Organism and Population

Ecology

- Branch of science
- Studies(I) the interaction among organisms (ii) between organisms (iii) physical/abiotic environment.
- Concerns with four levels of organisation – organism, populations, communities and biomes.

LEVELS OF ORGANIZATION
(I) Organism

- Every individual of a species is an organism.
- Basic unit of ecology.
- Ecology in this level deals with adaptations for survival and reproduction in their environment or habitat.

(II) Population

- Consists of individuals of same species at a given place.
- Have intraspecific competition for basic needs.

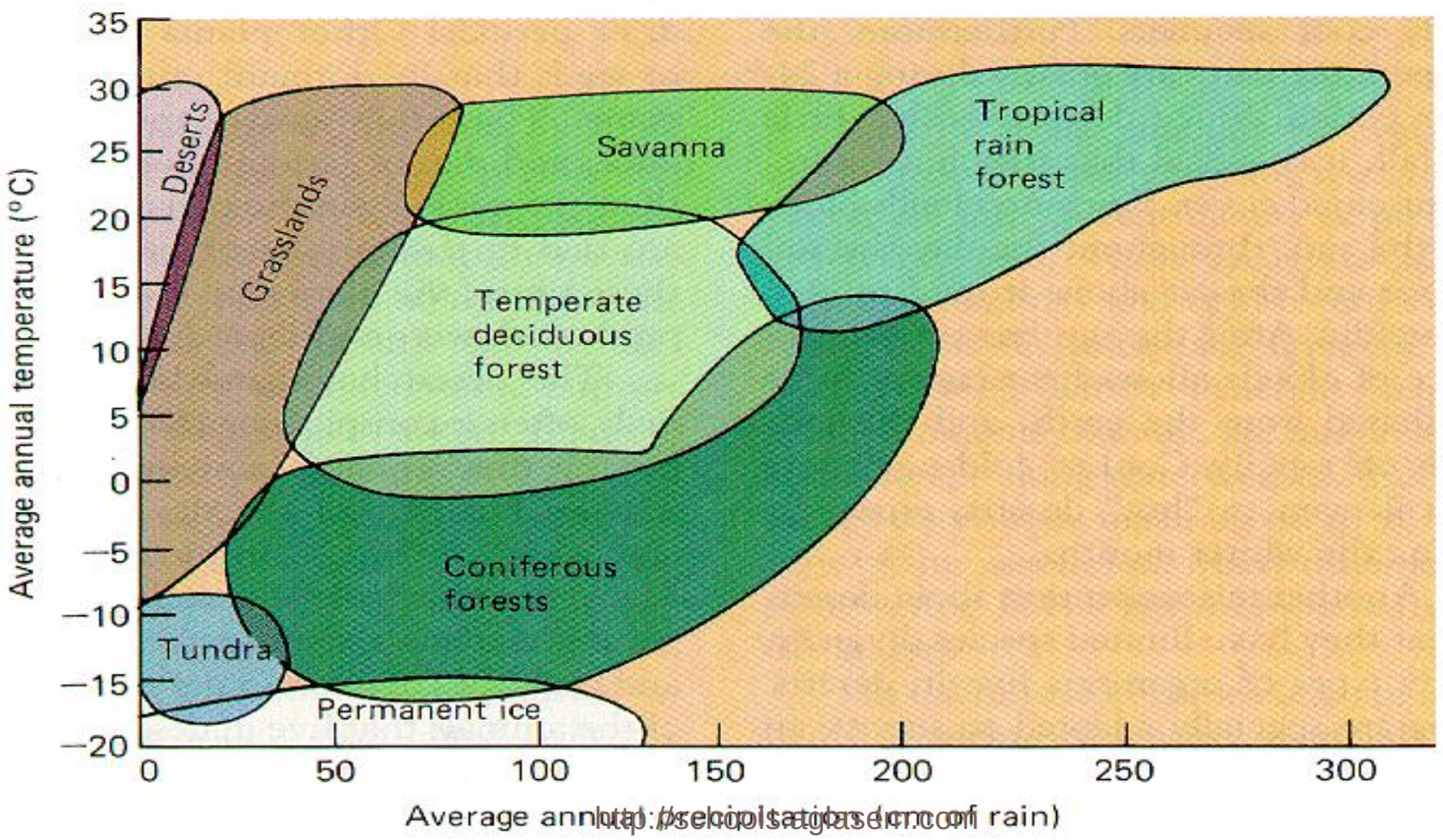
(III) Communities

- Formed by an assemblage of populations of all different species that live in an area and interact among themselves.
- A biotic community has distinct species composition and structure.

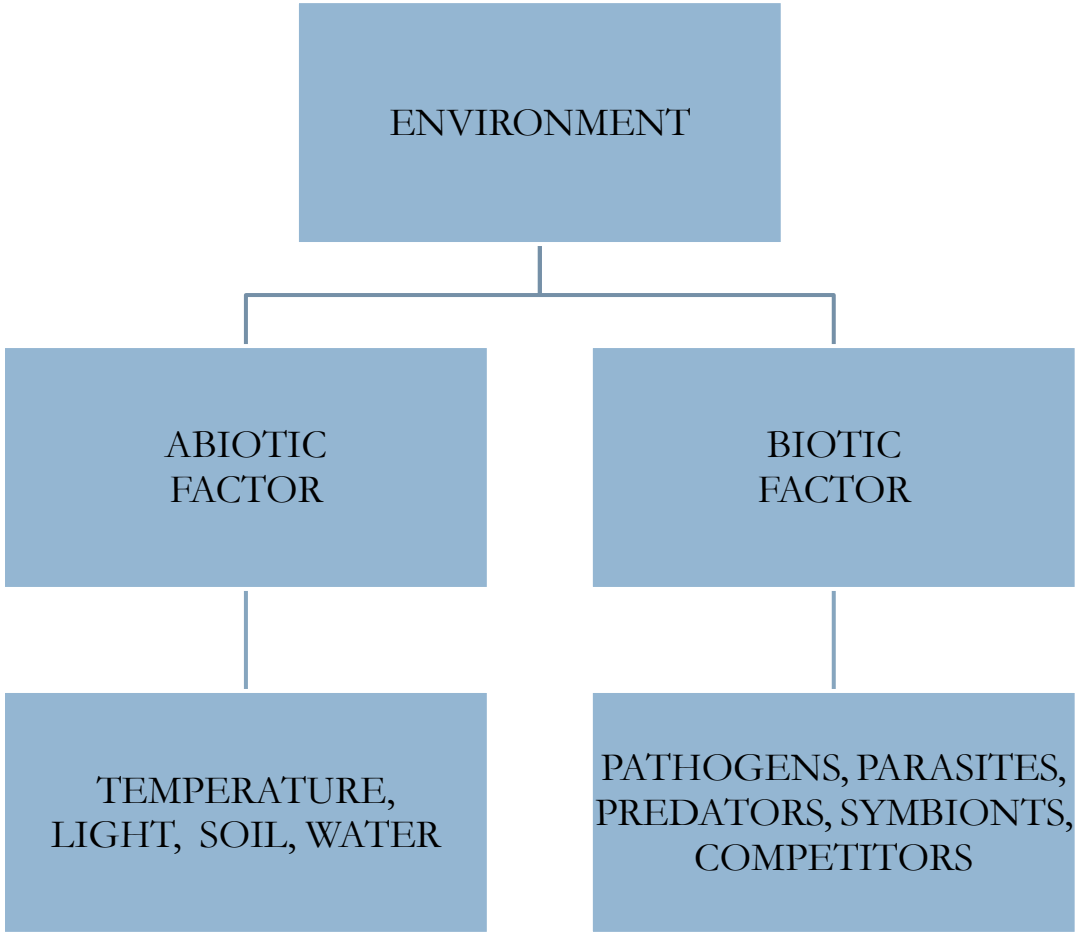
(IV) Biome

- It is a large unit.
- Has major vegetation type and associated fauna in a specific climatic zone.
- Seasonal variation and annual variation in precipitation lead to biome formation.
- E.g. artic and alpine tundra, coniferous forest, temperate forest, grass land, tropical forest and desert.

Biome distribution



Environment



Temperature

- Average temperature varies seasonally.
- Decreases from equator to pole and plains to mountain tops.
- Temp. ranges from sub zero (polar) to $> 50^0$ in tropical forests.
- Function and distribution of organisms depends on temperature.
- Organisms are eurythermal or stenothermal.
- Global warming poses problems to organisms both in survival and distribution.

Water

- Influences life of organism of organism and it cannot sustain without water.
- Productivity and distribution of plants depend on water.
- Quality (pH, Chemical composition, salinity) of water is important for aquatic organisms.
- Organisms may be euryhaline or stenohaline.

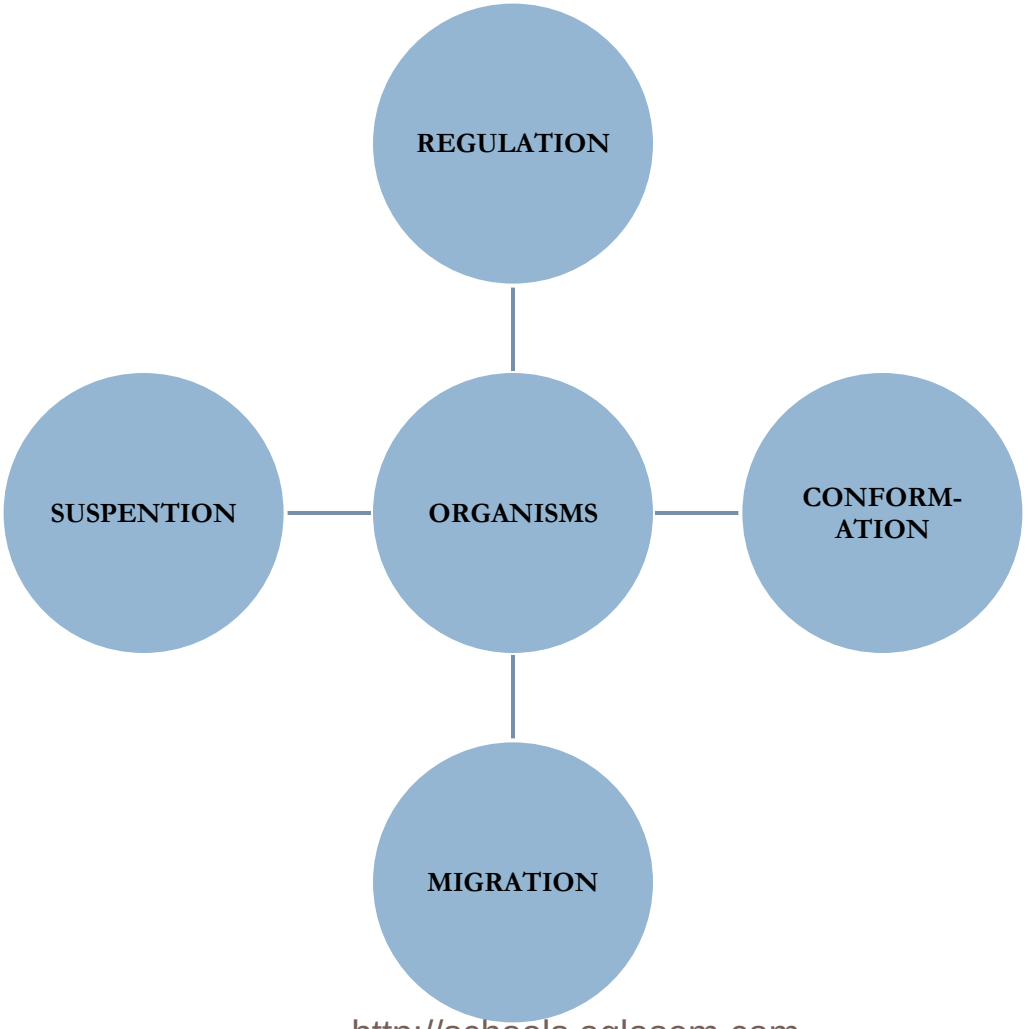
Light

- Photosynthesis and release of oxygen by plants need light
- Sciophytes need very low light intensities for photosynthesis.
- Animals use diurnal and seasonal light intensity variation and photoperiod for timing of forage, migration and reproduction.
- Distribution of red, brown and green algae at different depth depends on light.

Soil

- Nature and properties of soil in a place depends on climate, weathering process, soil types(transported/ sedimentary) and development of soil.
- Soil composition, grain size and aggregation determine percolation and water holding capacity of soil.
- Physical and chemical properties determine type of plants that can be grown and type of animals depend on those plants.
- Bottom sediments in aquatic condition determine the type of benthic animals.

Response to environmental condition



Regulation

- Organisms maintain homeostasis achieved by physiological and/ or behavioral means.
- Have constant body temperature (thermoregulation).
- Constant osmotic concentration (osmoregulation)

Conformation

- Cannot maintain constant internal environment.
- Body temperature changes with the ambient temperature.
- Osmotic concentration of body fluid changes with the ambient concentration of medium.
- Thermoregulation is an energy expensive process, heat loss or gain is a function of surface area of body.

Migration

- Occurs in stressful condition.
- Organisms move away temporarily to another habitat.
- Birds undertake long distance migration.

Suspension

- Organisms suspend their metabolic activities during stressful condition.
- Resume their function at the return of favorable condition.
- E.g. hibernation of frog, certain reptiles, polar bears. Aestivation in snail and fish. Seed dormancy.

Adaptation

- It is the attribute of organism (morphological, physiological and behavioral) that enables the organism to survive and reproduce successfully in its habitat.
- Kangaroo rat meets its water requirement through internal oxidation of fat, urinate minimal volume of concentrated urine.

cont…….

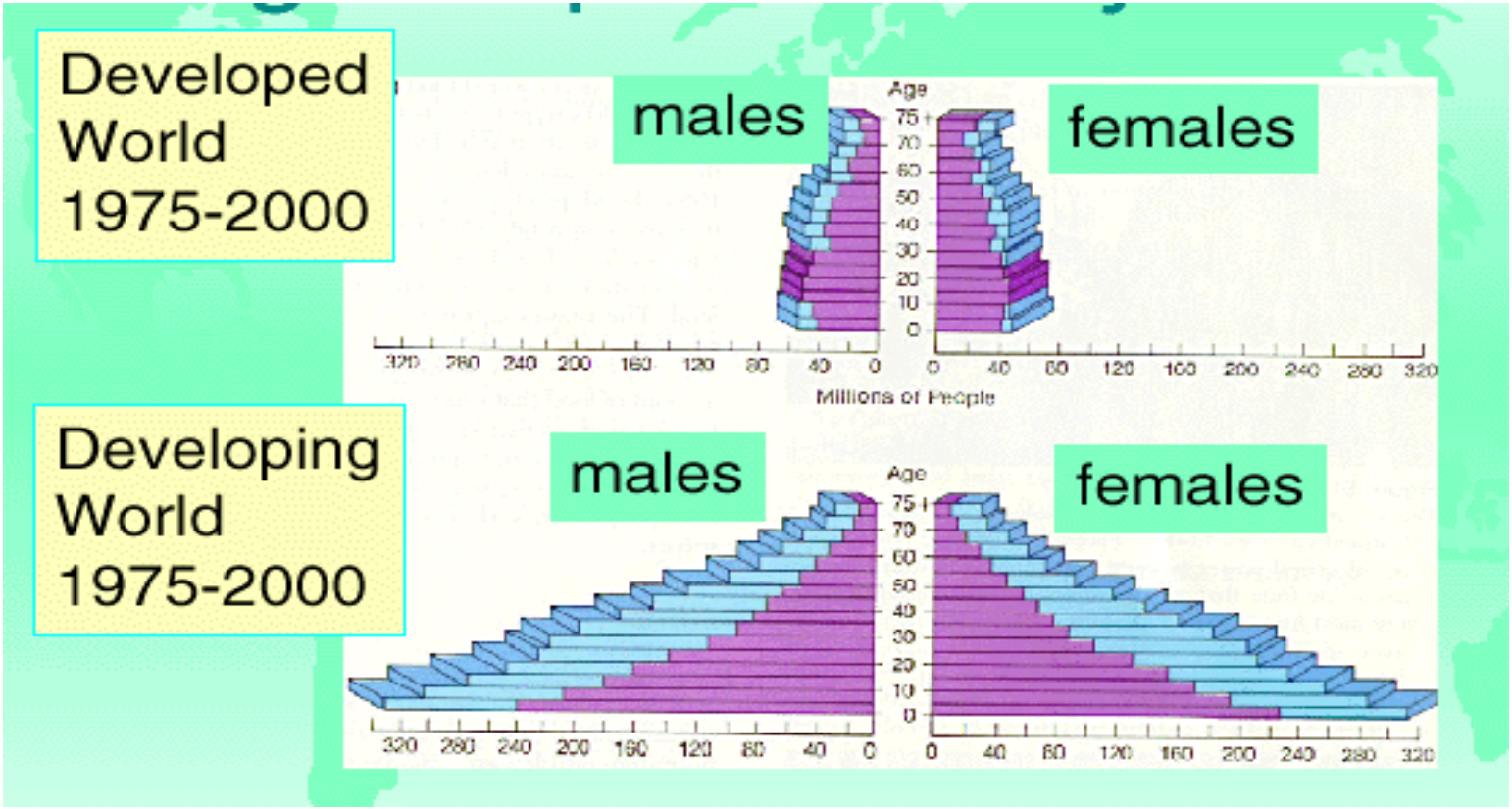
Adaptation

- Cold climate mammals have shorter ears and limbs to minimize heat loss(Allen's rule).
- Polar mammals like seals have blubber below their skin to prevent heat loss.
- Burrowing habit of some animals to escape from heat.
- Higher count of RBCs , Hb and high vital capacity of people of high altitude.

Population attributes

- Birth rate (natality)
- Death rate (mortality)
- Sex ratio
- Population density

Age pyramids for human population



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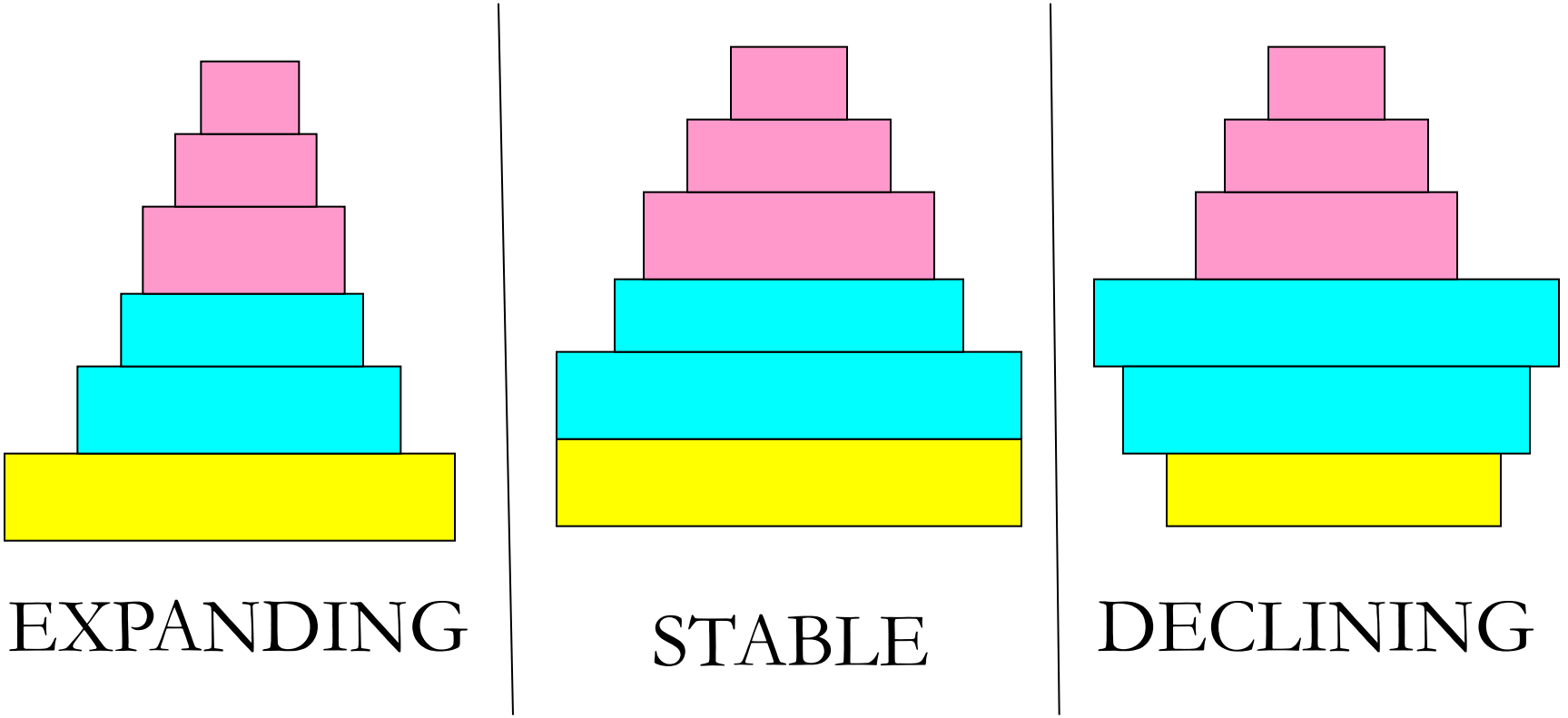
Representation of age pyramids for human population

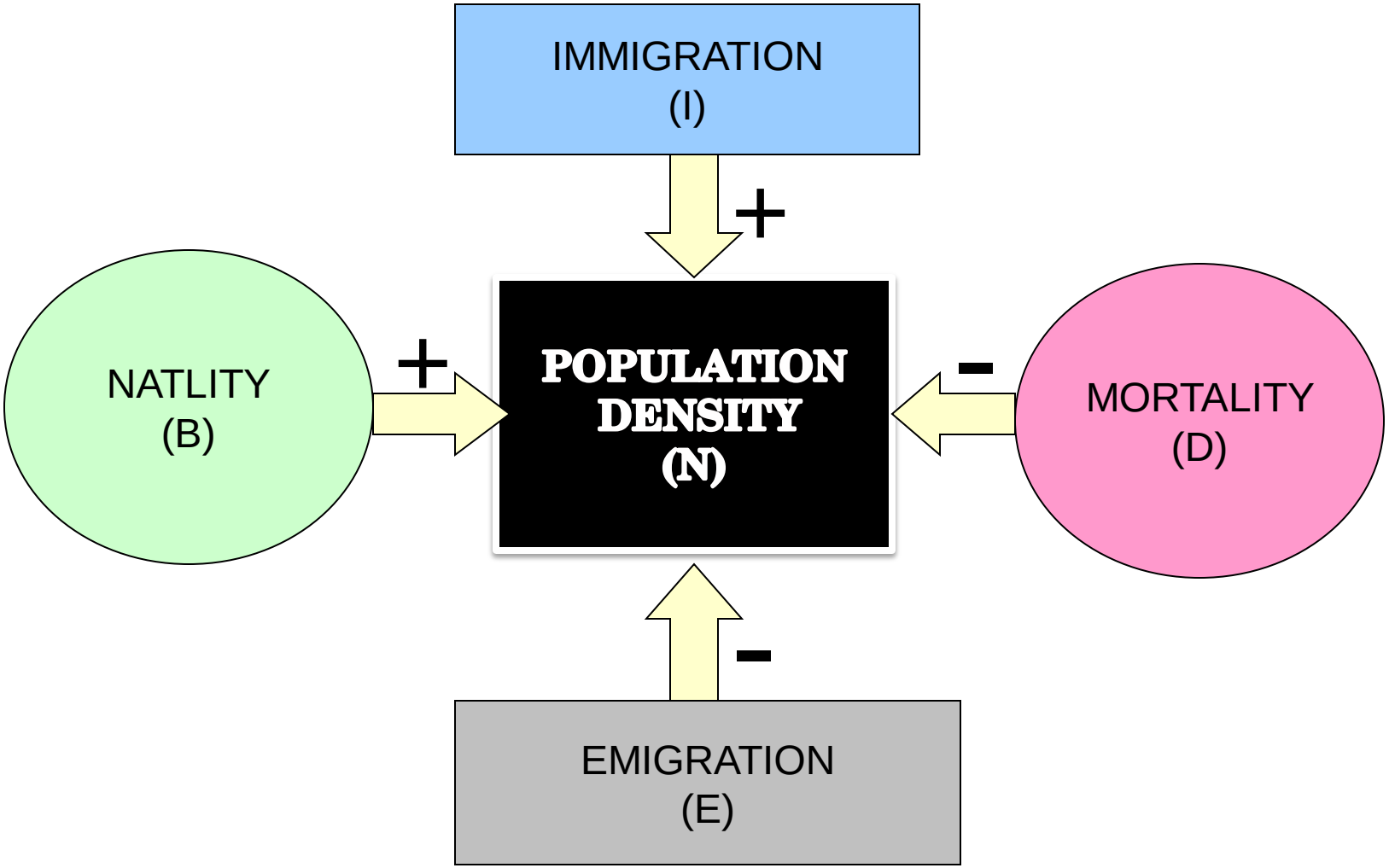


POPULATION GROWTH

Factors that affect size of any population

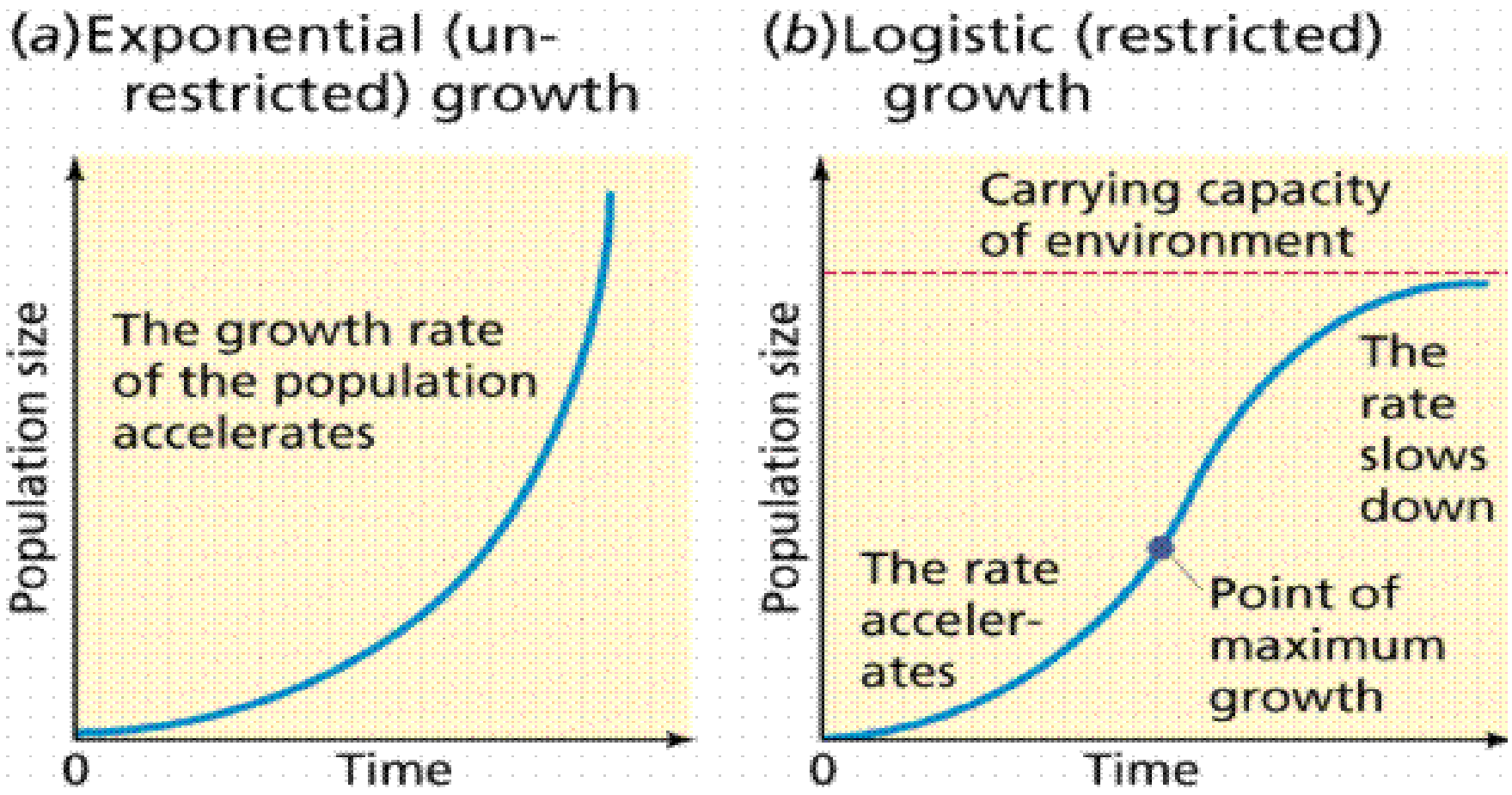
- Food availability
- Weather
- Predation pressure
- Competition

Density of a population at any time at a place depends on (i)natality, (ii) mortality, (iii) emigration and (iv) immigration



Factors that affect population density

POPULATION GROWTH MODELS



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POPULATION INTERACTION

Sl.No	INTERACTION	SPECIES A	SPECIES B
1	MUTUALISM	+	+
2	PREDATION	+	–
3	PARASITISM	+	–
4	COMMENSALISM	+	0
5	COMPETION	–	–
6	AMENSALISM	–	0

COMMENSALISM

Sea anemone and clown fish

COMMENSALISM

Buffalo and cattle egret

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MUTUALISM

- Lichen
- Mycorrhizae
- Insect pollinator and plants
- Orchid *ophrys* and male bee.

PREDATION

- Tiger and deer
- Snake and frog
- Sparrow eating fruit/ seed
- Herbivores and plants
- Phytophagous insects and plants

PARASITISM

- Head lice on humans
- Ticks on dogs
- Marine copepod on fish
- Cuscuta on plant
- Tapeworm, liverfluke, *plasmodium*
- Laying eggs by cuckoo birds in the nest of crow

COMPETITION

- Flamingo and native fish in lake of south America
- Abingdon tortoise and goats in Galapagos island

AMMENSALISM

- Fungus *Penicillium* used for obtaining penicillin
- *Streptococcus* bacteria used for obtaining streptomycin

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