Biyani Girls College

Session - (2017-2018)

Set B

B.Sc. (Part II) Zoology

Second Paper (Ecology and Environmental Biology)

Time allowed: Three Hour **Maximum Marks: 33**

Question No. 1 in Part I is compulsory. Attempt FOUR questions from Part II, selecting at least ONE question from each Section.
All questions carry equal marks.

PART -I

1. Answer the following questions in two or three lines (maximum 25 words) :-

i. What is ecological niche?

Ans.A species' niche is its ecological role or "way of life," which is defined by the full set of conditions, resources, and interactions it needs.

ii. Name four branches of ecology?

Ans. 1. Habitat ecology 2.Space ecology 3.Population ecology 4. Community ecology

iii. Give the full form of IUCN and WWF?

Ans. IUCN- International Union for Conservation of Nature and Natural Resources
WWF- World Wild Fund

iv. Difference between tropical and temperate rain forest.

Ans. Tropical rainforests are warm and moist; while temperate rainforests are cool. In tropical rain forest there are lots of different kinds including orchids and bromeliads while in case of temperate mostly mosses and ferns.

v. What is itai-itai disease?

Ans. It isa painful, degenerative bone disease caused by industrial cadmium pollution of the food and water supply.itaiitai is one of the major diseases caused by pollution in Japan.

vi. Define exobiology?

Ans. The branch of science that deals with the possibility and likely nature of life on other planets or in space.

vii. What is bioaccumulation?

Ans. Bioaccumulation means an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment. Compounds accumulate in living things any time they are taken up and stored faster than they are broken down (metabolized) or excreted. Exmpl.DDT accumulation in food chain.

viii. Defines Critically endangered species. Give two name of species?

Ans.A critically endangered (CR) species is one which has been categorized by the International Union for Conservation of Nature (IUCN) as facing an extremely high risk of extinction in the wild.Exampl. Indian vulture *(Gyps indicus)*, Great Indian bustard *(Ardeotisnigriceps)*Gharial*(Gavialisgangeticus)*

ix. What is Giant Panda? (1x9)

Ans. The giant panda, also known as panda bear or simply panda, is a bear native to south central China. It is easily recognized by the large, distinctive black patches around its eyes, over the ears, and across its round body. Giant panda is a global conservation icon and the symbol of our WWF.

PART II

SECTION A

2. Define Community ecology. Give the detailed account on structure, composition and stratification of community ecology? (1x6)

Ans.COMMUNITY

Individuals of a species together constitute a population is known as community. Different places of earth are shared by many coexisting populations such association is called community.

DEFINITION

The assemblage of population of living organism in a particular area or habitat is termed as community.

COMMUNITY ECOLOGY

Community ecology is the study of a community in respect to the environment.

CHARACTERISTICS OF COMMUNITIES

A community has the following characteristics.

1. SPECIES DIVERSITY: In ecosystem ecology each community is composed of taxonomically different species. Species diversity refers to number of different species in community both abundant and rare species. Species diversity has two components.

- **Species richness:** it refers different types of species and their numerical strength. Technically it refers to ratio between different species (s) and total number of species (n).
- **Species evenness:** it refers to a measure which qualifies as to how even species are in terms of their number.

Species diversity can be measured by using various diversity indices. the mathematical expression based on species abundance data. Species diversity can be measured separately either as species richness or evenness or diversity as a whole.

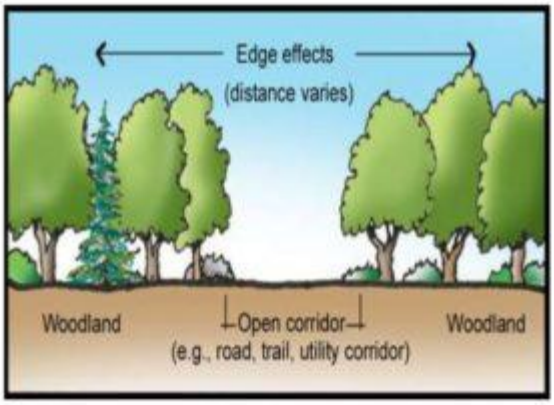
Richness Index	$R = \frac{S - 1}{\text{Log } N}$	as per Margalef (1958)
Index of dominance	$\lambda = \sum_{i=1}^{S} (n_i / N)^2$	as per Simpson (1949)
Index of diversity	$H' = -\sum_{i=1}^{S} n_i / N \ln n_i / N$	as per Shannon-Weaver (1963)
Evenness Index	$E = \frac{1/\lambda - 1}{e^{H'} - 1}$	as per Hill (1973)

Where, S = total number of species, N = total number of individuals of all the species in a given area, n_i = number of individuals of the ith species of the area.

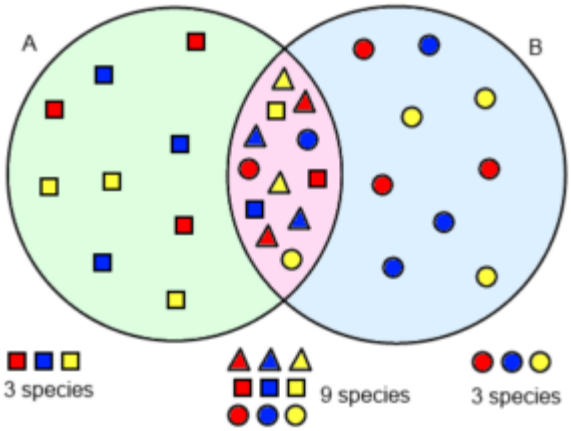
2. RESILIENCE AND RESISTANCE: for a community to be stable, it requires two components-resilience and resistance.

- **Resilience:** resilience is a ability of a community to recover after facing a disturbance or displacement.
- **Resistance:** it is the ability to avoid disturbance(any event that alter the structure of a community) or displacement(shifting of the community to some other place)

3. **DOMINANCE:** usually one community has one or more species which occur in large number. such species are called dominant and the community is often named after them.
4. **DIVERSITY:** the community consists of different group of plants and animals of different species, may be large or small, may belong to one life form or another but are essentially growing in a uniform environment.
5. **PERIODICITY:** this includes study of various life processes (respiration, growth, reproduction etc.) In the various seasons of the year in the dominant species in the community. The recurrence of these important life processes at regular intervals in a year and their manifestation in nature is called periodicity.
6. **STRATIFICATION:** natural forest communities possess a number of layers or stores related to the high of plant. Forexample, tall trees, smaller trees, shrubs and herbaceous layers from different strata. This phenomenon in a plant community is called stratification.
7. **ECOTONE AND EDGE EFFECT:**



- **Ecotone:** Each community has spatial limits or boundaries. The boundaries between communities may be very sharp. Such as, boundaries between a forest and a lake or the boundary may be less sharp, e.g., boundary between two types of forest or a forest and a grassland community. Often there is some transitional area in between two communities that is known as ecotone. Where species of both adjacent communities are found. Ecotone isa marginal zone and easily recognizable.



- **Edge effect:** usually in one ecotone the variety of one species is larger than in any of the adjacent communities. a phenomenon of increased variety and intensity of plants at the common junction is called edge effect and essentially due to wider range of suitable environmental conditions.

8. **ECOLOGICAL NICHE:** different species of animals and plants fulfill different functions in the ecosystem ecology. The role of each is spoken of as its ecological niche. That is the role that a species plays in its ecosystem. The total range of its interaction with other species of its environment is known as ecological niche.We can also say that ecological niche is a small habitat within a habitat, in which only a single species can survive.E.P.Odum has differentiated habitat and ecological niche by saying that the habitat is an organism's address and the ecological niche is its profession.
9. **KEYSTONE SPECIES:** in an ecological community, there are some little players and some big players. the biggest players of all are referred to as keystone species. Keystone species is first coined by by Paine in 1966.

A keystone species may be defined as one whose presence or absence, decrease or increase in abundance, strongly affects other species in the community. Paine through his classic experiments showed that predators and herbivores can manipulate relationships among species at lower trophic level s and thereby, control the structure of the community. Such predator species are called keystone species or keystone predator.

10. **INTERSPECIFIC ASSOCIATION:** species interact with variousways.Such as: competition, predation,parasitism,mutualisms, commensalisms etc.

- **Competition:** species can compete with each other for finite resources. it is considered to be an important limiting factor of population size, biomass and species richness. Direct competition has been observed between individuals, population and species.Example-a lion chasing a hyena from a kill, or a plant releasing allelopathic chemicals to impede the growth of a competing species.
- **Predation:** predation is hunting another species for food. There is a positive negative interaction.
  Some predators kill their prey before eating them (e.g., a hawk killing a mouse), herbivores feed on plants (e.g., a cow grazing)Predation may affect the population size of predators and prey and the number of species coexisting in a community.
- **Mutualism:** mutualism is an interaction between species in which both are benefited. Example-rhizobium bacteria growing in nodules on the roots of legumes and insects pollinating the flower of angiosperms.

- **Commensalism:** commensalism is a type of relationship among organisms' benefits while the other organism is neither benefited nor harmed. The organism that benefited is called the commensalism.While the other organism that is neither benefited nor harmed is called host.

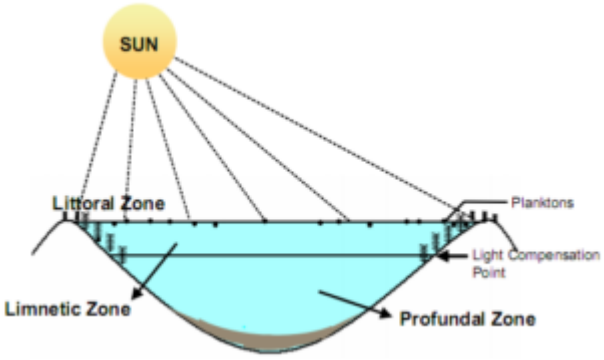
Example-an epiphytic orchid attached to the tree for support neither benefits the tree for support benefits the orchid but neither harms nor benefits the tree.

COMMUNITY STRUCTURE AND COMPOSITIONS

Structure of a community can be studied by determining the density, frequency, and abundance of species. Each community has its own structure and composition.

Such as, the community of a rain forest in silent valley will be different from that of the rain forest of Arunachal Pradesh.

Some plants needs better soil moisture and some may grow in dry stony areas. In aquatic bodies, particularly lakes and ponds,three different type of zones differentiated on the basis of light availability and depth of water are very common such as littoral zone,limnetic zone and profundal zone .each of these zone s support distinct community.



3. What is Population ecology? Describe the various characteristic or aspect of the population ecology.

Ans. Population ecology

A population is a group of interacting organisms of the same species, and contains stages: pre-reproductive juveniles and reproductive adults. Most populations have a mix of young and old individuals, and characterizing the numbers of individuals of each age or stage indicates the demographic structure of the population. In addition to demographic structure, populations vary in the number of individuals in the group, called population size, and how densely packed together those individuals are, called population density. A population's geographic range has limits, or bounds, established by the encroachment of other species, by the physical limits that the organisms can tolerated, such as temperature or aridity. A key characteristic of a population is the dynamics of whether its growing in size, shrinking, or remaining static over time.

I. Characteristics of populations: Each population has its own**:**

1. Population size: To study the demographics of a population, we'll want to start off with a few baseline measures. One is simply the number of individuals in the population, or *population size*—N*N*N. Another is the *population density*, the number of individuals per area or volume of habitat.

Size and density are both important in describing the current status of the population and, potentially, for making predictions about how it could change in the future:

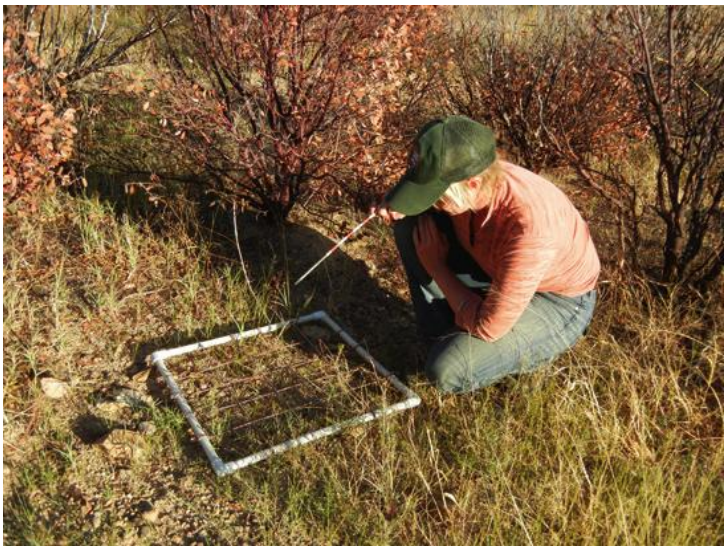
- Larger populations may be more stable than smaller populations because they’re likely to have greater genetic variability and thus more potential to adapt to changes in the environment through natural selection.
- A member of a low-density population—where organisms are sparsely spread out—might have more trouble finding a mate to reproduce with than an individual in a high-density population.

Measuring population size and Population density:

To find the size of a population, can’t we just count all the organisms in it? Ideally, yes! But in many real-life cases, this isn’t possible. For instance, would you want to try and count every single grass plant in your lawn? Or every salmon in, say, Lake Ontario, which is 393 cubic miles in volume?^11start superscript, 1, end superscript Counting all the organisms in a population may be too expensive in terms of time and money, or it may simply not be possible.
For these reasons, scientists often estimate a population's size by taking one or more samples from the population and using these samples to make inferences about the population as a whole. A variety of methods can be used to sample populations to determine their size and density. Here, we’ll look at two of the most important: the **quadrat** and **mark-recapture** methods.

Quadrat method

For immobile organisms such as plants—or for very small and slow-moving organisms—plots called *quadrats* may be used to determine population size and density. Each quadrat marks off an area of the same size—typically, a square area—within the habitat. A quadrat can be made by staking out an area with sticks and string or by using a wood, plastic, or metal square placed on the ground, as shown in the picture below.



After setting up quadrats, researchers count the number of individuals within the boundaries of each one. Multiple quadrat samples are performed throughout the habitat at several random locations, which ensures that the numbers recorded are representative for the habitat overall. In the end, the data can be used to estimate the population size and population density within the entire habitat.

Mark-recapture method

For organisms that move around, such as mammals, birds, or fish, a technique called the *mark-recapture method* is often used to determine population size. This method involves capturing a sample of animals and marking them in some way—for instance, using tags, bands, paint, or other body markings, as shown below. Then, the marked animals are released back into the environment and allowed to mix with the rest of the population.



Later, a new sample is collected. This new sample will include some individuals that are marked—recaptures—and some individuals that are unmarked. Using the ratio of marked to unmarked individuals, scientists can estimate how many individuals are in the total population.

Example: using the mark-recapture method

Let's say we want to find the size of a deer population. Suppose that we capture 80 deer, tag them, and release them back into the forest. After some time has passed—allowing the marked deer to thoroughly mix with the rest of the population—we come back and capture another 100 deer. Out of these deer, we find that 20 are already marked.

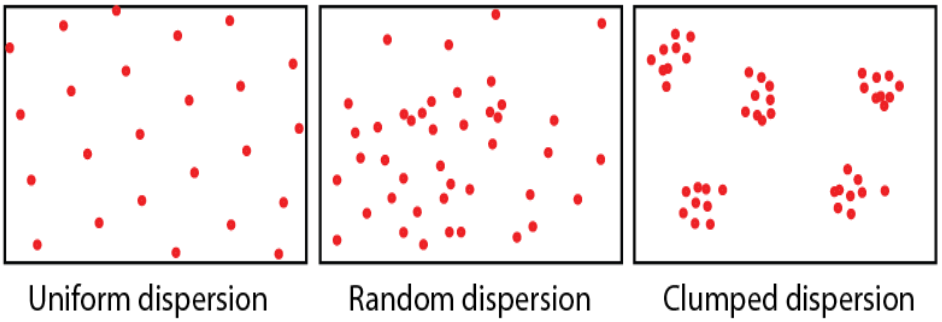
If 20 out of 100 deer are marked, this would suggest that marked deer—which we know are 80 in number—make up 20% of the population. Using this information, we can formulate the following relationship:

\dfrac{\text{number marked first catch } (M)}{\text{total population } (N)} total population (*N*)number marked first catch (*M*)start fraction, n, u, m, b, e, r, space, m, a, r, k, e, d, space, f, i, r, s, t, space, c, a, t, c, h, space, left parenthesis, M, right parenthesis, divided by, t, o, t, a, l, space, p, o, p, u, l, a, t, i, o, n, space, left parenthesis, N, right parenthesis, end fraction==equals\dfrac{\text{number marked second catch } (x)}{\text{total number of second catch } (n)}total number of second catch (*n*)

number marked second catch (x)start fraction, n, u, m, b, e, r, space, m, a, r, k, e, d, space, s, e, c, o, n, d, space, c, a, t, c, h, space, left parenthesis, x, right parenthesis, divided by, t, o, t, a, l, space, n, u, m, b, e, r, space, o, f, space, s, e, c, o, n, d, space, c, a, t, c, h, space, left parenthesis, n, right parenthesis, end fraction
\quad\quad\quad \:\:\quad\quad\quad\quad\quad\quad\quad\quad \dfrac{M}{N}NM space, space, space, space, space, space, space, space, space, space, space, space, space, space, space, space, start fraction, M, divided by, N, end fraction ==equals \dfrac{x}{n}nxstart fraction, x, divided by, n, end fraction
Next, we rearrange the equation:
\quad\quad\quad \quad\quad\quad\quad\quad\quad\quad\quad\quad\:\:\: NNspace, N ==equals \dfrac{nM}{x}xnMstart fraction, n, M, divided by, x, end fraction
And finally, we plug in the values from the deer example:
NNN ==equals \dfrac{(100 \text{ total second catch})(80\text{ marked first catch})}{(20\text{ marked second catch})}(20 marked second catch)(100 total second catch)(80 marked first catch)start fraction, left parenthesis, 100, space, t, o, t, a, l, space, s, e, c, o, n, d, space, c, a, t, c, h, right parenthesis, left parenthesis, 80, space, m, a, r, k, e, d, space, f, i, r, s, t, space, c, a, t, c, h, right parenthesis, divided by, left parenthesis, 20, space, m, a, r, k, e, d, space, s, e, c, o, n, d, space, c, a, t, c, h, right parenthesis, end fraction ==equals 400 \text{ deer}400 deer400, space, d, e, e, r
This approach isn't always perfect. Some animals from the first catch may learn to avoid capture in the second round, inflating population estimates. Alternatively, the same animals may preferentially be retrapped—especially if a food reward is offered—resulting in an underestimate of population size. Also, some species may be harmed by the marking technique, reducing their survival. The approach also assumes that animals don't die, get born, leave, or enter the population during the period of the study.
Alternative approaches to determine population size include electronic tracking of animals tagged with radio transmitters and use of data from commercial fishing and trapping operations.

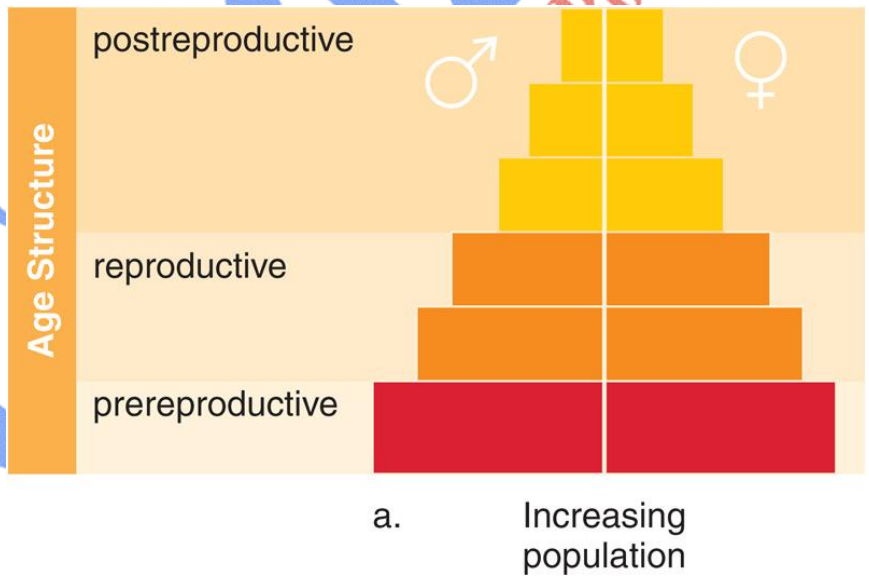
Species distribution

Often, in addition to knowing the number and density of individuals in an area, ecologists will also want to know their distribution. Species **dispersion patterns**—or **distribution patterns**—refer to how the individuals in a population are distributed in space at a given time.
The individual organisms that make up a population can be more or less equally spaced, dispersed randomly with no predictable pattern, or clustered in groups. These are known as uniform, random, and clumped dispersion patterns, respectively.



- *Uniform dispersion.* In uniform dispersion, individuals of a population are spaced more or less evenly. One example of uniform dispersion comes from plants that secrete toxins to inhibit growth of nearby individuals—a phenomenon called allelopathy. We can also find uniform dispersion in animal species where individuals stake out and defend territories.
- *Random dispersion.* In random dispersion, individuals are distributed randomly, without a predictable pattern. An example of random dispersion comes from dandelions and other plants that have wind-dispersed seeds. The seeds spread widely and sprout where they happen to fall, as long as the environment is favorable—has enough soil, water, nutrients, and light.
- *Clumped dispersion.* In a clumped dispersion, individuals are clustered in groups. A clumped dispersion may be seen in plants that drop their seeds straight to the ground—such as oak trees—or animals that live in groups—schools of fish or herds of elephants. Clumped dispersions also happen in habitats that are patchy, with only some patches suitable to live in.

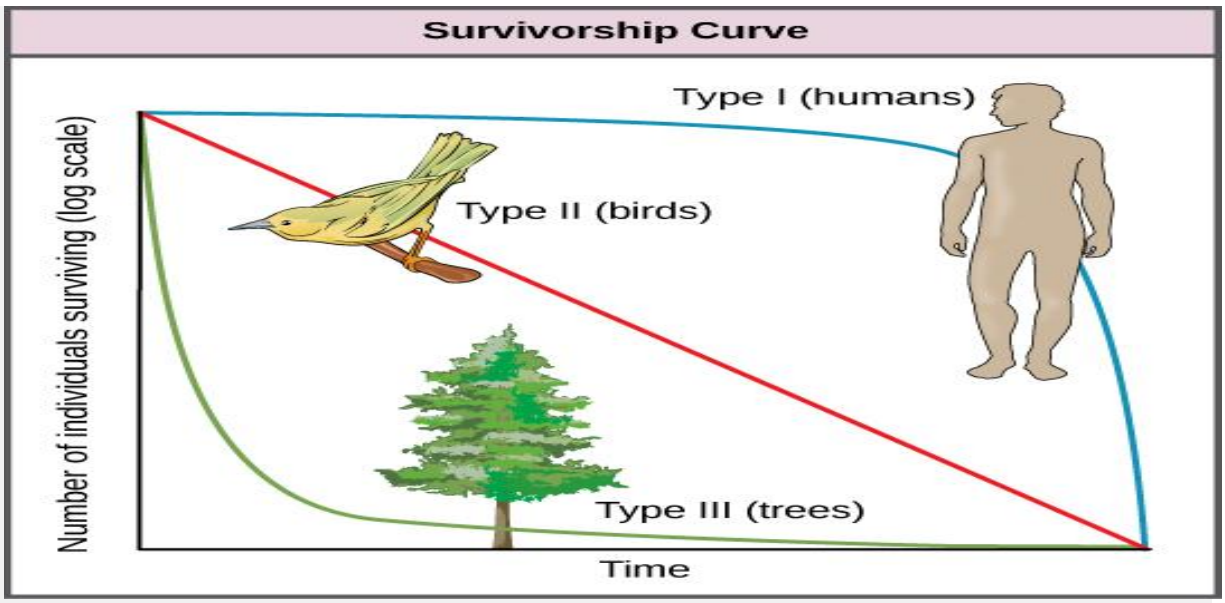
4. Age structure: pre-reproductive, reproductive, post-reproductive



5. Reproductive base: those individuals in the pre-reproductive or reproductive stage

6. **Survivorship curves**:Because of life history trade-offs, patterns of age-specific survival are predictive of the general life history of a population. While a life table shows the survivorship in a numerical form, assessing pattern from columns of data is difficult. Instead, ecologists create **survivorship curves** by plotting lx versus time.

Population biologists look for three types of patterns in survivorship curves (note that the y-axis is a log scale):



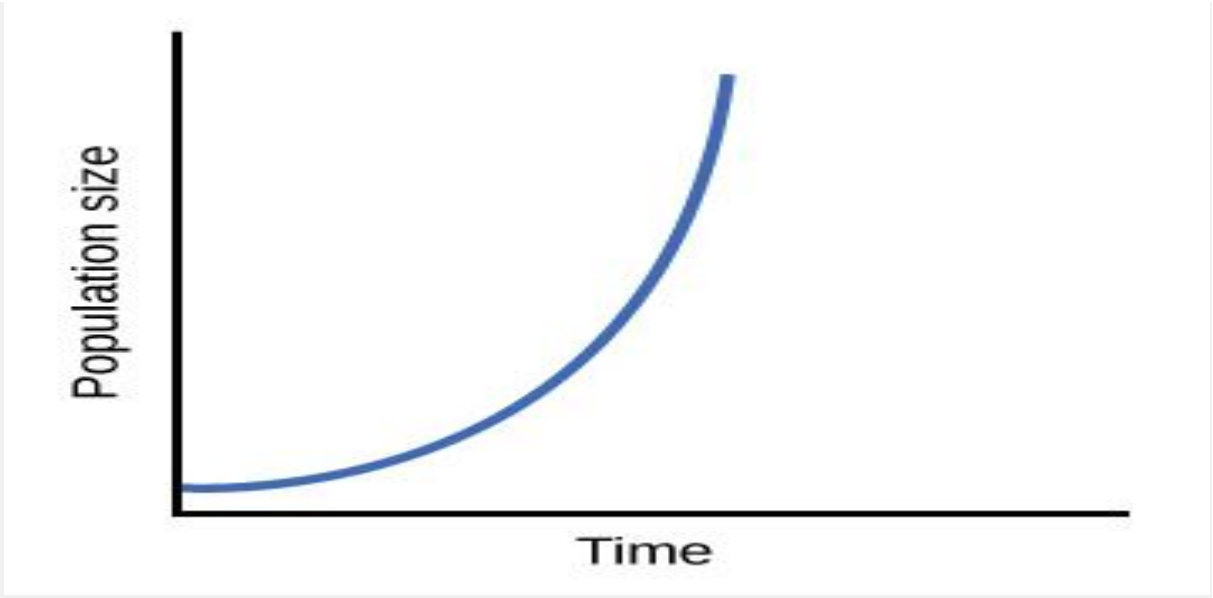
Survivorship curves show the distribution of individuals in a population according to age. Humans and most mammals have a Type I survivorship curve, because death primarily occurs in the older years. Birds have a Type II survivorship curve, as death at any age is equally probable. Trees have a Type III survivorship curve because very few survive the younger years, but after a certain age, individuals are much more likely to survive. (Source: OpenStax Biology)

Type I curves are observed in populations with low mortality in young age classes but very high mortality as an individual ages. Type II curves represent populations where the mortality rate is constant, regardless of age. Type III curves occur in populations with high mortality in early age classes and very low mortality in older individuals. Populations displaying a Type III survivorship curve generally need to have high birth rates in order for the population size to remain constant. High birth rates ensure that enough offspring survive to reproduce, ensuring the population sustains itself. In contrast, populations characterized by a Type I survivorship curve often have low birth rates because most offspring survive to reproduce, and very high birth rates result in exponential population growth.

Population Growth:-

Exponential (or Geometric) Population Growth:-

The most basic approach to population growth is to begin with the assumption that every individual produces two offspring in its lifetime, then dies, which would double the population size each generation. This population doubling at each generation is how an ideal bacterium in unlimited resources would reproduce.



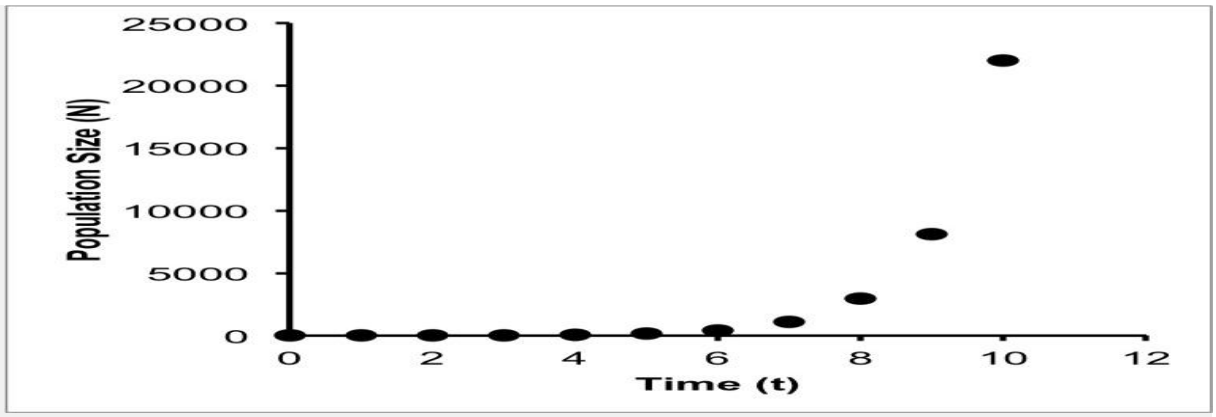
When resources are unlimited, populations exhibit exponential growth, resulting in a J-shaped curve. Source: OpenStax Biology

The **growth rate** of the population in this image is constant. Mathematically, the growth rate is **the intrinsic rate of natural increase**, a constant called **r**, for this population of size N. *r* is the birth rate *b* minus the death rate *d* of the population. The exponential growth equation

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

helps us understand the growth pattern over time t: the population size times the growth rate gives the change in population size with time. Considering population growth in discrete generations can clarify this for us even more. If the population size at the next generation is the current population size times the growth rate in that time interval, or

$N[t+1] = N[t]\exp[r]$, then we see stepwise population growth. We define $\exp[r]$ as the **discrete growth rate, lambda**.

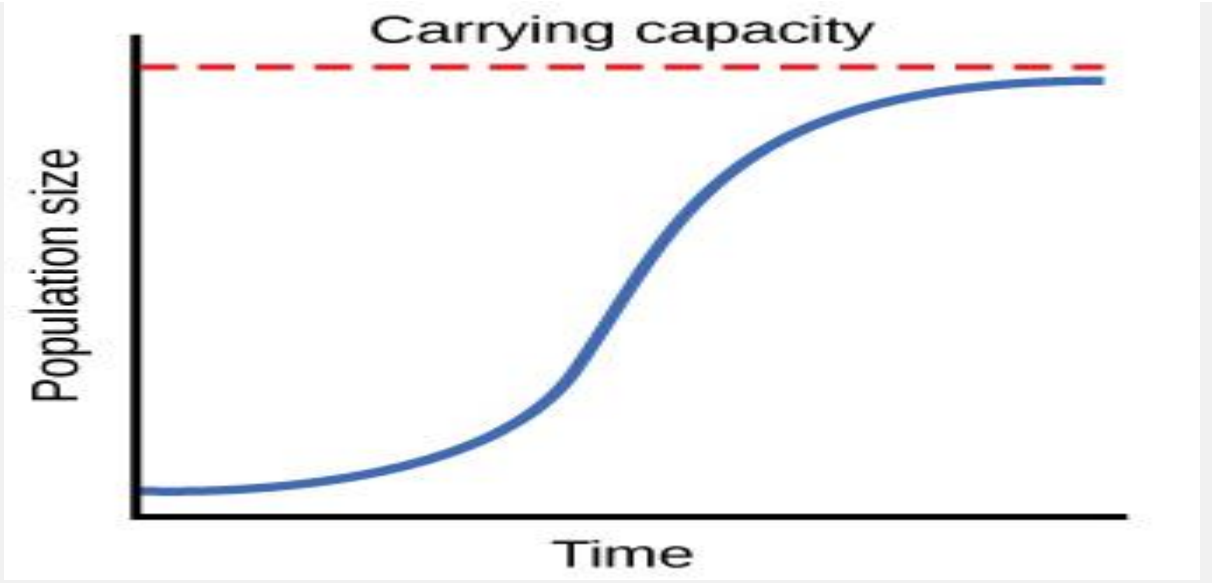


Exponential population growth with r = 1, lambda = 2.7.

The values of lambda and r are fixed with time, but the population doesn't grow linearly; instead every individual that was born in that generation reproduces. The population explodes in size very quickly. In nature, a population growing at this dramatic rate would quickly consume all available habitat and resources. Natural populations have size limits created by the environment.

Logistic Population Growth levels off at a carrying capacity

A natural population at the maximum population size that the environment can sustain is said to be at **carrying capacity**. Any individuals born into this population would increase the population size, so individuals must also be dying at a similar rate if the population size remains the same from one generation to the next. With exponential growth, population growth rate was constant, but with the addition of a carrying capacity imposed by the environment, population growth rate slows as the population size increases, and stops when the population reaches carrying capacity.



When resources are limited, populations exhibit logistic growth. In logistic growth, population expansion decreases as resources become scarce, and it levels off when the carrying capacity of the environment is reached, resulting in an S-shaped curve. Source: OpenStax Biology

Mathematically, we can achieve this by incorporating a density-dependent term into the population growth equation, where *K* represents carrying capacity:

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

What happens to population growth when *N* is small relative to *K*? When *N* is near *K*? And when is the population adding the most individuals in each generation?

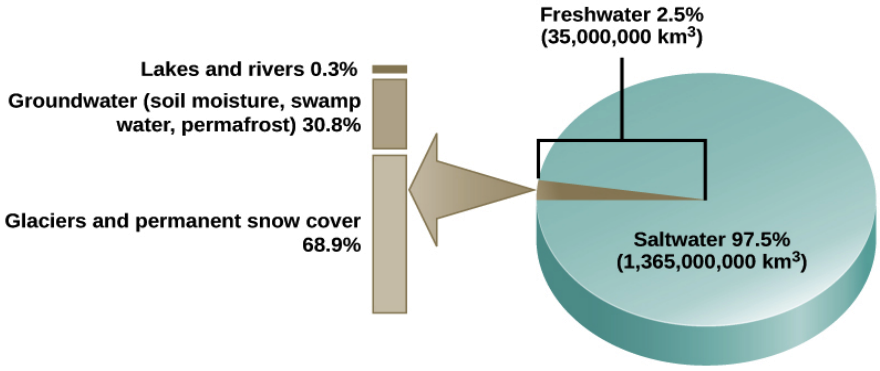
4. Write short notes on any two of the following: - (2x3)

a) Water cycle

Ans. Water:

Water is pretty darn important for living things. Your body is more than one-half water, and if we were to take a look at your cells, we'd find they were over 70% water! So, you—like most land animals—need a reliable supply of fresh water to survive.

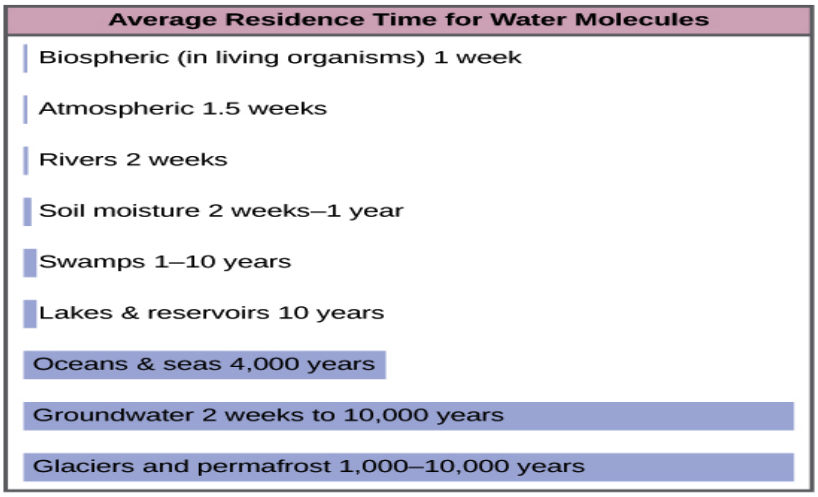
Of the water on Earth, 97.5% is salt water. Of the remaining water, over 99% is in the form of underground water or ice. All told, less than 1% of fresh water is found in lakes, rivers, and other available surface forms.



The pie chart shows that 97.5% of water on Earth, or 1,365,000,000 kilometers cubed, is salt water. The remaining 2.5%, or 35,000,000 kilometers cubed, is fresh water. Of the fresh water, 68.9% is frozen in glaciers or permanent snow cover. Groundwater—such as soil moisture, swamp water and permafrost—account for 30.8%. The remaining 0.3% is in lakes and rivers.

Many living things depend on this small supply of surface fresh water, and lack of water can have serious effects on ecosystems. Humans, of course, have come up with some technologies to increase water availability. These include digging wells to get at groundwater, collecting rainwater, and using desalination—salt removal—to get fresh water from the ocean. Still, clean, safe drinking water is not always available in many parts of the world today.

Most of the water on Earth does not cycle—move from one place to another—very rapidly. We can see this in the figure below, which shows the average time that an individual water molecule spends in each of Earth's major water reservoirs, a measurement called **residence time**. Water in oceans, underground, and in the form of ice tends to cycle very slowly. Only surface water cycles rapidly.



The water cycle

The water cycle is driven by the Sun's energy. The sun warms the ocean surface and other surface water, causing liquid water to evaporate and ice to sublime—turn directly from a solid to a gas. These sun-driven processes move water into the atmosphere in the form of water vapor.

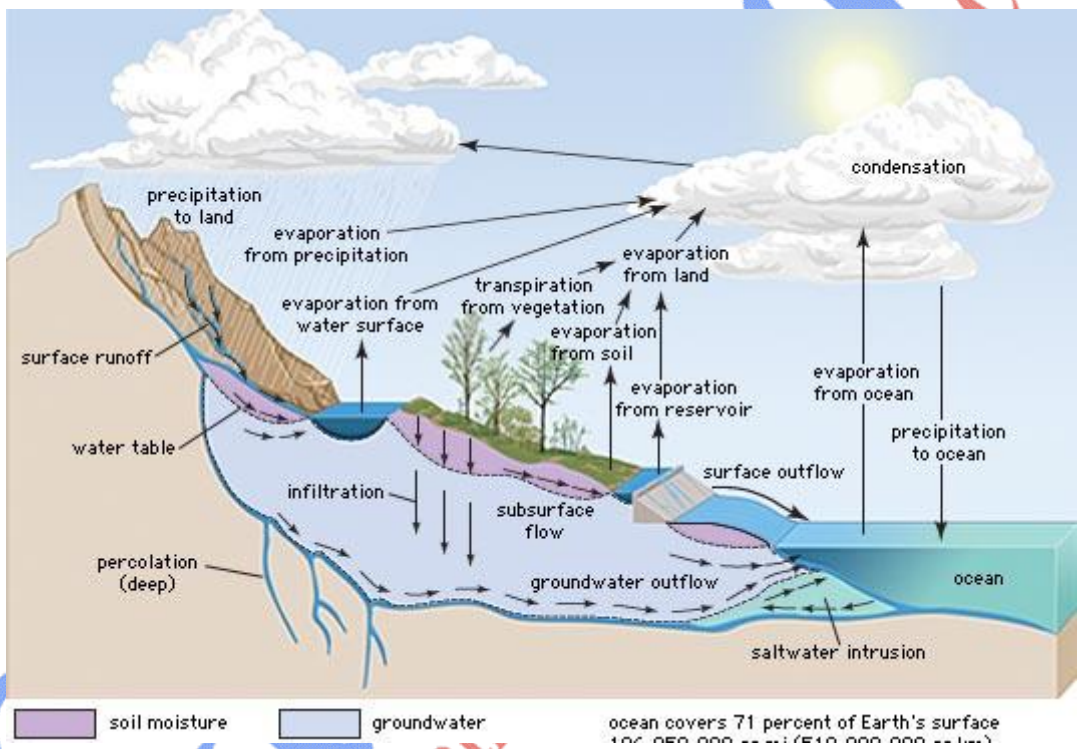
Over time, water vapor in the atmosphere condenses into clouds and eventually falls as **precipitation**, rain or snow. When precipitation reaches Earth's surface, it has a few options: it may evaporate again, flow over the surface, or **percolate**—sink down—into the ground.

In land-based, or **terrestrial**, ecosystems in their natural state, rain usually hits the leaves and other surfaces of plants before it reaches the soil. Some water evaporates quickly from the surfaces of the plants. The water that's left reaches the soil and, in most cases, will begin to move down into it.

In general, water moves along the surface as **runoff** only when the soil is saturated with water, when rain is falling very hard, or when the surface can't absorb much water. A non-absorbent surface could be rock in a natural ecosystem or asphalt or cement in an urban or suburban ecosystem. Water in the upper levels of the soil can be taken up by plant roots. Plants use some of the water for their own metabolism, and water that's in plant tissues can find its way into animals' bodies when the plants get eaten. However, most of the water that enters a plant's body will be lost back to the atmosphere in a process called transpiration. In transpiration, water enters through the roots, travels upwards through vascular tubes made out of dead cells, and evaporates through pores called stomata found in the leaves. If water is not taken up by plant roots, it may percolate down into the subsoil and bedrock, forming groundwater. Groundwater is water found in the pores between particles in sand and gravel or in the cracks in rocks, and it's an important reservoir of freshwater. Shallow groundwater flows slowly through pores and fissures and may eventually find its way to a stream or lake, where it can become part of the surface water again.

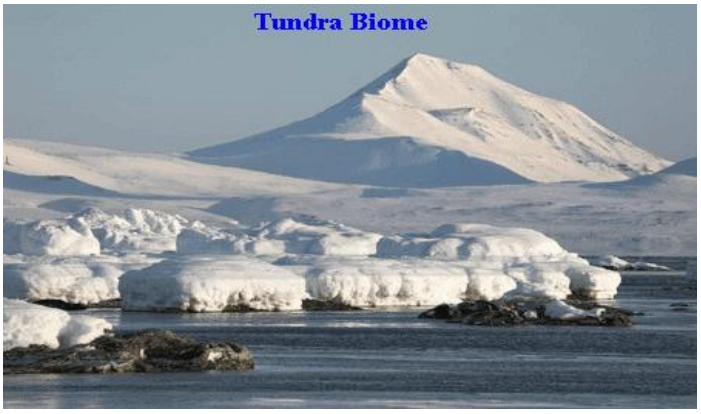
Some groundwater lies deep in the bedrock and can stay there for millennia. Groundwater reservoirs, or aquifers, are usually the source of drinking or irrigation water drawn up through wells. Today, many aquifers are being used up faster than they're renewed by water that moves down from above.

The water cycle drives other cycles.:- The water cycle is important in itself, and patterns of water cycling and rainfall have major effects on Earth's ecosystems. However, rainfall and surface runoff also play important roles in the cycling of various elements. These include carbon, nitrogen, phosphorus, and sulfur. In particular, surface runoff helps move elements from terrestrial, land-based, to aquatic ecosystems.



b) Tundra Biome

Ans. Tundra: Tundra biome is the coldest of all the biomes and the word tundra is derived from a Finnish word "*tunturi*" which means "treeless plain". It is among the harshest biome and they are found in the arctic region and on top of mountains where the climate is cold and windy and the rainfall is scanty. The tundra regions are covered with snow most of the year and summer brings blooms of wild flowers.



The landscapes of the tundra are frost-molded, the temperature of the region is very low and there is very little precipitation mostly in the form of snow. This region has poor growing seasons and poor nutrients. The nutrient pool here is the dead organic material. The major nutrients are nitrogen and phosphorus.

Characteristics:-

The characteristics of the tundra are as follows:

- The region has extremely cold climate.
- There is very low diversity.
- The vegetation structure is simple.
- The season of growth and reproduction is short.
- The drainage here is limited.
- The nutrients and the energy here is in the form of dead and organic material.

Climate:-

The tundra biome climate is as described as follows:

- The climatic condition of this biome is as in the high latitude conditions.
- The growing seasons are extremely short about 6 to 10 weeks.
- The winters are cold, long, and dark. About 6 to 10 months with monthly temperatures below 32°F or 0°C.
- There is very low precipitation, it's about less than five inches a year. This is coupled with strong, dry winds.
- Snowfall in the region is advantageous to plant and animal life as the snow provides and insulation layer on the surface of the ground.

Arctic Tundra:-

- The arctic tundra is located in the northern hemisphere.
- It encircles the North pole and extends south to the coniferous forest of the taiga.
- The arctic has cold, desert like conditions.

- The growing season in the tundra region is about 50 to 60 days.
- The average winter temperature is about -34°C, the average summer temperature is about 3 to12°C, this enables the biome to sustain life.
- Rainfall varies in different regions of the arctic.
- There is about 15 cm to 25 cm of yearly precipitation which includes melting snow.
- Soil formation is slow.
- A layer of permanently frozen subsoil known as permafrost exists and consists mostly of gravel and finer material.
- When there is saturation of the upper surface, there may be formation of bogs and ponds which provide moisture for plants.
- In this region there is no deep root system vegetation, though there are a wide variety of plants that can resist the cold climate.

Alpine Tundra:-

Alpine Tundra Biome:

- The Alpine tundra is located on the mountain regions throughout the world, there are at the high altitudes where trees cannot grow.
- The growing season in these regions is about 180 days.
- The temperature during the night is below freezing.
- The soil in the alpine is well drained.
- The vegetation in the alpine tundra is similar to the arctic tundra.
- The vegetation includes plants like tussock grasses, small-leafed shrubs, dwarf trees and heaths.
- The fauna of the alpine tundra are well adapted to its climate, the animals of the alpine include mammals like marmots, pikas, mountain goats, elk and sheep; birds like grouselike birds and insects like butterflies, grasshoppers, beetles, springtails, etc.

Tundra Climate:-

- The regions with the tundra climate are present between the 60-75 degree latitudes; it is present along the coast of the Arctic Ocean.
- The areas in the tundra experience harsh winters and cool summers.
- During the summer, the snow and the ice melts forming soggy marshes and bogs.
- The deeper part of the soil remains frozen throughout and is known as the permafrost.
- The temperature here during the winters is harsh, it is usually between -18 to -50 degrees F and summer temperature is about 30 - 50 degrees F.
- These areas do not receive direct sunlight; they receive indirect sunlight which delivers light but not heat.
- The tundra receives indirect sunlight even during summer and the temperatures reach above 50 F rarely.
- There is low precipitation seen in the tundra region. The region receives between 5-15 inches of precipitation every year usually in the summer.
- Evaporation is low as the temperatures are low.
- The permafrost soil does not aid in growth of any trees in the region.
- The climate here facilitates the growth of different types of mosses, lichens and algae. Some grasses and low shrubs are also seen.

Tundra Plants:

- The permanent frozen soil does not make tundra a favorable place for plants to grow.
- The permafrost prevents the plant roots from growing as long as they need.
- Most of the plants of the tundra are low shrubs, algae, mosses and lichens.
- There are about 1,700 different species of plants that grow in the arctic tundra.
- About 400 varieties of flowers bloom in the growing season.
- Plants like the cotton grass and arctic willow bloom in abundance in the arctic tundra.

- The soil of this region gets fertilized by animal droppings; the soil is low in nutrients and minerals.
- Plants have adapted to the conditions in this region growing in a dense mat of roots.
- The most prominent plants of the alpine tundra are mosses, lichens, sedges, perennial grasses and cushion plants.
- Caribou moss is abundantly seen in the alpine tundra.

Tundra Animals:

- Animals of the tundra have special adaptations to survive in the harsh climatic conditions.
- Though there is not much diversity, there are about 48 species of land mammals that occur in the tundra biome and also there are large numbers of each species.
- In North America, there are large herds of reindeer that feed on plants and lichens. In the frozen regions are herds of smaller musk-oxen.
- The predators of this region are the polar bears, arctic foxes, wolves and some smaller mammals like the lemmings and snowshoe rabbits.
- Birds like ravens, falcons, snowy owls, arctic tern and snow geese also inhabit this region.
- There are many types of insects in this biome, insects like mosquitoes, deer flies and black flies are very common.
- The most common animals of the alpine tundra are mountain goats, caribou, marmots, and pikas.

C) Ecological pyramid

An ecological pyramid (also trophic pyramid, energy pyramid, or sometimes food pyramid) is a graphical representation designed to show the biomass or bio productivity at each trophic level in a given ecosystem. Biomass is the amount of living or organic matter present in an organism. Biomass pyramids show how much biomass is present in the organisms at each trophic level, while productivity pyramids show the production or turnover in biomass. Ecological pyramids begin with producers on the bottom (such as plants) and proceed through the various trophic levels (such as herbivores that eat plants, then carnivores that eat herbivores, then carnivores that eat those carnivores, and so on). The highest level is the top of the chain. An ecological pyramid of biomass shows the relationship between biomass and trophic level by quantifying the biomass present at each trophic level of an ecological community at a particular time. It is a graphical representation of biomass (total amount of living or organic matter in an ecosystem) present in unit area in different tropic levels. Typical units are grams per meter2, or calories per meter2.

General concepts

Energy flows through the food chain in a predictable way, entering at the base of the food chain, by photosynthesis in primary producers, and then moving up the food chain to higher trophic levels. Because the transfer of energy from one trophic level to the next is inefficient, there is less energy entering higher trophic levels.

It may also be useful and productive to examine how the number and biomass of organisms vary across trophic levels. Both the number and biomass of organisms at each trophic level should be influenced by the amount of energy entering that trophic level. When there is a direct correlation between energy, numbers, and biomass then biomass pyramids and numbers pyramids will result. However, the relationship between energy, biomass, and number can be complicated by the growth form and size of organisms and ecological relationships occurring among trophic levels. Thus, it is possible, and common that biomass pyramids and numbers pyramids do not look like pyramids at all

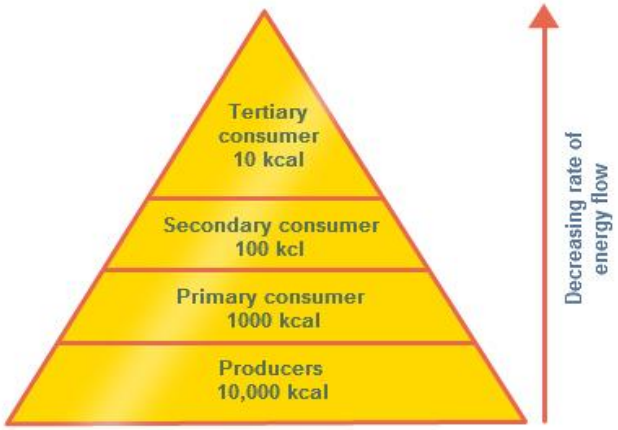
Types

There are 3 types of ecological pyramids as described as follows:

1. Pyramid of energy
2. Pyramid of numbers and
3. Pyramid of biomass**.**

Pyramid of Energy:-

The pyramid of energy or the energy pyramid describes the overall nature of the ecosystem. During the flow of energy from organism to other, there is considerable loss of energy in the form of heat. The primary producers like the autotrophs there is more amount of energy available. The least energy is available in the tertiary consumers. Thus, shorter food chain has more amount of energy available even at the highest trophic level.



Pyramid of Energy

- The energy pyramid always upright and vertical.
- This pyramid shows the flow of energy at different trophic levels.
- It depicts the energy is minimum as the highest trophic level and is maximum at the lowest trophic level.
- At each trophic level, there is successive loss of energy in the form of heat and respiration, etc.

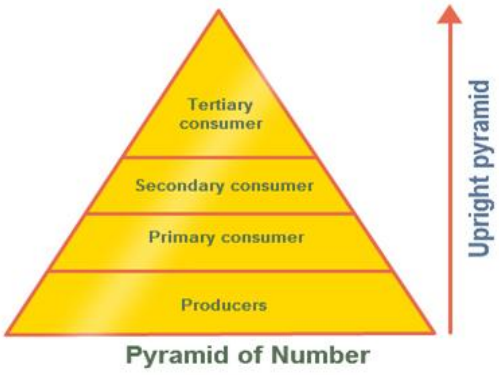
Pyramid of Numbers

The pyramid of numbers depicts the relationship in terms of the number of producers, herbivores and the carnivores at their successive trophic levels. There is a decrease in the number of individuals from the lower to the higher trophic levels. The number pyramid varies from ecosystem to ecosystem. There are three of pyramid of numbers:

- Upright pyramid of number
- Partly upright pyramid of number and
- Inverted pyramid of number.

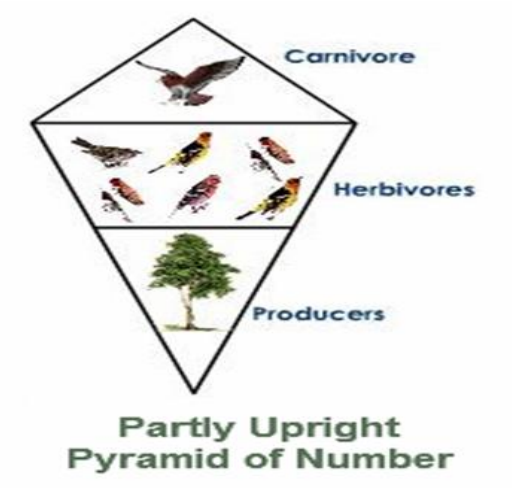
Upright Pyramid of Number

This type of pyramid number is found in the aquatic and grassland ecosystem, in these ecosystems there are numerous small autotrophs which support lesser herbivores which in turn support smaller number of carnivores and hence this pyramid is upright.



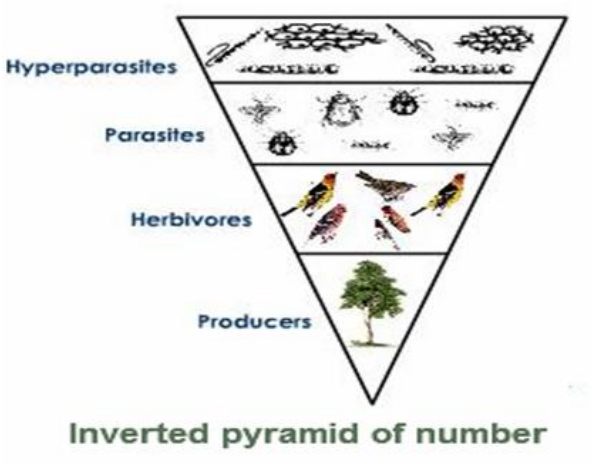
Partly Upright pyramid of Number

It is seen in the forest ecosystem where the number of producers are lesser in number and support a greater number of herbivores and which in turn support a fewer number of carnivores.



Inverted Pyramid of Number

This type of ecological pyramid is seen in parasitic food chain where one primary producer supports numerous parasites which support more hyperparasites.



Inverted pyramid of number

Pyramid of Biomass

The pyramid of biomass is more fundamental, they represent the quantitative relationships of the standing crops. In this pyramid there is a gradual decrease in the biomass from the producers to the higher trophic levels. The biomass here the net organisms collected from each feeding level and are then dried and weighed. This dry weight is the biomass and it represents the amount of energy available in the form of organic matter of the organisms. In this pyramid the net dry weight is plotted to that of the producers, herbivores, carnivores, etc.

There are two types of pyramid of biomass, they are:

- Upright pyramid of biomass and
- Inverted pyramid of biomass.
- Upright Pyramid of Biomass

This occurs when the larger net biomass of producers support a smaller weight of consumers.

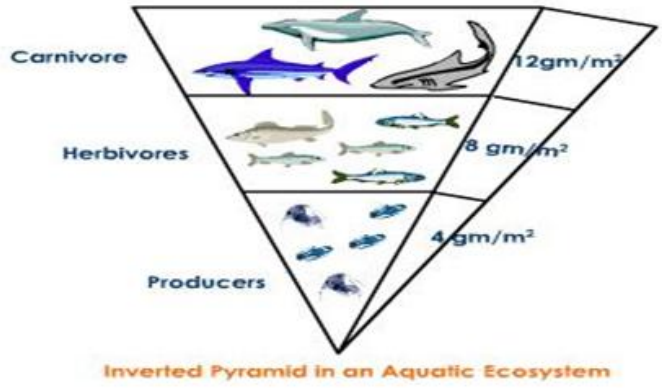
Example: Forest ecosystem.

Upright Pyramid of biomass in a Terrestrial Ecosystem

Inverted Pyramid of Biomass

This happens when the smaller weight of producers support consumers of larger weight.

Example: Aquatic ecosystem.



Inverted Pyramid in an Aquatic Ecosystem

SECTION-B

5. What are natural resources? Describe the conservation and the management of Renewable and non-renewable resources. (1x6)

Ans. The term "natural resource" means any thing that we use from our environment to achieve our objective. For example, we require bricks, cement, iron, wood etc. to construct a building. All these items are called resources for construction of building. A resource can be defined as 'any natural or artificial substance, energy or organism, which is used by human being for its welfare. These resources can be two types:

(a) Natural resources

(b) Artificial resources.

All that nature has provided such as soil, air, water, minerals, coal, sunshine (sunlight), animals and plants, etc., are known as natural resources. The resources, which have been developed by human beings during the growth of civilization, are called artificial resources. For example, biogas, thermal electricity, plastics. These man-made resources are generally derived from some other natural resources. For example, plastics from the natural resource, petroleum.

26.1.1 Classification of Natural Resources: The air we breathe and the light we get from the sun are available in unlimited quantity. But what about coal, forest, and petroleum? The stock of these resources is limited and is depleting day by day.

Resources

1. Natural (E.g. coal)- Types:
    - Exhaustible (Petroleum) Types:
        I. Renewable (E.g. wind, water, forests)
        II. Non-renewable (E.g. coal, petroleum, iron, biological species)

- Inexhaustible(E.g. solar energy, wind, rainfall, tidal energy)

2. **Artificial (E.g. electricity)**

- **Inexhaustible Resources**

The resources which cannot be exhausted by human consumption are called inexhaustible resources. These include energy sources like solar radiation, wind power, water power (flowing streams) and tidal power, and substances like sand, clay, air, water in oceans, etc.

- **Exhaustible Resources**

On the other hand, there are some resources, which are available in limited quantities and are going to be exhausted as a result of continuous use. These are called exhaustible resources. For example, the stock of coal in the earth is limited and one day there will be no more coal available for our use.

- **Renewable Resources**

Some of the exhaustible resources are naturally regenerated after consumption and are known as renewable resources. e.g. Forest trees and plants that make a forest may be destroyed but new ones gow in their place. But if forest is totally cut down to get land for construction of buildings, it is lost forever. Some other examples are fresh water, fertile soil, forest (yielding wood and other products), vegetation, wildlife, etc.

- **Non-renewable Resources**

The resources, which cannot be replaced after the use, are known as non-renewable Resources. These include minerals (copper, iron etc.) fossil fuels (coal, oil etc.).Even wildlife species (rare plants and animals) belong to this category

CONSERVATION OF NATURAL RESOURCES Consumption of natural resources is increasing with growing population. With the increasing industrialisation and urbanisation, we need to conserve natural resources for their destruction will also upset the ecological balance. Conservation is the proper management of a natural resource to prevent its exploitation, destruction or degradation. Conservation is the sum totals of activities, which can derive benefits from natural resources but at the same time, prevent excessive use leading to destruction or degradation.

Need for Conservation of Natural Resources: nature provides us with all our basic needs but we tend to over exploit. If we go on exploiting nature, there will be no more resources available in future. Hence there is an urgent need to conserve nature for the following reasons. Some of the needs are:

- To maintain ecological balance for supporting life.
- To preserve different kinds of species (biodiversity).
- To make the resources available for present and future generations. z
- To ensure survival of human race.

Coservation of Natural Resources and Traditions of India The need for conservation of natural resources was felt by our predecessors and in India, there was a tradition of respecting and preserving nature and natural resources. Natural resources were conserved in the form of sacred groves/forests, sacred pools and lakes, sacred species etc e.g. the river ganges. In our country the conservaton of natural forests is known from the time of Lord Ashoka. Sacred forests are forest patches of different dimensions dedicated by the tribals to their deities and ancestral spirits. Cutting down trees, hunting and other human interferences were strictly prohibited in these forests. This practice is widespread particularly in peninsular, central and eastern India and has resulted in the protection of a large number of plants and animals. Similarly, several water bodies, e.g., Khecheopalrilake in Sikkim was declared sacred by people, thus, protecting aquatic flora and fauna. Worshipping certain plants like banyan, peepal, tulsi etc. has not only preserved them but also encouraged their plantation. History recalls numerous instances where people have laid down their lives for protecting trees. Recent Chipko movement in India is one of the best examples. This movement was started by women in Gopeshwar village in Garhwal in the Himalayas. They stopped the felling of trees by hugging them when the lumbermen arrived to cut them. This saved about 12000 square kilometers of sensitive water catchment area. Similar movements also occurred in some other parts of the country.

SOIL Soil is a very important natural resource and an abiotic component of the environment. Soil is the uppermost layer of earth's crust, which supports growth of plants. It is a complex mixture of (i) mineral particles (formed from rocks), (ii) humus (organic material formed from decaying plant remains), (iii) mineral salts, (iv) water, (v) air, and (vi) living organisms (larger ones like earthworms and insects and microorganisms like the bacteria and fungi).

Soil is both a renewable as well as non-renewable resource. z Soil is renewable because its productivity can be maintained with fertilizers and manures rich in humus. z If the soil has been removed from a certain place by erosion, it is practically non-renewable because formation of new soil may take hundreds and thousands of years.

Soil Erosion Erosion literally means "to wear away". You might have noticed that in summer, when wind blows it carries away sand and soil particles. Similarly flowing water removes some amount of soil along with it. This removal of top layers of soil by wind and water is called soil erosion. The top layers of soil contain humus and

mineral salts, which are vital for the growth of plants. Thus, erosion causes a significant loss of humus and nutrients, and decreases the fertility of soil. 26.4.2. Causes of soil Erosion There are several causes of soil erosion.

(a) Natural causes; and

(b) Anthropogenic causes (human generated causes)

(a) Natural Causes of Soil Erosion Erosion of soil takes places due to the effect of natural agents like wind and water. High velocity winds over lands, without vegetation, carry away the loose top soil. Similarly in areas with no or very little vegetation, pouring raindrops carry away the soil.

(b) Anthropogenic Causes of Soil Erosion Besides the natural agents, there are some human activities, which cause soil erosion. Let us know about them.

1. Deforestation: If the forests are cut down for timber, or for farming purposes, or construction then the soil is no longer protected from the effect of falling rains. Consequently, the top soil is washed away into the rivers and oceans.

2. **Poor farming methods:** Improper tillage and failure to replace humus after successive crops and burning the stubble. The short, stiff stalks of grain or hay remaining on a field after harvesting of weeds reduce the water-holding capacity of the soil. So the soil becomes dry and can be blown away as dust.

3. **Overgrazing:** Overgrazing by flocks of cattle, buffaloes, goats and sheep leave very little plant-cover on the soil. Their hooves make the soil dry and soil can be blown away easily.

Conservation of Soil: Soil conservationmeans checking soil erosion and improving soil fertility by adopting various methods.

1. Maintenance of soil fertility: The fertility can be maintained by adding manure and fertilizers regularly as well as by rotation of crop.

2. Control on grazing: Grazing should be allowed only on specified areas.

3. Reforestation: Planting of trees and vegetation reduces soil erosion.

4. Terracing: Dividing a slope into several flat fields to control rapid run of water. It is practised mostly in hilly areas. 5. Contour ploughing: Ploughing at right angles to the slope allows the furrows to trap water and check soil erosion by rain water.

WATER – A PRECIOUS RESOURCE

Water is essential for survival of all living organisms. It is the most important component of all life forms and necessary for sustaining life. Water also regulates.

Climate generates electricity and is also useful in agriculture and industries. Health About 97% of the water on earth is saline in nature, found in seas and oceans. The remaining 3% is fresh water, most of which is stored in ice caps and glaciers, and just about 0.36% is distributed in lakes, rivers, ponds, etc. as 'fresh water'. Sea water supports marine life and contributes to the production of fish and sea foods and several other commercial products (iodine, agar, coral, pearls, etc.). Fresh water is needed by humans for their personal use (drinking, cleaning, sewage disposal), It is also used by other animals, in agriculture, and in industries. Fresh water is a renewable resource as it is continuously being produced through hydrological cycle (evaporation, condensation and precipitation)

Degradation of Water With increase in population and industrial growth, water is being degraded day by day.

The main reasons for the degradation of water are:

1. To meet the need of increasing population, surface water (water from ponds, lakes, rivers, etc) and ground water are overdrawn, depleting volume of water.

2. Sewage i.e., waste water from domestic and municipal use makes fresh water unfit for use by human beings and animals.

3. Waste water, from all industries flows down into the surface water bodies and ground water bodies and they get polluted.

4. Agricultural wastes containing manures, fertilizers and pesticides enter the water bodies and degrade the quality of water. 5. the continuous decrease of ground water level along coastal regions often cause movement of saline sea water into freshwater wells, thus, spoiling their water quality.

Conservation of Water Conservation and management of water are essential for the survival of mankind, plants and animals. This can be achieved adopting the following methods:

1. Growing vegetation in the catchment areas, which will hold water in the soil and allow it to percolate into deeper layers and contribute to formation of ground water.

2. Constructing dams and reservoirs to regulate supply of water to the fields, as well as to enable generation of hydroelectricity.

3. Sewage should be treated and only the clear water should be released into the rivers.

4. Industrial wastes (effluents) should be treated to prevent chemical and thermal pollution of fresh water.

5. Judicious use of water in our day-to-day life.

6. Rainwater harvesting should be done by storing rainwater and recharging groundwater.

6. Write short notes on the following:-(2x3)

a) Water pollution

Ans. <u>introduction</u> :-Over two thirds of Earth's surface is covered by water; less than a third is taken up by land.As Earth's population continues to grow, people are putting ever-increasing pressure on the planet's water resources. In a sense, our oceans, rivers, and other inland waters are being "squeezed" by human activities—not so they take up less room, but so their quality is reduced. Poorer water quality means water pollution.

What is water pollution :-Water pollution can be defined in many ways. Usually, it means one or more substances have built up in water to such an extent that they cause problems for animals or people. Oceans, lakes, rivers, and other inland waters can naturally clean up a certain amount of pollution by dispersing it harmlessly. If you poured a cup of black ink into a river, the ink would quickly disappear into the river's much larger volume of clean water. The ink would still be there in the river, but in such a low concentration that you would not be able to see it. At such low levels, the chemicals in the ink probably would not present any real problem. However, if you poured gallons of ink into a river every few seconds through a pipe, the river would quickly turn black. The chemicals in the ink could very quickly have an effect on the quality of the water. This, in turn, could affect the health of all the plants, animals, and humans whose lives depend on the river.

Main types of water pollution:-Surface waters and groundwater are the two types of water resources that pollution affects. There are also two different ways in which pollution can occur. If pollution comes from a single location, such as a discharge pipe attached to a factory, it is known as point-source pollution. Other examples of point source pollution include an oil spill from a tanker, a discharge from a smoke stack (factory chimney), or someone pouring oil from their car down a drain. A great deal of water pollution happens not from one single source but from many different scattered sources. This is called nonpoint-source pollution.

Causes of water pollution:-

Sewage :-With billions of people on the planet, disposing of sewage waste is a major

problem. According to 2013 figures from the World Health Organization, some 780 million people (11 percent of the world's population) don't have access to safe drinking water, while 2.5 billion (40 percent of the world's population) don't have proper sanitation (hygienic toilet facilities); although there have been great improvements in securing access to clean water, relatively little progress has been made on improving global sanitation in the last decade. Sewage disposal affects people's immediate environments and leads to water-related illnesses such as diarrhea that kills 760,000 children under five each year. [3] (Back in 2002, the World Health Organization estimated that water-related diseases could kill as many as 135 million people by 2020.) In developed countries, most people have flush toilets that take sewage waste quickly and hygienically away from their homes**.**

Nutrients:-Suitably treated and used in moderate quantities, sewage can be a fertilizer: it returns important nutrients to the environment, such as nitrogen and phosphorus, which plants and animals need for growth. The trouble is, sewage is often released in much greater quantities than the natural environment can cope with. Chemical fertilizers used by farmers also add nutrients to the soil, which drain into rivers and seas and add to the fertilizing effect of the sewage.

Waste water :-A few statistics illustrate the scale of the problem that waste water (chemicals washed down drains and discharged from factories) can cause. Around half of all ocean pollution is caused by sewage and waste water. Each year, the world generates perhaps 5–10 billion tons of industrial waste, much of which is pumped untreated into rivers, oceans, and other waterways.

Chemical waste:-Detergents are relatively mild substances. At the opposite end of the spectrum are highly toxic chemicals such as polychlorinated biphenyls (PCBs). They were once widely used to manufacture electronic circuit boards, but their harmful effects have now been recognized and their use is highly restricted in many countries.

Another kind of toxic pollution comes from heavy metals, such as lead, cadmium, and mercury.

The best known example of heavy metal pollution in the oceans took place in 1938 when a Japanese factory discharged a significant amount of mercury metal into Minamata Bay, contaminating the fish stocks there.

Radioactive wasts:-People view radioactive waste with great alarm—and for good reason. At high enough concentrations it can kill; in lower concentrations it can cause cancers and other illnesses.

Oil pollution:- When we think of ocean pollution, huge black oil slicks often spring to mind, yet these spectacular accidents represent only a tiny fraction of all the pollution entering our oceans. Even considering oil by itself, tanker spills are not as significant as they might seem: only 12 percent of the oil that enters the oceans comes from tanker accidents; over 70 percent of oil pollution at sea comes from routine shipping and from the oil people pour down drains on land.

Plastics:- If you've ever taken part in a community beach clean, you'll know that plastic is far and away the most common substance that washes up with the waves. There are three

reasons for this: plastic is one of the most common materials, used for making virtually every kind of manufactured object from clothing to automobile parts; plastic is light and floats easily so it can travel enormous distances across the oceans; most plastics are not biodegradable (they do not break down naturally in the environment), which means that things like plastic bottle tops can survive in the marine environment for a long time. (A plastic bottle can survive an estimated 450 years in the ocean and plastic fishing line can last up to 600 years.)

Alien species:-Most people's idea of water pollution involves things like sewage, toxic metals, or oil slicks, but pollution can be biological as well as chemical. In some parts of the world, alien species are a major problem. Alien species (sometimes known as invasive species) are animals or plants from one region that have been introduced into a different ecosystem where they do not belong.

Other forms of pollution:-These are the most common forms of pollution—but by no means the only ones. Heat or thermal pollution from factories and power plants also causes problems in rivers. By raising the temperature, it reduces the amount of oxygen dissolved in the water, thus also reducing the level of aquatic life that the river can support. Another type of pollution involves the disruption of sediments (fine-grained powders) that flow from rivers into the sea.

Effects of water pollution:

Some people believe pollution is an inescapable result of human activity: they argue that if we want to have factories, cities, ships, cars, oil, and coastal resorts, some degree of pollution is almost certain to result. In other words, pollution is a necessary evil that people must put up with if they want to make progress. Fortunately, not everyone agrees with this view. One reason people have woken up to the problem of pollution is that it brings costs of its own that undermine any economic benefits that come about by polluting.

Take oil spills, for example. They can happen if tankers are too poorly built to survive accidents at sea. But the economic benefit of compromising on tanker quality brings an economic cost when an oil spill occurs. The oil can wash up on nearby beaches, devastate the ecosystem, and severely affect tourism. The main problem is that the people who bear the cost of the spill (typically a small coastal community) are not the people who caused the problem in the first place (the people who operate the tanker). Yet, arguably, everyone who puts gasoline (petrol) into their car—or uses almost any kind of petroleum-fueled transport—contributes to the problem in some way. So oil spills are a problem for everyone, not just people who live by the coast and tanker operates.

Sewage is another good example of how pollution can affect us all. Sewage discharged into coastal waters can wash up on beaches and cause a health hazard. People who bathe or surf in the water can fall ill if they swallow polluted water—yet sewage can have other harmful effects too: it can poison shellfish (such as cockles and mussels) that grow near the shore. People who eat poisoned shellfish risk suffering from an acute—and sometimes fatal—illness called paralytic shellfish poisoning. Shellfish is no longer caught along many shores because it is simply too polluted with sewage or toxic chemical wastes that

have discharged from the land nearby.

Pollution matters because it harms the environment on which people depend. The environment is not something distant and separate from our lives. It's not a pretty shoreline hundreds of miles from our homes or a wilderness landscape that we see only on TV. The environment is everything that surrounds us that gives us life and health. Destroying the environment ultimately reduces the quality of our own lives—and that, most selfishly, is why pollution should matter to all of us.

b) Radiation pollution

Ans. Nuclear Pollution

Radionuclides are elements (uranium 235, uranium 283, thorium 232, potassium 40, radium 226, carbon 14 etc.) with unstable atomic nuclei and on decomposition release ionizing radiations in the form of alpha, beta and gamma rays. Out of the known 450 radioisotopes only some are of environmental concern like strontium 90, tritium, plutonium 239, argon 41, cobalt 60, cesium 137, iodine 131, krypton 85 etc. These can be both beneficial and harmful, depending on the way in which they are used-rays are used in routine to examine bones for fractures, Gamma radiations are used to treat cancer and many other radio-active isotopes are used to diagnose diseases. About 17% of the electrical energy generated in the world comes from nuclear power plants.

Sources of Nuclear Pollution: Radioactive substances when released into the environment are either dispersed or become concentrated in living organisms through the food chain. Other than naturally occurring radioisotopes, significant amounts are generated by human activity, including the operation of nuclear power plants, the manufacture of nuclear weapons, and atomic bomb testing. For example, strontium 90 behaves like calcium and is easily deposited and replaces calcium in the bone tissues. It could be passed to human beings through ingestion of strontium contaminated milk. Again another example is tritium, which is radioactive hydrogen. The amount of tritium released from nuclear power plants to the atmosphere have reached as high as tens of thousands of curies in one year, and releases to bodies of water have measured as high as tens of millions of picocuries per litre. The U.S. Environmental Protection Agency standard for permissible levels of tritium in drinking water is 20,000 picocuries per litre. Nuclear power plants routinely and accidentally release tritium into the air and water. Tritium has a half-life of 12.3 years and emits radioactive beta particles. Once tritium is inhaled or swallowed, its beta particles can bombard cells causing a mutation. The sources of radioactivity include both natural and manmade. Effects of Nuclear

Radiations: Few occupations that involve radioactive exposures are uranium mineworkers, radium watch dial painters, technical staff at nuclear power plants, etc. Exposure to radioactive and nuclear hazards has been clinically proven to cause cancer, mutations and teratogenesis (a prenatal toxicity characterized by structural or functional defects in the developing embryo or foetus).Nuclear hazard effects can be either initial or residual. Initial effects occur in the immediate area of explosion and are hazardous immediately after the explosionwhereas the residual effects can last for days or years and cause death. The principal initial effects are blast and radiation. Blast causes damage to lungs, ruptures eardrums, collapses structures and causes immediate death or injury. Thermal Radiation is the heat and light radiation, which a nuclear explosion's fireball emits producing extensive fires, skin burns, and flash blindness. Nuclear radiation consists of intense gamma rays and neutrons produced during the first minute after the explosion.

Figure: Natural and man-made sources of Nuclear Pollution

This radiation causes extensive damage to cells throughout the body. Radiation damage may cause headaches, nausea, vomiting, diarrhoea, and even death, depending on the radiation dose received. Studies have shown that the health effects due to radiation are dependent on the level of dose, kind of radiation, duration of exposure and types of cells irradiated. Radiation effects can be somatic or genetic.MZO-07

Somatic effects: Somatic affects the function of cells and organs. It causes damages to cell membranes, mitochondria and cell nuclei resulting in abnormal cell functions, cell division, growth and death.

Genetic effects: Genetic effects the future generations. Radiations can cause mutations, which are changes in genetic makeup of cells. These effects are mainly due to the damages to DNA molecules. People suffer from blood cancer and bone cancer if exposed to doses around 100 to 1000 roentgens. Instantaneous deaths on exposure in the event if disasters are many.

Management of Radioactive Waste:

a. The radioactive waste which comes out from industry, nuclear reactors should be stored and allowed to decay either naturally in closed drums or in very large underground air tight cemented tanks (Delay and Decay).

b. The intermediate radioactive waste should be disposed off into the environment after diluting it with some inert materials (Dilute and Disperse)c. Now-a-days small quantities of high activity wastes are converted into solids such as concrete and then it is buried underground or sea.

Control Measures:

a. Laboratory generated nuclear wastes should be disposed off safely and scientifically.

b. Nuclear power plants should be located in areas after careful study of the geology of the area, tectonic activity and meeting other established conditions.

c. Appropriate protection against occupational exposure.

d. Leakage of radioactive elements from nuclear reactors, careless use of radioactive elements as fuel and careless handling of radioactive isotopes must be prevented.MZO-07e. Safety measure against accidental release of radioactive elements must be ensured in nuclear plants.

f. Unless absolutely necessary, one should not frequently go for diagnosis byx-rays.

g. Regular monitoring of the presence of radioactive substance in high risk area should be ensured.

Among the many options for waste disposal, the scientists prefer to bury the waste in hundreds of meters deep in the earth's crust is considered to be the best safety long term option.

c) Ozone layer depletion

Ans. The decrease in ozone concentration in the middle layers of the atmosphere – mainly in the stratosphere – is extremely damaging to life on earth, and is largely caused by emissions of halogenated hydrocarbons produced by man, CFCs, HCFCs, halons, carbon tetrachloride and methyl bromide. For this reason, such substances are commonly referred to as Substances that Deplete the Ozone Layer (ODS).
The first warning voice came from a paper published in 1974 by scientists Sh. Rowland and M. Molina of the University of California, who showed that chlorofluorocarbons (CFCs) used in refrigeration, air conditioning and plastic foam manufacturing were responsible for the rapid destruction of ozone.
Ozone Destruction Mechanism

Substances such as CFCs, and others that are cited, that lower the ozone layer do not directly destroy ozone. First they undergo photolysis, forming hydrogen chloride (HCl) or chlorine nitrate (ClONO2), molecules that do not react with ozone directly, but slowly decompose, giving, among other things, a small number of chlorine atoms (Cl) and Of chlorine monoxide (ClO) molecules that catalyze the destruction of ozone.

The reactions involved in the processes of destruction are more than 100, but can be simplified in the following:

Cl + O 3 ——>ClO + O 2

ClO + O ——>Cl + O 2

Net effect: O 3 + O ——> 2 O 2

The chlorine atom acts as a catalyst, ie it is not consumed in the reaction, so it destroys thousands of ozone molecules before disappearing. The bromine atom is even more destructive than chlorine (about 10 or 100 times more). On the other hand, along with this, the chlorine concentrations are very low in the stratosphere and the bromine concentrations are even lower.

Cause of Ozone Layers Depletion

Chlorofluorocarbons (CFCs)

They are compounds formed by chlorine, fluorine and carbon. They are often used as refrigerants, solvents, and for the manufacture of spongy plastics. The most common are CFC-11, CFC-12, CFC-113, CFC-114, and CFC-115 which respectively have an ozone depletion potential of 1, 1, 0.8, 1, and 0.6.

Chlorofluocarbons, the chemicals used as the propellant for aerosol cans and Bromofluocarbons, Halon, are destroying the earth's Ozone layer. These chemicals were used in Freon and for fighting fires. Manufactures thought the chemicals were inert and not harmful to the environment.

When the chemicals reached the earth's stratosphere, they reacted with Ultraviolet radiation, which caused them to break down and release Chlorine and Bromine into the earth's ozone layer. The Ozone layer protects the earth from UV-B Rays. The chemicals caused a reaction, which made the ozone layer break down into pure oxygen. The layer lost its shielding effect from the suns UV rays. The Bromine and Chlorine kept interacting with the ozone molecules until they eventually left the ozone layer to bond with other compounds.

Hydrochlorofluorocarbons (HCFCs)

Compounds formed by H, Cl, F and C. They are being used as substitutes for CFCs because many of their properties are similar and are less harmful to ozone by having a shorter half-life and releasing fewer Cl atoms. Decreases are between 0.01 and 0.1. But as they remain harmful to the ozone layer, they are considered only a temporary solution and their use has been banned in developed countries since the year 1930.

Halons

They are compounds formed by Br, F and C. Because of their ability to put out fires are used in fire extinguishers, although their manufacture and use is prohibited in many countries because of their ozone-depleting action. Their ability to harm the ozone layer is very high because they contain Br which is a much more effective atom destroying ozone than the Cl. Thus, halon 1301 and halon 1211 have ozone depletion potentials of 13 and 4 respectively.

Note: Technically all compounds containing C and F and / or Cl are halons, but in many legislation halon only means fire extinguishing substances with the characteristics indicated above.

Methyl bromide (CH3Br)

It is a very effective pesticide that is used to fumigate soils and in many crops. Given its content in Br damages the ozone layer and has an ozone depletion potential of 0.6. In many countries dates have been set around 2000, from which it will be banned.

Carbon tetra-chloride (CCl4)

It is a compound that has been widely used as a raw material in many industries, for example, to manufacture CFCs and as a solvent. It was no longer used as a solvent when it was found to be carcinogenic. It is also used as catalysts in certain processes where chlorine ions need to be released. Its ozone depletion potential is 1.2.

Effects of Ozone Layers

1. Effects of the depletion of the ozone layer on human health

1.1 Skin Cancer

Today, it is estimated that skin cancer rates increased due to the decrease in stratospheric ozone (ozone layer). The most common type of skin cancer, called non-melanoma, is the cause of exposures to UV-B radiation for several years. There are already people who have received the dose of UV-B that can cause this type of cancer.

The United Nations Environment Program (UNEP) predicts that at an annual rate of 10 percent ozone loss over several decades, the increase in skin cancer will be around 250,000 per year. Even taking into account existing agreements for the phase-out of ozone-depleting substances (ODS), a realistic model would indicate that skin cancer would increase to 25 percent above the level of 1980 by the year 2050, along Of the 50 ° North latitude. The most lethal skin cancer, called melanoma, could also increase its frequency.

1.2 The Immune System

A person's defenses against infection depends on the strength of his immune system. It is known that exposure to ultraviolet light reduces the effectiveness of the immune system, not only relating to infections to the skin but also to those that can be verified in other parts of the body.

Exposure to UV-B radiation may well enable the immune system to tolerate disease rather than combat it. This could mean the uselessness of vaccination programs in both industrialized and developing countries.

2. Effects on aquatic ecosystems

The loss of phytoplankton, the basis of the marine food chain, has been observed as the cause of the increase in ultraviolet radiation. Under the ozone hole in the Antarctic phytoplankton productivity decreased between 6 and 12 percent.

UNEP indicates that a 16 percent decrease in ozone could result in a 5 percent loss of phytoplankton, which would mean a loss of 7 million tonnes of fish per year – around 7 percent of global fish production. 30 percent of human consumption of protein comes from the sea, this proportion increases even more in the developing countries.

3. Effects on terrestrial ecosystems

3.1 Animals

For some species, an increase in UV-B radiation implies the formation of skin cancer. This has been studied in goats, cows, cats, dogs, sheep and laboratory animals and is probably pointing out that this is a common feature of several species. Infections in cattle can be aggravated by an increase in UV-B radiation. 3.2 Plants In many plants UV-B radiation can have the following adverse effects: alter its shape and damage plant growth; Reduce tree growth; Change flowering times; Make plants more vulnerable to disease and produce toxic substances. There could even be losses of biodiversity and species.

Some solutions:

- Replace halon-based fire extinguishers with others using foam.
- Check on the label of the products, which we buy at the supermarket, to report that they do not damage the ozone layer.
- Use your car only when necessary. The less we use our cars, the less pollutants we will emit into the atmosphere. Remember that burning fossil fuels breeds many substances that damage the ozone layer.
- Do not buy refrigerators or air conditioner equipment that use CFCs as refrigerant. Look for this information in the labels, or ask the supplier of the product directly.
- Do not use cleaning solvents containing CFCs or ammonia.
- Do not use sprays, and do not buy objects made of plastic foam (dry ice or freezer). If you receive these products as a fill of your mail packages, return them immediately to the sender. Low consumption of these products will discourage plastic foam manufacturers.
- Make yourself heard. Please show this page to your children, relatives, friends and neighbors.

Conclusion:

The Ozone layer is improving since the Montreal Protocol came into effect to stop and control the use of these chemicals. The Ozone layer depends on UV-C rays from the sun to replenish its self. The contaminants from chemicals prevent it from getting what it needs to protect the earth from harmful UV-B Rays

The Ozone layer is improving, but it will need many years before it the damage is repaired.

7. Write short notes on the following: - (2x3)

a) Bio-magnification

Ans. Biomagnification stands for Biological Magnification, which means the increase of contaminated substances or toxic chemicals that take place in the food chains. These substances often arise from intoxicated or contaminated environments. The contaminants include heavy metals namely mercury, arsenic, pesticides such as DDT, and polychlorinated biphenyls (PCBs) compounds which are then taken up by organisms because of the food they consume or the intoxication of their environment. These materials are highly present in a variety of household and industrial chemicals. The harmful substances then build up inside

the organism's cells. When organisms in the higher food chain consume the organisms containing the toxins below their trophic levels, the toxins gradually become concentrated in the higher food chain. Because this is a repetitive process in the ecosystem and throughout the entire food chain, the higher organisms are the ones that will accumulate most of the toxins.

Causes of Biomagnification

The release of toxic chemicals and pollutants into the environments such as the seas, air, and land results in the accumulation of toxins and harmful substances in the environment. The concentration of these toxic chemicals and pollutants seem to be very low when released in different environments, it eventually accumulates and gets absorbed by lower organisms in the food chains such as fish, earthworms, and plants. When the lower organisms are eaten by other organism and the process goes up the trophic levels, biomagnifiaction occurs.

Agriculture

Agricultural pesticides, fungicides, herbicides, and chemical fertilizers, among other agricultural chemicals are highly toxic and often find way into the soils, rivers or lakes and the seas through surface storm water runoff. The primary agricultural inputs including pesticides, industrial by-product wastes, some fertilizers, and specific agrochemical products contain traces of heavy metals such as arsenic, cadmium, mercury, copper and lead. These substances cause severe health impacts to humans and aquatic animals such as fish when indirectly ingested and accumulate in the body tissues.

Organic contaminants

Manures and Biosolids frequently contain nutrients including nitrogen, carbon, phosphorus and nitrogen. Furthermore, because they are industrially processed, they may also have within them contaminants such as personal care products (PPCPs) and pharmaceuticals. These products have been found in human and animal bodies and are believed to have negatively health impacts to wildlife, animals, and humans.

Industrial manufacturing activities and pollution

The manufacturing processes of industries indirectly or directly release toxic and harmful substances which find a way to the soils, rivers, lakes and oceans. Industrial processes pollute the environment in several ways by emitting or discharging toxic pollutants into the environment which find way into the food chain, leading to biomagnifications.

Mining activities in the ocean

Mining activities in the deep sea is to extract minerals and metal ores like zinc, cobalt, silver, aluminum and gold destroy the oceans and the coastal regions as the mining processes generate scores of sulfide and selenium deposits in the waters. The toxicity levels build up and are absorbed by ocean creatures which are then consumed by organisms in the higher trophic levels of the food chain.

Effects of Biomagnification

Impact on human health

Humans become more susceptible to cancers, liver and kidney failure, respiratory disorders, birth defects in pregnant women, brain damage, and heart diseases are a result of mercury, cadmium, lead, cobalt, chromium and other chemical poisoning. For instance, diseases like hepatitis and cancer have been attributed to consuming seafood that has been poisoned by mercury and polycyclic aromatic hydrocarbons (PAHs).

Effects on reproduction and development of marine creatures

The various toxic chemicals and elements accumulate in the vital organs of the various aquatic creatures affecting their reproduction and development. For instance, seabird eggs are laid with thinner shells than normal, and can result in the birds crushing their eggs instead of incubating them. Selenium and heavy metals such as mercury also affect the reproduction of aquatic creatures such as fish as it destroys their reproductive organs. Besides, PCB'S (polychlorinated biphenyls) also biomagnifies and impairs reproduction and is considerable high in aquatic systems.

Destruction of the coral reefs

The coral reefs are destroyed by cyanide which is used in leaching gold and in fishing. The reefs provide for spawning, feeding, and dwelling grounds for numerous sea creatures. When destroyed, the survival of aquatic creatures is highly compromised.

Disruption of the food chain

Many sea creatures depend on the natural food chain for survival. When chemicals and other toxins are carried into the soils, rivers, lakes or oceans and taken up by various organisms, it disrupts the interconnected relationships within the food chain.

It happens when small animals ingest or plants absorb the toxic elements after which they are eaten by bigger animals, consequently, affecting the entire natural food chain. The creatures or plants intoxicated with substances such as mercury, copper, chromium, selenium and

cobalt may also be consumed by humans and top animals in the food chain leading to susceptibility to diseases, reproductive disorders, and even deaths.

Process of Biomagnification

Biomagnification process occurs when certain toxic chemicals and pollutants such as heavy metals, pesticides or polychlorinated biphenyls (PCBs) compounds go up the food chain by working their way through the environment and into the soil or the water systems after which they are eaten by aquatic animals or plants, which in turn are consumed by animals, humans, and large birds. Eventually, these substances increase in concentration in the organisms as they move up the food chain because they are slowly excreted or metabolized/broken down.

Here is an explanation showing the process of biomagnification:

Release of toxic chemicals and pollutants into the environment

The process begins with the release of toxic chemicals and pollutants into the environment and eventually works their way into soils, rivers or lakes, and the seas. The concentration of these toxic chemicals and pollutants seem to be very low when released in different environments. They are very minute even in terms of weight.

Phytoplankton

Phytoplankton refers to small plants that float in the seas that normally absorb toxins. Once absorbed, the toxins stay in their tissues without being excreted or broken down. With time, the toxins accumulate to high concentrations up to 200 parts a trillion which represents a toxin accumulation increase by about four fold.

Zooplankton

Zooplankton refers to small marine animals that float in the seas. They consume the phytoplankton and thus take in the toxin. The toxins stay locked in the organism's tissue without being excreted or broken down. Over time, the toxin concentration increases up to two parts per billion which represents about a ten-fold increase over the previous concentration.

Small fish consume the zooplankton

Whenever the small fish feed on the zooplanktons, they consequently take up the toxins which get absorbed in their fatty tissues. As a result, accumulation occurs and the concentrations build up to about 20 parts per billion which is another ten-fold increase.

Large fish graze on the smaller fish

Again, when the large fish graze on the smaller fish for food, they consume the toxins that accumulate in their fatty tissues. The concentrations become higher up to ranges of 80 to 100 parts per billion. This is about four to five fold increase in the toxic levels.

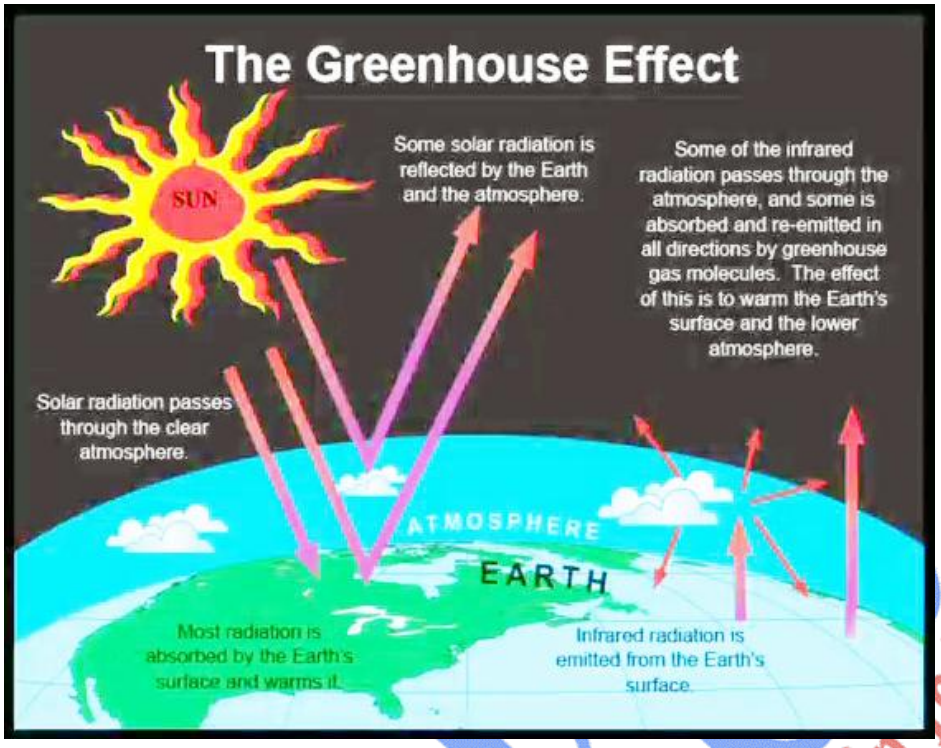
The top food chain organisms consumes the fish

The organisms at the top of the food chain including the marine mammals such as dolphin, sea birds, and humans gradually build up the toxins in their tissues such as their liver when they consume the large fish. The levels of concentrations here increase to the highest ranges of 10,000 to 15,000 parts per billion. The results impact the animal's fertility and make them vulnerable to diseases as they interfere with the normal functioning of vital organs.

b) Green-house effects

Ans. The greenhouse effect is a natural process that warms the Earth's surface. When the Sun's energy reaches the Earth's atmosphere, some of it is reflected back to space and the rest is absorbed and re-radiated by greenhouse gases. Greenhouse gases include water vapour, carbon dioxide, methane, nitrous oxide, ozone and some artificial chemicals such as chlorofluorocarbons (CFCs). The absorbed energy warms the atmosphere and the surface of the Earth. This process maintains the Earth's temperature at around 33 degrees Celsius warmer than it would otherwise be, allowing life on Earth to exist.

Greenhouse Gases:-Carbon dioxide () is one of the greenhouse gases. It consists of one carbon atom with an oxygen atom bonded to each side. When its atoms are bonded tightly together, the carbon dioxide molecule can absorb infrared radiation and the molecule starts to vibrate. Eventually, the vibrating molecule will emit the radiation again, and it will likely be absorbed by yet another greenhouse gas molecule. This absorption-emission-absorption cycle serves to keep the heat near the surface, effectively insulating the surface from the cold of space. Carbon dioxide, water vapor (), methane (), nitorus oxide (), and a few other gases are greenhouse gases. They all are molecules composed of more than two component atoms, bound loosely enough together to be able to vibrate with the absorption of heat. The major components of the atmosphere (and) are two-atom molecules too tightly bound together to vibrate and thus they do not absorb heat and contribute to the greenhouse effect.



Greenhouse Effect

Atmospheric scientists first used the term 'greenhouse effect' in the early 1800s. At that time, it was used to describe the naturally occurring functions of trace gases in the atmosphere and did not have any negative connotations. It was not until the mid-1950s that the term greenhouse effect was coupled with concern over climate change. And in recent decades, we often hear about the greenhouse effect in somewhat negative terms. The negative concerns are related to the possible impacts of an enhanced greenhouse effect. This is covered in more detail in the Global Climate Change section of this Web site. It is important to remember that without the greenhouse effect, life on earth as we know it would not be possible.

While the earth's temperature is dependent upon the greenhouse-like action of the atmosphere, the amount of heating and cooling are strongly influenced by several factors just as greenhouses are affected by various factors.

In the atmospheric greenhouse effect, the type of surface that sunlight first encounters is the most important factor. Forests, grasslands, ocean surfaces, ice caps, deserts, and cities all absorb, reflect, and radiate radiation differently. Sunlight falling on a white glacier surface strongly reflects back into space, resulting in minimal heating of the surface and lower atmosphere. Sunlight falling on a dark desert soil is strongly absorbed, on the other hand, and contributes to significant heating of the surface and lower atmosphere. Cloud cover also affects greenhouse warming by both reducing the amount of solar radiation reaching the earth's surface and by reducing the amount of radiation energy emitted into space.

Scientists use the term albedo to define the percentage of solar energy reflected back by a surface. Understanding local, regional, and global albedo effects is critical to predicting global climate change.

SECTION-C

8. What do you mean by wildlife? Explain conservation and management of wildlife. **(1x6)**

Ans. Wildlife traditionally refers to undomesticated animal species, but has come to include all plants, fungi, and other organisms that grow or live wild in an area without being introduced by humans. The goal of wildlife conservation is to ensure that nature will be around for future generations to enjoy and also to recognize the importance of wildlife and wilderness for humans and other species alike. Wildlife conservation activities relate to the protection of plants and animal species, and their habitats. Conservation efforts are made with a goal to preserve the nature, and the endangered species for the future generations. Wildlife conservation is very important because wildlife and wilderness play an important role in maintaining the ecological balance. Organizations, both on international and national levels are dedicated to wildlife conservation. The World Wildlife Fund is an international organization making worldwide efforts for the conservation of nature, and the protection of endangered species. Wildlife conservation organizations/societies can be private or government owned. Wildlife conservationists work to identify plant and animal species that require protection.

Wildlife conservation efforts are aimed in several main areas. These include the creation of wildlife sanctuaries where wildlife can live protected and free from harm, and where scientific studies can be conducted to better understand the threats to various species and what solutions are needed to ensure their survival.

Wildlife management is interdisciplinary that deals with protecting endangered and threatened species and subspecies and their habitats, as well as the non-threatened agricultural animals and game species. The Wildlife Management program emphasizes both applied and basic research in wildlife ecology, management, education and extension.

Wildlife management takes into consideration the ecological principles such as carrying capacity of the habitat, preservation and control of habitat, reforestation, predator control, re-introduction of extinct species, capture and reallocation of abundant species and management of "desirable" or "undesirable" species.

The profession of wildlife management was established in USA during 1920-1930 by **Aldo Leopold** (1887-1948) and others. The institutional foundations of the profession of wildlife management were established in the 1933 when Leopold was granted professorship in wildlife management in University of Wisconsin, Madison and he published his books, *Game Management* and *Game and fish handbook*. Aldo Leopold

eventually developed the first graduate game management program for wildlife biologists at the University of Wisconsin, USA.

There are two general types of wildlife management:

Manipulative management involves regulating numbers of animals directly by harvesting or by influencing numbers by altering food supply, habitat, density of predators etc.

Custodial management is preventive or protective and minimizes external influences on the population and its habitat. It is done by setting up national parks where ecological conditions are protected and threatened species are conserved by law.

The Wildlife Management program focuses on the following:

- Predator-prey relationship
- Urban and suburban wildlife
- Migratory wildlife species
- Wildlife-human interaction
- International wildlife

Elements of Wildlife Management

Management of wildlife depends on certain elements such as public support and awareness to protect wildlife and their habitats.

Public Participation: It is necessary to make local people realise and accept the idea and importance of wildlife protection. Public interaction can help in making local people responsible and cooperate in enforcement of wildlife management laws and regulations. Their feedback should also be taken for effective functioning of wildlife management.

Public Awareness: People should understand the concept of conservation of natural resources. The wildlife managers and other responsible persons should held public discussions, shows, and talks and should also take help of other media like newspapers, magazines, radio and television to make people aware about the basic concepts behind wildlife management. This can stop people from exploiting natural resources, which is the major threat to wildlife and their habitats.

Education: The role of education in pubic awareness programs is very important. There should be environmental subjects based on wildlife conservation in school and college curricula. The well-educated and trained specialists on environmental and forest issues should participate in public training and interact with people and solve their queries to make them more responsible towards their wildlife management duties.

Nature Interpretation Centres: Nature interpretation centres may include setting up of educational camps or exhibition in nearby regions of protected areas such as zoological gardens, parks and wildlife sanctuaries. It is usually taken up by the concerned forest departments. The interpretation centres should be handled by qualified and trained staff in order to explain and motivate the concepts of wildlife management to the tourists and people of the nearby-protected areas.

Coordination: Wildlife management is operated at four basic levels – local, state, national and international. Government agencies plan the policies of protecting, conserving and managing wildlife. All the management levels participate in passing wildlife management tools and many a time, conflicts arise.

Forms of Wildlife Management

Habitat Restoration and Management

Habitat management is a primary tool wildlife biologists use to manage, protect, and enhance wildlife populations. Increased wildlife diversity in an area may be a wildlife management goal. It is difficult to develop strategies for managing each species separately. Several wildlife species can benefit when a complete ecosystem is improved or preserved intact to meet the needs of threatened or endangered species or groups of species.

Managers may enhance grassland areas by clearing brush (prescribed burning, cutting, herbicides) and removing trees, as well as over-planting them with native prairie species. This helps reduce cover used by edge predators (skunks, raccoons, red-tailed hawks) and improves the quality of the habitat for grassland animals.

Harvest

Managers may strive to reduce or maintain populations so animals conflict less with human activities. For example, white-tailed deer are abundant in urban areas. This presents challenges for wildlife managers because hunting with firearms is not allowed. The most effective solution has been controlled hunts. Monkey population in urban India can be controlled by capture and release in wild areas.

Endangered Species Management

Endangered or threatened species require intensive management. Critical habitat and locations of existing populations must be identified so they can be managed successfully. An animal species is considered endangered when its numbers become so low that experts think it may become extinct unless action is taken to save it.

Threatened species' populations are showing signs of unnatural decline or they are vulnerable to becoming endangered. Many endangered or threatened species are specialists

that have very restrictive habitat needs and eat specialized foods. The leading cause for a species becoming endangered or threatened is habitat loss.

Species Reintroduction

Another wildlife management goal may be to re-establish species in suitable habitat. The lost species can be reintroduced from other areas once again in reintroduction programs and management efforts. Study of biology and ecological requirements of the species is necessary before the introductions.

Conservation and Preservation

Wildlife conservation helps ensure future generations can enjoy our resources. Conservation can include harvesting natural resources, activities such as hunting, fishing, trapping and harvesting timber as well as non-consumptive activities such as bird watching, photography, and hiking. Conservation must balance issues between wildlife and human populations. Conservation of wildlife implies insuring threatened and endangered species receive special management to protect their presence in the future.

Conservation may include preservation or protection of natural resources that emphasizes non-consumptive activities. A habitat or ecosystem can be preserved by manipulation and an area also may be managed by doing nothing at all. For example, a forest can be conserved by allowing it to mature without any human manipulation such as timber harvest, grazing, or tree planting.

Biodiversity conservation in forest ecosystems

Conservation of natural forest ecosystems is the main function of most protected forest areas and the term “protected area” encompasses a vast variety of approaches for the management of natural and semi-natural forest types. National parks and forest reserves are no longer the only methods that can be used for the conservation of biological diversity. A possible alternative is multiple use forest management, which incorporates harvesting of forest products within a framework of sustainable management that aims at both conserving biodiversity and supplying benefits to local people and the national economy.

Protected areas

Numerous problems arise in relation to the management of protected areas. Problems include conflicts with local people over land rights and illegal extraction of animal and plant resources. These problems are often intensified due to the inability of state authorities to protect such areas. Hence, stated conservation achievements do not always reflect reality. In practice, even though there are good examples of effective national parks and forest reserves, the past hundred years or more have witnessed a parallel increase in

both the number and surface area of protected areas and a growing number of extinct or threatened species.

Buffer zones

Experience has shown that legal protection alone is not enough to ensure effective conservation activity. In particular, protected areas will only fulfill their conservation goals if the land around them is managed appropriately. In reality, many protected areas suffer from encroachment by farming and cropping activities. Currently therefore, the objective of biodiversity conservation in forests can only generally be ensured by the creation of substantial areas of natural forest for production around them. Such a "buffer zone" can support the protected area while, at the same time, provide local people with benefits.

Buffer zones are meant to form a physical barrier against human encroachment of the centrally protected area. Furthermore, the support of local people in conservation objectives can be promoted by their participation in the harvesting and management of buffer zones.

Sustainable wildlife management

Wildlife is being used for tourism, mainly in Africa. Besides the financial value of these activities, this method of utilizing wildlife resources should be ecologically and socially viable, but it is important to remember that wildlife also has considerable socio-cultural and religious importance. In the past, authoritarian management of wildlife resources has often failed. Total bans on the use and marketing of game have also forced communities to poaching. The implication is that it is not generally possible to manage natural resources and fauna without the active participation of local communities in decision-making and subsequent benefits. Integrated community programmes for resource conservation have been formulated with success in several African countries, leading to a considerable drop in poaching, an increase in animal populations and to habitat regeneration.

Fire protection

Although fire is a natural component of many forest ecosystems, it can damage vegetation and consequently lead to soil erosion and a loss of fertility if not used properly. Likewise, fires may also have harmful effects in that they can lead to carbon emissions during combustion. It has been proven that most forest fires are caused by human intervention due to a number of different causes. However, if used properly and with care, fire is a valuable tool for farmers and herders. In forestry, for example, it is used in the preparation of sites for establishing plantations or to encourage natural regeneration. In reality, problems of fire control are more sociological in nature than technical. Effective fire control is more a matter of popular education and agricultural policy than direct control and response.

Management for soil and water conservation

Forested watersheds that provide water to densely populated areas should be protected against shifting cultivation and unplanned urbanization. The only management in such cases should be effective surveillance to protect forest cover. Associating the functions of water supply and natural reserves for wildlife and plant life in the same watershed does not generally present any technical problems and water management carried out downstream from these areas can be successful.

9. What is Space Ecology? Describe the space problems, solution and colonization.

Ans. Space Ecology Lots of fictional universes have some small degree of what I call "space ecology." Space ecology involves an actual space-based ecosystem with at least some entities that fit one or more of the following descriptions:

They can be found on multiple planets throughout the known space of the setting.
They travel between worlds, possibly on a regular basis.
They live in space.
They may cause massive ecological damage to planets by visiting them, sometimes to the extreme of actually "eating" the planet to some degree.

Many fictional universes have at least one creature in it that qualifies for at least one of these descriptors, even if the creature in question is simply a human or sapient alien species.

If they bother, each universe has its own explanation or explanations for each of these features.

Found on multiple planets: These entities, which I will refer to as panplanetary, are typical planetary life. However, for reasons which may be glossed over or gone into deeply, they exist on numerous worlds rather than a single native planet. Reasons for this can range from the simple "well, they're useful/likeable, so we imported them" or "they stowed away" to the nonsensical "it was parallel evolution 'k?"

Travel between worlds: These entities, worldhoppers, are occasionally ordinary non-sapient creatures; however, the idea of a non-sapient worldhopping race is rather implausible if they don't have adaptations for it. Generally, such a creature would prefer to live in a planetary environment, but is capable of brief to somewhat extended jaunts through space. However, and this is key to distinguishing the more extreme cases from those that live in space entirely, they must at least occasionally touch down on a world for some reason.

Living in space: Beings that are pure spacelife are presumably immensely durable by our standards, as they would have to be able to withstand the types of things that our spacecraft merely endure for their entire lives. Conversely, such beings probably couldn't survive in atmosphere, as they would spend their entire lives in microgravity and airlessness-the very idea of trying to swim through air with a fixed up and down would probably be too alien for them to stand. (Note: For the purposes of this essay, a living thing that existed in an airless environment on a quasiplanetary surface, such as the Moon, is planetary life, despite seeming like "spacelife" to us.)

Harmful invasive visitors: There are many potential categories of this type, ranging from space locusts to world devourers. The crucial point is that they deliberately travel from world to world to feed in some way, and hypothetically could be as innocuous as space plankton (though that's rarely the case).

Over the next few weeks, I hope to go over these types in a certain amount of detail. Why? If for no other reason, then because it'll be an exercise in thinking things through that should be interesting.

10. Write short notes on any two of the following: - (2x3)

a) Effects of Urbanization

Ans. <u>Introduction:-</u>Urbanization is a process whereby populations move from rural to urban area, enabling cities and towns to grow. It can also be termed as the progressive increase of the number of people living in towns and cities. It is highly influenced by the notion that cities and towns have achieved better economic, political, and social mileages compared to the rural areas. Accordingly, urbanization is very common in developing and developed worlds as more and more people have the tendency of moving closer to towns and cities to acquire "privileged" social and economic services as well as benefits. These include social and economic advantages such as better education, health care, sanitation, housing, business opportunities, and transportation.

Urbanisation has become a common feature of Indian society. Growth of Industries has contributed to the growth of cities. As a result of industrialisation people have started moving towards the industrial areas in search of employment. This has resulted in the growth of towns and cities. Urbanisation denotes a diffusion of the influence of urban centres to a rural hinterland. Urbanisation can also be defined as a process of concentration of population in a particular territory. According to Mitchell urbanisation is a process of becoming urban, moving to cities, changing from agriculture to other pursuits common to cities.

Causes of Urbanisation: Various reasons have led to the growth of cities. They are as follows:

i. Industrialization: Industrialization is a major cause of urbanization. It has expanded the employment opportunities. Rural people have migrated to cities on account of better employment opportunities.

ii. Social factors: Many social factors such as attraction of cities, better standard of living, better educational facilities, need for status also induce people to migrate to cities.

iii. Employment opportunities: In rural sector people have to depend mainly on agriculture for their livelihood. But Indian agriculture is depending on monsoon. In drought situations or natural calamities, rural people have to migrate to cities.

iv. Modernization: Urban areas are characterized by sophisticated technology better infrastructure, communication, medical facilities, etc. People feel that they can lead a comfortable life in cities and migrate to cities.

Rural urban transformation: It is an interesting aspect that not only cities are growing in number but rural community is adopting urban culture, no longer rural communities are retaining their unique rural culture. Rural people are following the material culture of urban people. Urban rural transformation can be observed in the following areas.

Spread of education: The literacy rate has increased among the rural people. They have become more modernised.

b) Wild life of Rajasthan

Ans. The hot, dry climate of Rajasthan, its vast sandy areas, hilly tracts and numerous lakes, rivers and waterbodies provide diverse habitat conditions suitable for a number of species of reptiles which include crocodiles, snakes, lizards and turtles. Two species of crocodiles, the marsh crocodile and the gharial inhabit the rivers. The gharial is a fish-eating crocodile and does not attack humans. Once endangered, Rajasthan has contributed substantially in saving the inoffensive gharial from extinction, with most of its country-wide population hatched from eggs collected from the state's Chambal river. Of a total of 30 species of snakes found here, 26 are non-poisonous. The four venomous snakes include the Indian cobra (Najanaja), Indian krait (Bungaruscaeruleus), Russell's viper (Viperarusselii) and Pud (Ecbiscaeruleus). Unless provoked or stepped upon, these snakes do not attack humans. The common rock python (Python molurus) is the biggest snake found in Rajasthan. Although pythons can be found in a number of wildlife sanctuaries, the best place to spot them during the winter months is at the Keoladeo national park, Bharatpur.

Of the 26 species of lizards found in Rajasthan, two are monitor lizards- the Varanusbengalensis widely spread throughout the state, and the Varanusgriseus which is confined to the western part o the state. Sanda or the spiny tailed lizard lives only in the drier, western region of the state. A shy vegetarian, it uses its spiny tail for defense against enemies.

Rajasthan has only one specie of land turtle, the star turtle (Geocbeloneelegans). Confined to the hilly tracts of the Aravallies, it is threatened because of loss of habitat. The remaining 11 species are acuatic, found in the perennial waterbodies of eastern and southern Rajasthan. The Chambal sanctuary on the eastern boundary of the state provides a suitable habitat for highly endangered, freshwater or Gangetic dolphins, as well as for gharials, crocodiles and a number of species of turtles. The religious, cultural, social and historical traditions of the people of the state have contributed a good deal to saving its natural heritage. The ethics of conservation are a part of the state's fabric, nurtured by saints, philosophers and religious gurus. Te desert community shards its scarce resources of food and water willingly with wild animals. Food and water is provided for birds and animals in many parts of India. However, there is no parallel to the feeding of Demoiselle cranes in Kheechan village near Phalodi in Jodhpur district. During migration (September-March) thousands of Demoiselle cranes arrive early in the morning and land in the village to be fed by the villagers. Treated like guests and addressed as friends and companions, they have found a place in the state's folklore and folk songs.

Communities like those of the Bishnois provide protection to all wild animals in their villages because of their religious faith and belief. The blackbuck and abinkara are considered sacred and aggressively protected. Large herds of these graceful antelopes roam freely in the Bishnoi fields in the desert districts of the state. Even the powerful maharajas of pre-independent India refrained from hunting on Bishnoi lands, respecting the sentiments of these conservators. No hunter or poacher is likely to attempt to hunt in these areas for fear of the wrath of the entire community. Because of this, there are more wild animals to b found in the non-forest areas than in the forest area. The rulers of the erstwhile states contributed substantially to the preservation of wildlife. Athough they themselves enjoyed sbikar, at the same time they prevented others from the sport. Most of the state's wildlife sanctuaries and national parks were once their exclusive shooting reserves.

Ranthambhor National Park:

Wildlife of RajasthanOne of the most famous tiger reserves of India, Ranthambore National Park, Rajasthan came under the Project Tiger in 1980. Located in eastern Rajasthan, it is surrounded by the Vindhyas and Aravallis, has many artificial lakes and is home to many beautiful pavilions, palaces and the Ranthambore fort, which creates a unique backdrop to the stunning views of the barbaric nature of the wild cats here. This former hunting preserves of the Jaipur royalty, tigers, leopards, sambhars or Indian deers, cheetals, sloth bears, neelgais or blue bulls, chinkaras or Indian gazelles, hyenas, jackals, oxes, caracals, jungle cats, ratels, langurs and wild boars along with over 300 species of birds in the park are quite used to click of the cameras and do not really bother when they see humans trying to sneak into their private lives. Infinite number of still photographs and movies related to the tigers that have been shot here bear a testimony to this fact.

Desert National Park and Sanctuary:

Sprawling over 3162 sq km on the vast tracts of the sandy desert lands around Jaisalmer, Desert National Park and Sanctuary was conceptualized in 1980 to conserve the eco-system and the drought-resistant species of the region. The most notable achievement of the park is

saving the Great Indian Bustard that had till recently been in the list of endangered species. Insects and animals typical to the arid areas such as the spiny-tailed uromastix living in underground colonies, desert monitors, which look like miniature replicas of dragons, sandfish that has adapted itself to 'swim' under the sand, chameleons and snakes such as the poisonous and deadly saw-scaled viper and Sind krait can also be found here. One can also spot desert hares, hedgehogs, predatory Indian wolfs, desert foxes and desert gerbils here with patience that marks a true wildlife lover.

Sariska National Park:
A tiger reserve in Alwar, Sariska National Park serves as the hunting grounds for the Alwar royalty, was declared a sanctuary in 1958 and finally, a tiger reserve in 1979. It houses the ruins of a fort, more than 1000 year old temples and the beautiful royal hunting lodge that has now been converted into a luxury hotel. Being situated on the Aravallis, Sariska's forests consist of low hills, steep escarpments, wide valleys and hill plateaus, making it a natural habitat for the endangered species of tigers. Being a major milk pocket, the cattle have eroded the region and the environmental balance of the region has been disturbed by the human interferences, posing a major threat to its wildlife.

With a little skilful watch, one can spot leopards, tigers, wild dogs, sambhars, neelgais or blue bulls, cheetals, four-horned antelopes, ratels, and chinkaras here.

India National ParksKeoladeo Ghana National Park:
Known all over the world as one of the best water-bird sanctuaries, Keoladeo Ghana National Park is the winter retreat of more than 400 species of our feathered friends from all over the world including China and Siberia, and especially the rare Siberian cranes. It has shallow, fresh water marsh that is the first love of so many migratory birds that made it one of the finest duck-hunting grounds for the erstwhile Maharajas until it was declared a national park in 1983.

Painted storks, spoonbills, ibises, geese and duck, cranes, herons and egrets, pelicans and flamingos, paradise flycatchers, parakeets, cormorants and darters, kingfishers, blue jays, shrikes, orioles, eagles and harriers make it a bird-watcher's paradise. There is an artificial lake in the park in which you go for an exotic boat ride to take a closer look of its rich fauna, which includes sambhars, blackbucks, chitals, neelgais, fishing cats, otters and mongooses.

c) Biosphere Reserve.
Ans. Biosphere reserves are the forests where flora and fauna of all types are conserved in their natural environment. The purposes of setting up of Bio-reserve are as under:

(i) To preserve wildland, its flora and fauna in their natural forms.
(ii) The surrounding zones will be utilised for research and development of forests and their products.
(iii) To utilise the peripheries for agricultural research and experimentation.
Biosphere reserves are fourteen in number in India as on March 31, 2006.

Some of them are Nilgiri, Nanda Devi, Nokrek, Sunderbans and Andaman and Nicobar Islands.

The planning that goes into these activities helps residents in a biosphere reserve to identify and meet their own needs, in their own way. It also provides opportunities to draw together a broad base of support from all sectors of the community or communities associated with the biosphere reserve.

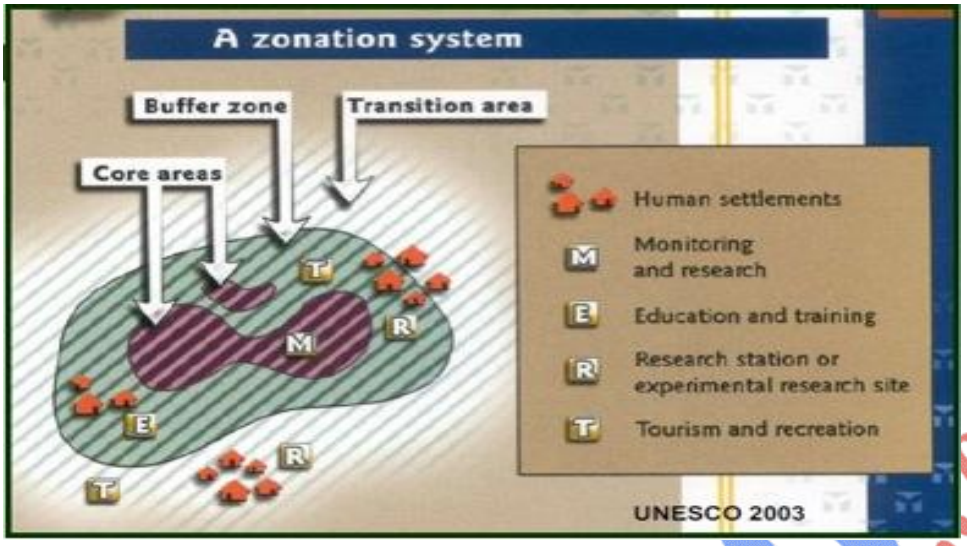
To carry out the complementary activities of biodiversity conservation and sustainable use of natural resources, biosphere reserves are traditionally organized into three interrelated zones, known as the core area, the buffer zone, and a transition zone or 'area of cooperation.' The zone concept is designed to be flexible and may be used in a variety of ways in order to address local needs and conditions. Ownership arrangements in a biosphere reserve vary as well. The core areas of biosphere reserves are often public lands with legal protection, such as a previously designated national park, wilderness area or wildlife refuge. However, the core area may be privately owned or belong to non-governmental organizations.

The Zonation System

Core area: includes protected areas, as they act as reference points on the natural state of the ecosystems represented by the biosphere reserves. Information from these core areas may be used to assess the sustainability of activities, or the maintenance of environmental quality, in surrounding areas. Managers of the core areas may contribute resources to projects developed with residents, businesses and other partners of the biosphere reserve.

Buffer zone: surrounds or is contiguous to the core area. Activities are organized so they do not hinder the conservation objectives of the core area, but rather help to protect it. The buffer zone might be an area for experimental research, or may involve ways to manage natural vegetation, agricultural land, forests, fisheries or ranchland to enhance overall quality of production while conserving natural processes and biodiversity. This zone may also accommodate education, training, tourism, and recreation facilities. In many biosphere reserves the buffer zone is regarded as an area in which human use is less intensive than what might be found in the transition zone.

Transition Zone, or Area of Cooperation: the large outer area of a reserve where people live and work, using the natural resources of the area in a sustainable manner. The term 'area of cooperation' underscores the role of cooperation as the main tool to achieve the objectives of the biosphere reserve. It is here that the local communities, conservation agencies, scientists, civil associations, cultural groups, businesses and other stakeholders agree to work together to manage and use the area in a sustainable way that will benefit the people who live there.



Examples. Nilgiri Biosphere Reserve, Gulf of Mannar Biosphere Reserve, Nanda Devi Biosphere Reserve