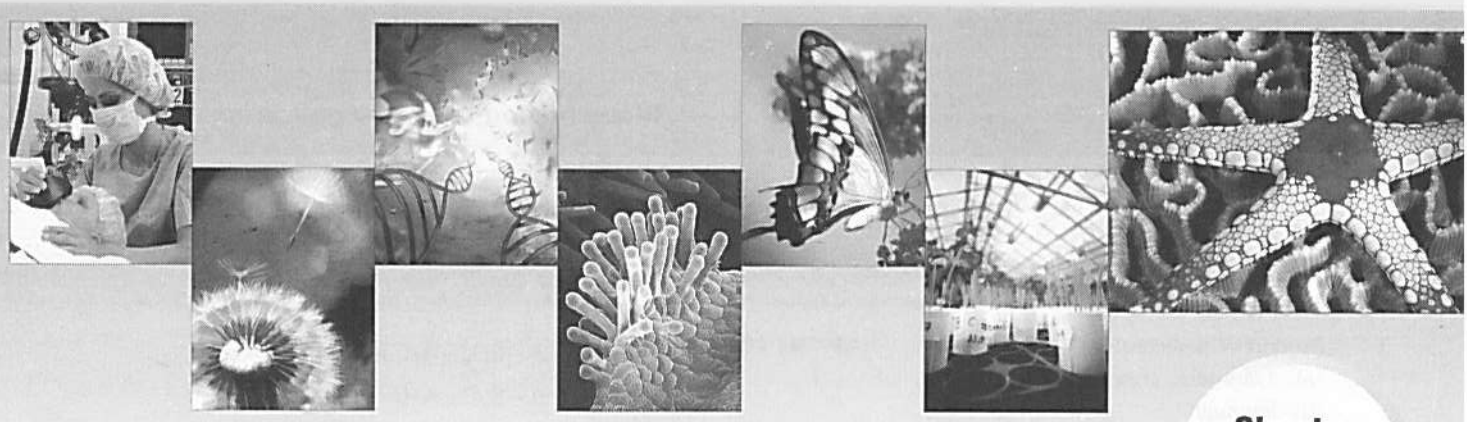


Chapter

10.1

# Organisms and Population

Ecology (Oikologie, made of two greek words, *i.e.*, Oikos – house or dwelling + logos – study or discourse. Thus literary meaning of ecology is study of organisms at their home. The term ecology was first coined by E. Haeckel 1868. Although, first used in literature by H. Reiter. Ernst Haeckel (1886) first correctly defined ecology as "the science dealing with reciprocal relationship of organism and the external world". Prof. R.Mishra is known as "Father of ecology in India". He defined ecology as interactions of form, functions and factors E. Podum is a leading ecologist. Other famous Indian ecologists include G.S.Puri, S.C.Pandeya. Dudgeon (1921) started ecological studies in India. Study of ecology is important to strike a balance between development and maintenance of natural environment and its biotic communities, use and conservation of resources, solve local regional and global environment problems.

**Branches of ecology**

(1) **Autecology/Species ecology :** The study of reciprocal relationships between every stage of development of a population/species and its environment is called autecology.

(2) **Synecology :** It is the study of reciprocal relationships between composition, organisation and development of communities and their environment.

(3) **Applied ecology :** It is the study of specialised fields of ecology which are concerned with conservation and economic exploitation of organisms, *e.g.*, agronomy, agriculture, animal husbandry, forestry, wildlife management, conservation ecology and pollution ecology.

(4) **Paleoecology :** Study of relationship between organisms and environment in the past.

(5) **Systems ecology :** Branch of ecology dealing with interpretation of ecological concepts and processes in terms of mathematical models and formulae.

(6) **Genecology :** Study of genetic composition and changes in relation to the origin of ecads, ecotypes, new species, etc.

**Levels of ecological organisation :** Organisation is the arrangement and coordination of small components into larger components in a hierarchy where each level is formed of components of lower level and itself becomes constituent of still higher level. The hierarchy in the levels of organisation connected with ecological grouping of organisms is called ecological hierarchy or ecological levels of organisation.

(1) **Organism :** An individual organism is a distinct living entity made up of one or more cells which carries out all the life processes in its body which are quite separate from life processes being performed in the body of others.

(i) **Basic unit :** Organism is the basic unit of ecological hierarchy.

(ii) **Size :** It may be microscopic (*e.g.*, *Amoeba, Chlorella,* bacterium) or macroscopic (*e.g.*, Rose, Mango, Crocodile, Dog, Human being).

(iii) **Cellularity :** An organism can be unicellular (*e.g.*, *Amoeba, Euglena, Chlamydomonas*), colonial (*e.g.*, *Volvox*) or multicellular (*e.g.*, Fish, Lizard, Mango tree).

(iv) **Subunits :** An organism has a number of subunits in the form of organ systems, organ system with organs, organs with tissues, etc. The subunits coordinate to produce a functional whole. They themselves cannot survive independently.

(v) **Life processes :** It performs all the life processes independent of life processes being performed in the body of others.

(vi) **Self regulation :** Each organism is capable of growth, self repair, movement and self regulation of its activities.

(vii) **Distinct identity :** Organisms possess a distinct identity so that they can be easily identified, counted and measured *e.g.*, Mango tree, Acacia, Sunflower, Mustard, Rat, Deer, Cow.

(viii) **Interdependence :** Organisms do not live in isolation. They show interactions with other organisms of the same species as well as organisms of other species.

(ix) **Environment :** Organisms obtain matter and energy from their environment and pass out wastes into it. They are also perfectly adapted to their environment. Environment also changes to suit the organisms.

(x) **Life span :** An organism has a definite life span which involves definite series of stages like birth/hatching, growth, maturity, ageing and death.

(xi) **Reproduction :** New individuals develop from the pre-existing ones through the process of reproduction. Reproduction can be vegetative, asexual and sexual.

(xii) **Resemblance :** Organisms resemble their parents because they receive the genes for various traits from them.

(xiii) **Continuity of race :** Individuals die but the race continues due to regular formation of new individuals through reproduction.

(2) **Population :** It is a grouping of similar individuals in a particular geographical area or space. The different populations of the same organism present in a particular geographical area are called local populations/demes. A local population adapted genetically to its particular environment is called ecotype. There may be several ecotypes of the same organism which show variation amongst them. Various characteristics of a population are : population density, natality (birth) rate, mortality (death) rate, age distribution, biotic potential, dispersion and growth form.

$$\text{Population density (D)} = \frac{\text{No.of individuals (N)}}{\text{Space (S)}}$$

N= Total no. of individuals, S= No. of units of space $m^2/m^3$.

**Control of population :** It is by three factors :

(i) Geographic factors.

(ii) Demographic factors.

(iii) Socioeconomic factors.

(3) **Species :** It is grouping of individuals of one or more populations which resemble one another in all important morphological, anatomical, biochemical and genetic characters besides ability to interbreed freely. The sum of all the populations of same kind of organisms all over the world is called species. It is basic unit of classification and the population is subordinate to species. Only the species has a natural existence, other units of classification (*e.g.*, Genus, Family, Order, Class, Phylum and Kingdom) are man made artificial groups.

**Exceptions to species concept**

(i) Difference in the morphology of developmental stages of an individual.

(ii) **Sexual dimorphism :** Occurrence of two forms among the organisms of the same species is known as dimorphism. Plants such as the date palm have male and female individuals which bear different types of flowers. Man and woman, peacock and pea hen are two sexual forms of same species. They show sexual dimorphism.

(iii) **Polymorphism :** The occurrence of many forms of individuals within the same kind of organism (species) is known as polymorphism. *e.g.* :

(a) Colonies of social insects.

(b) Colonies of coelentrates and *Volvox*.

(c) Different human races (Negraoids, Caucasoids, Mongoloids, Indian, Australoid, Polynesian).

**Speciation or Origin of species :** May be

(i) Due to physical barrier (Allopatric)

(ii) Due to reproductive barrier (Sympatric)

(iii) Mutation

(iv) Polyploidy

(v) Genetic (Wright effect)

**Home range :** A space to live is a basic need of an organism. Several members of a species may cover a defined area in search of food and mates, which is called home range.

**Niche/Ecological Niche** (Grinnel, 1917)

It is specific part of habitat occupied by individuals of a species which is circumscribed by its range of tolerance, range of movement, microclimate, type of food and its availability, shelter, type of predator and timing of activity.

A habitat has several ecological niches and supports a number of species. An ecological niche is used by a single species. Two or more species cannot use the same niche despite having a mutualistic association.

Where two different species happen to occupy the same niche, one is excluded, *e.g.*, *Paramecium aurelia* eliminates *Paramecium caudatum* while *Tribolium confusum* exterminates *T. castaneaum*. This is known as Gause's Principle or Principle of competitive exclusion.

(4) **Biotic community :** The assemblage of interdependent and interacting populations of different species present in an area. It has three components –

(i) Plant community or community of producer.

(ii) Animal community or community of consumers.

(iii) Microbial community or community of decomposers. Animal community may show diurnal and seasonal changes. Annual plants also show changes with change of season.

The terms biocoenosis is also used for community, which was coined by Carl Mobius (1880)

(5) **Ecosystem :** The sum of the biotic (living) and abiotic (non-living) components of a particular geographical area, collectively called ecosystem.

(6) **Biome :** It is a large ecosystem or a group of small ecosystems which is delimited by a specific climate or geographical area. A biome may also possess a patch of different ecosystem, *e.g.*, lake in a forest.

(7) **Biosphere :** Biosphere, also called ecosphere or giant ecosystem is the largest and nearly self-sufficient biological system. It is formed of all the ecosystems of the world. It is also called "life-supporting zone" of the earth.

## Environment

The environment is the aggregate of all those things and set of conditions which directly or indirectly influence not only the life of organisms but also the communities at a particular place. Any external force or influence, which surrounds and affects the life of a plant in any way, becomes a factor of its environment. These factors are called environmental factors and may be living (biotic) as well as non-living (abiotic). The abiotic factors affect the structure, life history, physiology and behaviour of organisms. The biotic factors mostly influence growth and reproduction. The environmental conditions which influence the life and development of plants, each part of the environment is called ecological factors. Ecological factors are grouped into four main classes which are as follows :

**Climatic factors :** The study of climatic factor is known as climatology. The chief climatic factors are :

(1) **Water :** Rainfall is the chief source of soil moisture. Water exchange between earth surface and atmosphere is called hydrological cycle. Humidity of the air is expressed in terms of relative humidity. It is measured by hygrometer (Psychrometer). Epiphytes and cryoptogamic plants grow in those regions where relative humidity is high.

(2) **Light :** Light (solar radiations) is a very important ecological factor as it is the source of energy to the whole biosphere. It enters the biosphere through the process of photosynthesis performed by green plants and other autotrophs. Here organic food is manufactured from inorganic raw materials. Solar energy is changed into chemical energy of food. The radiant energy of sunlight carries out all important functions, without this life except few bacteria would disappear. On this basis of relative light requirements and the effect of light on the overall vegetative development, plants are classified ecologically into following categories :

(i) Heliophytes are popularly called sun plants because they grow in open in full sunlight. They possess a number of characteristics like.

(a) Small leathery leaves having dull gray colour with yellow or brown tints

(b) Leaves are either arranged vertically or at an angle to sunlight.

(c) Cuticle is thick.

(d) Stomata are often sunken and present on the lower surface.

(e) Hair, spines and thorns are often present.

(ii) Sciophytes are shade plants which grow in areas having moderate to low intensity light, as below the shade of other plants. Optimum growth occurs with light of 10-30% of full sunlight.

(a) Leaves are large, soft and thin.

(b) Leaves lie horizontally to receive maximum sunlight.

(c) Spongy parenchyma is more developed as compared to palisade parenchyma.

(d) Cells are large

(e) Intercellular spaces are large.

The plants grow in total darkness are called etiolated (Long, thin, weak and yellow in colour).

(3) **Temperature :** Temperature influences every reaction and activity of organisms. Temperature shows daily as well as annual variations. The phenomenon of change of temperature between day and night and in different seasons of the year is called thermoperiodicity. It is of two types, diurnal (or daily) and seasonal (or annual). Thermoperiodicity determines periodical phenomena like seed germination, stem growth, flower formation, fruiting, dispersal, maturation of gonads, breeding, egg laying, etc. Low night temperature is suitable for seed germination in many plants, *e.g., Rumex, Asclepias*. Cooler nights also help in increasing size of tuber in Potato and fruit setting in Tomato. Organisms adapted to live at relatively constant temperature during the whole year are known as stenothermal, *e.g.,* many palms, corals, snakes and some fishes. The organisms which can tolerate large changes of temperature are called eurythermal, *e.g., Artemesia, Cyclops*, Toad, Wall Lizard.

On the basis of temperature the plants are classified as below :

(i) **Megatherms or Climate or Tropical :** The vegetation growing in the condition in which high temperature prevails throughout the year (30-40°C). The dominant vegetation is tropical rain forest.

(ii) **Mesotherms :** Climate-subtropical, the high and low temperature alternates. The dominant vegetation is tropical deciduous forest type. Those plants in which leaf fall takes place once in a year are called deciduous plants *e.g., Ficus religiosa* (Sacred tree).

(iii) **Microtherms :** The vegetation growing in the low temperature (10-20°C) condition. (The temperature remains low throughout the year). The vegetation is mixed coniferous forests type (Taiga).

(iv) **Hekistotherms :** The vegetation growing in the very low temperature (0-10°C) conditions. The dominant vegetation is Alpine vegetation (Tundra).

The plants growing at very low temperature are called cryophytes or psychrophytes.

(4) **Wind :** High wind velocity causes soil erosion, breakage and up rooting of trees. Most of the pollutants are dispersed through the medium of air. Wind harms is blossom trees because it prevents working of insects.

Wind modifies the humidity. Dry winds cause dwarfing of plants. Wind helps in pollination, dispersal of fruits and seeds and prevents frost damage. In the areas subjected to strong winds the leaves of plants become small and rolled and these plants develop an overall shape that offer resistance to wind.

Sometimes shrubs and trees are planted to protect the field against wind. Such structures are known as wind breaks or shelter belts. These plants (Trees) are planted at 90° to the wind velocity.

(5) **Atmospheric humidity :** Moisture in the form of invisible vapours in atmosphere is called humidity.

Atmospheric humidity is generally expressed in terms of relative humidity (R.H.) which is defined as, "amount of vapours in atmosphere as the percentage of total amount which the air or atmosphere can hold at the existing temperature." Rate of transpiration is inversely related to relative humidity. Areas having

high humidity have dense vegetation due to lower rate of transpiration. The areas with low relative humidity are dry. They produce sparse vegetation due to high rate of transpiration.

R.H. is influenced by environmental conditions like solar radiation, temperature, wind, etc. If temperature is high, R.H. is low and if temperature is low, R.H. is high.

(6) **Atmosphere**

Gaseous cover over the earth surface is called atmosphere. Earth's atmosphere is upto the height of 300 km, out of which 95% of gases are upto the height of 20 km and rest 5% in next 280*km*.

Earth's atmosphere is having a mixture of gases out of which important ones are :

**Table : 10.1-1**

| | | |
|---|---|---|
| (1) | **Nitrogen** | 78.08% (by volume) |
| (2) | **Oxygen** | 20.84% (by volume) |
| (3) | **Argon** | 0.93% (by volume) |
| (4) | **$CO_2$** | 0.03% (300 ppm) |

Earth's atmosphere is divided into four different zones from below to above :

(i) **Troposphere :** First 20 *km* of earth's atmosphere is called troposphere in which different physical phenomena, *i.e.*, lightening, thundering and cloud formation occur.

(ii) **Stratosphere :** About 30 *km* zone over troposphere is called stratosphere.

Temperature increases in this zone (upto 90°C) due to ozone formation. In this zone under the influence of ultra-violet rays, this ozone layer is formed, which prevents entry of harmful UV-rays to reach the earth surface.

(iii) **Mesosphere :** Next 40 *km* zone above stratosphere is called mesosphere. Last limit of mesosphere is called mesopause.

(iv) **Ionosphere :** Uppermost zone of atmosphere is ionosphere and in this zone all the gases are in ionized form.

(7) **Fire**

Fire may be man caused or natural. It is basically of three types :

(i) Surface fire (ii) Ground fire (iii) Crown fire

Such plants which grow well in fire burnt condition are called pyrophytes or fire loving plants.

**Topographic or Geographic factors :** Topographic factors are concerned with the physical geography of the earth in an area. The chief topographic factors are as follows :

Micro climate refers to local combinations of factors such as wind, rate of evaporation, humidity and temperature which differ from regional climate.

(1) **Altitude :** Height of mountain chains. 300 feet rise in altitude decreases temperature by 1°F. There is also increase in humidity and wind velocity. Slope winds are local wind movements which are uphill during the daytime and downhill at night. Shade caused by mountains reduces the total sunlight falling on these areas. Sunlight has more of ultraviolet rays. In high mountains situated in tropical areas, all the vegetation zones are found – tropical, subtropical, temperate and alpine. With the increase in altitude climate changes as decrease in temperature, increase in humidity, increase in precipitation and increase in wind velocity.

Generally the vegetation that develops on base of mountain to top is Tropical → Temperate → Taiga → Tundra. Species diversity generally increase as one proceeds from high altitude to low altitude and from high latitude to low latitude.

(2) **Steepness of the slopes :** Steep slopes cause fast running of water which result in erosion and do not permit the accumulation of humus so the soil becomes denuded. In such soil plants can not grow properly and vegetation changes to xerophytic plants.

(3) **Exposure of slopes :** Exposure of slope to sun and wind affects very much the kind of plants growing there. Generally the slopes exposed to sun and wind supports vegetation. That's why green houses and hot beds are always built in a way to face sun or southern slopes which receive greater amount of solar energy.

(4) **Direction of mountains chain :** Mountains steer or deflect winds into different directions. Outer Himalayas show frequent rains with luxuriant vegetations while the middle and inner Himalayas are dry with poor vegetation. The southern slopes of Himalayas *e.g.*, Kullu valley are directly exposed to sunlight and has luxuriant mesophilous vegetation due to monsoon wind. Where as Northern slopes of Himalayas *e.g.*, Lahul valley is exposed to weak light and strong dry wind, thus they have xerophilous vegetation.

**Edaphic factor :** The study of soil is called edaphology or pedology. The soil can be defined as "the upper crust of earth surface in which plants roots are anchored." The term soil is derived from the Greek word solum.

(1) **Soil formation :** It is derived from rocks by weathering which is of three types :

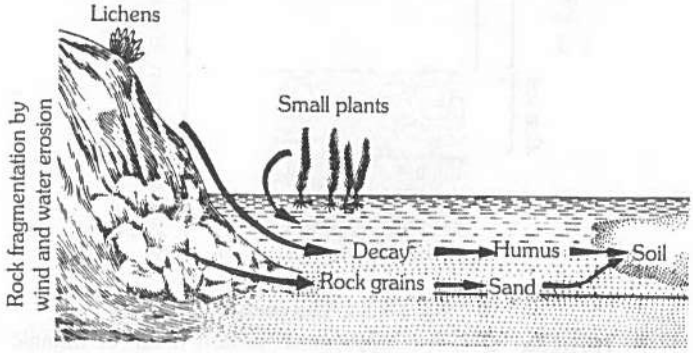



**Fig : 10.1-1 The formation of soil**

(i) **Chemical weathering :** It is caused by oxidation, hydrolysis or carbonation.

(ii) **Mechanical weathering :** It is caused by living organisms, *e.g.*, lichens, grazing animals or earthworm.

(iii) **Physical weathering :** It is caused by water, wind, gravity, glaciers, etc.

Weathering results into conversion of rocks to small fragments. Humus accumulates and now this can be called as soil. The development of soil is called pedogenesis. Soil is of two types :

(a) **Residual soil :** If the soil remains at the same place where it is formed.

(b) **Transported soil :** This soil brought from their place of origin to other place by some agents. It may be :

**Alluvial soil** : Carried by running water (rivers).
**Colluvial soil** : Carried by gravity.
**Eolian soil** : Carried by wind.
**Glacial soil** : Carried by glacier.

The soils of planes of India is mainly alluvial. In India the principal residual soil types are :

(a) Reddish soil of Vindhyas and South.

(b) Black soils of South West India.

(c) **Calcareous soil :** With 20% $CaCO_3$.

(d) **Laterite soil :** Oxides of iron and aluminium.

(e) **Peat soil :** With high percentage of humus 90%.

(f) **Black soil :** Predominantly with clay and humus (very fertile because most of minerals are present in it).

(2) **Soil profile :** A fully formed soil shows different layers called horizons. The sequence and nature of these layers is called soil profile (Cross section of soil) which consists of following horizons.

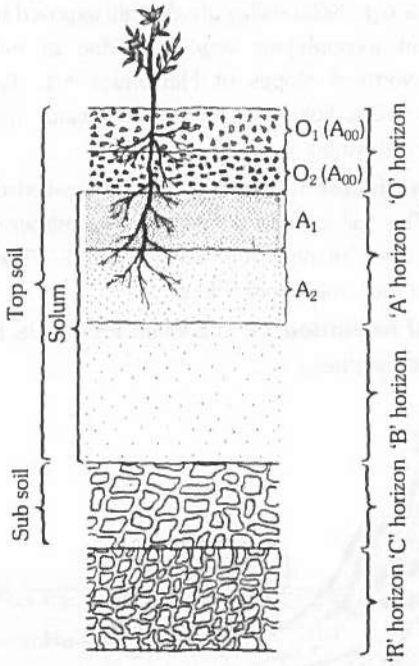



**Fig. 10.1-2 Soil profile**

(i) **Horizon 'O' :** It is uppermost horizon made of organic matter. It has both fresh or nondecomposed as well as partially decomposed matter. It consists of following two sub-layers :

(a) **$O_1$ region (Aoo) :** It is uppermost layer which consists of freshy added organic matter such as dead leaves, branches, flowers and fruits.

(b) **$O_2$ region (Ao) :** It is present below $O_1$ region. It consists of organic matter which is in different stages of decomposition.

(ii) **Horizon 'A' :** It is rich in mineral elements. A large amount of completely decomposed organic matter is present in this region.

(iii) **Horizon 'B' :** It is dark in colour due to accumulation of leached substances like clay, iron and aluminium from horizon. So it is called as zone of accumulation or zone of a alluviation.

Horizon 'O', A and B are together called as top soil.

(iv) **Horizon 'C' :** It consists of partially weathered parental rock material. It is called as sub soil.

(v) **Horizon 'R' :** It is the lowermost layer of soil which consists of bed rocks (unweathered).

(3) **Composition of soil :** The garden soil is made up of :

(i) **Mineral matter (40%) :** They are derived from rocks (by disintegration). The soil, derived from lime stone, is called chalky soil.

Sandy soils have more coarser particles and lower water holding capacity and better aerations. Sand is most porous. Plants grow sparsely in arid regions of the world because the soil is sandy. Clayey soils have fine particles which have high water holding capacity and very poor aeration. Clay is least porous (water logged). It occurs around the ponds. Loam (50% sand + 25% clay + 25% slit) are best for plant growth.

The best apparatus used to analyse the soil is sieving.

(ii) **Organic matter :** Humus is total organic matter in the soils. It is rich in N P K. The humus is formed from decay and decomposition of dead plant and animal matter. It is in colloidal state and increases water holding capacity of the soil. The formation of humus is called humification which is caused by microbial activity.

The three distinct layers of humus in soil of forests are :

(a) **Litter :** All dead fresh organic matter fallen (undecomposed) recently to the ground is called litter.

(b) **Duff :** The layer, where decomposition is just started, is called as duff or duff layer. Partially decomposed litter is called duff.

(c) **Leaf mold or Real humus :** When the litter is modified into dark, finely divided, amorphous organic matter by the activities of micro-organisms living in soil it is called humus. Humus is maximum in peat soil (90%).

(iii) **Soil solution :** The soil solution is the primary source of inorganic nutrients for plants. Soil solution helps in exchange of ions. pH of fertile soil is 6 to 7. *pH* below 5 inhibits bacterial activity. The plants which prefer to grow in acidic soil are called oxylophytes *e.g.*, *Drosera*. The plants prefer to grow in alkaline soil are called halophytes.

The soil rich in nutrients is called eutrophic and soil with less amount of minerals is called as oligotrophic.

(iv) **Soil air :** 20-25% air or $O_2$ is necessary for proper growth of plants. The well aerated soil support, the plant growth well because :

(a) Root respiration increases.

(b) The capillary potential of the soil increases.

(c) The accumulation of $CO_2$ can not take place.

(d) The root growth increases.

(e) Poor soil aeration supresses root hair development and may reduce the rates of absorption of water and minerals.

(v) **Soil micro-organims :** Soil contains a number of organisms. Edaphology is the relationship between soil and living organisms. They are classified into four groups – microflora, macroflora, microfauna and macrofauna.

(a) **Microflora :** It consists of microscopic nonphagotrophic organisms.

(b) **Macroflora :** It consists of those fungi which form fructifications, *e.g.*, mushrooms, tubers, truffles. The fungi are otherwise saprophytic in nature.

(c) **Microfauna :** It consists of microscopic phagotrophic microorganisms like protozoans (*e.g., Amoeba, Arcella*), rotifers, nematodes (*e.g., Rhabditis*).

(d) **Macrofauna :** They are animals residing in the soil. The common ones are insects (ants, beetles, mites, termites), spiders, millipedes, earthworms, snails and burrowing vertebrates.

**Biotic factor :** Living organisms living together influence each other's life and these living organisms constitute biotic factors. In these biotic interactions both the organisms may be benefitted or one is benefitted or one is benefitted while another is harmed or both are harmed. These biotic interactions are of two main types :

(1) **Positive interactions :** Where both the organisms or one organism is benefitted. The main types of positive interactions are :

**Mutualism or Symbiosis :** Here both the organisms in association are mutually benefitted and further this association is obligatory, *i.e.*, necessary for existence of both organisms. The term symbiosis or mutualism was given by De Bary.

Important examples of symbiosis are :

(i) Dispersal of fruits and seeds by living organisms.

(ii) Pollination by insects, animals, etc.

(iii) **Symbiotic nitrogen fixation :** In the root nodules of legumes and some non-legumes, *Rhizobium* bacteria (symbiotic) are present which obtain food and shelter from parent plant and in turn fix atmospheric nitrogen.

(iv) **Mycorrhiza or Mycorrhizal association :** Association between roots of higher plants and fungal hyphae is called mycorrhiza. It is of two types :

(a) **Ectotrophic or Ectophytic mycorrhiza :** In this association fungal hyphae are on surface of roots, *e.g.*, in *Pinus*.

(b) **Endotrophic or Endophytic mycorrhiza :** Here fungal hyphae are inside the root tissue, *e.g.*, in orchids.

(v) **Lichens :** These are composite plants in which algal partner and fungal partner are mutually associated.

(vi) **Myrmecophilly :** Association between ants and higher plants is called myrmecophilly, *e.g.*, jamun, litchi, mango, etc., where ants live. The ants get their food from the plants and in turn act as body-guards.

(vii) **Zoochlorellae :** Unicellular green alga *Chlorella vulgaris* lives in gastrodermal cavity of *Hydra*. The alga gives food and oxygen to *Hydra* and *Hydra* in turn gives shelter and nitrogenous substances to alga.

**Commensalism :** It is the relationship between two living individuals of different species in which one is benefitted while the other is neither harmed nor benefitted except to negligible extent. *e.g.*, epizoic algae, epiphytes and parasitic vascular plants. Jackals follow a lion or tiger while arctic fox follows a seal for obtaining food from pieces or bits left by the predators, The sucker fish (Echenis) provides another example, by means of its dorsal fin, the fish attaches to the underside of sharks and there by secure scrap of food, wide geographical dispersal and protection. The shark neither benefits nor suffer.

(i) **Epiphytes or Aerophytes :** These are vascular plants which are not rooted in soil and grow upon other plants for support (but not food), *e.g.*, some orchids like *Vanda, Dendrobium*, etc., members of family Bromeliaceae (bromeliads), *Dischidia* (here a pitcher like structure is present for accumulation of water), *Asplenium* (bird's nest epiphyte), etc.

Three types of roots are present in epiphytes :

(a) Clinging roots for attachment.

(b) Absorptive roots for absorption of nutrients and minerals from organic matter accumulated in crevices of bark.

(c) Aerial roots possess a special tissue having thickenings called velamen, which help in absorption of moisture from atmosphere.

(ii) **Lianas :** These are vascular plants rooted in soil and get support of other plants or objects for their erectness.

Most common lianas in Indian tropical forests is *Bauhinia vauhilii*.

(iii) **Rhizosphere, Rhizoplane, Phyllosphere and Phylloplane :** Soil zone around the roots in which a large number of microbes are present due to secretion of sugars, etc., by roots is called rhizosphere. The root proper surface is called rhizoplane. Similarly air zone around leaves having good population of microbes due to secretion of volatile substance by leaves is called phyllosphere and leaf proper surface is called phylloplane.

Some workers consider these as example of mutualism.

**Protoco-operation :** It is interaction between two living organism of different species in which both are mutually benefitted but they can live without each other. *e.g.*, tick bird, ox, pecker, and Rhinoceros.

(2) **Negative interactions :** Here one or both organisms in association are harmed. Important examples of these interactions are :

**Parasitism :** A parasite is an organism which lives in constant association with host and gets its food directly or indirectly without killing the host. This phenomenon is called parasitism. In plants four major types of parasites are present.

(i) **Total stem parasite,** *e.g., Cuscuta*.

(ii) **Total root parasite,** *e.g., Rafflesia* and *Orobanche*.

(iii) **Partial stem parasite,** *e.g., Viscum* and *Loranthus*.

(iv) **Partial root parasites,** *e.g., Santalum* and *Thesium*.

**Predation :** A predator is an organism which gets its food from the host after killing it. It does not live in constant association with host. This phenomenon is called predation.

**Important examples of predation are :**

(i) **Grazing and Browsing**

(ii) **Carnivorous or Insectivorous plants :** These plants grow in marshy conditions where there is lack of nitrogen, so in order to fulfil their nitrogen requirement, they catch small insects by some special adaptations in them.

(iii) **Predaceous fungi :** In soil there are present some fungi like *Dactylella, Dactylaria, Arthobotrys* and *Zoophagus*, etc., which are called predaceous fungi.

**Competition :** It is a type of cold war in which both the organisms in association are harmed. Competition is for basic necessities of life. Competition may be interspecific or intraspecific but intraspecific competition is more severe because organisms of same species have similar basic requirements. Territoriality occurs as a result of competition.

**Amensalism :** This is a type of association in which one organism in association is harmed and second is not affected.

Amensalism is of two types :

(i) **Antibiosis :** Some micro-organisms secrete certain chemical substances which kill or inhibit other micro-organisms. These substances are called antibiotics and phenomenon is called antibiosis.

(ii) **Allelopathy :** Some higher plants also secrete certain poisonous substances which inhibit the growth of other plants. This phenomenon is called allelopathy, *e.g.*, roots of carrot grass or congress grass (*Parthenium argentatum*), which is most troublesome terrestrial weed in India secrete trans-cinnamic acid which checks the growth of other plants.

**Man as biotic factor :** Man is always the most important biotic factor. He changes the environment by his activities regularly, *e.g.*, by excessive cutting of trees, fire, domestication of plants and animals, by causing different types of pollution, etc.

## Ecological Adaptations

Water as an important ecological factor was first recognized by Warming. On the basis of water requirement plants are divided into 3 major types :

(1) **Hydrophytes :** They live in abundance of water. They require abundance of water to complete their life cycle. They are of the following types :

(i) **Rooted submerged :** The hydrophytes, which are rooted in mud at bottom and remain under water. *e.g., Hydrilla, Vallisneria.*

(ii) **Submerged floating :** They are not rooted in the soil but completely submerged and floating *e.g., Ceratophyllum, Utricularia.*

(iii) **Rooted with floating leaves :** They are rooted in the soil but the leaves are floating on the surface of water *e.g., Nelumbo, Trapa, Victoria.*

(iv) **Free floating :** They are not rooted in soil and mud. These hydrophytes float freely on the surface of water *e.g., Wolffia* (Smallest angiosperm), *Lemna, Spirodella, Pistia, Azolla, Salvinia.*

(v) **Rooted emergent :** Roots are in the soil while the shoots or leaves are partly outside and partly inside the water. Plants show heterophilly (Amphibious plants) *e.g., Typha, Ranunculus, Sagittaria, Cyperus.*

**Morphological adaptations**

(i) Roots of hydrophytes are poorly developed or completely absent in *Wolffia, Ceratophyllum* etc. Root hair and root cap are absent but root pockets may be present *e.g., Pistia, Eichhornia, Trapa.*

(ii) Stem is reduced in free floating plants *e.g., Pistia,* narrow and slender in submerged plants *e.g., Hydrilla, Ceratophyllum* and well developed in amphibious plants *e.g., Typha.*

(iii) Petioles become long, swollen and spongy for floating.

(iv) Leaves are usually long ribbon like *e.g., Potamogeton,* or finely divided *e.g., Ranunculus or thin and broad e.g., Nelumbo, Victoria.*

(v) In some hydrophytes leaves of different are produced by same plant. Aerial leaves are not dissected but submerged leaves are dissected (Heterophilly) *e.g., Ranuneculus, Limnophila.*

(vi) Stem is spongy, flexible, delicate, mucilagenous and soft.

**Anatomical adaptations**

(i) Cuticle absent or poorly developed.

(ii) Stomata are absent in submerged plants. Floating hydrophytes have stomata on upper surface *e.g.,* Lotus (epistomatic).

(iii) Air spaces are extensively developed in root, stem and leaves. Well developed aerenchyma helps in buoyancy and gaseous exchange.

(iv) Leaves have spongy tissues and palisade is poorly developed. As light difuses from all palisade and spongy tissue. Epidermal cells contain chloroplasts for maximum capturing of difused light.

(v) Mechanical tissues like sclerenchyma (lignified tissues) and collenchyma are poorly developed or absent.

(vi) Vascular tissues are poorly developed.

**Physiological adaptation**

(i) Water and mineral nutrients are absorbed through general body surface.

(ii) Osmotic concentration or osmotic potential of cells is equal to or is slightly higher than external water.

(2) **Xerophytes :** They are adapted to grow in dry habitats. The vegetation of Rajasthan is xerophyic. On the basis of pattern of life cycle, xerophytes are of three types :

(i) **Ephemerals :** They complete their life cycle in a very short period, evade dry season by disappearing, leaving their seeds. They are referred to as drought escapers or drought evaders *e.g., Cassia toria, Argemone maxicana, Solanum xanthocarpum.*

(ii) **Succulents (Fleshy xerophytes) :** They absorb large quantities of water during rainy season and store water in different body parts. They are common in deserts and referred to as drought avoiding xerophytes *e.g., Opuntia, Bryophyllum, Euphorbia, Mesembryanthemum* (ice plant) and *Agave.*

(iii) **Non succulents :** They are true xerophytes and called drought resistant. They can with stand long drought periods *e.g., Acacia, Calotropis, Casuarina, Nerium, Capparis, Prosopis.*

Xerophytes are further divided into different types :

(a) **Oxylophytes :** Plants growing on acidic soil.

(b) **Psychrophytes :** Plants growing on cold soil.

(c) **Halophytes :** Plants growing on saline soil.

(d) **Lithophytes :** Plants growing on rocks.

(e) **Chersophytes :** Plants growing on waste land.

(f) **Eremophytes :** Plants growing in deserts and steppes.

(g) **Psilophytes :** Plants growing in savannah.

(h) **Helophytes :** Plants growing in mud.

**Morphological adaptations**

(i) Roots of xerophytes are extensively developed to increase water absorption. Roots are much more longer than the shoots. Root hairs and root caps are well developed. The roots reach to great depth in the soil.

(ii) Stems of xerophytes are usually stunted (dwarf), woody, dry, hard and covered with thick bark. Stem is modified into flat leaf like phylloclades or cladodes *e.g., Opuntia, Ruscus, Asparagus.*

(iii) Leaves of xerophytes are usually thick, may be reduced to spines *e.g., Opuntia*, scales *e.g., Casuarina* or may become needle like *e.g., Pinus* (Microphyllous) or may absent *e.g., Capparis*. Leaves and stem become fleshy (Malacophyllous) *e.g., Bryophyllum*.

**Anatomical adaptations**

(i) Stomata are sunken and generally on the lower surface of leaves.

(ii) Epidermal cells thick walled and covered by hairs (Trichophyllous). *e.g., Calotropis*. Epidermis may be multilayered (Multiple epidermis) *e.g., Ficus, Nerium*.

(iii) Palisade generally on both sides (surfaces) of leaves *e.g., Nerium*.

(iv) In leaves spongy parenchyma are absent.

(v) Water storing parenchyma, conducting tissues and mechanical tissues are well developed.

(vi) Bulliform or motor cells are found in between the cells of upper epidermis. These cells cause rolling and unrolling of leaves *e.g., Poa, Ammophila* (grasses).

(vii) In *Nerium* leaf, upper as well as lower epidermis are multiseriate or multiple and are covered with thick cuticle. Mesophyll is differentiated into palisade and spongy parenchyma palisade tissue occurs near both the epidermis while spongy parenchyma is located in between the palisade.

(viii) In *Ficus* leaf, upper epidermis is multiseriate and is thickly cuticularised. Cystoliths are present in the cells of inner layers of this epidermis.

**Physiological adaptations**

(i) Osmotic concentration or osmotic potential of cell sap is high.

(ii) They have resistance to desiccation and mucilage to hold water.

(iii) They show less transpiration.

(3) **Halophytes :** They are special types of xerophytic plants which grow on saline soils with high concentrations of salts like *NaCl*, $MgCl_2$, $MgSO_4$ (Physiologically dry soil). They are salt resistant. Most of these are succulents. They have negatively geotropic roots for gaseous exchange called Pneumatophores. Halophytes show Vivipary (germination of seeds inside the fruits).

Halophytic communities growing on swamps are called helophilous halophytes which are of two types :

(i) Salt swamp and salt desert.

(ii) Littoral swamp forests which are most extensive in all tropical areas.

Swamp forest forms a characteristic vegetation called mangroves *e.g., Rhizophora, Sonneratia, Avecenna, Heritiera, Salsola, Atriplex*.

In India mangroves are quite common in sea shores of Bombay and Kerala, Andaman Nicobar Islands and West Bengal. Sunderbans of West Bengal are the examples of mangrove vegetation.

(4) **Mesophytes :** Plants growing in places of moderate water supply. These plants cannot live for a long time either in water saturated or in moisture deficient soil. *e.g.,* garden plants and crops.

The vegetation of Delhi is chiefly mesophytic.

## Population

History of man is only about 50,000 years old. In the course of human history there have been three major explosions, each corresponding to a major changes in the environment. The first population explosion occurring about 20,000 years ago. It was brought about by the use of tools that allowed improvement in hunting and food gathering methods. The second revolution occurred about 6,000 years ago, and was brought by improvements in farming. The third revolution was brought about 300 years ago and was caused by improvement in food production, industry and medicine. If the present birth rate is maintained, it is stated that only one square feet of the earth surface will be available per one person within the next 700 years.

**Definition :** The term population refers to the total number of individuals of the same species occupying a particular geographic area at a given time. This definition of population was given by **Clark** in 1954.

**Demography :** The scientific study of human population is called **demography.** It deals with

(1) Change in population i.e. growth or decline in population.

(2) Composition of population i.e. age groups, sex ratio etc.

(3) Distribution of population in space.

**Census :** Census is an official count of the people of a country, state, or district, with statistics as to age, sex, employment, education, etc. In India census started in 1891, and, since then, it has been conducted uninterruptedly every ten years. Census is conducted as per the provision made under the census Act, 1948, as amended.

## Population Dynamics/Factor Affecting Population

(1) **Population density :** Population density is the number of individuals present per unit area or volume at a given time. For instance, number of animal per square kilometer, number of trees per area in a forest, or number of plank tonic organism per cubic meter of water. If the total number of individuals is represents by letter N and the number of units of space by Letter S, the population density D can be obtained as D=N/S. Space is indicated in two dimensions ($m^2$) for land organisms, and in three dimensions ($m^3$) for aquatic organisms and for the organisms suspended in space.

(2) **Birth rate or Natality :** The birth rate of a population refers to the average number of young ones produced by birth, hatching or germination per unit time (usually per year). In the case of humans, it is commonly expressed as the number of births per 1000 individuals in the population per year.

The maximum birth rate of a species can achieve under ideal environmental conditions is called potential natality. However, the actual birth rate under the existing conditions is much less. It is termed realised natality.

(3) **Death rate or mortality :** The death rate of a population is the average number of individuals that die per unit time (usually per year). In humans it is commonly expressed as the number of death per 1000 persons in a population per year. Lowest death rate for a given species in most favourable conditions is called potential mortality, while the actual death rate being observed in existing conditions is called realized mortality.

(4) **Survivorship curve :** The death rate of population can be easily represented by survivorship curve. In this curve time is plotted against number of survivors. There are three kind of survivorship curves.

(i) **Diagonal curve :** If death rate of different age group organism are equal then the curve is represented or plotted as a straight line.

Example : *Hydra*, mice and many adult birds.

(ii) **Convex curve :** When organism completed their potential life span and died in old age then the curve is convex, the curves goes horizontal till potential life span and then decline rapidly.

Example : Men, rabbit and many mammals.

(iii) **Concave curve :** This kind of curve mostly found in such organism who die before their potential life span.

Example : Fish, Oysters and Invertebrates.

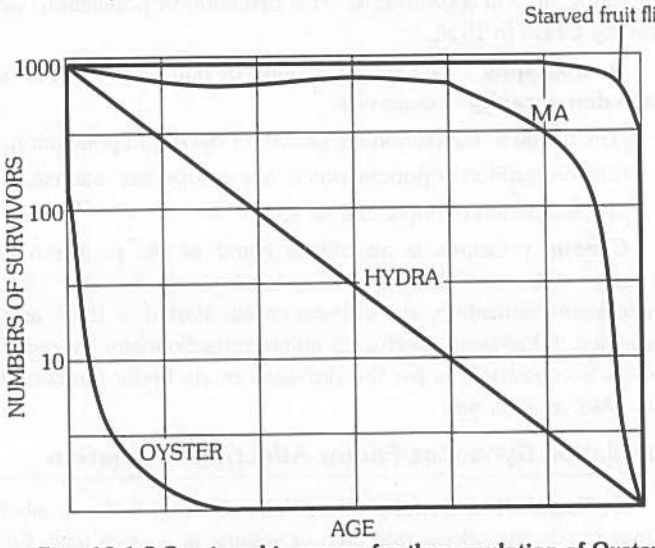



**Fig : 10.1-3 Survivorship curves for the population of Oyster, Hydra man and Fruitflies**

(5) **Vital index :** The percentage ratio of natality over mortality is known as vital index i.e. natality / mortality $\times 100$. It determines the growth of a population.

(6) **Immigration :** It is permanent entry of additional person into the existing population of a country or region from out side. Example; Many Nepalese and Chinese come to settle in India.

(7) **Emigration :** It is the permanent departure of some persons from the existing population of a region to a different state or a foreign country. Example; Many Indians go to Western countries to settle there.

Immigration and emigration bring about redistribution of population, and are common in animals. These occur for various reasons, such as search for food, escape from competition due to overcrowding, need of shelter etc.

(8) **Sex ratio :** The number of females in a population per 1000 males is called sex ratio.

$$\text{Sex ratio} = \frac{No.\,of\ females}{1000\,(males)}$$

(9) **Age structure :** The age structure of a population is the percentage of individual of different ages such as young, adult and old. Age-sex structure of a population can be shown by a pyramid-like diagram by plotting the percentage of population of each sex in each age-group. Figure shows the age-sex structural pyramids for India over the 20-year period from 1971 to 1991. These pyramids show that Indian population may still take many years to be stabilized.

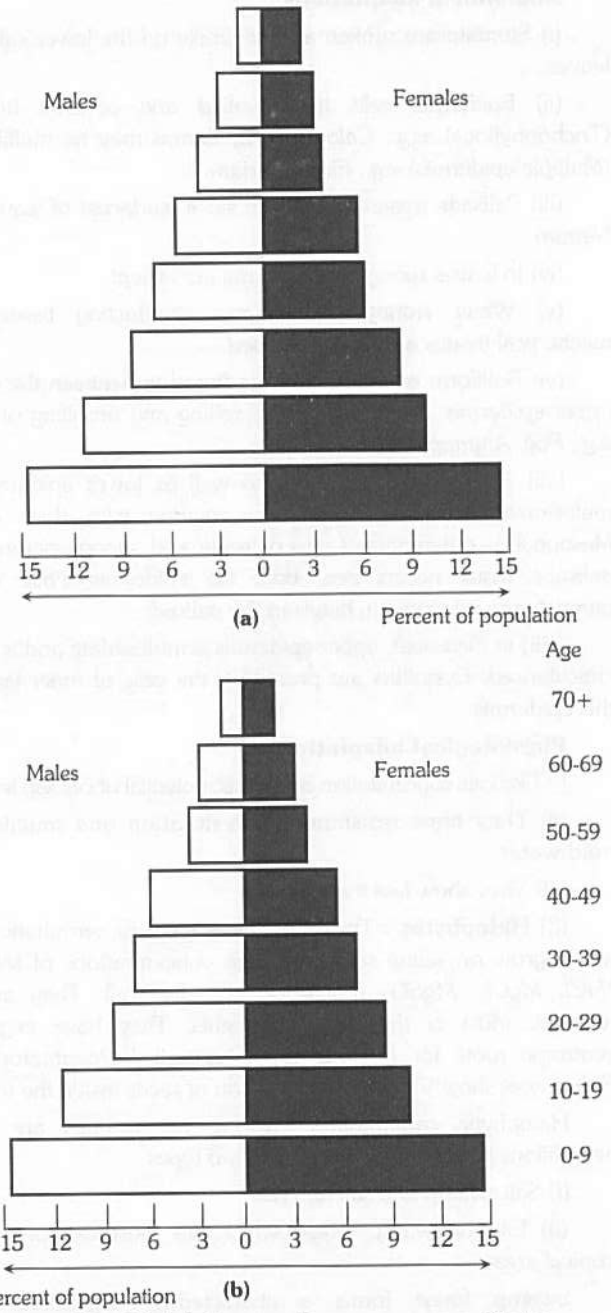



**Fig : 10.1-4 Comparative age-sex pyramids for India; (a) Year 1971 (b) Year 1991**

(10) **Age distribution :** The relative abundance of the organisms of various age groups in the population is called age distribution of population. With regard to age distribution, there are three kinds of population.

(i) **Rapidly growing or Expanding population :** It has high birth rate and low death rate, so there are more number of young individuals in the population.

(ii) **Stationary or stable population :** It has equal birth and death rates, so population shows zero population growth. The pyramid of this type of population is 'bell' shaped.

(iii) **Declining population :** It has higher death rate than birth rate, so the population of young members is lower than that of old members e.g. Japan (Ageing population). The pyramid of this type of population is 'urn' shaped.

**Human population has three age groups :** Pre reproductive, Reproductive, and post reproductive.

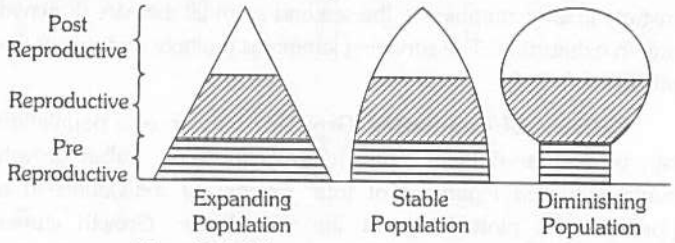



**Fig : 10.1-5 Age groups of human population**

**Factors affecting the age composition**

(i) Number of infants below one year of age and the older people as these have higher mortality rate than individuals of other age groups.

(ii) Proportion of reproductive active males and females in a population.

(iii) Number of females in active reproductive age (i.e. between 15 to 44 years)

(11) **Change in Population Size and Growth Rate :** Whether a population grows, declines or maintains it size depends upon the balance between the above factors:

| | |
|---|---|
| Change in Population Size during time interval | = (Birth + Immigration during time interval) – (Death + Emigration during time interval) |

The above expression in words may be represented in a simple way by a mathematical model. suppose N = population size and $t$ = time. The Greek letter delta, $\Delta$, indicates change. We can now represent change in population as $\Delta N$, and time interval as $\Delta t$. The verbal equation can be written as $\Delta N/\Delta t$=(B+I) – (D+E) in which B is absolute number of births in the population during the time interval, and D =the absolute number of deaths during that interval; I means immigrant and E, emigrants. I and E, being insignificant, may be ignored. Then the equation simplifies to $\Delta N/\Delta t$ =B-D.

Migration is a two-way movement of a population for adjusting to seasonal changes. It occurs in some fishes (*Anguilla*, an eel), birds (Siberian crane), and mammals (fur seal). Migration is not considered a determinant of population size.

**Annual average growth rate** is the percentage of increase in population size per year. It can be calculated with the help of following equation :

$$\text{Annual growth rate } (\%) = \left(\frac{P_2 - P_1}{P_1 \times N}\right) \times 100$$

Where $P_1$= Population size of previous census. $P_2$= Population size of present census.

$N$= Number of years between the two census.

## Growth of Human Population

Population growth refers to the increase in its size. It is determined by the number of individuals added to the population and the number of individuals lost from the population. Addition occurs by births and immigration. Loss results from deaths and emigration. If more individuals are added than are lost i.e., the vital index is more than 100, the population will increase or show **positive growth.** If more individuals are lost than are added i.e., the vital index is less than 100, the population will decrease or show **negative growth.** If addition and loss are balanced, i.e., the vital index is 100, the population will become stationary or show **zero growth**.

**Malthus Theory of Human Population Growth :** Thomas Malthus, a British political economist, put forward a theory of human population growth in 1778. Malthus in his "Essay on the principle of population" pointed out that population tends to increase in geometric progression while food supply increase only in arithmetic progression. Faster growth of population than of its requirements causes an imbalance between the two. When this imbalance reaches a certain limit, environmental factors like famine, epidemic of a disease, earth quake, flood, war etc reduce the population to a size, the available resources can support. The factors that control the population size were called positive checks by Malthus.

**Natural Control of Population Growth :** Growth of a population is controlled by an interaction between three factors : biotic potential, environmental resistance and carrying capacity of environment.

(1) **Biotic or reproductive potential :** Biotic potential is the natural capacity of a population to increase at its maximum rate under ideal environmental conditions and stable age and sex ratios. The biotic potential for all animals is very high. If unchecked, the numbers of any species will quickly over run the world. Biotic potential in the human female is estimated to be about 12 per female during its reproductive period between the puberty and the menopause period.

(2) **Environmental Resistance :** In nature full biotic potential of an organism or population is never realized, since conditions are rarely ideal. Various harmful environmental (abiotic) factors like non-availability of food and shelter, natural calamities like drought, cloud bursts, floods, fires, temperature fluctuations, accidents, etc. and certain biotic factors like pathogens, parasites, predators etc. check the biotic potential from being realized. The sum of all these inhibitory factors is called **environmental resistance**.

(3) **Carrying capacity :** It is defined as "Feeding capacity of an environment of an ecosystem for a population of a species under provided set of conditions". When a population reaches the carrying capacity of its environment, the population has zero growth rate. So the population generally stabilizes around the carrying capacity. The carrying capacity of the earth for human population is considered to be about 8 to15 billions. Carrying capacity of the environment for a population depends upon three major components :

(i) **Productive systems** which produce food and fibre e.g. croplands, orchards, etc.

(ii) **Protective systems** which buffer air and water cycles and keep moderate environmental temperatures e.g. ocean etc.

(iii) **Assimilative systems** which utilize the wastes produced by human activities e.g. waterways, wetlands, etc.

Productive system and protective systems collectively form the **life-supporting capacity,** while assimilative systems collectively form the **waste assimilative capacity.**

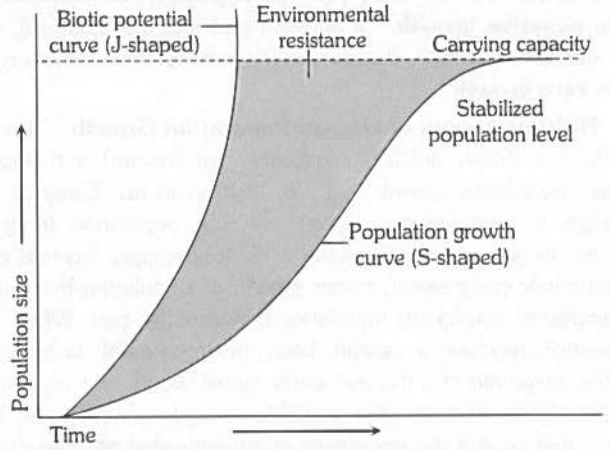



**Fig : 10.1-6 The theoretical relationships between biotic potential, environmental resistance and carrying capacity**

(iv) **Population fluctuations and population cycles :** The populations are not stable and do change due to a number of extrinsic as well as intrinsic factors. These variation in the population size are of two types :

(a) **Population fluctuations or irruptive variations :** In these changes, population density tends to fluctuate irregularly above and below some steady-state level. These are characterized by sudden increase in population in short time which is followed by equally quick decrease in population size. These are caused by random seasonal or annual changes in availability of resources (food or energy) or extrinsic factor (e.g., temperature, rainfall etc.) e.g., more birds during early summer due to their hatching period, more insects during summer months and more weeds in rainy season.

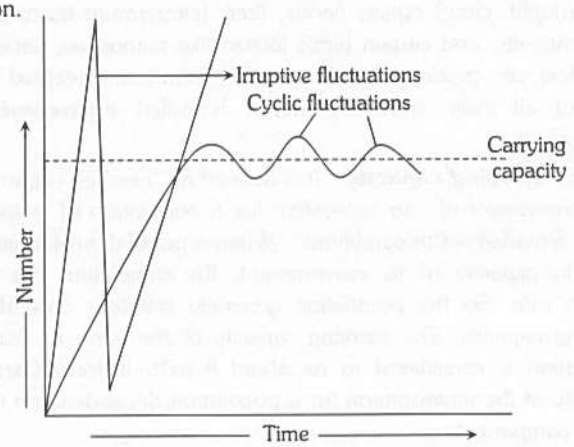



**Fig : 10.1-7 Cyclic and irruptive fluctuations in populations**

(b) **Population cycles :** These are regular changes in the population size. In these, population size is nearly constant over long period of time. These are caused by seasonal changes in environment e.g. population cycles (of 3 to 4 years) of lemmings of Tundras (Elton, 1942) Lemmings (*Lemmus lemmus*) (small mouse-like rodents found in arctic regions of Canada and Norway) increase in their number for a period of about 3 years when it reaches a peak beyond the carrying capacity of that area. They eat up all the available food. In the winter months, the lemmings migrate in large numbers in the sea and swim till they are drowned due to exhaustion. The surviving lemmings multiply and repeat the process.

**Patterns of Population Growth :** Growth of a population can be expressed by a mathematical expression, called growth curve in which logarithm of total number of individuals in a population is plotted against the time factor. Growth curves represent interaction between biotic potential and the environmental resistance.

**Two basic types of growth curves**

(i) **Sigmoid or S-shaped growth curve :** It is shown by yeast cells and most of organisms. It is formed of five phases :

(a) **Lag phase.** In which the individuals adapt themselves to the new environment, so there is no or very little increase in population.

(b) **Positive Acceleration phase.** It is the period of slow increase in population in the beginning.

(c) **Logarithmic** or **Exponential phase :** It is the period of rapid rise in population due to availability of food and requirements of life in plenty and there being no competition.

(d) **Negative Acceleration phase :** In which again there is slow rise in population as the environmental resistance increases.

(e) **Stationary (Plateau) phase :** Finally, growth rate becomes stable because mortality and natality rates become equal to each other. So there is zero growth rate. A stable population is said to be in equilibrium, or at saturation level. This limit in population is a constant *K* and is imposed by the carrying capacity of the environment. S-shaped curve is also called logistic curve. Sigmoid growth curve was described by **Verhulst, (1839)**

(ii) **J-shaped Growth curve :** It is shown by small population of **Reindeer** experimentally reared in a natural environment with plenty of food but no predators. It has only two phases:

(a) **Lag phase :** It is period of adaptation of animals to new environment so is characterized by slow or no growth in population.

(b) **Logarithmic or Exponential phase :** It is characterized by rapid growth in population which continues till enough food is available. But with the increase in reindeer population, there is corresponding decrease in the availability of food and space, which finally become exhausted, which leads to mass starvation and mortality. This sudden increase in mortality is called **population**

**crash.** Lemming of Tundra, some insect, algal blooms and annual plants also show J-shaped curves. The population growth curve is S- shaped in most of the organisms, Human population also shows S-shaped curve.

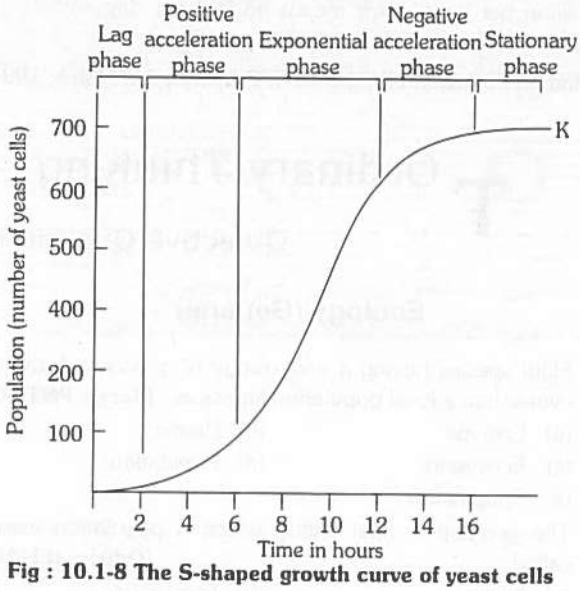



**Fig : 10.1-8 The S-shaped growth curve of yeast cells**

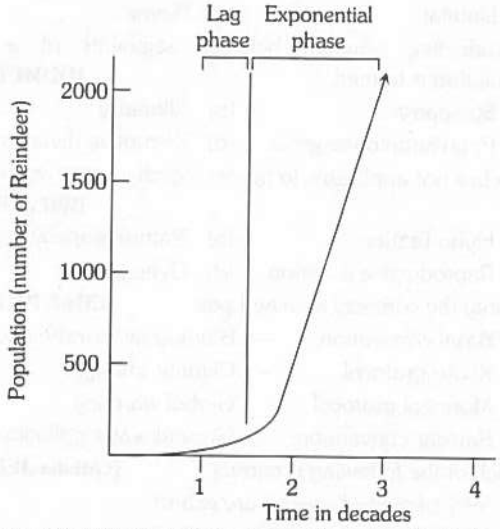



**Fig : 10.1-9 The J-shaped growth curve of reindeer**

**Table : 10.1-2 Difference between S-shaped and J-shaped Growth curves**

| S.No. | S-shaped Growth Curve | J-shaped Growth Curve |
|---|---|---|
| (1) | It is formed of 5 phases : lag phase, positive acceleration phase, exponential phase, negative acceleration phase and stationary phase. | It is formed of 2 phases : lag phase and exponential phase. |
| (2) | Finally the population shows zero growth rate as birth rate equals death rate. | Finally, the population shows a population crash due to rapid increase in mortality rate. |
| (3) | *Examples.* Yeast cells in a culture medium. | *Examples.* Reindeers, algae blooms, lemmings of Tundras |

## Tips & Tricks

- Environmental biology : Depending upon the branch studied, it is of several types like population ecology, ecosystem ecology, pollution ecology, habitat ecology, fresh water ecology (limnology), marine ecology (oceanography), forest ecology, conservation ecology, production ecology, radiation ecology, microbial ecology, space ecology, ecological energetics.
- Father of Plant Ecology is Warming : He wrote the first book on plant ecology – 'Oecology of Plants' (1895).
- The species which are found primarily, most abundantly or spend most of their time in ecotone or community boundary are known as edge species.
- Term phytogeography is made up of two words phyton = plant and geography *i.e.*, geography of plant distribution.
- Tectonics is the study of earth's crust.
- Mutations causing genetic isolation produce sibling species (morphologically similar but reproductively isolated).
- Ethology : Term used by Hilarie (1859) for ecology.
- Hexicology : Term used by Mivart (1894) for ecology.
- Bioecology : Term used by Shelford and Clements for study of both plant and animal ecology.
- Ecological equivalents : Different organisms occupying similar niches in different geographical areas.
- Speciation or Cladogenesis is the phenomenon of development of one or more new species from an existing one by buildup of resproductive isolation between them.
- Reproductive isolation among adjacent members of a population in the absence of a geographic barrier is parapatric speciation.
- Soil salinity is measured by conductivity meter.
- Allopatric speciation is the formation of new species from spatially isolated population.
- Sympatric speciation is the formation of new species from segment of a population due to sudden appearence of the reproductive isolation.
- Ecesis is the establishment of organisms in an area into which they have come by dispersal or migration.
- Microhabitat is a part of habitat having specific property *e.g.*, forest floor, tree trunk.
- Ecades/Ecophenes : Individuals which have the similar genetic constitutions.
- Ecotypes/Ecological races : Individuals which have the different genetic constitution.
- Keystone species are species which influence ecosystem and determines it's properties.
- Direct factors : Factors which influence growth and distribution of organisms directly, *e.g.*, light, temperature, soil water, soil minerals, atmospheric humidity.
- Indirect factors : They are factors which express their effect on organisms through direct factors, *e.g.*, wind, rainfall, soil texture.

✍ Remote factors : The factors influence growth and distribution of organisms generally through indirect factors which in turn affect the direct factors, *e.g.*, topographic factors like attitude.

✍ Crypsis : It is a type of colouration in which an animal helps to camouflage in its natural environment. It may enable the animal to match or blend with its surroundings.

✍ Probiosis : Opposite of antibiosis, as stimulating growth of useful intestinal flora.

✍ Biotype : A clearly demarcated unit of environment showing uniformity of principal habitat conditions is known as a biotope *e.g.*, a sand desert, a sandy or rocky beach etc.

✍ Snow line : It is zone in latitude and altitude beyond which snow occurs permanently.

✍ World environment day – 5th June.

✍ Agrostology is related with the study of grasses.

✍ Extreme xerophytic character is shown by cactus.

✍ Endophyte : A plant growing within an other as parasite or symbiont.

✍ Ectophyte : An external plant parasite.

✍ Euryhaline : Organisms which can tolerate wide fluctuations in salt concentration.

✍ Sternohaline : Organisms which cannot tolerate fluctuations in salt concentrations but live at nearly constant concentration.

✍ Tropophytes : Hygrophilous in rainy season, xerophilous at other times.

✍ Crinohalophytes : Salt secreting halophytes.

✍ Apline plants which are commonly found at the top of mountains show xerophytism.

✍ Strict enforcement of Child Marriage Restraint Act and Pre-Natal Diagnostic Technique Act.

✍ India's population growth rate is about 2% a year and China's 1.4%.

✍ Maximum population growth rate in the world is in Kenya (5.5%).

✍ Austria has shown a negative growth rate.

✍ The most thickly populated country of the world is Bangladesh.

✍ Greenland is the most thinly populated country (45/$Km^2$) followed by Australia.

✍ Mumbai will become the second largest megapolis in the world by the turn of the century with a population of 18.9 million.

✍ Tokyo is the largest city with 26.5 million people.

✍ In last census Nagaland registered the highest growth rate of 56.86% while Kerala the lowest, 13.98%.

✍ The most thickly populated state of India is West Bengal (766/$Km^2$); the most sparsely populated area of the country is Arunachal Pradesh (10 $Km^2$).

✍ The first district to become 100% literate is Ernakulam in Kerala.

✍ Indian population is a young population, while the population of USA, England, Germany, etc. is ageing population.

✍ Population explosion : Also called Population holocaust. It is high growth rate of human population.

✍ In July, 1997, Indian population was growing at the rate of 16 million per year which means 45,000 per day and 31 per minute.

✍ Indian Population Project-VI (IPP-6) ended in March, 1997.

## OT Ordinary Thinking

### Objective Questions

### Ecology (General)

**1.** Plant species having a wide range of genetical distribution evolve into a local population knows as **[Kerala PMT 2009]**
(a) Ecotype (b) Biome
(c) Ecosystem (d) Population
(e) Ephemerals

**2.** The geographic limit within which a population exists is called **[Odisha JEE 2009]**
(a) Niche (b) Ecosystem
(c) Habitat (d) Biome

**3.** Reproductive isolation between segments of a single population is termed **[DUMET 2009]**
(a) Sympatry (b) Allopatry
(c) Population divergence (d) Disruptive divergence

**4.** Which is not applicable to the biological species concept **[WB JEE 2009]**
(a) Hybridization (b) Natural population
(c) Reproductive isolation (d) Gene pool

**5.** Identify the correctly matched pair **[CBSE PMT 2005]**
(a) Basal convention – Biodiversity conservation
(b) Kyoto protocol – Climatic change
(c) Montreal protocol – Global warming
(d) Ramsar convention – Ground water pollution

**6.** Which of the following is correct **[Odisha JEE 2005]**
(a) 99% of existed species are extinct
(b) 25% of existed species are extinct
(c) 40% of existed species are extinct
(d) 30% of existed species are extinct

**7.** The organisms spending most of the time in transitional area between two communities are called **[HP PMT 2005]**
(a) Exotic species (b) Edge species
(c) Keystone species (d) Critical link species

**8.** Which of the following statements is true regarding individuals of same species **[CBSE PMT 2002]**
(a) They are interbreeding (b) They live in same niche
(c) They live in different niche (d) They live in different habitat

**9.** Which one of the following correctly represents an organism and its ecological niche **[AIIMS 2005]**
(a) Vallisneria and pond
(b) Desert locust (Scistocerca) and desert
(c) Plant lice (aphids) and leaf
(d) Vultures and dense forest

**10.** Niche overlap indicates **[CBSE PMT 2006]**
(a) Sharing of one or more resources between the two species
(b) Mutualism between two species
(c) Active cooperation between two species
(d) Two different parasites on the same host

**11.** What is a keystone species **[CBSE PMT 2004; AIIMS 2007]**
(a) A rare species that has minimal impact on the biomass and on other species in the community
(b) A dominant species that constitutes a large proportion of the biomass and which affects many other species
(c) A species which makes up only a small proportion of the total biomass of a communities, yet has a huge impact on the communities organization and survival
(d) A common species that has plenty of biomass, yet has a fairly low impact on the communities organization

**12.** One of the following pair of animals is an example of commensalism **[MHCET 2015]**
(a) *Sacculina* – crab (b) *Plasmodium* – *Anopheles*
(c) Golden Jackal – Tiger (d) Ascaris – Man

**13.** The ecological niche of population is a **[MHCET 2003]**
(a) Geographical area that it covers
(b) Place where it lives
(c) Set of conditions and resource it uses
(d) None of these

**14.** Two plants can be conclusively said to belong to the same species if they **[CBSE PMT 2007]**
(a) Can reproduce freely with each other and form seeds
(b) Have more than 90 percent similar genes
(c) Look similar and possess identical secondary metabolites
(d) Have same number of chromosomes

**15.** The study of inter-relationship between living organisms and their environment is called **[KCET 1993; RPMT 1996, 2005; CPMT 2002]**
(a) Ecosystem (b) Phytogeography
(c) Ecology (d) Phytosociology

**16.** Term '*ecology*' was proposed by **[RPMT 1995; MP PMT 2003; KCET 2004]**
(a) William (b) Odum
(c) Reiter (d) Daubenmier

**17.** Which one of the following is a population **[WB JEE 2012]**
(a) A spider and some trapped flies in its web
(b) Earthworm that lives in a grassland along with other arthropods
(c) All the plants in a forest
(d) All the oak trees in a forest

**18.** E.P. Odum is a leading **[HP PMT 2005]**
(a) Bryologist (b) Physiologist
(c) Ecologist (d) Mycologist

**19.** The term '*biocoenosis*' was proposed by **[MP PMT 2000; KCET 2001]**
(a) Tansley (b) Carl Mobius
(c) Warming (d) None of the above

**20.** The species of plants that play a vital role in controlling the relative abundance of other species in a community are called **[Kerala CET 2005; Kerala PMT 2007]**

**Or**

Name the term used to describe a single dominant species that dictates community structure **[Kerala PMT 2004; Bihar CECE 2006]**
(a) Edge species (b) Link species
(c) Keystone species (d) Pioneer species
(e) Successional species

**21.** World environment day is celebrated on **[CPMT 2002; KCET 2004; RPMT 2005; Odisha JEE 2011]**
(a) 15th March (b) 15th April
(c) 4th May (d) 5th June

**22.** If the soil composition is as under, then which of the compositions can have higher water holding capacity **[MP PMT 2013]**
(a) Clay > Silt > Sand (b) Clay < Silt > Sand
(c) Clay < Silt < Sand (d) Clay = Silt < Sand

**23.** Some organisms resemble other organisms and thus escape from enemies. This phenomenon is known as **[AFMC 2006]**
(a) Homology (b) Variation
(c) Analogy (d) Mimicry

**24.** Biogenetic law was put forward by **[EAMCET 1993; AMU (Med.) 2000; CPMT 2002, 10; RPMT 2005]**

**Or**

The term ecology was coined by **[BHU 2001; AFMC 2004]**
(a) E. Haeckel (b) Charles Darwins
(c) Karl von Bear (d) Lamarck

**25.** Agrostology is related with the study of **[RPMT 1997]**
(a) Agricultural growth (b) Epiphytes
(c) Grasses (d) Nematode diseases

**26.** An association of individuals of different species living in the same habitat and having functional interactions is **[AIPMT 2015]**
(a) Biological community (b) Ecotone
(c) Biome (d) Consociation

**27.** A high density of elephant population in an area can result in **[CBSE PMT 2007]**
(a) Mutualism (b) Intra specific competition
(c) Inter specific competition (d) Predation on one another

**28.** Name the famous plants ecologist **[MP PMT 1998]**

**Or**

Who is considered as the Father of Ecology in India **[DUMET 2010]**
(a) Jagdish Chandra Bose (b) Birbal Sahani
(c) Ramdeva Misra (d) Charles Darwin

**29.** On based temperature plants are classified by **[RPMT 1999]**
(a) Warming (b) Climent
(c) Haeckel (d) Raunkiaer

**30.** The term 'niche' of a species refers to **[AFMC 1999; CPMT 2005; DUMET 2009]**
(a) Specific and habitual function
(b) Specific place where an organism lives and performs its duty
(c) Competitive power of an organism
(d) Specific function of organism

**31.** Which of the following isolation is important for speciation **[CBSE PMT 2002; Wardha 2005]**
(a) Seasonal (b) Tropical
(c) Behavioural (d) Reproductive

**32.** Number of endangered species of angiosperms in India is **[KCET 2001]**
(a) 487 (b) 3000
(c) 5000 (d) 15,000

**33.** The carrying capacity of a population is determined by its **[BHU 2001]**
(a) Birth rate (b) Death rate
(c) Limiting resource (d) Reproductive status

**34.** Tectonic is the study of **[MHCET 2001]**
(a) Earthquakes (b) Earth's crust
(c) Sand (d) None of these

**35.** A community is defined as **[CBSE PMT 2001]**
(a) A group of birds (b) A collection of species
(c) Interacting populations (d) An interactive ecosystem

**36.** Distribution of different plants geographically is called **[MP PMT 1996; CBSE PMT 1998; AFMC 2002, 06; DPMT 2004]**
(a) Allopatric (b) Sympatric
(c) Geopatric (d) Sibling

**37.** Group of two or more than two plant species is called as **[RPMT 2002]**
(a) Plant community (b) Animal ecosystem
(c) Plant ecosystem (d) Ecological niche

**38.** Match the following with correct combination

| Column I | | Column II |
|---|---|---|
| A. Mutualism | 1 | Tiger and deer |
| B. Commensalism | 2 | Cuscuta on Cissus |
| C. Parasitism | 3 | Sucker fish and shark |
| D. Predation | 4 | Crab and sea anemone |

**[Kerala PMT 2006, 08; NEET 2013]**
(a) A – 1, B – 2, C – 3, D – 4 (b) A – 4, B – 3, C – 2, D – 1
(c) A – 1, B – 3, C – 2, D – 4 (d) A – 2, B – 3, C – 1, D – 4
(e) A – 4, B – 2, C – 3, D – 1

**39.** Which one of the following combination is wrong **[WB-JEE 2016]**
(a) Ramsar Convention - Air pollution
(b) Kyoto Protocol - Climate change
(c) Montreal Protocol - Ozone depletion
(d) Rio Convention - Sustainable development

## Environment (Abiotic and Biotic factors)

**1.** When both partners/components are affected negatively, the nature of interaction is **[AFMC 2008; AIPMT 2015]**
(a) Commensalism (b) Predation
(c) Competition (d) Amensalism

**2.** Lime is added to the soil which is too **[DUMET 2009]**
(a) Sandy (b) Salty
(c) Alkaline (d) Acidic

**3.** Maximum damage to forest cover on earth is being caused by **[MP PMT 2012]**
(a) Edaphic factors (b) Climatic factors
(c) Biotic factors (d) Physiographic factors

**4.** The least porous soil among the following is a **[DUMET 2009]**
(a) Loamy soil (b) Silty soil
(c) Clay soil (d) Peaty soil

**5.** Which of the following statements is false regarding predators **[Kerala PMT 2012]**
(a) Predators keep prey populations under control
(b) Predators help in maintaining species diversity in a community
(c) If a predator is not efficient, then the prey population would become extinct
(d) Herbivores (predators) have a greater advantage since the plants cannot run away to avoid predation
(e) Tiger is an example of a predator

**6.** An association of two species where both the partners derive mutual benefit from each other is **[HP PMT 2005]**
(a) Parasitism (b) Symbiosis
(c) Commensalism (d) Predation

**7.** Small fish get stuck near the bottom of a shark and derives its nutrition from it. This kind of association is called as **[BHU 2005]**

**Or**

Barnacles growing on the back of whale is an example for **[Kerala PMT 2010]**
(a) Symbiosis (b) Commensalism
(c) Predation (d) Parasitism

**8.** Which is not a part of atmosphere **[MP PMT 2005]**
(a) Light (b) Temperature
(c) Edaphic factor (d) Precipitation

**9.** Acclimatization is **[MHCET 2004]**
(a) Pure-line breeding
(b) Pure-line selection
(c) Introduction
(d) Adaptation to new environment

**10.** In which one of the following pairs is the specific characteristic of a soil not correctly matched **[CBSE PMT 2004]**
(a) Chernozems – Richest soil in the world
(b) Black soil – Rich in calcium carbonate
(c) Laterite – Contains aluminium compound
(d) Terra rossa – Most suitable for roses

**11.** The instrument which measures wind velocity is **[MP PMT 2004]**
(a) Lactometer (b) Anemometer
(c) Hydrometer (d) Barometer

**12.** A phenomenon when parasite parasitizes themselves is known as **[DUMET 2010]**
(a) Hyperparasitism (b) Parasitoids
(c) Monoxenous parasitism (d) Polyxenous parasitism

**13.** The possible beneficial affect of grazing animals is the **[BVP 2003]**
(a) Removal of wild animals
(b) Eradication of weeds
(c) Removal of wild plants
(d) Addition of their excrete to the soil

**14.** Prolonged liberal irrigation of agricultural fields is likely to create the problem of **[CBSE PMT 2005]**
(a) Acidity (b) Aridity
(c) Salinity (d) Metal toxicity

**15.** Humus is important for plant growth because **[BVP 2003]**
(a) It is partially decomposed
(b) It is derived from leaves
(c) It is rich in nutrients and increases the water holding capacity of soil
(d) It is made up of dead organic matter

**16.** Humus is found in **[CPMT 2003]**
(a) Top portion of soil (b) Middle portion of soil
(c) Deep portion of soil (d) None of these

**17.** Ozone saves the biosphere by absorbing the high energy radiation called **[Kerala CET 2003]**
(a) Infra-red (IR) (b) Ultraviolet ray (UV)
(c) X-ray (d) Gama rays

**18.** Which one of the following is a right matching pair of certain organism(s) and the kind of association **[AIIMS 2003]**
(a) Shark and sucker fish-Amensalism
(b) Algae and fungi in lichens-Mutualism
(c) Orchids growing on trees-Parasitism
(d) Cuscuta (dodder) growing in other flowering plantsepiphytism

**19.** Surface water of lake enrich in having **[AFMC 2003]**
(a) Organic substance (b) Minerals
(c) Inorganic substance (d) Pollutants

**20.** Which of the following soil is transported by wind **[CPMT 2002, 10; BHU 2006]**
(a) Alluvial (b) Aerial
(c) Eolian (d) Glacial

**21.** Ozone hole means **[AFMC 2001]**
(a) Hole in the stratosphere
(b) Same concentration of ozone
(c) Decrease in concentration of ozone
(d) Increase in the concentration of ozone

**22.** A bird enters the mouth of crocodile and feed on parasitic leeches. The bird gets food and crocodile gets ribs of blood sucking leeches. Both the partners can live independently. Such an association is **[BHU 2001]**
(a) Mutualism (b) Amensalism
(c) Commensalism (d) Protocooperation

**23.** Clay soil is obtained **[Pb. PMT 2000]**
(a) In desert (b) Around ponds
(c) On seashore (d) On rocks

**24.** Soil is a mixture of **[Pb. PMT 2000]**
(a) Sand and clay (b) Sand and humus
(c) Clay and humus (d) Sand, clay and humus

**25.** Populations are said to be sympatric when ..... **KCET 2010]**
(a) Two populations live together and freely interbreed to produce sterile offspring
(b) Two populations are physically isolated by natural barriers
(c) Two populations are isolated but occasionally come together to interbreed
(d) Two populations share the same environment but cannot interbreed

**26.** Match the following and choose the correct combination from the options given below

| Column I (Population interaction) | | Column II (Examples) | |
|---|---|---|---|
| A. | Mutualism | 1. | Ticks on dogs |
| B. | Commensalism | 2. | *Balanus* and *Chathamalus* |
| C. | Parasitism | 3. | Sparrow and any seed |
| D. | Competition | 4. | Epiphyte on a mango branch |
| E. | Predation | 5. | Orchid *Ophrys* and bee |

**[Kerala PMT 2011, 12]**
(a) A–1, B–5, C–4, D–3, E–2 (b) A–2, B–1, C–5, D–4, E–3
(c) A–3, B–2, C–1, D–5, E–4 (d) A–4, B–3, C–2, D–1, E–5
(e) A–5, B–4, C–1, D–2, E–3

**27.** Which is the main causative factor of desertification **[CBSE PMT 1995]**
(a) Developmental activities (b) Tourism
(c) Overgrazing (d) Irrigated agriculture

**28.** Ultraviolet radiation from sunlight cause the reaction that produce **[CBSE PMT 1990; MP PMT 2012]**
(a) Carbon monoxide (b) Sulphur dioxide
(c) Ozone (d) Fluorides

**29.** Maximum contribution of $O_2$ is from
(a) Phytoplankton (b) Grasslands
(c) Herbs and shrubs (d) Dense forests

**30.** Which of the following statements is incorrect **[KCET 1998]**
(a) Lichen, an association of fungus and algae is an example of Mutualism
(b) Those Epiphytes which use other plants for support only and not for water or food supply are examples of commensalism
(c) Sea-anemone on hermit-crab is an example of protocooperation
(d) Mutualism, protocooperation, commensalism cannot be included under Symbiosis

**31.** Column-I represent the size of the soil particles and Column-II represents type of solid components. Which of the following is correct match for the Column I and Column II.

| Column I | | Column II | |
|---|---|---|---|
| A. | 0.2 to 2.00 *mm* | (i) | Slit |
| B. | Less than 0.002 *mm* | (ii) | Clay |
| C. | 0.02 to 0.2 *mm* | (iii) | Coarse sand particle |
| D. | 0.002 to 0.02 *mm* | (iv) | Fine sand particle |

**[GUJCET 2007]**
(a) (A)–(ii),(B)–(iii),(C)–(iv),(D)–(i)
(b) (A)–(iv),(B)–(i),(C)–(iii),(D)–(ii)
(c) (A)–(iii),(B)–(ii),(C)–(iv),(D)–(i)
(d) None of the above

**32.** Soil salinity is measured by **[BHU 1995]**
(a) Porometer (b) Potometer
(c) Conductivity meter (d) Calorimeter

**33.** Which biological factor is responsible for poor vegetation in deserts **[CPMT 1993]**
(a) Grazing by animals and goats
(b) Low rainfall
(c) Poor fertility of soil
(d) Native mankind

**34.** If carbon dioxide is withdrawn from the biosphere, which organism would first experience negative effects **[MP PMT 1993]**
(a) Primary producers
(b) Producers
(c) Secondary consumers
(d) Tertiary consumers

**35.** Select the incorrect statement **[Kerala PMT 2011]**
(a) Species diversity increases as we move away from the equator towards the poles
(b) Stellar's sea cow and passenger pigeon got extinct due to over exploitation by man
(c) Lantana and Eichhornia are invasive weed species in India
(d) The historic convention on biological diversity was held in 1992
(e) Among animals, insects are the most species-rich taxonomic group

**36.** Which of the following is a climatic factor **[Pune CET 1998]**
(a) Oxygen (b) Temperature
(c) Soil structure (d) Altitude

**37.** The sun loving plants are referred to as **[CPMT 1998; Pb. PMT 1999]**
(a) Halophytes (b) Heliophytes
(c) Heterotrophs (d) Sciophytes

**38.** In an aqueous environment, the microscopic animals are collectively called **[MP PMT 1999; CBSE PMT 2001]**
(a) Herbivores (b) Carnivores
(c) Planktons (d) Fauna and flora

**39.** Edaphology is the relationship between **[AIIMS 1999]**
(a) Plant and biosphere (b) Animal and ecosystem
(c) Soil and living organisms (d) Soil and biosphere

**40.** Edaphic factors are related to **[KCET 1994; CPMT 2000]**
(a) Soil (b) Animal
(c) Man (d) Temperature

**41.** Stopage of reproduction in an organism by creating hurdle in its biology or physiology or its distruction by use of another organism is known as **[CBSE PMT 1996]**
(a) Predation (b) Competition
(c) Biological control (d) Physiological control

**42.** An area of soil is thoroughly wetted and allowed to drain until capillary movement of water stopped. The water contents of the soil will give an estimate of its
(a) Capillary water (b) Storage water
(c) Field capacity (d) Gravitational water

**43.** Deforestation has an alarming effect on **[AIIMS 2001]**
(a) Increase in grazing area
(b) Sunlight
(c) Weed control
(d) Soil erosion or desertification of habitat

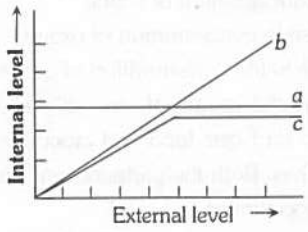
**44.** Which of the following statements regarding species interdependence are true
A. An association of two species where one is benefited and other remains unaffected is called mutualism
B. An interspecific association where both partners derive benefit from each other is called commensalism
C. A direct food relation between two species of animals in which one animals kills and feeds on another is referred as predation
D. A relationship between two species of organism where both the partners are benefited from each other is called symbiosis **[Kerala PMT 2007]**
(a) A and B only (b) C and D only
(c) A and C only (d) B and C only
(e) B and D only

**45.** The *pH* of a fertile soil is usually around **[CBSE PMT 2001; Bihar CECE 2006; MP PMT 2011]**
(a) 2 – 3 (b) 6 – 7
(c) 8 – 10 (d) 11 – 12

**46.** Territoriality occurs as a result of **[AFMC 1999; BVP 2000; Pb. PMT 2004]**
(a) Parasitism (b) Predation
(c) Co-operation (d) Competition

**47.** Solubility and availability of plant nutrients are more related to
(a) Soil *pH* (b) Soil porosity
(c) Soil temperature (d) Soil colour

**48.** The figure given below is a diagrammatic representation of response of organisms to abiotic factors. What do a, b and c represent respectively **[NCERT; CBSE PMT (Pre.) 2010]**




| | (a) | (b) | (c) |
|---|---|---|---|
| (a) | Regulator | Conformer | Partial regulator |
| (b) | Conformer | Regulator | Partial regulator |
| (c) | Regulator | Partial regulator | Conformer |
| (d) | Partial regulator | Regulator | Conformer |

**49.** Crop rotation is helpful because **[CPMT 1995]**
(a) It gives more nitrates in the soil
(b) It gives more sulphates in the soil
(c) It gives more nitrogen in the soil
(d) It gives more phosphorus in the soil

**50.** Deep black soil is considered to be highly productive due to high proportion of **[CBSE PMT 1991]**
(a) Silt and earthworm (b) Clay and humus
(c) Gravel and $Ca^{++}$ (d) Sand and *Zn*

**51.** Sheet erosion is caused by
(a) Fast running rivers (b) Wind
(c) Heavy rains (d) Glaciers

52. Mulching helps in
(a) Soil fertility
(b) Moisture conservation
(c) Improvement of soil structure
(d) Soil sterility

53. Soil conservation can be best achieved by having
(a) Wind screens (b) Good plant covers
(c) Restricted human activity (d) Low rainfall

54. Which one of the following is most appropriately defined **[CBSE PMT (Mains) 2010]**
(a) Host is an organism which provides food to another organism
(b) Amensalism is a relationship in which one species is benefited whereas the other is unaffected
(c) Predator is an organism that catches and kills other organism for food
(d) Parasite is an organism which always lives inside the body of other organism and may kill it

55. Salinity of the soil is often caused due to
(a) Accumulation of soluble minerals near or in the surface in arid region
(b) Excessive addition of water
(c) Rapid evaporation of surface water
(d) Excessive leaching

56. Select the incorrect statement **[Kerala PMT 2011]**
(a) An overwhelming majority of animals and nearly all plants maintain a constant internal temperature
(b) An orchid growing as an epiphyte on a mango branch is an example of commensalism
(c) In brood parasitism, the parasitic bird lays its eggs in the nest of its host and lets the host to incubate them
(d) Very small animals are rarely found in polar regions
(e) In amensalism, one species is harmed whereas the other is unaffected

57. Soil formed by transportation of disintegrated parent material from one place to another is called **[Pune CET 1998]**
(a) Light soil (b) Alluvial soil
(c) Heavy soil (d) Sedimentary soil

58. Soil erosion is greater when **[Pune CET 1998]**
(a) There is no rain
(b) The rainfall is low
(c) Winds do not blow
(d) The rainfall is received in heavy downpour

59. When one organism is benefitted without affecting the others is called **[CPMT 1998, 2000; MP PMT 2004; AMU (Med.) 2006; DPMT 2007; J & K CET 2008, 12; Odisha JEE 2010]**
(a) Parasitism (b) Commensalism
(c) Saprophytism (d) Symbiosis

60. Biotic factors are
(a) Chemical factors of soil which affect life
(b) Physical factors of soil which affect life
(c) All living organisms which influence other organisms
(d) Factors of atmosphere which affect life

61. Which one of the following factors is biotic **[CPMT 1993]**
(a) Photoperiod
(b) $CO_2$ content to the soil
(c) Texture and porosity of soil
(d) Rainfall

62. If the strong partner is benefitted and the weak partner is damaged, it is known as **[J & K CET 2008]**
(a) Amensalism (b) Symbiosis
(c) Predation (d) Allotrophy

63. The best source of energy in the environment is
(a) Water (b) Soil
(c) Trees (d) Ponds

64. The *Orobanche* plant is **[CPMT 1993]**
(a) Partial root parasite (b) Total root parasite
(c) Symbiont (d) Total stem parasite

65. If '+' sign is assigned to beneficial interaction '–' sign to detrimental and '0' sign to neutral interaction, then the population interaction represented by '+' '–' refers to **[NEET (Phase-II) 2016]**
(a) Parasitism (b) Mutualism
(c) Amensalism (d) Commensalism

66. Mycorrhizae are the example of **[NEET 2017]**
(a) Fungistasis (b) Amensalism
(c) Antibiosis (d) Mutualism

## Ecological Adaptation

1. The plant of this group are adapted to live partly in water and partly above substratum and free from water **[Odisha JEE 2008]**

**Or**

Pneumatophore roots are present in **[Pb. PMT 1999; RPMT 1999; BHU 2005; Odisha JEE 2008, 09]**
(a) Xerophytes (b) Thalophytes
(c) Halophytes (d) Hydrophytes

2. Which is not an adaptive feature in plants growing in physiological dry soil **[Odisha JEE 2008]**
(a) Pneumatophore
(b) Vivivary
(c) Sunkens stomata
(d) Conducting tissue rudimentary

3. Ephemerals are xerophytes that are
(a) Drought enduring (b) Drought escaping
(c) Drought resisting (d) None of the above

4. Which one of the following is not a parasitic adaptation **[NEET (Karnataka) 2013]**
(a) Development of adhesive organs
(b) Loss of digestive organs
(c) Loss of reproductive capacity
(d) Loss of unnecessary sense organs

5. Extreme xerophytic condition is shown by
(a) Brassica (b) Capparis
(c) Cactus (d) *Nerium*

6. Desert can be converted into greenland by **[MP PMT 1994; AIIMS 2001, 13]**
(a) Oxylophytes (b) Psammophytes
(c) Halophytes (d) Tropical trees

7. *Acacia arabica* is a **[AFMC 1997; BVP 2000]**
(a) Mesophyte (b) Hydrophyte
(c) Xerophyte (d) Halophyte

8. Excessive aerenchyma is characteristic of **[CPMT 1999; RPMT 2006]**
(a) Hydrophytes (b) Xerophytes
(c) Mesophytes (d) Heliophytes

**9.** A nonsucculent xerophyte with thick leathery leaves having white sticky waxy coating is **[DPMT 1999]**
(a) *Nerium* (b) *Calotropis*
(c) *Bryophyllum* (d) *Ruscus*

**10.** The feature of the xerophytic plant leaves are
(i) Leathery surface
(ii) Large surface area
(iii) Waxy cuticle
(iv) Sunken stomata on upper epidermis **[Odisha JEE 2011]**
(a) (i), (ii) and (iv) (b) (ii) and (iii)
(c) (i), (iii) and (iv) (d) (i) and (iv)

**11.** Xeric environment is characterised by **[CBSE PMT 1994]**
(a) Precipitation
(b) Low atmospheric humidity
(c) Extremes of temperature
(d) High rate of vapourisation

**12.** What is wrong about xerophytes **[CPMT 1994; Odisha JEE 2008]**
(a) Sunken stomata (b) Small spiny leaves
(c) Thick Cuticle (d) Larger number of stomata

**13.** Which one is not a trait of xerophytes **[Bihar PMT 1995; Bihar CMEE 1995]**
(a) Thick cuticle
(b) Sunken stomata
(c) Aerenchyma
(d) Well developed mechanical tissue

**14.** The vegetation of Rajasthan is **[CPMT 1996; Pb. PMT 2000; MHCET 2001, 03]**
(a) Arctic (b) Alpine
(c) Deciduous (d) Xerophytic

**15.** Type of plants having adaptations to check transpiration is **[JIPMER 1998]**
(a) Xerophytes (b) Lithophytes
(c) Halophytes (d) Epiphytes

**16.** A physiological xerophyte is **[APMEE 2002]**
(a) *Salicornia* (b) *Euphorbia*
(c) *Salvia* (d) *Agave*

**17.** A succulent xerophyte is **[DPMT 2002]**
(a) *Capparis* (b) *Calotropis*
(c) *Agave* (d) None of the above

**18.** Plants adapted to grow in shade are **[CMC 2003; Kerala PMT 2009]**
(a) Psammophytes (b) Sciophytes
(c) Mesophytes (d) Xerophytes

**19.** Conifers are adapted to tolerate extreme environmental conditions because of **[NEET (Phase-II) 2016]**
(a) Presence of vessels (b) Broad hardy leaves
(c) Superficial stomata (d) Thick cuticle

**20.** Plants which produce characteristic Pneumatophores and show vivipary belong to **[NEET 2017]**
(a) Mesophytes (b) Halophytes
(c) Psammophytes (d) Hydrophytes

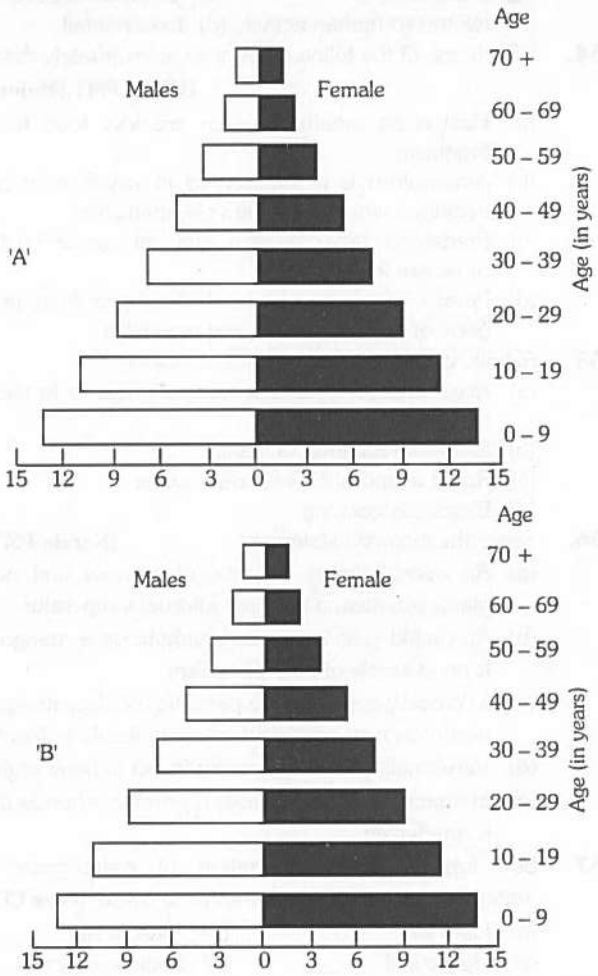
## Population Attributes

**1.** Number of births per thousand people in the population is expressed as
(a) Growth rate (b) Crude birth rate
(c) Conception rate (d) Reproduction rate

**2.** Which one of the following factors has contributed most in the rapid rise of human population in the present century
(a) Increase in birth rate
(b) Decrease in death rate of old people
(c) Decrease in infantile mortality
(d) Polygamy

**3.** Who was the first scientist to estimate the human population
(a) Darwin (b) Malthus
(c) Garrod (d) Vavilor

**4.** A country with a high rate of population growth took measures to reduce it. The figure below shows age-sex pyramids of populations A and B tewenty years apart. Select the correct interpretation about them **[CBSE PMT 2009]**




Interpretations
(a) "A" is more recent and shows slight reduction in the growth rate
(b) "B" is earlier pyramid and shows stabilized growth rate
(c) "B" is more recent showing that population is very young.
(d) "A" is the earlier pyramid and no change has occurred in the growth rate

**5.** The rate at which new born individuals are joining the population by reproduction is known as **[HP PMT 2005; MP PMT 2012]**
(a) Natality (b) Fertility
(c) Contractability (d) None

**6.** Population pyramids were first made by **[AFMC 2008]**
(a) Bodenheimer (b) Van Humboldt
(c) Daubenmaire (d) Elton

**7.** If the mean and the median pertaining to a certain character of a population are of the same value, the following is most likely to occur **[CBSE PMT 2007]**
(a) A normal distribution (b) A bi-modal distribution
(c) A T-shaped curve (d) A skewed curve

**8.** Adaptive radiation refers to **[CBSE PMT 2007]**

(a) Adaptations due to Geographical isolation
(b) Evolution of different species from a common ancestor
(c) Migration of members of a species to different geographical areas
(d) Power of adaptation in an individual to a variety of environments

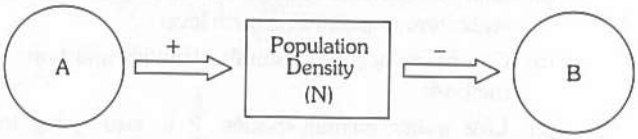
**9.** Natality is the characteristic of a population which means **[Kerala PMT 2006]**

(a) The total number of individuals present per unit area at a given time
(b) The increase in number of individuals in a population under given environmental conditions
(c) Loss of individuals due to death in a population under given environmental conditions
(d) The movement of individuals into and out of population
(e) Each population has three different age groups

**10.** Geometric representation of age structure is a characteristic of **[CBSE PMT 2007]**

(a) Biotic community (b) Population
(c) Landscape (d) Ecosystem

**11.** Following figure refer the density of a population in a given habitat during a given period. Due to changes in four basic processes it fluctuates. Fill up A and B boxes in the given diagram with correct options **[NCERT]**




(a) A = Natality + Emigration, B = Mortality + Immigration
(b) A = Birth rate + Death rate, B = Migration + Emigration
(c) A = Natality + Mortality, B = Immigration + Emigration
(d) A = Natality + Immigration, B = Mortality + Emigration

**12.** The formula for exponential population growth is **[CBSE PMT 2006; Kerala PMT 2010]**

(a) $rN / dN = dt$ (b) $dN / dt = rN$
(c) $dt / dN = rN$ (d) $dN / rN = dt$

**13.** The aggregate of process that determine the size and composition of any population is called **[MP PMT 1995]**

(a) Population dispersal (b) Population dynamics
(c) Population explosion (d) Population density

**14.** In India, human population is heavily weighed towards the younger age groups as a result of **[CBSE PMT 1995]**

(a) Long life-span of many individuals and low birth rate
(b) Short life-span of many individuals and of high birth rate
(c) Long life-span of many individuals and of a high birth rate
(d) Short life-span and low birth rate

**15.** Population density of terrestrial organisms is measured in terms of individual per **[NCERT; KCET 2007]**

(a) $Meter^3$ (b) $Meter^4$
(c) Meter (d) $Meter^2$

**16.** The age pyramid with broad base indicates **[NEET (Karnataka) 2013]**

(a) High percentage of old individuals
(b) Low percentage of young individuals
(c) A stable population
(d) High percentage of young individuals

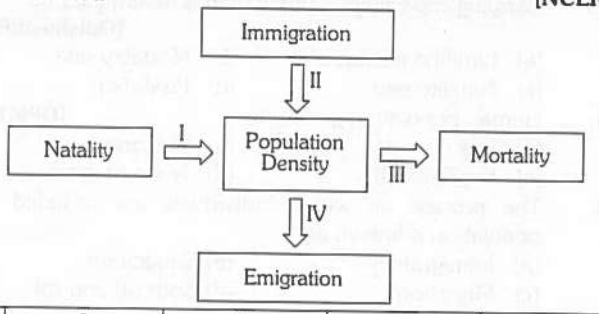
**17.** The abundance of a species population within its habitat is called **[CBSE PMT 1995]**

(a) Niche density (b) Absolute density
(c) Relative density (d) Regional density

**18.** The population of an insect species shows an explosive increase in numbers during rainy season followed by its disappearance at the end of the season. What does this show **[CBSE PMT 2007]**

(a) S- shaped or sigmoid growth of this insect
(b) The food plants mature and die at the end of the rainy season
(c) Its population growth curve is of J-type
(d) The population of its predators increases enormously

**19.** Select the right option in which I, II, III and IV are correctly identified **[NCERT]**




| | I | II | III | IV |
|---|---|---|---|---|
| (a) | Increase | Decrease | Increase | Decrease |
| (b) | Decrease | Increase | Decrease | Increase |
| (c) | Increase | Increase | Decrease | Decrease |
| (d) | Decrease | Decrease | Increase | Increase |

**20.** The animal population becomes too large for its feeding source or its habitat, its members starve die but humans escape this disaster by

(a) Immigration only
(b) Emigration only
(c) Transportation of food
(d) Both emigration and transportation of food

**21.** Population surge 230 years ago was due to

(a) Industrial revolution (b) Agricultural revolution
(c) Cultural revolution (d) Intellectual revolution

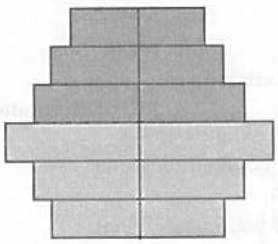
**22.** The rate of natural increase in human population refers to

(a) Birth rate (b) Mortality
(c) Natality minus death rate (d) Birth rate plus death rate

**23.** Bell-shaped polygonal pyramid indicates **[DUMET 2010]**

(a) High percentage of young individuals
(b) Moderate percentage of young individuals
(c) Low percentage of young individuals
(d) Low percentage of old individuals

**24.** What type of human population is represented by the following pyramid **[NCERT; CBSE PMT (Pre.) 2011]**




(a) Expanding population (b) Vanishing population
(c) Stable population (d) Declining population

**25.** The relation between species richness and area is described on a logarithmic scale by the equation [where S= species richness, A=area, Z=slope of the line (regression coefficient) C=Y-intercept] **[Kerala PMT 2012]**

(a) log S= log C- Z log A (b) log S= Z log A
(c) log S= log C+ Z log A (d) log S= log C
(e) log C= log S +Z log A

## Growth of human population

**1.** In stable population predation
(a) Is harmful
(b) Is beneficial
(c) Increases the number of predators
(d) Depletes the prey

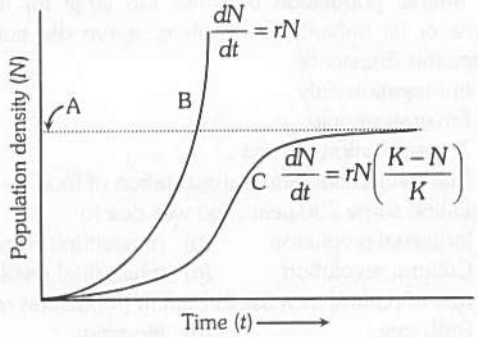
**2.** Carrying capacity of a population is determined by **[Odisha JEE 2009]**
(a) Limiting resources (b) Mortality rate
(c) Natality rate (d) Predation

**3.** Human population growth is **[DPMT 2006]**
(a) Lag (b) Stationary
(c) Exponential (d) None of these

**4.** The process by which individuals are included into a population is known as
(a) Immigration (b) Emigration
(c) Migration (d) Both (a) and (b)

**5.** The eqn. $\frac{\Delta N_n}{\Delta N_t} = B$ represents which of the following **[WB JEE 2008]**
(a) Natality (b) Growth rate
(c) Mortality (d) All of these

**6.**




Which is correctly labelled with respect to the given diagram **[AIIMS 2012]**
(a) B : Logistic curve
(b) C : Carrying capacity
(c) C : Exponential curve
(d) A : Carrying capacity

**7.** If in a population, natality is balanced by mortality then there will be **[MH CET 2004; AFMC 2009]**
(a) Decrease in population growth
(b) Zero population growth
(c) Increase in population growth
(d) Over population

**8.** Population termed r-strategists **[MH CET 2003]**
(a) Have J-shaped growth curves
(b) Have type III survivorship curves
(c) Are usually pioneer species
(d) All of these

**9.** Two opposite forces operate in the growth and development of every population. One of them related to the ability to reproduce at a given rate. The force opposite to it is called **[CBSE PMT 1998, 2003]**
(a) Biotic control (b) Mortality
(c) Fecundity (d) Environmental resistances

**10.** When environmental conditions are favourable, then population growth curve will be **[MP PMT 2000]**
(a) Sigmoid (b) 'J' Shaped
(c) 'S' shaped (d) Both (a) and (c)

**11.** A logistic growth curve depicting a population that is limited by a definite carrying capacity is shaped like the letter **[DUMET 2010]**
(a) *J* (b) *L*
(c) *M* (d) *S*

**12.** In India, the population growth **[CBSE PMT 1996]**
(a) Like some animal species, human population is likely to reach zero population growth level
(b) Can be reduced by natural calamities and birth control methods
(c) Like many animal species, it is also going to take sigmoid curve
(d) Can be controlled by adopting national family welfare programmes

**13.** The concept that "*Population tends to increase geometrically while food supply increases arithmetically*" was put forward by **[CBSE PMT 1995; BHU 2000]**
(a) Thomas Malthus (b) Adam Smith
(c) Stuart Mill (d) Charles Darwin

**14.** Which of the following factors regulate human life with reference to population density **[MP PMT 1994]**
(a) Availability of blood, housing and health facilities
(b) Urbanisation
(c) Climatic conditions
(d) All the above

**15.** The measure of maximum rate of reproduction under optimal conditions is known as **[MP PMT 1994]**
(a) Population growth (b) Biotic potential
(c) Carrying capacity (d) None of these

**16.** The best method to solve the population problem in India is to **[MP PMT 2012]**
(a) Increase food production (b) Increase medical facilities
(c) Conserve natural resources (d) Reduce birth rate

**17.** Information on birth-rate, death-rate, sex-ratio, age distribution of a population can be got from **[MP PMT 1994]**
(a) Natality table (b) Mortality table
(c) Age distribution table (d) Life table

**18.** In a population where competition between individuals is severe, then the distribution is said to be **[MP PMT 1994]**
(a) Random (b) Uniform
(c) Irregular (d) Non-random

**19.** Which of the following is not a controlling factor of population density **[MP PMT 2010]**
(a) Psychological factor (b) Geographical factor
(c) Socioeconomic factor (d) Demographic factor

**20.** Human population after 17th century A.D. is thought to be in **[MP PMT 1993]**
(a) Lag phase (b) Exponential phase
(c) Stationary phase (d) None of these

**21.** The impact of human population is directly related to **[MP PMT 1993]**
(a) Standard of living (b) Food supply and housing
(c) Health and medical care (d) All of the above

**22.** The logistic population growth is expressed by the equation **[CBSE PMT (Mains) 2011]**

**Or**

The carrying capacity of environment for a given population be represented by the equation **[AMU (Med.) 2012]**

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

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

**23.** Number of death and birth in the last stage of plateau growth curve of a population will be
(a) Equal unlike of middle stage
(b) Unequal with more deaths
(c) Unequal with less deaths
(d) Equal like of middle stage

**24.** Main cause of population explosion in the world is
(a) Excellent job facilities
(b) Increase in agricultural production
(c) Excellent health care
(d) Fewer battles and wars

**25.** Sigmoid growth curve define by
(a) Malthus (b) Adam smith
(c) Verhulst (d) Charles Darwin

**26.** Population growth curve in most animals, except humans is **[MH CET 2004]**
(a) S–shaped (b) J–shaped
(c) J–shaped with tail (d) S–shaped with tail

**27.** Match list I with list II and choose the correct option

| | List I | | List II |
|---|---|---|---|
| A | Pacific salmon fish | 1 | Verhulst-Pearl Logistic growth |
| B | $N_t = N_0e^{rt}$ | 2 | Breeds only once in lifetime |
| C | Oyster | 3 | Exponetial growth |
| D | $dN/dt = rN\left(\frac{K-N}{K}\right)$ | 4 | A large number of small sized offsprings |

**[Kerala PMT 2011]**
(a) A–4, B–3, C–1, D–2 (b) A–3, B–4, C–1, D–2
(c) A–3, B–1, C–4, D–2 (d) A–2, B–3, C–4, D–1
(e) A–2, B–4, C–3, D–1

**28.** High growth at the time of exponential phase of human population growth curve is due to **[MP PMT 2006]**
(a) High birth and death rates
(b) High birth and low death rate
(c) Low birth and high death rate
(d) Low birth and death rates

**29.** Rate of human population growth is
(a) Directly proportional to good weather
(b) Directly proportional to industrial development
(c) Inversely proportional to education
(d) Directly proportional to the use of drugs

**30.** A biologist studied the population of rats in a barn. He found that the average natality was 250, average mortality 240, immigration 20 and emigration 30. The net increase in population is **[NEET 2013]**
(a) Zero (b) 10
(c) 15 (d) 05

**31.** Population density means
(a) The number of human per unit area
(b) The number of human in a unit area at a specific time
(c) The concentration of human population at a place
(d) None of above

**32.** According to which theory will be the human population out-run food supply
(a) Altrusian theory
(b) Malthusian theory
(c) Eltons theory
(d) Kalthusian theory

**33.** Pertaining to human population if there is a decrease in competition, it would be the result of
(a) High population density
(b) Explosion of population density
(c) Stable but high population density
(d) Low population density

**34.** When does the growth rate of a population following the logistic model equal zero. The logistic model is given as $dN/dt = rN(1-N/K)$ **[NEET (Phase-I) 2016]**
(a) When N/K is exactly one
(b) When N nears the carrying capacity of the habitat
(c) When N/K equals zero
(d) When death rate is greater than birth rate

**35.** Asymptote in a logistic growth curve is obtained when **[NEET 2017]**
(a) The value of 'r' approaches zero
(b) K = N
(c) K > N
(d) K < N

## NCERT Exemplar Questions

**1.** Autecology is the **[NCERT]**
(a) Relation of heterogenous populations to its environment
(b) Relation of an individual to its environment
(c) Relation of a community to its environment
(d) Relation of a biome to its environment

**2.** Ecotone is **[NCERT]**
(a) A polluted area
(b) The bottom of a lake
(c) A zone of transition between two communities
(d) A zone of developing community

**3.** Biosphere is **[NCERT]**
(a) A component in the ecosystem
(b) Composed of the plants present in the soil
(c) Life in the outer space
(d) Composed of all living organisms present on earth which interact with the physical environment

**4.** Ecological niche is **[NCERT]**
(a) The surface area of the ocean
(b) An ecologically adapted zone
(c) The physical position and functional role of a species within the community
(d) Formed of all plants and animals living at the bottom of a lake

**5.** According to Allen's Rule, the mammals from colder climates have **[NCERT]**
(a) Shorter ears and longer limbs
(b) Longer ears and shorter limbs
(c) Longer ears and longer limbs
(d) Shorter ears and shorter limbs

**6.** Salt concentration (Salinity) of the sea measured in parts per thousand is **[NCERT]**
(a) 10 – 15 (b) 30 – 70
(c) 0 – 5 (d) 30 – 35

**7.** Formation of tropical forests needs mean annual (c) One species is benefitted and other is unaffected temperature and mean annual precipitation as **[NCERT]**
(a) 18 - 25°C and 150 – 400 cm
(b) 5 - 15°C and 50 – 100 cm
(c) 30 - 50°C and 100 – 150 cm
(d) 5 - 15°C and 100 – 200 cm

**8.** Which of the following forest plants controls the light conditions at the ground **[NCERT]**
(a) Lianas and climbers (b) Shrubs
(c) Tall trees (d) Herbs

**9.** What will happen to a well growing herbaceous plant in the forest if it is transplanted outside the forest in a park **[NCERT]**
(a) It will grow normally
(b) It will grow well because it is planted in the same locality
(c) It may not survive because of change in its micro climate
(d) It grows very well because the plant gets more sunlight

**10.** If a population of 50 *Paramoecium* present in a pool increases to 150 after an hour, what would be the growth rate of population **[NCERT]**
(a) 50 per hour (b) 200 per hour
(c) 5 per hour (d) 100 per hour

**11.** What would be the per cent growth or birth rate per individual per hour for the same population mentioned in the previous question (Question 10) **[NCERT]**
(a) 100 (b) 200
(c) 50 (d) 150

**12.** A population has more young individuals compared to the older individuals. What would be the status of the population after some years **[NCERT]**
(a) It will decline
(b) It will stabilise
(c) It will increase
(d) It will first decline and then stabilise

**13.** What parameters are used for tiger census in our country's national parks and sanctuaries **[NCERT]**
(a) Pug marks only
(b) Pug marks and faecal pellets
(c) Faecal pellets only
(d) Actual head counts

**14.** Which of the following would necessarily decrease the density of a population in a given habitat **[NCERT]**
(a) Natality>mortality (b) Immigration>emigration
(c) Mortality and emigration (d) Natality and immigration

**15.** A protozoan reproduces by binary fission. What will be the number of protozoans in its population after six generations **[NCERT]**
(a) 128 (b) 24
(c) 64 (d) 32

**16.** In 2005, for each of the 14 million people present in a country, 0.028 were born and 0.008 died during the year. Using exponential equation, the number of people present **[NCERT]**
(a) 25 millions (b) 17 millions
(c) 20 millions (d) 18 millions

**17.** Amensalism is an association between two species where **[NCERT]**
(a) One species is harmed and other is benefitted
(b) One species is harmed and other is unaffected
(c) One species is benefitted and other is unaffected
(d) Both the species are harmed

**18.** Lichens are association of **[NCERT]**
(a) Bacteria and fungus (b) Alga and bacterium
(c) Fungus and alga (d) Fungus and virus

**19.** Which of the following is a partial root parasite **[NCERT]**
(a) Sandal wood (b) Mistletoe
(c) *Orobanche* (d) *Ganoderma*

**20.** Which one of the following organisms reproduces sexually only once in its life time **[NCERT]**
(a) Banana (b) Mango
(c) Tomato (d) Eucalyptus

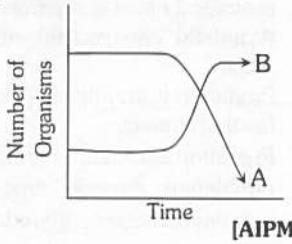
# Critical Thinking

## Objective Questions

**1.** In recent years, there has been an increasing incidence of floods in the plains of northern India because
(a) There has been an increase in annual rainfall
(b) The rate of silting of dams has gone up
(c) There has been increased deforestation in the catchment areas
(d) Increased areas of land is being self cultivated

**2.** The change of the lighter coloured variety of peppered moth *Biston betularia* to its darker variety (carbonaria) is due to **[CBSE PMT 1995]**
(a) Mutation of single Mendelian gene for survival in the smoke-laden industrial environment
(b) Deletion of a segment of gene due to industrial pollution
(c) Industrial carbon deposited on the wings of moth resulting in darker variety
(d) Translocation of a block of genes in chromosomes in response to heavy carbons

**3.** The following graph depicts changes in two populations (A and B) of herbivores in a grassy field. A possible reason for these is that




**[AIPMT (Cancelled 2015]**
(a) Population B competed more successfully for food than population A
(b) Population A produced more offspring than populaiton B
(c) Population A consumed the members of population B
(d) Both plant populations in this habitat decreased

**4.** Study of relationship between communities and environment is called **[CPMT 1999; JIPMER 2001]**
(a) Ethnology (b) Ecology
(c) Synecology (d) Autecology

**5.** The closely related morphologically similar sympatric populations, but reproductively isolated, are designated as **[MP PMT 1993; CBSE PMT 1995; CPMT 2000]**
(a) Clines (b) Demes
(c) Clones (d) Sibling species

**6.** The abundance of a species population within its habitat is called **[AIIMS 2001, 02]**
(a) Niche density (b) Regional density
(c) Relative density (d) Absolute density

**7.** Which of the following statements is correct for species **[Wardha 2005]**
(a) The members of a species occupy the same habitat
(b) They are morphologically similar
(c) They can interbreed among themselves
(d) They cannot interbreed with members of the other species

**8.** Which of the following is not true for a species **[CBSE PMT 2005]**
(a) Members of a species can interbreed
(b) Gene flow does not occur between the populations of a species
(c) Each species is reproductively isolated from every other species
(d) Variations occur among members of a species

**9.** Mass of living matter at a trophic level in an area at any time is called **[CBSE PMT (Pre.) 2011; AMU (Med.) 2012 AIPMT (Cancelled) 2015]**
(a) Standing state (b) Standing crop
(c) Detritus (d) Humus

**10.** What is true about the isolated small tribal populations **[NCERT; CBSE PMT 2008]**
(a) Wrestlers who develop strong body muscles in their life time pass this character on to their progeny
(b) There is no change in population size as they have a large gene pool
(c) There is a decline in population as boys marry girls only from their own tribe
(d) Hereditary diseases like colour blindness do not spread in the isolated population

**11.** For better survival of the human population which of the following steps is most important
(a) Reduction in the use of various resources
(b) Afforestation
(c) Conservation of wild life
(d) Ban on mining activity

**12.** To which population category India belongs **[MP PMT 2001]**
(a) High birth rate and high mortality rate
(b) Low birth rate and low mortality rate
(c) Low birth rate and high mortality rate
(d) High birth rate and low mortality rate

**13.** *Avicennia*, *Rhizophora* and *Atiplex* are **[Odisha JEE 2005]**
(a) Xerophytes (b) Halophytes
(c) Hydrophytes (d) Mesophytes

**14.** Which of the following is not a hydrophytic angiosperm **[RPMT 1997]**
(a) *Chara* (b) *Hydrilla*
(c) *Lotus* (d) *Water lettuce*

**15.** Mechanical tissue is undeveloped in **[CPMT 1994]**
(a) Xerophytes (b) Hydrophytes
(c) Halophytes (d) Mesophytes

**16.** Which one is partially submerged and fixed in mud **[RPMT 1996]**
(a) *Marsilea* (b) *Cyperus*
(c) *Eichhornia* (d) *Typha*

**17.** Xerophytes are mostly **[AFMC 2009]**
(a) Succulents (b) Water related
(c) Mesophytes (d) None of these

**18.** Some organisms are tolerant to a narrow range of salinity and are termed as **[AMU (Med.) 2012]**
(a) Euryhaline (b) Stenohaline
(c) Neither (a) nor (b) (d) Saline

**19.** The second stage of hydrosere is occupied by plants like **[CBSE PMT (Mains) 2012]**
(a) *Azolla* (b) *Typha*
(c) *Salix* (d) *Vallisneria*

**20.** The percentage ratio of natality over mortality is called **[NCERT; MP PMT 1997, 2000, 12]**
(a) Vital index $\left(\frac{B}{D}\times 100\right)$ (b) Population density
(c) Total count of individuals (d) Fertility rate

**21.** The physiological capacity of a population to produce offsprings is known as **[CBSE PMT 2002; WB JEE 2011]**
(a) Environmental resistance (b) Carrying capacity
(c) Biotic potential (d) None

**22.** When births are equal to deaths. It is called **[AFMC 2002]**
(a) Plateau stage (b) Exponential growth stage
(c) Early growth stage (d) Acceleration stage

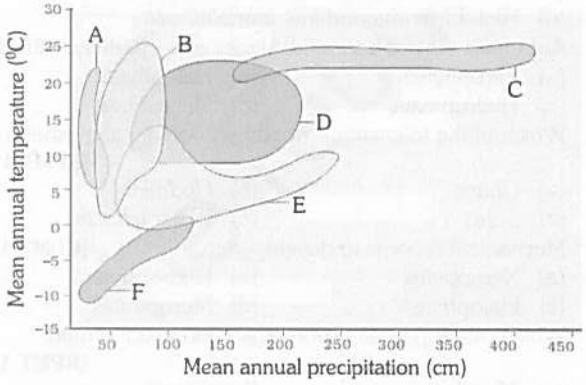
**23.** The growth of a population without limit at its maximal rate and also that, rates of immigration and emigration are equal, then it is called **[NCERT; EAMCET 2009]**
(a) Carrying capacity (b) Biotic potential
(c) Positive growth (d) Negative growth

**24.** In an ecosystem, the biotic components herbivorous are **[MHCET 2015]**
(a) Photosynthetic (b) Chemosynthetic
(c) Macro consumers (d) Micro consumers

**25.** Gause's principle of competitive exclusion states that **[NEET (Phase-I) 2016; NEET (Phase-II) 2016]**
(a) More abundant species will exclude the less abundant species through competition
(b) Competition for the same resources excludes species having different food preferences
(c) No two species can occupy the same niche indefinitely for the same limiting resources
(d) Larger organisms exclude smaller ones through competition

**26.** A cuckoo laying eggs in the nest of other species of birds, is an example of **[MHCET 2015]**
(a) Adelphoparasitism (b) Broodparasitism
(c) Ectoparasitism (d) Hyperparasitism

**27.** In the following diagram, identify the temperate forest and coniferous forest from the markings alphabets (A–F) and select the right option **[NCERT]**




(a) C and F (b) D and E
(c) B and D (d) A and B

**28.** Match the following and select the correct option

| | | | |
|---|---|---|---|
| A. | Earthworm | (i) | Pioneer species |
| B. | Succession | (ii) | Detrivore |
| C. | Ecosystem service | (iii) | Natality |
| D. | Population growth | (iv) | Pollination |

**[CBSE PMT 2014]**

| | A | B | C | D |
|---|---|---|---|---|
| (a) | (iii) | (ii) | (iv) | (i) |
| (b) | (ii) | (i) | (iv) | (iii) |
| (c) | (i) | (ii) | (iii) | (iv) |
| (d) | (iv) | (i) | (iii) | (ii) |

**29.** At a given time in a forest 900 deers are found, 100 deers can be accommodated, then 1000 is _____ **[GUJCET 2014]**
(a) Population carrying capacity of deer
(b) Mortality of deer
(c) Maximum natality
(d) Realised natality

**30.** Monarch Butterfly is not eaten by predators because of **[AIIMS 2011]**
(a) Rough skin (b) Bitter taste
(c) Foul smell (d) Colouration

## AR Assertion & Reason

Read the assertion and reason carefully to mark the correct option out of the options given below :

*(a) If both the assertion and the reason are true and the reason is a correct explanation of the assertion*
*(b) If both the assertion and reason are true but the reason is not a correct explanation of the assertion*
*(c) If the assertion is true but the reason is false*
*(d) If both the assertion and reason are false*
*(e) If the assertion is false but reason is true*

**1.** Assertion : No two species can occupy the same ecological niche in a habitat
Reason : A habitat can contain only one ecological niche

**2.** Assertion : Predation is an interspecific interaction with a feeding strategy
Reason : Predation and their prey maintain fairly stable population through time and rarely one population become abundant or scarce. **[EAMCET 2009]**

**3.** Assertion : With increase in population size, environmental resistance tends to increase.
Reason : This is a nature's way to check the expression of biotic potential.

**4.** Assertion : "The Biological Species" concept helps us to ask how species are formed.
Reason : The concept of biological species focuses our attention on the question of how reproductive isolation comes about. **[EAMCET 2009]**

**5.** Assertion : Living organisms are regarded as closed systems.
Reason : Energy of living organisms can not be lost or gained from external environment. **[AIIMS 2002, 13]**

**6.** Assertion : Biotic community has higher position than population in ecological hierarchy.
Reason : Population of similar individuals remains isolated in the community.

**7.** Assertion : The crown fires are most destructive as they burn the tree top.
Reason : Due to crown fire the temperature of that area may rise upto 700°C. **[AIIMS 1995]**

**8.** Assertion : Removal of keystone species doesn't cause any serious disruption in the functioning of the community.
Reason : Keystone species are low in abundance (or biomass) than the dominant species.

**9.** Assertion : Relationship between sea anemone and hermit crab is said to be an example of obligate mutualism.
Reason : Obligate mutualism is a positive (beneficial) interaction between two species.

**10.** Assertion : Ecological equivalents possess similar types of adaptations.
Reason : Ecological niche is the total interaction of a species with environment.

**11.** Assertion : Inhibition of death of one organism by another through the production of some by-products is known as antibiosis.
Reason : Antibiosis is a type of negative interaction. **[AIIMS 2010]**

**12.** Assertion : Allelopathy is a form of ammensalism that occurs in plants.
Reason : Association of rooting plants with fungal hyphae, is an important example of ammensalism. **[AIIMS 2009]**

**13.** Assertion : Aerenchyma is present in the leaves and petioles of hydrophytes.
Reason : Aerenchyma imparts buoyancy to the hydrophytes.

**14.** Assertion : Many mangrove plants possess high levels of organic solutes.
Reason : This is an adaptation to cope with the conditions of high salt concentration and osmotic potential.

With respect to *Eichorrnia*

**15.** Assertion : It drains off Oxygen from water and is seen growing in standing water with respect to eichornia.
Reason : It is an indigenous species of our country. **[KCET 2015]**

**16.** Assertion : True xerophytes store water in the form of mucilage which helps to withstand prolonged period of drought.
Reason : Vascular and mechanical tissues are well developed in true xerophytes. **[EAMCET 2009]**

**17.** Assertion : Conducting tissues, especially xylem show greatest reduction in submerged hydrophytes.
Reason : Hydrophytes live in water so no need of tissues. **[AIIMS 2010]**

**18.** Assertion : Mechanical tissues are absent or less developed in the floating and submerged parts of hydropytic plants.
Reason : Generally, elongated and loosely arranged spongy cells are found in the body of submerged hydrophytic plants **[AIIMS 2010]**

# Answers

## Ecology (General)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | a | 2 | c | 3 | a | 4 | a | 5 | b |
| 6 | a | 7 | b | 8 | a | 9 | c | 10 | a |
| 11 | c | 12 | c | 13 | c | 14 | a | 15 | c |
| 16 | c | 17 | d | 18 | c | 19 | b | 20 | c |
| 21 | d | 22 | a | 23 | d | 24 | a | 25 | c |
| 26 | a | 27 | b | 28 | c | 29 | d | 30 | b |
| 31 | d | 32 | a | 33 | c | 34 | b | 35 | c |
| 36 | a | 37 | a | 38 | b | 39 | a | | |

## Environment (Abiotic and Biotic factors)

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | c | 2 | d | 3 | c | 4 | c | 5 | c |
| 6 | b | 7 | b | 8 | c | 9 | d | 10 | d |
| 11 | b | 12 | a | 13 | d | 14 | c | 15 | c |
| 16 | a | 17 | b | 18 | b | 19 | a | 20 | c |
| 21 | c | 22 | d | 23 | b | 24 | d | 25 | d |
| 26 | e | 27 | c | 28 | c | 29 | a | 30 | d |
| 31 | c | 32 | c | 33 | b | 34 | a | 35 | a |
| 36 | b | 37 | b | 38 | c | 39 | c | 40 | a |
| 41 | c | 42 | c | 43 | d | 44 | b | 45 | b |
| 46 | d | 47 | b | 48 | a | 49 | a | 50 | b |
| 51 | c | 52 | b | 53 | b | 54 | c | 55 | a |
| 56 | a | 57 | d | 58 | d | 59 | b | 60 | c |
| 61 | b | 62 | c | 63 | c | 64 | b | 65 | a |
| 66 | d | | | | | | | | |

## Ecological Adaptation

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | c | 2 | c | 3 | b | 4 | c | 5 | c |
| 6 | b | 7 | c | 8 | a | 9 | b | 10 | c |
| 11 | b | 12 | d | 13 | c | 14 | d | 15 | a |
| 16 | a | 17 | c | 18 | b | 19 | d | 20 | b |

## Population Attributes

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | b | 2 | c | 3 | b | 4 | a | 5 | a |
| 6 | a | 7 | a | 8 | c | 9 | b | 10 | b |
| 11 | d | 12 | b | 13 | b | 14 | b | 15 | d |
| 16 | d | 17 | a | 18 | c | 19 | c | 20 | d |
| 21 | a | 22 | c | 23 | b | 24 | d | 25 | c |

## Growth of human population

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | d | 2 | a | 3 | c | 4 | a | 5 | b |
| 6 | d | 7 | b | 8 | a | 9 | d | 10 | b |
| 11 | d | 12 | d | 13 | a | 14 | d | 15 | b |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 16 | d | 17 | d | 18 | b | 19 | a | 20 | b |
| 21 | d | 22 | d | 23 | a | 24 | c | 25 | c |
| 26 | a | 27 | d | 28 | b | 29 | c | 30 | a |
| 31 | b | 32 | b | 33 | d | 34 | a | 35 | b |

## NCERT Exemplar Questions

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | b | 2 | c | 3 | d | 4 | c | 5 | d |
| 6 | d | 7 | a | 8 | c | 9 | c | 10 | d |
| 11 | b | 12 | c | 13 | b | 14 | c | 15 | c |
| 16 | b | 17 | b | 18 | c | 19 | a | 20 | a |

## Critical Thinking Questions

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | c | 2 | a | 3 | a | 4 | c | 5 | d |
| 6 | a | 7 | d | 8 | b | 9 | b | 10 | c |
| 11 | c | 12 | d | 13 | b | 14 | a | 15 | b |
| 16 | d | 17 | a | 18 | b | 19 | d | 20 | a |
| 21 | c | 22 | a | 23 | b | 24 | c | 25 | c |
| 26 | b | 27 | b | 28 | b | 29 | a | 30 | b |

## Assertion and Reason

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | c | 2 | a | 3 | a | 4 | a | 5 | d |
| 6 | c | 7 | a | 8 | e | 9 | e | 10 | b |
| 11 | b | 12 | c | 13 | a | 14 | a | 15 | c |
| 16 | e | 17 | c | 18 | a | | | | |

# Answers and Solutions

## Ecology (General)

**5.** (b) Kyotoprotocol is an international conference held in Kyoto, Japan obtained commitments from different countries for reducing overall greenhouse gas emissions by 2008-2012.

**7.** (b) The species which are found primarily, most abundantly or spend most of their time in ecotone or community boundary are known as edge species.

**8.** (a) Uniform interbreeding population or group of individuals which freely interbreed among themselves, constitute a species.

**15.** (c) The term ecology is derived from two greek words, namely *Oikos* and *Logos*. *Oikos* means 'home' or 'habitation' or a 'place to live in'. *Logos* means 'study' or 'discourse'. Hence literally speaking, ecology is the study of organisms at home.

**16.** (c) The term ecology is believed to have been coined by Ernst Haeckel (1869) though its first authentic use was made by Reiter (1885).

**19.** (b) The term biocoenosis is also used for community, which was coined by Carl Mobius (1880).

**20.** (c) According to Paine (1969), keystone species are those whose role or activities determine community structure.

**23.** (d) Mimicry is the superficial but close resemblance of one organism to another or to natural objects among which it lives that secure its concealment, protection or some other advantage.

**26.** (a) Biological community is the assemblage of interdependent and interacting populations of different species present in an area.

**27.** (b) Intraspecific competition for food, reproduction, habitat.

**28.** (c) Prof. R. Mishra is known as "Father of ecology in India".

**29.** (d) According to Raunkiaer temperature is of the greatest importance in the distribution of plants and the entire vegetation of the earth can be divided into following 4 classes : (1) Megatherms (2) Mesotherms (3) Microtherms (4) Hekistotherms

**30.** (b) Ecological niche is specific habitat where a specific species lives. Niche is specific part of habitat occupied by individuals of a species which is circumscribed by its range of tolerance, range of movement microclimate, type of food and its availability.

**31.** (d) The interruption of gene flow (reproductive isolation) between populations is a pre-requisite for the formation of new species.

**33.** (c) The carrying capacity of a population is determined by its limiting resources. Carrying capacity is the upper limit of an ecosystem upto which it can provide the basic needs to the population under given circumstances.

**35.** (c) A community is an assemblage of populations of plants, animals, bacteria and fungi that live in an area and interact with each other.

**36.** (a) Allopatric species are present in different geographical regions, separated by spatial barriers are called allopatric species.

**39.** (a) Ramsar convention is related to wetland conservation.

## Environment (Abiotic and Biotic factors)

**7.** (b) Commensalism is an association between 2 organisms in which one is benefited without the other being harmed *e.g.*- Sucker fish has a hold fast and attached itself underside of shark and thus remains protected and also get food left over when shark is feeding on its prey.

**8.** (c) Because edaphic factors affects through soil and rest are the climatic factors.

**9.** (d) Acclimatization is the development of a favourable morphological and physiological response to a change in environment.

**13.** (d) Although grazing is harmful for plants but grazing may beneficial by adding their excretion into soil, which provides essential mineral nutritions to plants.

**15.** (c) Humus is total organic matter in the soils. It is rich is NPK. The humus is formed from decay and decomposition of dead plant and animal matter. The humus soil is the best soil as it has got high water holding capacity, high porocity, aeration and high organic content.

**16.** (a) Humus is found in top portion of soil. It is formed by dead organic material by the process of decomposition.

**17.** (b) Stratosphere zone of earth's atmosphere contains a layer of ozone ($O_3$) which prevents the earth surface from about 99% of incoming solar UV-radiations.

**18.** (b) In lichens, algae and fungi are symbiotically associated. This association is known as mutualism.

**22.** (d) Protoco-operation is the interaction between two living organism of different species in which both are mutually benefitted but they can live without each other.

**27.** (c) Excessive falling of trees and overgrazing remove the vegetation cover and land is exposed to erosion and desertification.

**29.** (a) Because phytoplanktons (primary producers) are largest in number.

**31.** (c) The texture of soil is determined by the proportions of particles of different sizes. Coarse sand particles are of 0.2 to 2.00 *mm* in size; 0.02 to 0.2 *mm* particles constitute fine sand; 0.002 to 0.02 particles represent silt and particles smaller than 0.002 *mm* are called clay.

**33.** (b) Deserts have 25 cm (10 inches) or less of precipitation and show poor biodiversity and their productivity is minimum.

**34.** (a) Because primary producer first requires $CO_2$, for the process of photosynthesis by which they make their food.

**37.** (b) The plants which grow best in full sunlight are called sun plants or heliophytes.

**38.** (c) Microscopic free floating animals are called zooplanktons. Both microscopic plants and animal are known as planktons.

**40.** (a) Soil; because man and animals are biotic factors and temperature is climatic factor.

**41.** (c) Biological control methods include using natural predators of pests, using resistant varieties, crop rotation, etc.

**42.** (c) The amount of water retained by a unit weight of undisturbed soil after complete drainage under controlled conditions is called field capacity or holard.

**43.** (d) By deforestation the land is exposed to erosion and desertification.

**46.** (d) An interesting behaviour pattern which results in intraspecific competition for space, shelter and food etc, effective control of population size.

**49.** (a) If the same crop is grown year after year, fertility of soil is lost due to utilization of same minerals again and again, thus disturbing the soil structure, which facilitates soil erosion. Legumes are useful in rotation of crops because of having nodulated roots and it gives more nitrates in the soil.

**50.** (b) Black soil predominantly with clay and humus. This soil is very fertile because most of minerals are present in it.

**51.** (c) Due to heavy rain, top fertile soil is removed in the form of thin sheet.

**59.** (b) Commensalism is the relationship between two living individuals of different species in which one is benefitted while the other is neither harmed nor benefitted except to negligible extent.

**60.** (c) Living organisms have effect on other living organisms and these constitute biotic factors or living factors.

**61.** (b) Because $CO_2$ is released through plants in soil by repiration process.

**62.** (c) It is an association between members of two species in which members of one species capture, kill and eat up members of other species. The former is called predator and later is called prey.

**65.** (a) Parasitism +, -
Mutualism +, +
Amensalism 0, -
Commensalism +, 0

## Ecological Adaptation

**3.** (b) Ephemerals complete their life cycle in a very short period, evade dry season by disappearing, leaving their seeds. They are referred as drought escapers or drought evaders.

**5.** (c) Because it has all the xerophytic character like modification of leaves into spines etc.

**6.** (b) Because plants which grow on sand are called psammophytes and deserts are made up of sand.

**8.** (a) In aquatic plants, the intercellular spaces in parenchyma develop to a considerable extent so as to form a connected system throughout the plant. Such a modified parenchymatous tissue is called aerenchyma. It helps in the circulation of air as well as provides buoyancy to plants.

**12.** (d) In xerophytes stomata are sunken, less in number and restricted to lower surface of the leaves.

**13.** (c) Aerenchyma is a trait of hydrophytes.

**14.** (d) In Rajasthan, the rainfall is less and soil has little amount of water. Here, the vegetation is xerophytic.

**15.** (a) In xerophytes, a thick envelope of hairs on epidermis and around sunken stomata. This layer forms an insulating envelope and checks increase in temperature which is helpful to check transpiration.

**17.** (c) In succulent xerophyte, plants have fleshy organs where water and mucilage are stored. Depending upon the organ where succulence occurs, the succulents show chylocauly e.g., Opuntia, and chylophylly e.g., Agave or chylorhizy e.g., Asparagus.

**18.** (b) Sciophytes are shade plants which grow in areas having moderate to low intensity light, as below the shade of other plants. Optimum growth occurs with light of 1030% of full sunlight.

**19.** (d) In conifers, the needle like leaves, thick cuticle and sunken stomata help to reduce water loss

## Population Attributes

**1.** (b) Crude birth rate is the number of births per 1000 persons in the middle of a given year i.e. on July.

**3.** (b) Malthus in his "Essay on the principle of population" (1798) pointed out that population tends to increase in geometric progression while food supply increase only in arithmetic progression.

**5.** (a) Number of offsprings produced per unit of population by reproduction is called Natality or birth rate.

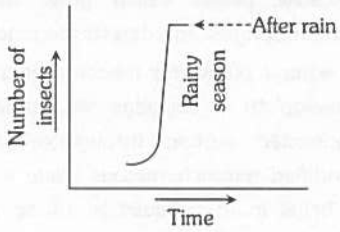
**13.** (b) Population dynamics is quantitative variations in the population size and density.

**14.** (b) India has high birth rate, but average life span is lower (62 year) as compared to 75 – 80 in advanced countries.

**15.** (d) Population density is the total population within a geographic entity divided by the number of square miles of land area of that entity measured in square kilometers square meters or square miles.

**17.** (a) A population of each species within community has a separate ecological niche.

**18.** (c) During a rainy season food water etc. will found in a large quantity so number of insects will increase fast. But after the rain food and water will not be obtained in adequate quantity. So insects will die very fast.




**21.** (a) Industrial revolution caused a spurt in human population and a third phase of growth began in the 18th century.

**24.** (d) It is an Urn shaped pyramid with least number of prereproductive individuals.

## Growth of human population

**3.** (c) Population growth curve is the graphic representation of population growth by plotting number of individuals at different time intervals.

The human population growth curve is S-shaped or sigmoid. It has three phases

(a) Lag phase is slow in the beginning due to small size of population, lack of adaptation to new environment and slow development.

(b) Log phase or exponential phase is the geometric increase in population size due to abundance of food, space and natural resources.

(c) Stationary phase or zero growth phase is the stability of population, i.e., birth and death rates are equal, so that there is no growth in population size.

**4.** (a) Individuals can enter the population by either birth or immigration.

**7.** (b) Zero growth rate means natality (i.e. birth rate) balances the mortality (i.e. death rate).

**8.** (a) During short period of time, some population produce many offsprings which require little care. Therefore, these populations usually have a survivorship curve similar to type III. These tend to have J-shaped growth curves until some environmental change causes them to decline usually within a short time. From an evolutionary point of view, such species have undergone selection to maximize their rate of natural increase and for this reason they are termed as r-strategies.

**9.** (d) Environmental resistance is sum of all the inhibitory factors of the environment to decrease the population.

**10.** (b) J-shaped growth curve is shown by small population of Reindeer experimentally reared in a natural environment with plenty of food but no predator.

**13.** (a) It was an essay on the priniciples of population by R.T. Malthus which made Darwin realise that under intense competition, natural selection operates.

**15.** (b) The reproductive capacity of any population, when it is unrestricted, is called its biotic potential.

**20.** (b) Main reason of this rapid decline in doubling rate was that the exponential phase of human population growth started in 1750 AD.

**23.** (a) In middle stage growth rate is very high due to lack of environmental resistance, but in last stage growth rate is very low due to high environmental resistance. In this phase both natality and mortality is equal to each other.

**24.** (c) The main cause of population explosion in the world is excellent health care as a better medical facilities control of insect vectors of fatal disease and epidemics and proper care of new born children and their mothers.

**26.** (a) Population growth curve in most animals except human is S-shaped while in humans it is J-shaped.

**31.** (b) Population density of a species is the number of individual of a species per unit area or volume *e.g.*, number of animals per square *km*. Population density can be calculated as $PD = \frac{N(number)}{S(space)}$

**32.** (b) The human population may outrun food supply according to Malthusian theory.

## Critical Thinking Questions

**8.** (b) Gene flow means the spread of genes through populations as affected by movements of individual and their propagules e.g., spores, seeds etc. Gene flow ensures that all populations of a given species share a common gene pool i.e., it reduces difference between populations. The interruption of gene flow between populations is a pre-requisite for the formation of new species.

**9.** (b) Standing state represent all non-living matter in an area at a given time.

**11.** (c) Conservation of wild life conserves the ecosystem in its natural form. Future of man depends on ecological balance.

**14.** (a) Chara is not a hydrophytic angiosperm, it belongs to the chlorophyceae or green algae.

**15.** (b) Mechanical tissues like sclerenchyma (lignified tissues) and collenchyma are poorly developed or absent.

**16.** (d) Typha is a rooted emergent. Roots are in. soil shoots or leaves are partly outside and partly inside the water.

**19.** (d) Second stage of Hydrosere is submerged stage that is represented by Vallisneria.

**20.** (a) The percentage ratio of natality over mortality is known as vital index i.e., natality/mortality X 100. It determines the growth of a population.

**22.** (a) Stationary (Plateau) phase – Finally, growth rate becomes stable because mortality and natality rates become equal to each other. So there is zero growth rate.

**23.** (b) Biotic potential is the maximum capacity of a population to reproduce under ideal conditions (environmental).

**28.** (b) Detrivores, (eg. earthworm) break down detritus into smaller particles.

The species that invade a base area in succession is called pioneer species.

## Assertion and Reason

**1.** (c) The place where an organism lives is called its habitat. Habitats are characterised by conspicuous physical features, which may include the dominant forms of plant and animal life. Habitat may also refer to the place occupied by an entire biological community. For example, a large number of species are found in a forest habitat. On the other hand, the ecological niche of an organism represents (i) the range of conditions it can tolerate (ii) the resources it utilises, and (iii) its functional role in the ecological system. A habitat can contain many ecological niches and support a variety of species. Each species has a distinct niche, and no two species are believed to occupy exactly the same niche.

**2.** (a) Predation is an interspecific interaction with a feeding strategy i.e., one species (prey) is eaten up by another (predator). The number of predator usually depends upon the population of prey, but the later is also controlled by predators. Thus, predatory and the prey maintains fairly stable population through time and rarely one population becomes abundant or scarce.

**3.** (a) The inherent maximum capacity of an organism to reproduce or increase in number is termed biotic potential (designated by the symbol 'r). Biotic potential is realised only when the environmental conditions are non-limiting, so that natality rate (birth-rate) is maximum and mortality rate (death –rate) is minimum. Under these conditions, population size increases at the maximum rate. However, nature keeps a check on the expression of biotic potential. For example, if a pair of flies is allowed to reproduce unchecked, the fly population may outweight the earth in a few years. The environmental check on population size, or its biotic potential is called environmental resistance. With increase in population size, the environmental resistance (against the population) tends to increase.

**4.** (a) Ernst Mayr proposed the biological species concept, which defines species as groups of actually or potentially inter-breeding natural populations which are reproductively isolated from other such groups.

**5.** (d) Living organisms are regarded as open system as they can gain or loose energy from external environment. All living organisms restore their energy either directly from sunlight or indirectly from food.

**6.** (c) The organisms of all the species that live in a particular area and interact in various ways with one another form biotic community. Biotic community is a grouping higher than population. It is an assemblage of all the populations of different organisms occurring in an area. The different populations of a community do not remain isolated. They show interactions and interdependence.

**7.** (a) Crown fires are most destructive. These destroy the canopies of trees and entire vegetational cover of that particular area. Due to this fire, the temperature, rises upto 700°C and may adversely effect the nearly vegetation.

**8.** (e) Only one or few species in a community are in sufficient abundance (having high density) to dominate and influence other species in terms of numbers and biomass production. Such species are called dominant species. But there are other species which have much greater influence on community characteristics, relative to their low abundance or biomass. Such species are called keystone species. These species play a vital role in controlling the relative abundance of other species. Removal of keystone species causes serious disruption in the functioning of the community.

**9.** (e) The interactions between populations of species in a community are broadly categorised into positive (beneficial) and negative (inhibitory) interactions, depending upon the nature of effect on the interacting organisms. An association of two species, in which both species are benefitted, is called mutualism. Mutualism is a functional association, not merely living together. Mutualism may be obligate in which species are completely dependent upon each other, for example, in the case of coral reef, coelentrates and algae live in obligate relationship, or mutualism can be facultative in which one species may survive even in the absence of the other partner species. The relationship between sea anemone and hermit crab is an example of facultative mutualism. The sea anemone grows on the back of the crab, providing camouflage and protection (the sea anemone has stinging cells) and, in turn, the sea anemone is transported about reaching new food sources. This type of mutualism is also called protocooperation.

**10.** (b) Organisms occupying similar ecological niches but living in different regions are called ecological equivalents. Ecological equivalents possess similar types of adaptations but belong to different taxonomic groups . For example; succulents of American deserts are cacti while those of African desert are euphorbias.

**11.** (b) In a negative interaction, one organism or both the organisms (associating) are harmed in any way during their life period. Antibiosis is a type of negative interaction in which complete or partial inhibition or death of one organism is taken place by the products of another organism. Here, none of them derive any benefit, eg, Antibiotics derived from fungi are antagonistic to microbes.

**12.** (c) Allelopathy is a phenomenon associated with plants, in which one plant produce some chemical substances, which inhibits the growth of other plant species. While, in ammensalism, one species suffer and other remain unaffected.

**13.** (a) Plants which remain permanently immersed in water are called hydrophytes. They may be submerged or partly submerged and show the presence of aerenchyma (large air space) in the leaves and petioles. Aerenchyma helps to transport oxygen produced during photosynthesis and permits its free diffusion to other parts, including roots located in anaerobic soils. These tissues also impart buoyancy to the plants. Presence of inflated petioles in Eichhornia (water hyacinth) keeps the plants floating on the surface of water.

**14.** (a) Mangroves are found in marshy conditions of tropical deltas and along ocean edges. For coping with conditions of high salt concentration and osmotic potential, many mangrove plants have high levels of organic solutes, such as proline and sorbitol. Dunaliella species (green and halophytic algae found in hyper saline lakes) can tolerate saline conditions by accumulating glycerol in the cells, which helps in osmoregulation. Some species of mangroves can excrete salts through the salt glands on the leaves. Some mangroves can exclude salts from the roots by pumping excess salts back into soil.

**15.** (c)

**16.** (e) True xerophytes are the non-succulent perennials which suffer dryness externally as well as internally, e.g., Calotropis, Acacia, Zizyphus, Nerium, etc. These possess thick, waxy cuticle, multilayered epidermis, well developed mechanical tissue, etc.

**17.** (c) Conducting tissues are very less developed in submerged hydrophytes because the whole plant body of these plants absorbs water and nutrients from external aquatic environment. In vascular tissues, particularly xylem, shows greatest reduction. In some cases, xylem elements are not at all developed.

**18.** (a) Mechanical tissues are poorly developed or absent in floating or submerged hydrophytes because the buoyancy nature of water saves them from physical injuries. Generally, elongated and loosely arranged spongy cells are found in the plant body. These thinwalled cells, when turgid, provide mechanical support to the plants.

# Organisms and Population

## SET Self Evaluation Test

**1.** Which of the following changes would be likely to make terrestrial life on this planet impossible
(a) A decrease in mean temperature by 10° C
(b) Change in atmosphere permitting all the solar radiation reaching the upper atmosphere to penetrate to the surface of the earth
(c) Change in the orbit of the earth from an ellipse to a circle
(d) Disappearance of the moon

**2.** At which latitude, heat gain through insolation approximately equals heat loss through terrestrial radiation **[CBSE PMT 2005]**
(a) $22\frac{1}{2}°$ North and South (b) 40° North and South
(c) $42\frac{1}{2}°$ North and South (d) 66° North and South

**3.** The factor governing the structure of earth surface is **[BHU 1995]**
(a) Topographic (b) Edaphic
(c) Biotic (d) Temperature

**4.** Study of inter-relationship between a species and its environment of a forest is called **[KCET 2000]**
(a) Forest ecology (b) Autecology
(c) Synecology (d) None of the above

**5.** In the mountains, there is a lot of moisture and water and still the plants are xerophytes, because
(a) Water turns into snow on mountains
(b) Water runs away due to the presence of slopes and can not be used by plant (physiological dryness)
(c) Rocks of mountains cannot absorb water
(d) None of them is correct

**6.** Which one of the following is wrongly matched **[Kerala CET 2005]**
(a) Temperate zone – 20 – 40° latitude
(b) Hypolimnion – Thermal stratification in lakes
(c) Ozone layer – Stratosphere
(d) Profundal zone – Dark zone
(e) Ecotherms – Cold blooded animals

**7.** Competition of species leads to **[DPMT 2007]**
(a) Extinction
(b) Mutuation
(c) Greater number of niches are formed
(d) Symbiosis

**8.** Rotation of crops is essential for **[AIIMS 1999; CPMT 2002; BHU 2006]**
(a) Increasing the quantity of proteins
(b) Increasing the quantity of minerals
(c) Increasing fertility of the soil
(d) Getting different kinds of crops

**9.** Proportion of young individuals is highest in **[MP PMT 2013]**
(a) Expanding population (b) Declining population
(c) Stable population (d) Both (a) and (b)

**10.** The principal cation in alkaline soil is **[MP PMT 2011]**
(a) $Na^+$ (b) $K^+$
(c) $Ca^{2+}$ (d) Either of these

**11.** The soil near the surface is usually darker than about one meter down, this is because the top soil **[AIIMS 1999]**
(a) Is richer in *Ca* and *Mg*
(b) Contains more organic matter
(c) Is wetter than the sub soil
(d) Is drier than the sub soil

**12.** The formula for the calculation of population density is $D = \frac{n/a}{t}$, in this formula '*a*' represents **[MP PMT 2001]**
(a) Whole world population (b) Unit of time
(c) Population density (d) Area of the land

**13.** If the rate of addition of new members increases with respect to the individual host of the same population, then the graph obtained has **[Pb. PMT 1999]**
(a) Declined growth (b) Exponential growth
(c) Zero population growth (d) None of these

## AS Answers and Solutions

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | b | 2 | b | 3 | a | 4 | b | 5 | b |
| 6 | a | 7 | a | 8 | c | 9 | a | 10 | c |
| 11 | b | 12 | b | 13 | b | | | | |

**3.** (a) Topographic factors are concerned with the physical geography of the earth in an area.

**5.** (b) Steep slopes cause fast, running of water which result in erosion and do not permit the accumulation of humus so the soil becomes denuded. In such soil plants cannot grow properly and vegetation changes into xerophytic plants. In valleys humus accumulates, so they have luxuriant vegetation and slopes contain xerophytic plants.

**6.** (a) Temperate zone is the part of the earth between the tropics and the poles.

**8.** (c) If the same crop is grown year after year, fertility of soil is lost due to utilization of same minerals again and again. Soil fertility is usually maintained in the field by rotation of crops *i.e.*, a crop is alternated by a leguminous crop.

**11.** (b) Top soil contains decomposed and amorphous organic matter composing of sand with humus.

**13.** (b) Exponential phase is the period of rapid rise in population due to availability of food and requirements of life in plenty and there being no competition.