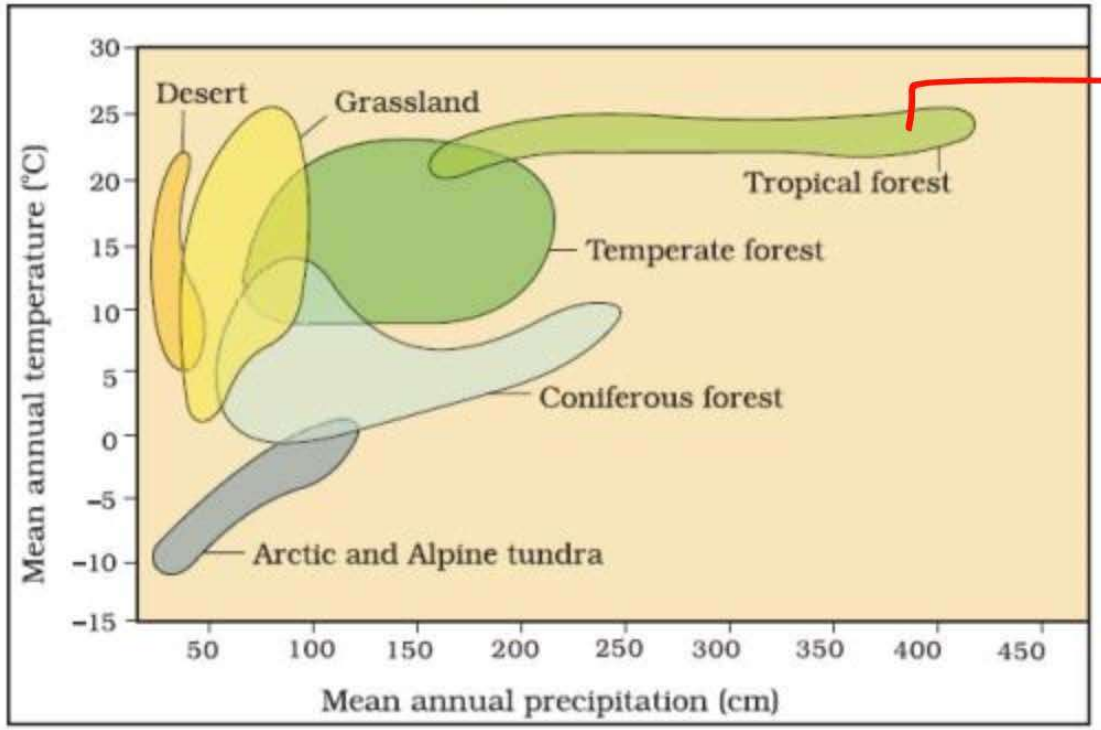


Figure 13.1 Biome distribution with respect to annual temperature and precipitation

Most productive

Maximum species diversity.

Regional and local variations within each biome lead to the formation of a wide variety of habitats. Major biomes of India are shown in Figure 13.2. On planet Earth, life exists not just in a few favourable habitats but even in extreme and harsh habitats – scorching Rajasthan desert, rain-soaked Meghalaya forests, deep ocean trenches, torrential streams, permafrost (snow laden) polar regions, high mountain tops, thermal springs, and stinking compost pits, to name a few. Even our intestine is a unique habitat for hundreds of species of microbes.

(a)

(b)

(c)

(d)

Figure 13.2 Major biomes of India : (a) Tropical rain forest; (b) Deciduous forest; (c) Desert; (d) Sea coast

What are the key elements that lead to so much variation in the physical and chemical conditions of different habitats? The most important ones are temperature, water, light and soil. We must remember that the physico-chemical (abiotic) components alone do not characterise the habitat of an organism completely; the habitat includes biotic components also – pathogens, parasites, predators and competitors – of the organism with which they interact constantly. We assume that over a period of time, the organism had through natural selection, evolved adaptations to optimise its survival and reproduction in its habitat.

Habitat

Place where a species not only interact with it's physical environments.
but also interacts with other Biotic components

- Pathogens
- Parasites
- Competitors
- Predators

Abiotic Components

13.1.1 Major Abiotic Factors

Temperature: Temperature is the most important ecologically relevant environmental factor. You are aware that the average temperature on land varies seasonally, decreases progressively from the equator towards the poles and from plains to the mountain tops. It ranges from subzero levels in polar areas and high altitudes to >50°C in tropical deserts in summer. There are, however, unique habitats such as thermal springs and deep-sea hydrothermal vents where average temperatures exceed 100° C. It is general knowledge that mango trees do not and cannot grow

Temperature Controls the activity of enzymes.

in temperate countries like Canada and Germany, snow leopards are not found in Kerala forests and tuna fish are rarely caught beyond tropical latitudes in the ocean. You can appreciate the significance of temperature to living organisms when you realise that it affects the kinetics of enzymes and through it the metabolic activity and other physiological functions of the organism. A few organisms can tolerate and thrive in a wide range of temperatures (they are called *eurythermal*), but, a vast majority of them are restricted to a narrow range of temperatures (such organisms are called *stenothermal*). The levels of thermal tolerance of different species determine to a large extent their geographical distribution. *Can you think of a few eurythermal and stenothermal animals and plants?*

In recent years, there has been a growing concern about the gradually increasing average global temperatures (Chapter 16). *If this trend continues, would you expect the distributional range of some species to be affected?*

Stenothermal

Tolerate _Narrow_ range of temperature

Exp :
- Reptiles
- Plants
- Amphibians
- Fishes

Eurythermal

Tolerate _wide_ range temperature

Exp :
- Mammals
- Birds

Due to increase in global temperature species will shifted.

Tropical species will be shifted to _____ Temperate areas area

Temperate species will be shifted to _____ Polar areas areas

Water: Water is another the most important factor influencing the life of organisms. In fact, life on earth originated in water and is unsustainable without water. Its availability is so limited in deserts that only special adaptations make it possible for organisms to live there. The productivity and distribution of plants is also heavily dependent on water. You might think that organisms living in oceans, lakes and rivers should not face any water-related problems, but it is not true. For aquatic organisms the quality (chemical composition, pH) of water becomes important. The salt concentration (measured as salinity in parts per thousand), is less than 5 in inland waters, 30-35 in the sea and > 100 in some hypersaline lagoons. Some organisms are tolerant of a wide range of salinities (euryhaline) but others are restricted to a narrow range (stenohaline). Many freshwater animals cannot live for long in sea water and vice versa because of the osmotic problems, they would face.

Salt Concentration

In ppt (parts per thousand)

(a) Inland water → less than 5 ppt

(b) Sea water → 30-35 ppt

(c) Hypersaline lagoons → More than 100 ppt

Stenohaline

↓

Tolerate narrow range of salinity

Exp : **Sharks**

Euryhaline

↓

Tolerate wide range of salinity

Exp : **Salmon fish**

Light: Since plants produce food through photosynthesis, a process which is only possible when sunlight is available as a source of energy, we can quickly understand the importance of light for living organisms, particularly autotrophs. Many species of small plants (herbs and shrubs) growing in forests are adapted to photosynthesise optimally under very low light conditions because they are constantly overshadowed by tall, canopied trees. Many plants are also dependent on sunlight to meet their photoperiodic requirement for flowering. For many animals too, light is important in that they use the diurnal and seasonal variations in light intensity and duration (photoperiod) as cues for timing their foraging, reproductive and migratory activities. The availability of light on land is closely linked with that of temperature since the sun is the source for both. But, deep (>500m) in the oceans, the environment is dark and its inhabitants are not aware of the existence of a celestial source of energy called Sun. *What, then is their source of energy?*. The spectral quality of solar radiation is also important for life. The UV component of the spectrum is harmful to many organisms while not all the colour components of the visible spectrum are available for marine plants living at different depths of the ocean. *Among the red, green and brown algae that inhabit the sea, which is likely to be found in the deepest waters? Why?*

Sunlight

↓

Prime source of energy

Plants

Sciophytes

Adapted to low light conditions

Exp: Herbs and shrubs growing under large trees.

Heliophytes

Need more light to grow.
Trees
Banyan
Peepal
Mango

Plants

Photosynthesis

* Photoperiod (Duration of light)

Affect Flowering in Plants

Animals

↓

Photoperiod

↓

Diurnal Animals

- Reproduction (Breeding)
- Migration
- Foraging

Organisms

↓

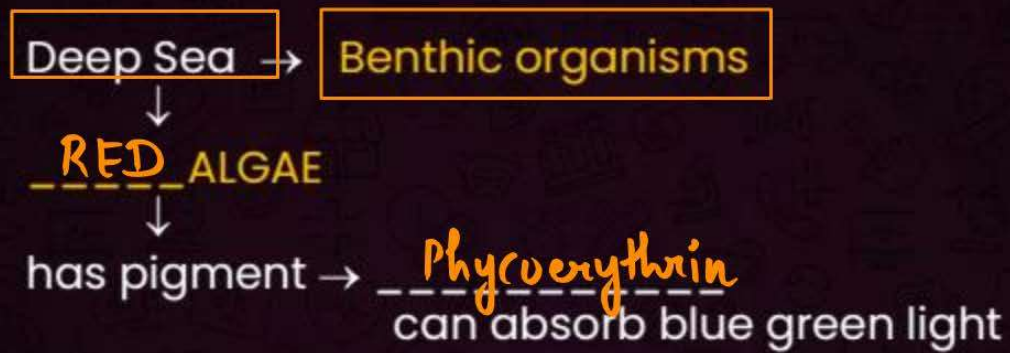
In Deep sea
(more than 500 m depth)

Source of energy → Not Sun

↳ "Heterotrophic organisms"
(Decomposers)

↓

Derive nourishment from other organisms


Deep Sea → Benthic organisms
RED ALGAE
has pigment → Phycoerythrin
can absorb blue green light

Soil: The nature and properties of soil in different places vary; it is dependent on the climate, the weathering process, whether soil is transported or sedimentary and how soil development occurred. Various characteristics of the soil such as soil composition, grain size and aggregation determine the percolation and water holding capacity of the soils. These characteristics along with parameters such as pH, mineral composition and topography determine to a large extent the vegetation in any area. This in turn dictates the type of animals that can be supported. Similarly, in the aquatic environment, the sediment-characteristics often determine the type of benthic animals that can thrive there.

Response to Abiotic Factors

↓

How living organisms give response to abiotic factors.

- Regulate
- Conform
- Migrate
- Suspend

Regulate

- Organisms which do not change their internal environment according to external environment, they regulate and are called as Regulators.

Exp :

- All mammals
- Birds
- Few lower vertebrates and invertebrates

How Regulators Regulate ?

Ans : Show "Homeostasis"

↓

"Energy-expensive"

Conform

- organisms which change their internal environment according to external environment, they conform and are called as CONFORMERS

Exp:

- All plants
- Animals except Birds and Mammals (99% animals)
- Homeostasis Absent

Partial Regulators

upto a limit, they regulate but after that they simply confirm.

Exp :

- Shrews ✓
- Squirrels ✓

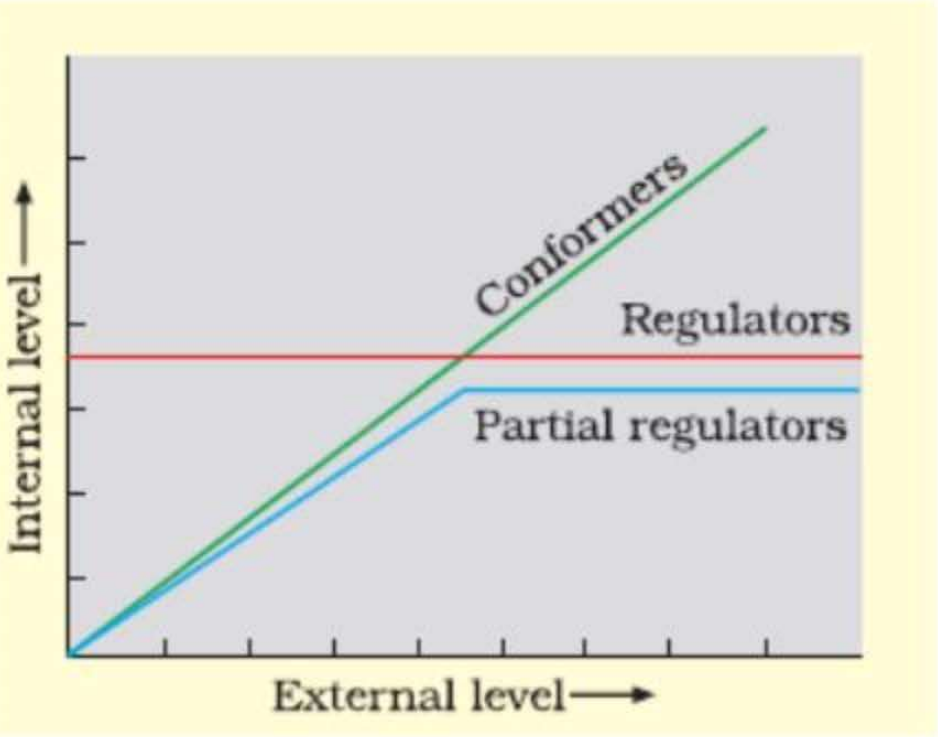


Figure 13.3 Diagrammatic representation of organismic response

Migration

To escape the stressful habitat temporarily.

Exp: Migration of Siberian Crane (from Siberia)
to
Keolado National Park in Rajasthan

Suspension

To change physiology, biochemical behavior to pass through unfavorable conditions called as Suspension.

Formation of Resistant spores

- Bacteria
- Fungi
- Algae

Plants → **Seed**

Show **Dormancy**

Hibernation (winter sleep)

- Bear

Aestivation (Summer sleep)

- Snails
- Fishes

Diapause → Shown by **Zooplanktons** (Microscopic aquatic organisms)

Adaptation

Strategy of an organism to cope-up with environment.

Adaptation

- **Genetic**
  - can be fixed genetically and passed onto generations
- **Epigenetic**
  - not fixed genetically and in not passed on.

Adaptation

Types

(a) Morphological
(b) Anatomical
(c) Physiological
(d) Behavioural

(1) Kangaroo-Rat

In deserts

Physiological adaptation

* Internal fat oxidation

Water is produced as by product

Urine Highly concentrated

(2) Desert plants → Cactus Opuntia, Euphorbia)

Morphological

a) Leaf modifies into spines

b) PHYLLOCLADE

Photosynthetic stem

Anatomical

a) Thick cutide on leaf

b) Sunken stomata

c) Scot active stomata

Stomata open during night

Physiological

CAM cycle

Crassulacean Acid Metabolism

Cactus

Kangaroo Rat


Seal

(3) Seal

in Polar area

Anatomical adaptation

A thick layer of fat under skin called as BLUBBER

(4) Altitude sickness

Breathless, nausea etc.

Physiological adaptation

a) Increase RBC production
b) Increased Breathing rate
c) Decreased binding of O_2 with hemoglobin

(5) Lizards

Behaviroural Adaptation

Sun exposure

Goes into shade (high temp)

Shade

Exposed to Sun (low temp.)

(6) Fishes

In Antarctic Areas

Physiological adaptation

Produce Antifreeze Proteins

(7) Archaebacteria

(Cell → wall special)

- Can tolerate 100° C Temp
- Deep sea hydrothermal vent
- Hot sulphur springs

QUESTION

Match the following Columns.

HW

Column-I		Column-II	
A.	Stenothermal	(i)	Shark
B.	Eurythermal	(ii)	Salman
C.	Euryhaline	(iii)	Lizards
D.	Stenohaline	(iv)	Mammals

(A) A-(iii), B-(iv), C-(ii), D-(i)

(B) A-(iii), B-(ii), C-(iv), D-(i)

(C) A-(i), B-(iv), C-(ii), D-(iii)

(D) A-(iii), B-(iv), C-(i), D-(ii)

QUESTION

The salt concentration (measured as salinity in parts per thousand) for hypersaline lagoons is _(A)_ for sea is _(B)_ and for inland water is _C_.

HW

(A) A = < 5, B = > 100, C = 3-35

(B) A = < 5, B = 30-35, C = > 100

(C) A = > 1000, B = 30-35, C = < 50

(D) A = > 100, B = 30-35, C = < 5

QUESTION

How does a kangaroo rat cope with the North America desert environment?

A. Water requirement is met internal oxidation of stored fat

B. It can concentrate its urine

C. Minimum water is used to remove excretory products

D. All of the above

QUESTION

Which of the following is a xerophytic adaptation?

A. Absence of CAM

B. Presence of thin cuticle

C. Sunken stomata present

D. Absence of C_3 cycle