

Unit - I Environment, Ecosystems and Biodiversity

Environment

INTRODUCTION

The word environment is coined from the French word "Environ" meaning "surround or surroundings" i.e., each and everything surrounding us. **E.g.** Lion in a jungle surrounded by living and non-living things like air, water, trees, other animals etc.

DEFINITIONS

1. Environment

Environment is defined as "the sum of total of all the living and the non-living things around us influencing one another." **e.g.** Lion in a jungle surrounded by living and non-living things like air, water, trees, other animals etc.

2. Environmental Science

The study of the environment, its biotic (living) and abiotic (non-living) components and their interrelationship is called environmental science. It includes the basic concepts of physics, chemistry, geography, geology etc., which is used in understanding the structure, function and physical characteristics of environment

3. Environmental Engineering

Environmental engineering is the application of engineering principles, science, education, ethics and law in the protection and enhancement of quality of the environment, public health and welfare.

4. Environmental Studies

Environmental studies are the process of educating the people for preserving quality environment. It is the multidisciplinary studies of science, engineering, technology and management which show the impact of human activities on the environment.

TYPES OF ENVIRONMENT

Environment is divided into 2 types

1. **Natural Environment:** Natural environment consists of natural components including all biotic (biological) and abiotic (physical) components created through a natural process without any human support.

e.g. Soil, water, air, trees, radiations, noise etc.

2. **Man-made environment:** Man is most powerful agent who modifies the environment using modern technologies, according to his needs for survival and well-being.

e.g. Houses, parks, hospitals, schools, roads etc.

SCOPE OF ENVIRONMENTAL STUDIES

Environmental studies are the tool for educating people to preserve environment. Main scope includes:

1. To get awareness and sensitivity of environment and its related problems.
2. To motivate the active participation of individuals in environmental protection and improvement.
3. To develop skills for identifying and solving environmental problems.
4. To know the necessity of conservation of natural resources.
5. To conduct environmental programmes in terms of social, economic, ecological and aesthetic factors.

IMPORTANCE/ SIGNIFICANCE/ NEED OF ENVIRONMENTAL STUDIES

The air we breathe, water we drink, food we eat and the land we live are all polluted. There is no zero pollution.

To solve the above problems, knowledge of environment and its studies are very important.

1. To understand the concept of "need of development without destruction of environment".

2. To gain knowledge of different types of environment their various resources and the effects of different environmental hazards.
3. To inform people about their effective role in protecting the environment by demanding changes in laws and enforcement systems.
4. To develop a concern and respect for the environment.

NEED FOR PUBLIC AWARENESS

1. Necessity to maintain a natural balance, sensible planning of development in order to save humanity from extinction.
2. To check nominal use of natural resources as watch dogs informing government about the degradation of environment.
3. To educate and create awareness through mass media like tv, radio, short films, internet, mobile phones, etc.,
4. To motivate and active participation of individuals in protecting the environment from various types of pollution.

ECOSYSTEM

Definition:

Ecology

Ecology is the study of ecosystems which is the relationship between organisms and their surroundings (living and non-living).

Ecosystem

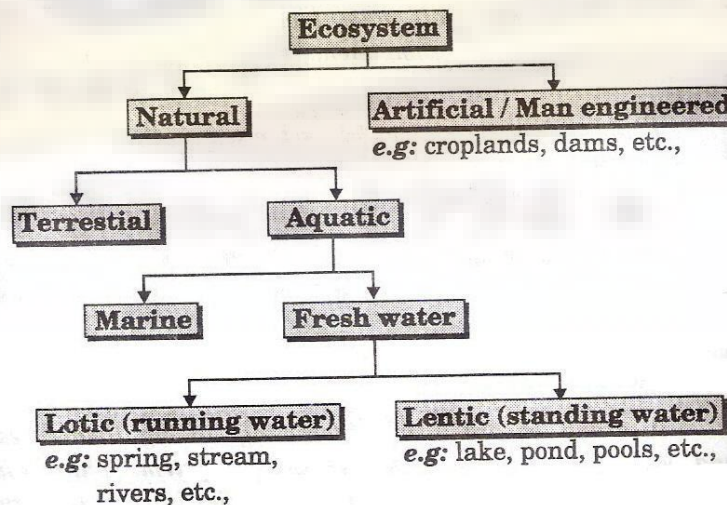
Ecosystem is the basic functional unit of ecology. It is derived from Greek word "study of home". Ecosystem is a group of organisms interacting among themselves and with environment exchanging its energy and matter.

Eg, forest, desert etc.

Biome

Biome is a small ecosystem within an ecosystem having dominant species with similar lifestyle, climatic conditions and physical structure etc.

TYPES OF ECOSYSTEM



STRUCTURE OR COMPONENTS OF AN ECOSYSTEM

The ecosystem has two major components (a) abiotic and (b) biotic.

(a) Abiotic Components

Non-living components of ecosystem (physical and chemical) form the abiotic community.

(i) Physical components: It includes energy, climate, raw materials and living space.

e.g. Air , water, soil, sunlight

(ii) Chemical components: They are the sources of nutrients.

- (a) Organic substances e.g. proteins, lipids, carbohydrates
- (b) Inorganic substances e.g. (C, N, O, P, K, H) and (Al, Co, Cu, Zn).

(b) Biotic Components

Living members in a community form the biotic community.

- (i) **Autotrophic/Producers/Self-feeders:** They prepare their own food with the help of chlorophyll, sunlight, water and carbon dioxide. e.g. plants, trees.
- (ii) **Heterotrophic / Consumers/ other-feeders:** They lack chlorophyll and do not prepare their own food but depend on the producers for their food.
 - (a) Macro consumers: Herbivores, carnivores and omnivores.
 - (b) Micro consumers/ Saprotrophs: Decomposers (bacteria, fungi)

Classification/members of biotic components

Based on their source of food

1. **Autotrophs/ Producers:** Prepare their food through photosynthesis using chlorophyll, CO₂ and sunlight.



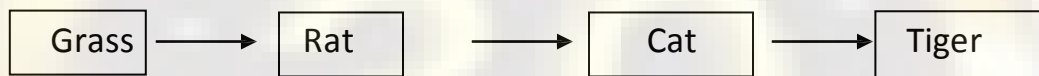
2. **Heterotrophs/Consumers:** They do not make their food but depend on producers for their food.

(A) Primary consumers/Herbivores. Depend on plants for their food. e.g. Insects, rats. (B)

Secondary consumers/Primary carnivores: They feed on primary consumers.

e.g. Frogs, cat, snakes.

(C) Tertiary consumers/Secondary carnivores: They feed on secondary consumers e.g. lions, tigers.



3. **Decomposers:** They feed on dead plants and animals and decompose them into simpler compounds releasing inorganic nutrients. These are again utilized by plants with other organic substances for the synthesis of food.
e.g. Bacteria, fungi.

FUNCTION OF AN ECOSYSTEM

Its main function is to allow the flow of energy and nutrients.

Types of function

1. Primary function/ production: It is manufacturing of starch by photosynthesis.
2. Secondary function/ production: It is the distribution of energy to all consumers in the form of food which is stored by them.
3. Tertiary function: The dead systems (plants and animals) are decomposed by decomposers thereby initiating the third function called "cycling".

ENERGY FLOW IN THE ECOSYSTEM

Solar energy is the main energy on earth's surface. About 1% of this is used by plants for photosynthesis. They convert this into chemical energy part of which is used for their growth and remaining is passed onto consumers.

Thus, energy enters ecosystem through photosynthesis and travels through different feeding or trophic levels at the rate of 10% and the rest 90% is lost in the form of heat. This indicates that the energy flow is greatly reduced at each trophic levels from producers to carnivores. The energy flow is unidirectional i.e energy from sun never return back to sun.

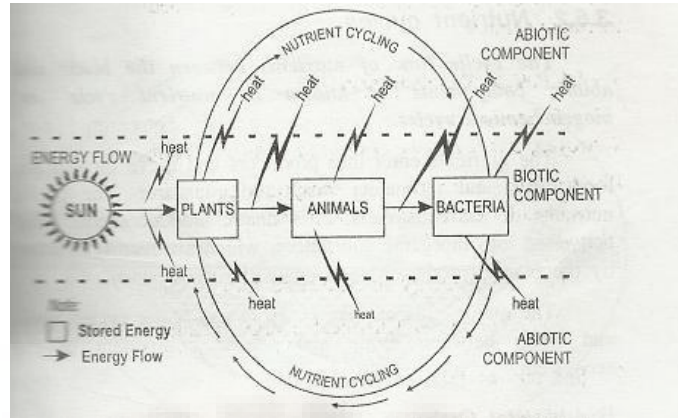
Energy flow through an atmosphere in an ecosystem is governed by laws of thermodynamics

I law of thermodynamics - Energy can neither be created nor destroyed, but it can only be converted from one form to another.

II law of thermodynamics - Whenever there is transformation of energy, there is loss of

energy in the form of heat. The loss of energy takes place through respiration, running, hunting etc.

Relationship between structure and function (flow model)



ECOLOGICAL SUCCESSION

The progressive replacement of one community by another till the development of a stable community in a particular area is called ecological succession.

Stages of Ecological succession

1. Pioneer Community:

The first group of organisms which establish their community in an area is called pioneer community.

2. Seres or Seral Stage:

The various developmental stages of a community are called 'seres'.

Community: Group of plants or animals living in an area

Types of ecological succession

1. Primary succession: Involves gradual establishment of biotic communities on a lifeless ground.
2. (a) **Hydrarch:** Establishment starts in watery area (lake, pond)
3. (b) **Xerarch:** Establishment starts in dry land (desert, rocks)
4. Secondary succession: Involves the establishment of biotic communities in an area, where some type of biotic community is already present.

Process of ecological succession

Ecological succession takes place in the following steps:

1. **NUDATION:** It is the development of bare land without any life form.
2. **INVASION:** It is the establishment of one/more species on a bare land through migration followed by establishment.
 - (a) **MIGRATION:** Migration of seeds by wind, water and birds.
 - (b) **ESTABLISHMENT:** The seeds then germinate and grow on the land and establish their pioneer communities
3. **COMPETITION:** Competition within the species and between different species for water, nutrient and living space
4. **REACTION:** The living organisms take water, nutrients and grow and modify the environment is known as reaction. It becomes unsuitable for the existing species and favours some new species.
5. **STABILIZATION:** It leads to stable community, which is in equilibrium with the environment

Types of food chain

1. Grazing food chain:

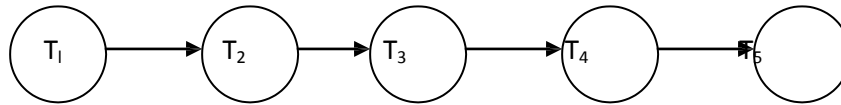
Found in grass land and pond ecosystems. It starts with green plants and goes to the decomposer/detritus food chain through herbivores and carnivores.

2. Detritus food chain:

Found in grassland and forest ecosystems. It starts with dead organic matter and goes to decomposer food chain through herbivores and carnivores.

Trophic levels

The various steps through which food energy passes in an ecosystem is called trophic levels.



T₁ - Green plants/producer

T₂ - Herbivores/primary consumers T₃ - Carnivores/secondary consumers T₄ - Tertiary consumers

T₅ - Decomposers

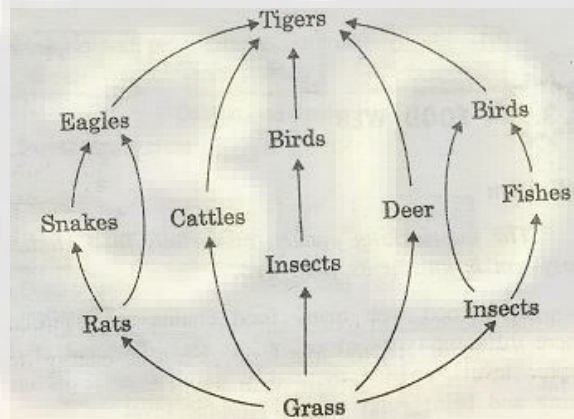
FOOD WEB

Definition: The interlocking pattern of various food chains which are linked together in an ecosystem is called food web. Different types of organisms are connected at different trophic levels so that there are number of opportunities of eating and being eaten at any trophic level.

Functions:

- Maintains the stability of ecosystems.
- Maintains the nutritional balance in an ecosystem.
- Control the population size of species in an ecosystem.
- Provide alternate food source.

Energy flow in a food web



Significance of food chains and food webs

1. Food webs and food chains play an important role in ecosystem as energy and nutrient flow takes place through them.
2. They maintain and regulate the population size of different trophic levels thereby maintaining ecological balance.
3. They have property of biomagnification. The passing of non-biodegradable material from one trophic level to another causing its concentration to increase and this is called biomagnification.

e.g., Biomagnification of DDT

The concentration of DDT sprayed on plants increases along the food chain through phytoplankton to zooplanktons and then goes to fish, animals and human beings. Thus concentration of DDT is magnified in birds, animals and humans damaging the egg shells in birds and cell tissues in humans. As DDT is fat soluble its accumulation in human body is easier and cannot be removed easily.

ECOLOGICAL PYRAMIDS

Definition: The graphical representation of structure and function of trophic levels of an ecosystem is called ecological pyramid.

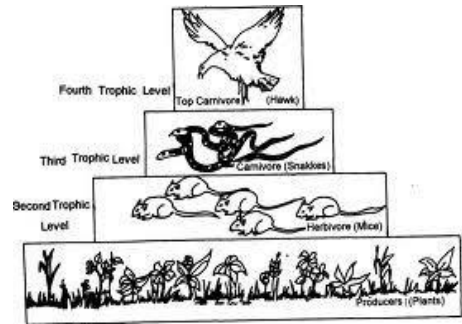
In an ecological pyramid the producers forms the base level and the tertiary consumer occupies the apex level.

Types of Ecological Pyramids

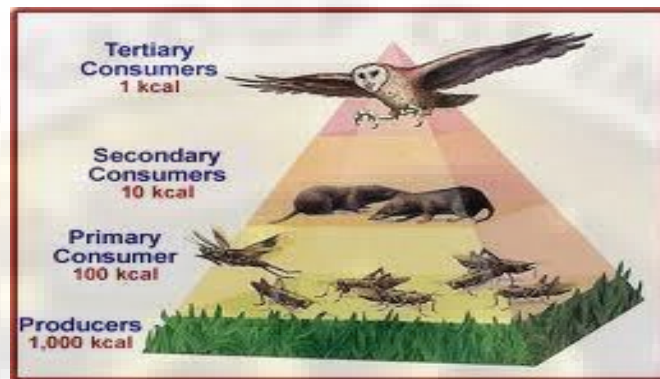
1. Pyramids of Numbers:

It represents the number of individual organisms present in each trophic level. e.g., Grassland ecosystem

Here, the producers are grasses which are small in size and large in numbers. So, they occupy the lower most level of the pyramid. The primary consumers (rats) occupy the second trophic level as its number is lower compared to that of grass. The secondary consumers (snakes) which are even larger in size and smaller in number form the third level. The tertiary consumers (eagles) occupy the top layer as the numbers of it is the least.



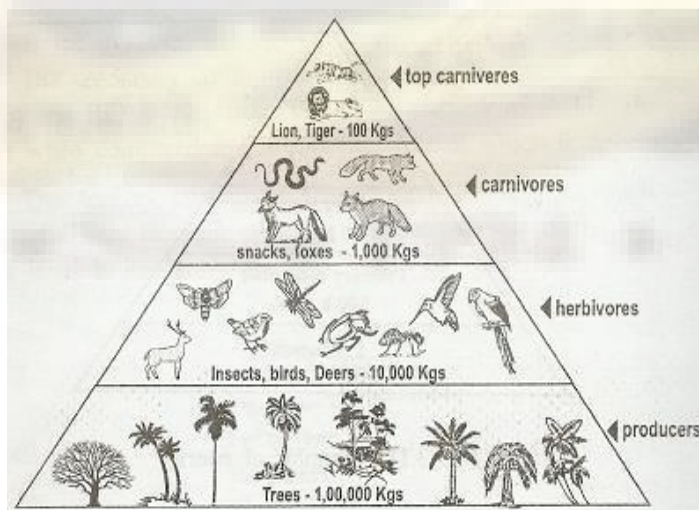
2. Pyramids of energy



It represents the amount of energy present in each trophic level.

At every successive trophic level there is a heavy loss of energy (about 90%) in the form of heat. Thus at each next higher trophic level only 10% of energy is transferred.

3. Pyramids of biomass



It represents the total amount of biomass (mass or weight of biological material or organism) present in each trophic level.

e.g., Forest ecosystem

The trees in forest ecosystem are the producers and they are maximum in number contributing to a huge biomass. The next trophic levels are the herbivores (insects, birds) and then carnivores (snakes, foxes). The topmost level is the tertiary consumers (tiger, lion) which are few and hence having low biomass.

FOREST ECOSYSTEM

Forest consists of densely growing trees which cover 40% of world's land and 19% of Indian land.

Types of forests and their features

Depending on the climatic conditions forests are classified into the following types:

- (a) **Tropical rain forest**: They are found near the equator. They are characterized by high temperature. Trees like teak and sandal and animals like lion and tiger are found in these forests.
- (b) **Tropical deciduous forest**: They are found a little away from equator. They have warm climate and rain only during monsoon. Trees like maple, oak and animals like deer and fox are found in these forests.
- (c) **Tropical shrub forest**: They have dry climate for long time. Have small deciduous trees and shrubs and animals like deer, fox, etc.
- (d) **Temperate rain forest**: They are found in temperate areas with adequate rain. Coniferous trees like fir, pines and animals like squirrels, fox are found here.
- (e) **Temperate deciduous forest**: These are found in areas with moderate temperatures. Trees like oak, hickory and animals like deer, fox are found in these forests.

Characteristics of forests ecosystem

- 1. They have warm climate and adequate rainfall, which generates number of ponds, lakes etc.
- 2. Forests maintain rainfall and climate.
- 3. Forests support many wild animals and protect biodiversity.
- 4. Soil is rich in nutrients and organic matter which support the growth of trees.
- 5. As sunlight penetration is poor, conversion of organic matter into nutrients is very fast.

Structure and function of forest ecosystem

- 1. **Abiotic components**: e.g., Temperature, light, rain and minerals. They are the inorganic and organic substances found in soil and atmosphere.
- 2. **Biotic components**:
 - (a) **Producers**: Trees, shrubs
 - (b) **Consumers**:
 - (i) Primary consumers: Insects
 - (ii) Secondary consumers: Birds, snakes
 - (iii) Tertiary consumers: Tiger, lion
 - (c) **Decomposers**: Bacteria, fungi. Rate of decomposition of dead matter in tropical and subtropical forest is more than in temperate forest.

GRASSLAND ECOSYSTEM

Grasslands are large areas of grass with scattered trees which occupies about 20% of world's land.

Types and features of grasslands

- 1. **Tropical Grassland**: they are found near borders of tropical rain forests. They have high temperature and moderate rainfall (40 to 100cm). They are also called Savanna-type. They have tall grasses and shrubs and animals like zebra, giraffe.
- 2. **Temperate grassland**: They are found in centres of continents, on flat, sloped hills. They have cold winters and hot summers. Intense grazing and summer fires do not allow shrubs or trees to grow in this grassland.
- 3. **Polar grassland**: They are found in arctic polar region and have severe cold and strong wind with snow and ice. In summers several annual plants grow and animals like arctic wolf, arctic fox is found here.

Characteristics of grassland ecosystem

- 1. Grassland ecosystem is plain land occupied by grasses.
- 2. Soil is rich in nutrients and organic matter.
- 3. Since there are tall grasses, it is an ideal place for grazing animals.
- 4. It is characterized by low or even rainfall.

Structure and function of grassland ecosystem

- 1. **Abiotic components**: e.g., Nutrients (C, H, O, N, P, S) supplied by CO₂, H₂O, nitrates, phosphates and sulphates.

2. Biotic components:

- (a) **Producers:** Grasses, shrubs
- (b) **Consumers:**
 - (i) Primary consumers: Cows, deer
 - (ii) Secondary consumers: Snakes, lizards
 - (iii) Tertiary consumers: Eagles
- (c) **Decomposers:** Fungi and bacteria.

DESERT ECOSYSTEM

Deserts occupy about 35% of world's land. The atmosphere is dry and hence a poor insulator.

Types and features of desert

1. **Tropical desert:** They are found in

- (i) Africa: Sahara desert
- (ii) India: Thar desert

They have few species and wind-blown sand dunes are common.

2. **Temperate desert:** They are found in

South California: Mojave desert

They have very hot summer and very cool winter.

3. **Cold desert:** They are found in China: Gobi desert

They have cold winters and warm summers.

Characteristic features of desert ecosystem

- 1. The desert air is dry and climate is hot.
- 2. Annual rainfall is less than 25cm.
- 3. The soil is poor in nutrients and organic matter.
- 4. Vegetation is poor.

Structure and function of desert ecosystem

1. **Abiotic components:** Temperature, rainfall, sunlight

The temperature is very high and rainfall and nutrient cycling are very low.

2. **Biotic components:**

(a) **Producers:** Shrubs, bushes, some grass

In desert there are succulent plants like cacti which have water inside them and waxy outer coating to protect from sun.

(b) **Consumers:** Squirrels, mice, reptiles.

These animals dig holes in the ground to live and come out at night for food. Most of the desert animals can extract water from seeds.

(c) **Decomposers:** Fungi and bacteria

Desert has poor vegetation with low amount of dead organic matter. They are decomposed by few bacteria and fungi.

AQUATIC ECOSYSTEM

This deals with water bodies. The major types of organisms found in aquatic environments are determined by water salinity.

Types of aquatic ecosystems: Based on the salinity it is classified into 2 types as

- (i) Fresh water ecosystem: Ponds, lakes, rivers, streams
- (ii) Marine/ salt water ecosystem: Oceans, estuaries

1. Fresh water ecosystem:

POND ECOSYSTEM

Characteristic features of pond ecosystem

- 1. Pond is temporary, only seasonal.
- 2. It is stagnant fresh water body.
- 3. Pond gets polluted easily due to limited amount of water.

Structure and Function of Pond ecosystem

1. **Abiotic components:** Temperature, light, water, organic and inorganic compounds.

2. **Biotic components:**

(a) **Producers:** They are of 2 types

(i) **Phytoplankton:** These are microscopic aquatic plants, which freely float on the water surface. e.g., Algae, pandorina.

(ii) **Microphytes:** These are large floating plants and submerged plants. e.g., Hydrilla, woffia.

(b) **Consumers:** (i) **Primary consumers** (Zooplanktons): These are microscopic animals which float freely on the water surface. e.g., Protozoa, very small fish, ciliates

Zooplanktons are found along with phytoplankton as they feed on them.

(ii) **Secondary consumers** (Carnivores): Insects like water beetles and small fish.

(iii) **Tertiary consumers:** Large fish like game fish.

(c) **Decomposers:** Fungi, bacteria, flagellates.

LAKE ECOSYSTEM

Lakes are supplied water by rainfall, melting snow and streams.

Types of lakes

1. Oligotrophic lakes: They have low nutrient concentrations.

2. Eutrophic lakes: They are over nourished by nutrients like N and P.

3. Dystrophic lakes: They have low pH, high humic content and brown waters.

4. Volcanic lakes: They receive water from magma after volcanic eruptions.

5. Meromictic lakes: They are rich in salts.

6. Artificial lakes: They are created due to construction of dams.

Zones of lake

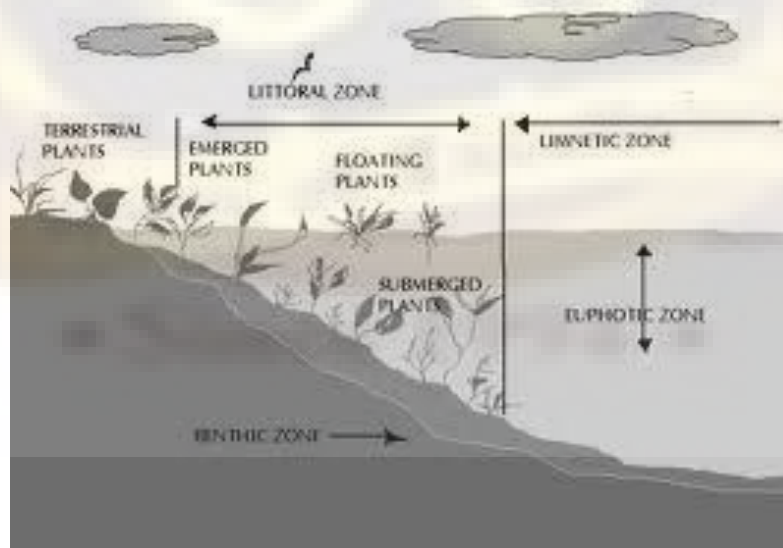
Depending upon their distance from the shore, a lake consists of 4 distinct zones.

1. **Littoral zone:** It is the top layer of the lake. It has shallow water.

2. **Limnetic zone:** It lies below the littoral zone, where effective penetration of sunlight takes place.

3. **Profundal zone:** This is the deep open water, where it is too dark.

4. **Benthic zone:** This layer is the bottommost layer of the lake.



Characteristic feature of Lake Ecosystem

1. Lake is shallow fresh water body.

2. It is a permanent water body with large water resources.

3. It is useful for irrigation and drinking purpose.

Structure and function of Lake Ecosystem

1. **Abiotic components:** Temperature, light, proteins and lipids.
2. **Biotic components:**
 - (a) **Producers:** These are the green plants which may be submerged, free floating and amphibious plants. e.g., Phytoplankton, algae
 - (b) **Consumers:**
 - (i) Primary consumers (Zooplankton): Ciliates, protozoans.
 - (ii) Secondary consumers (Carnivores): Insects and small fishes.
 - (iii) Tertiary consumers: Large fish like game fish.
 - (c) **Decomposers:** Bacteria and fungi

RIVER/STREAM ECOSYSTEM

The running water of a river or stream is well oxygenated, because it absorbs oxygen from air. The numbers of animals are low in river or stream.

Characteristic features of river or stream ecosystem

1. It is fresh water and free flowing water system.
2. Due to mixing of water, dissolved oxygen content is more.
3. River deposits large amount of nutrients.

Structure and function of river ecosystem

1. **Abiotic components:** Temperature, light, pH, nutrients.
2. **Biotic components:**
 - (a) **Producers:** Phytoplankton, algae, water grasses.
 - (b) **Consumers:**
 - (i) Primary consumers: Water insects, snails
 - (ii) Secondary consumers: Birds and mammals
 - (c) **Decomposers:** Bacteria, fungi

MARINE/OCEAN ECOSYSTEM

Oceans cover more than two thirds of earth's surface. It supplies a vast variety of sea products and drugs. It has high concentration of salts and minerals.

Zones of Oceans

The oceans have two major life zones.

- (i) **Coastal zone:** It is relatively nutrient rich, shallow water and has high productivity because of high nutrients and sunlight.
- (ii) **Open sea:** It is the deeper part of the ocean and is vertically divided into 3 regions.
 - (a) **Euphotic zone:** It receives abundant light and shows high photosynthetic activity.
 - (b) **Bathyal zone:** It receives dim light and is geologically active.
 - (c) **Abyssal zone:** It is the dark zone and is very deep (2000 to 5000 m).



Characteristic features of marine ecosystem

1. It occupies a large surface area with saline water.
2. Since, ships, submarines can sail in ocean a large number of commercial activities are carried out.
3. It is rich in biodiversity.
4. It moderates the temperature of earth.

Structure and function of marine ecosystem

1. **Abiotic components:** Temperature, light, NaCl, KCl.
2. **Biotic components:**
 - (a) **Producers:** Phytoplankton and marine plants
 - (b) **Consumers:**
 - (i) Primary consumers (Herbivores): Crustaceans, molluscs
 - (ii) Secondary consumers (Carnivores): Herring, mackerel
 - (iii) Tertiary consumers: Cod
 - (c) **Decomposers:** Bacteria, fungi.

ESTUARINE ECOSYSTEM

"An estuary is a partially enclosed coastal area at the mouth of a river which joins the sea".

They are rich in nutrients and have high food potential.

Characteristics of estuarine ecosystem

1. Estuaries are transition zones, which are strongly affected by tides of sea.
2. Water characteristics are periodically changed.
3. The living organisms here have wide tolerance.
4. Salinity in estuaries are highest in summer and lowest in winter.

Structure and function of estuarine ecosystem

1. **Abiotic components:** Temperature, pH, sodium and potassium salts.
2. **Biotic components:**
 - (a) **Producers:** Marsh grasses, sea weeds, sea grasses.
 - (b) **Consumers:** Oysters, Crabs, small fishes.
 - (c) **Decomposers:** Bacteria, fungi.

BIODIVERSITY DEFINITION: Bio means 'life' and diversity means 'variety', hence Biodiversity refers to variety of life on the earth. Planet earth (biosphere) contains more than 20 million species of organisms. They differ widely from one another. Diversification in the species is influenced by various physical and climatic factors, resulting in the production of new sub-species. Biodiversity is defined as, "the variety and variability among all groups of living organisms and the ecosystem in which they occur".

LEVELS OF BIODIVERSITY:

A. GENETIC BIODIVERSITY

The genes found in organisms can form enormous number of combinations each of which gives rise to some variability. When the genes within the same species show different version due to new combinations, it is called genetic variability. For example rice belongs to the species *Oryzasativa* which has many varieties that differ in size, shape, aroma etc.

B. SPECIES BIODIVERSITY

This is the variability found within the population of a species or between different species of a community. It broadly represents the species richness and their abundance in a community. Shannon Wiener index and Simpson index are two popular indices of measuring species diversity.

C. ECOSYSTEM BIODIVERSITY

This is the diversity of ecological complexity showing variations in ecological niche, trophic structure, food webs, nutrient cycling etc. The ecosystem also shows variations with respect to physical parameters like moisture, temperature, altitude, precipitation etc.

BIOGEOGRAPHICAL CLASSIFICATION OF INDIA:

S. No.	Biogeographic zone	Biotic province	Important Flora & Fauna
1	Trans-Himalayan	Upper region	Pine, deodar- Wild sheep, yak, tibetanass, leopard, wolf
2	Himalayan	North west, west, central and East Himalayas	Pine, cork tree, sal, dhaak- Wild bear, sambar, leopard, Sikkim stag, musk deer
3	Desert	Kutch, thar and ladkh	Acacia, zizyphus, khejri, date palm- Camel, bastard, wild ass, desert cat, fox, rat
4	Semi-arid	Central india, Gujarat	Acacia, date palm, peepal -Gir lion, tiger, sariska and Ranthampore tiger
5	Western ghats	Malabar coast Western ghats mountain	Sheeshan, peepal, tuna, bahera- Tortoise, frog, lizards, snakes
6	Deccan peninsula	Deccan plateau	Acacia, palaash, tuna, pine, castor- Sambar, sloth bear, tiger, cheetal, four horned stag, wild elephant, wild buffalo
7	Gangetic plain	Upper and lower gangetic plain	Sal, acacia, jamun, mango, bael- black chinkara, stag, rhinoceros, gazzel, Alligator, turtle
8	North-east India	Brahmaputra valley	Bamboo, sal, jack fruit, tuna, Chestnut cator- Elephnat, Rhinocers, yak, deer, porcupine
9	Islands	Andaman islands, Nicobar islands & Lakshadeep islands	Bahera, Harar, jack fruit, cardamom, coconut, cloves- Dolphin, alligator, Molluscs
10	Coasts	West coast East coast	Coconut, Banana, cashew Nut – Dugong, Dolphin, Turtle, Alligator, Molluscs

VALUE OF BIODIVERSITY: (Consumptive use, Productive use, Social, Ethical, Aesthetic and Option values)

1. CONSUMPTIVE USE VALUE

- **Food:** A large number of wild plants are consumed by human beings as food. About 80,000 plants are from wild. About 90% of crops are domesticated from tropical forest.
- **Drugs and medicine:** About 75% of population depends upon plant or plant extracts for medicine. Penicillin antibiotic drug is derived from the fungus penicillium.
- **Fuel:** The fossil fuels coal, petroleum and natural gas are products of fossilized biodiversity.

2. PRODUCTIVE USE VALUE

These are the commercially usable values where the product is marketed and sold. It may include lumber or wild gene resources that can be traded for use by scientist for introducing desirable traits in the crops and domesticated animals. It includes animal products like tusk of

elephants, musk deer, silk from silk worm, wool from sheep, fur of many animals etc. Many industries like paper and pulp. Silk, textile, ivory works industry depend on them.

3. SOCIAL VALUE

It is associated with social life, customs, and religion and psycho-spiritual aspects of the people. Many plants are considered holy and sacred in our country like tulsi, peepal, Mango, Lotus, Bael etc. many animals like cow, snake, peacock, bull, owl etc also have significant place in social importance. The tribal people are very closely linked with the wildlife in the forest.

4. ETHICAL VALUE

It is otherwise called existence value. It involves ethical issues like “all life must be preserved” and “live and let live” concept. For the survival of human race, all biodiversity has to be protected because biodiversity is valuable.

5. AESTHETIC VALUE

People from far and wide spend a lot of time and money to visit wilderness areas where they can enjoy the aesthetic value of biodiversity and this type of tourism is known as eco –tourism. The willingness to pay concept annually generates 12 billion revenue.

6. OPTIONVALUE

It is the value of knowing that there are biological resources existing on the biosphere that may one day prove to be an effective option for something important in the future it suggests that any species may prove to be miracle species someday.

7. ECOSYSTEM SERVICE VALUE

It refers to the service provided by ecosystem services like prevention of soil erosion, prevention of floods, maintenance of soil fertility, cycling of nutrients, fixation of nitrogen, cycling of water, their role as carbon sinks, pollutant absorption and reduction of the threat of global warming etc.

BIODIVERSITY AT GLOBAL, NATIONAL AND LOCAL LEVEL:

Global biodiversity:

In 1992 Earth summit took place in Rio de Janeiro. Mapping the biodiversity became an emergency task for conservation plans and practical utilization. **Tropical biodiversity** is reducing half percentage every year. 50 to 80% of global biodiversity lies in rain forest. 1/4th of worlds prescribed drugs come from tropical forest and 3000 plant species has cancer fighting ability. **Temperate forest** has less biodiversity but has good documentation. It has 1, 70,000 flowering plants, 30,000 vertebrates and about 2, 50,000 other group of species. **Marine diversity** is even much higher than terrestrial biodiversity and ironically, they are still less known and described. Out of 35 existing Phyla of multicellular animals, 34 are marine and 16 of these are exclusively marine

NATIONAL LEVEL - INDIAN BIODIVERSITY:

1. India ranks 10th among the plant rich countries of the world
2. 11th in terms of Endemic species.
3. 6th among origin of agricultural crops.
4. 1,50,000 species identified.
5. It has two hot spot regions.
6. 12th mega biodiversity countries in the world.

REGIONAL OR LOCAL BIODIVERSITY:

1. **Point Richness:** Refers to number of species at a single point.
2. **Alpha Richness:** Refers to the number of species found in a small homogeneous area.
3. **Beta Richness:** Refers to rate of change in species composition across different habitats.
4. **Gamma Richness:** Refers to the rate of change across large landscape gradients.

INDIA AS A MEGA BIODIVERSITY NATION:

India is one of the 12 mega biodiversity countries in the world. The Ministry of environmental and forests, Government of India (2000) records 47,000 species of plants and 81,000 species of animals which is about 7% and 6.5% respectively of global flora and fauna.

1. **Endemism:** Species which are restricted to only to a particular area are known as endemic. India shows a good number of endemic species. About 62% of amphibians and 50% of lizards are endemic.

2. **Centre of origin:** A large number of species have known to originate in India. Nearly 5000 flowering species, 166 species of crop plants and 320 species of wild relatives of cultivated crops origin in India.

3. **Marine diversity:** Along 7500 km long coastline of our country in the mangroves, estuaries, coral reefs, back waters etc. there exist a rich biodiversity. More than 340 species of corals of the world are found here.

HOTSPOTS OF BIODIVERSITY

A **biodiversity hotspot** is a biogeographic region with a significant reservoir of biodiversity that is under threat from humans. To qualify as a biodiversity hotspot on Myers 2000 edition of the hotspot- map, a region must meet two strict criteria:

1. It must contain at least 0.5% or 1,500 species of vascular plants as endemics.
2. It must have lost at least 70% of its primary vegetation.

Around the world, at least 25 areas qualify under this definition, with nine others possible candidates. These sites support nearly 60% of the world's plant, bird, mammal, reptile, and amphibian species, with a very high share of endemic species.

The importance of biodiversity: Biodiversity is often used to draw attention to issues related to the environment. It can be closely related to:

- The health of ecosystems.

For example, the loss of just one species can have different effects ranging from the disappearance of the species to complete collapse of the ecosystem itself. This is due to every species having a certain role within an ecosystem and being interlinked with other species.

- The health of mankind.

Experiencing nature is of great importance to humans and teaches us different values. It is good to take a walk in the forest, to smell flowers and breathe fresh air. More specifically, natural food and medicine can be linked to biodiversity.

Hot spots of Biodiversity in India:

The hot spots of biodiversity are the geographic areas which possess the high endemic species. At the global level these are the areas of high conservation priority, if these species are lost they can never be replaced or regenerated.

Criteria for recognizing Hotspots: The richness of the endemic species is the primary criterion; they should have a significant percentage of specialized species; the site should be under threat and should contain important gene pools of plants of potential use.

- Two hot spots of mentioned in India are: 1. Eastern Himalayas (Indo-Burma region) and 2. Western Ghats (Srilanka region).

Eastern Himalayas: Comprises of Nepal, Bhutan and neighboring states of Northern India- 35,000 plant species are found here and 30 % are endemic – also rich in wild plants of economic value eg. Rice, banana, citrus, ginger, chilli, jute and sugarcane – Taxal yielding plant also scarcely distributed – 63% mammals are from this region- 60% of Indian Birds- huge wealth of fungi, insects, mammals and birds found in this region

Western Ghats: Comprises of parts of Maharashtra, Karnataka, Tamilnadu and Kerala – nearly 1500 endemic, dicotyledones 62% amphibians and 50% lizards are endemic here- Ternstroemia, Japonica, Rhododendron and Hypericum common plants- Blue Bird and Lizard hawk are common animals.

Biodiversity is the richness & varied species of different organisms contained in a particular ecosystem – Indian biodiversity is highly diverse and rich such that there are various hot spots. However there are numerous threats to our Biodiversity.

THREATS TO BIODIVERSITY :(Habitat loss, poaching of wildlife & Man-wildlife conflicts)

In 2006 many species were formally classified as rare or endangered or threatened; moreover, scientists have estimated that millions more species are at risk which has not been formally recognized. About 40 percent of the 40,177 species assessed using the IUCN Red List criteria are now listed as threatened with extinction.

LOSS OF HABITAT:

Habitat destruction:

Habitat destruction has played a key role in extinctions, especially related to tropical forest destruction. Factors contributing to habitat loss are: overpopulation, deforestation, pollution (air pollution, water pollution, soil contamination) and global warming or climate change. Habitat size and numbers of species are systematically related. Physically larger species and those living at lower latitudes or in forests or oceans are more sensitive to reduction in habitat area.

Climate change:

Global warming is also considered to be a major potential threat to global biodiversity in the future. Climate change has seen many claims about potential to affect biodiversity but evidence supporting the statement is tenuous. Increasing atmospheric carbon dioxide certainly affects plant morphology and is acidifying oceans, and temperature affects species ranges, phenology, and weather, but the major impacts that have been predicted are still just *potential* impacts. We have not documented major extinctions yet, even as climate change drastically alters the biology of many species.

POACHING: Illegal trade of wildlife products by killing prohibited endangered animals i.e. poaching is another threat to wildlife. Despite international ban on trade in products from endangered species, smuggling of wildlife items like furs, hides, horns, tusks, live specimens and herbal products worth millions of dollars per year continues. The developing nations in Asia, Latin America and Africa are the richest source of biodiversity and have enormous wealth in wildlife.

Overexploitation:

Overexploitation occurs when a resource is consumed at an unsustainable rate. This occurs on land in the form of overhunting, excessive logging, poor soil conservation in agriculture and the illegal wildlife trade. Joe Walston, director of the Wildlife Conservation Society's Asian programs, called the latter the "single largest threat" to biodiversity in Asia. The international trade of endangered species is second in size only to drug trafficking.

MAN-WILDLIFE CONFLICTS:

CAUSES OF MAN WILDLIFE CONFLICT:

1. Dwindling habitats of elephants, Tigers, rhinos and bears due to forest shrinkage compels them to move outside forest.
2. Usually ill, weak, and injured animals have a tendency to attack the humans.
3. Earlier Forest department used to cultivate paddy, sugarcane within the sanctuaries, due to lack of such practices the animals move out of forest food.
4. Villagers put Electric Wiring around their crop field which injures the elephants and turn them violent.
5. Wildlife corridors have been disrupted which makes the animals attack human beings during their migration.

REMEDIAL MEASURES TO CURB THE CONFLICT:

1. Tiger conservation Project (TCP) has made provisions for making available vehicles, tranquillizer guns, binoculars and radio sets etc., to tactfully deal with any imminent danger.

2. Adequate crop compensation and cattle compensation scheme must be started.
3. Solar powered fencing should be provided to prevent animals from straying into fields.
4. Cropping pattern should be changed near the border.
5. Wildlife corridors should be provided.

Introduced and invasive species:

Barriers such as large rivers, seas, oceans, mountains and deserts encourage diversity by enabling independent evolution on either side of the barrier, via the process of allopatric speciation. The term invasive species is applied to species that breach the natural barriers that would normally keep them constrained. Without barriers, such species occupy new territory, often supplanting native species by occupying their niches, or by using resources that would normally sustain native species.

Genetic pollution:

Endemic species can be threatened with extinction through the process of genetic pollution, i.e. uncontrolled hybridization, introgression and genetic swamping. Genetic pollution leads to homogenization or replacement of local genomes as a result of either a numerical and/or fitness advantage of an introduced species. Hybridization and introgression are side-effects of introduction and invasion.

Hybridization, genetic pollution/erosion and food security

In agriculture and animal husbandry, the Green Revolution popularized the use of conventional hybridization to increase yield. Often hybridized breeds originated in developed countries and were further hybridized with local varieties in the developing world to create high yield strains resistant to local climate and diseases. Local governments and industry have been pushing hybridization. Formerly huge gene pools of various wild and indigenous breeds have collapsed causing widespread genetic erosion and genetic pollution. This has resulted in loss of genetic diversity and biodiversity as a whole.

ENDANGERED AND ENDEMIC SPECIES OF INDIA:

1. ENDANGERED SPECIES OF INDIA

The international Union for conservation of Nature and Natural Resources (IUCN) publishes the red Data book which includes the list of endangered species of plants and animals.

S. No.	Species	Names
1	Reptiles	Gharial, green sea turtle, tortoise, python
2	Birds	Great Indian bustard, Peacock, Pelican, Great Indian hornbill, Siberian White crane
3	Carnivores Mammals	Indian Wolf, red fox, sloth bear, red panda, tiger, leopard, Stripped Hyena, Indian lion, Golden cat, desert cat, Dugong
4	Primates	Hoolock Gibbon, lion tailed Macaque, Nilgiri langur, capped monkey, Golden monkey
5	Plants	A large number of species of Orchids, Rhododendrons, Medicinal Plants like Rauwolfia serpentina, the sandal wood tree santalum, Cycas beddomei

2. ENDEMIC SPECIES OF INDIA:

India has two biodiversity hotspots and thus possesses a large number of endemic species. Out of about 47,000 species of plants in our country 7000 species are endemic. Thus, Indian

subcontinent has about 62% endemic flora, restricted mainly to Himalayas, Khasi Hills and Western Ghats. Some of the endemic flora includes orchids and species like *Sapria Himalaya*, *Uvarialurdia*

A large number out of total 81,000 species of animals in our country is endemic. The Western Ghats are particularly rich in amphibians and reptiles. About 62% Amphibians and 50% lizards are endemic to Western Ghats. Different species of Monitor lizards, reticulated python and Indian salamander and viviparous toad are some important endemic species of our country.

CONSERVATION OF BIODIVERSITY (In-situ conservation & Ex-situ conservation)

In-situ and ex-situ conservation along with their merits and limitations:

Conservation of Biodiversity: Biodiversity faces threat of extinction – due human activities – to salvage situation – conservation of biodiversity need of the hour- to preserve biodiversity to prevent their extinction and future flourishing – conservation of Biodiversity required

In-situ conservation: Involves allocating large areas of the land mass for wild life development- such areas can be closed to the public for tourism – wild life can be allowed to flourish in their own environment- promotes genetic diversity- does not stagnate the gene pool

Advantages: cheap and convenient method Species gets adjusted the natural disasters like drought, floods and forest fires.

Limitations: Large surface area of the earth required – shortage of staff and pollution may lead to improper maintenance of the habitat.

Ex-situ conservation: Involves conservation of wild life in zoos, botanical gardens-human supervision- wildlife can grow under controlled conditions - animals would be properly taken care- food, shelter and water- help in the flourishing of endangered species- possible the gene pool could stagnate and result in no genetic diversity taking place.

Advantages: Special care and attention lead to survival of endangered species– In captive breeding, animals are assured food, water, shelter and security - hence longer life span- it is carried out for the endangered species, which do not have any chances of survival in the wild.

Limitations: Expensive method- freedom of wild life is lost – animals cannot survive in such confined places.

UNIT 1 - ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY (QUESTION BANK)

PART - A

1. Define ecosystem. (May 2012)
2. Write about ecological pyramids. (May 2012)
3. What are producers, consumers and decomposers? (Nov 2011)
4. What are hotspots of biodiversity? Mention the criteria for hot spots. (Nov 2011)
5. Define genetic and species diversity. (Nov 2011)
6. What is Biodiversity? (Nov 2011, May 2011)
7. What is ecological succession? (Nov 2011)
8. Differentiate between endangered and endemic species. (Nov 2011)
9. Differentiate between food chain and food web. (Nov 2011, May 2011)
10. What is meant by hot spots of biodiversity? (May 2011)
11. What are endangered species? (May 2011)
12. Define environment and ecosystems. (May 2011)
13. What is the major significance of biodiversity? (May 2011)
14. Why knowledge on environment at individual level is very important? (May 2011)
15. What do you mean by Red Data Book? (May 2011)
16. Define Species diversity. (Nov 2010)

17. What are the types of grassland ecosystem? (Nov 2010)
18. What are food chains? Mention their types. (Nov 2010)
19. What are the biotic components of an ecosystem? (Nov 2010)
20. Justify the need for environmental education. (Nov 2010)
21. Write short notes on wetland ecosystem. (Nov 2010)
22. Mention any two significance of Biodiversity. (Nov 2010)
23. Write a short note on biodiversity. (May 10)
24. Name various ecosystems. (May 10)
25. Suggest three important features of forest ecosystem. (May 10)
26. What is meant by food web? (May 10, Dec 09, Dec 08) (OR) What is food web? Give example. (Dec 07)
27. Define ecological pyramids. (May 10)
28. What is ecology? (May 10)
29. Why do we need environmentalist? (May 10)
30. Write a short note on biodiversity. (May 10)
31. State the significance and scope of environmental education. (Dec 09, Dec 08)
32. 'India is a mega diversity nation' – Account. (Dec 09, Dec 08)
33. What are food chains and food webs? (Dec 09, May 06)
34. Define primary production and secondary production. (Dec 09)
35. What are biogeochemical cycles? (Dec 09)
36. Where is most of the world's biodiversity found? (Dec 09)
37. What do you mean by the term indicator species? (Dec 09)
38. What are the main kinds of organisms in aquatic life zones? (Dec 09)
39. What is ecological pyramid? Why is pyramid of energy always taking up-right? (Dec 09)
40. Define 'Hot spots of Biodiversity'. (Dec 09, Dec 08)
41. Distinguish between primary and secondary succession. (May 09)
42. What are endangered and endemic species? (May 09)
43. Mention the major causes of human-wildlife conflicts. (May 09)
44. What do you understand by the terms flora and fauna? (Dec 08)
45. What is meant by key stone species? (Dec 08)
46. What are the characteristics of the Desert ecosystem? (Dec 08)
47. Distinguish a biome and an ecosystem. (May 08) (OR) How a biome does differ from an ecosystem? (Dec 07)
48. Give the classification of Biodiversity. (May 08)
49. Define the terms producers and consumers. (May 08)
50. What is meant by genetic diversity? (May 08)
51. Define the term biodiversity. (Dec 07, May 07, Dec 05)
52. Define genetic diversity and species diversity. (Dec 07)
53. What is food chain? (May 07, Dec 06, May 06)
54. Define endangered species. (May 07) (OR) Explain endangered species. (Dec 06)
55. Explain the concept of an ecosystem. (May 07)
56. Explain ecological succession. (Dec 06)
57. State any four components of ecosystem. (4) (Dec 06)
58. What are the classifications of biotic components of ecosystems? (May 06)
59. Name the few endangered wild life species of India. (May 06)
60. Define environmental science. (Dec 05)
61. Define producers. (Dec 05)
62. Name the four ecosystems. (Dec 05)
63. Enumerate the human activities which destroy the biodiversity. (Dec 05)
64. Explain Biosphere. (Dec 05)
65. Explain threatened and endangered species. (Dec 05)
66. State the need for public awareness for solving environmental problems. (May 05)
67. What is biodiversity and what is its significance? (May 05)
68. What is ecological succession? (May 05)

PART - B

1. Explain the **structure and function of Ecosystem** with a neat sketch. (16) (May 2012, May 2011, Nov 2011, Nov 2010, May 10) (OR) Describe the structural features of ecosystem. (8) (Dec 09) (OR) Define ecosystem. Give an account of the structure and function of an ecosystem. (8) (May 08, May 06) (OR) What is an ecosystem? Describe the structure and function of various components of an ecosystem. (16) (Dec 05) (OR) Define and explain the term ecosystem, its types, characteristics, structure and function. (16) (May 10, Dec 05)

2. Explain the conservation of Biodiversity in Global level. (8) (May 2012)

3. What is **food chain**? How it is important to nation? (8) (May 2012) (OR) Write a note on food chain. (6) (May 07, Dec 06) (OR) Explain food chain and food web. (4) (Dec 05)

4. Discuss the Universal model of **energy flow in an ecosystem** and explain how the flow of energy follows the I and II law of thermodynamics? (8) (Nov 2011) (OR) Give an account of energy flow in ecosystem. (8) (Dec 09, Dec 08, May 07, Dec 06, May 06) (OR) Explain the flow of energy through the atmosphere and its utilisation in an ecosystem. (8) (May 08) (OR) With a neat sketch explain the flow of energy through the various components of the ecosystem (producers, consumers and decomposers) (8) (Dec 07) (OR) Briefly explain the energy flow through ecosystem. (4) (Dec 05) (OR) Energy flow in an ecosystem obeys 1st and 2nd laws of thermodynamics. Justify. (6) (Dec 07)

5. What are ecological pyramids? Explain why in grassland ecosystems the pyramids of numbers are upright while in parasitic food chain it is inverted? (8) (Nov 2011)

6. Explain different methods of In-situ conservation of Biodiversity. (8) (Nov 2011)

7. What are the major causes of man-wildlife conflicts? Discuss the remedial steps that can curb the conflict. (8) (Nov 2011)

8. Explain the **values of biodiversity**. (16) (Nov 2011, May 10) (OR) Discuss the consumptive use, ethical, optional and ecosystem service value of biodiversity. (10)

(May 2011) (OR) Classify and explain the value of biodiversity. (8) (Nov 2011, Nov 2010) (OR) Enumerate the values of biodiversity. (5) (May 09) (OR) Substantiate the value of biodiversity with suitable illustrations and statistical evidences. (8) (Dec 08)

9. Explain **in-situ and ex-situ conservation of biodiversity**. (8) (Nov 2011, May 2011) (OR) Give an account of conservation of biodiversity. (16) (May 10, Dec 09, May 06) (OR) How is biodiversity conserved? Explain. (8) (Dec 08) (OR) How is conservation of biodiversity achieved? Give details. (8) (May 08) (OR) Explain the strategy adopted to conserve biodiversity. (Dec 05) Write informative notes on 'In-situ' Conservation. (8) (Dec 09, Dec 08) (OR) Explain the various methods of conservation of biodiversity. (6) (May 09) (OR) Explain in-situ and ex-situ conservation along with their merits and limitations. (8) (May 08) (OR) Describe in-situ and ex-situ conservation of biodiversity. (8) (May 06)

10. Discuss elaborately the characteristic features, structure and functions of **grassland and aquatic ecosystems**. (16) (Nov 2011) (OR) Discuss the major features of grass land ecosystem. (8) (Dec 09, May 06)

11. Explain the role of producers, consumers and decomposers in ecosystem. (8) (Nov 2011) (OR) Explain the role of producers, consumers and decomposers in an ecosystem. (8) (May 08) (OR) Define: Producers, Consumers and Decomposers (9) (May 07) (OR) Write short notes on: Producers, Consumers and Decomposers (3x2=6) (Dec 06)

12. What are the major factors that are responsible for the loss of biodiversity? Explain. (8) (Nov 2011)

13. Discuss the **aquatic ecosystem and forest ecosystem**. (16) (May 10) (OR) Show the structure and function of (i) Forest Ecosystem (ii) Aquatic Ecosystem (8) (Dec 09, May

08) (OR) Describe the types, characteristics features, structure and function of (i) Forest Ecosystem (ii) Aquatic Ecosystem (8+8) (Nov 2011, Dec 08, May 05)

14. Write notes on (i) Ecological pyramid (ii) Values of biodiversity (8+8) (May 2011)

15. Give a detailed account of the following: (i) Components of Ecosystem (ii) In-situ and Ex-situ conservation of biodiversity. (4+12) (May 2011)

16. Explain the structure and functions of the following: (i) Forest ecosystem (ii) Grassland

ecosystem (iii) Desert ecosystem (iv) Aquatic ecosystem (16) (May 2011)

17. Write elaborately on **biodiversity at global, national local levels**. (16) (May 2011, May10, May 07)

18. Discuss the process of **Ecological Succession** with an example using neat sketch. (16) (May2011) (OR) Discuss briefly the ecological succession. Explain how it is classified. (8) (Nov 2010)

19. Write the significance of the two **Hot spots of Biodiversity** in India. (6) (May 2011, Nov 2010) (OR) Discuss the biodiversity hot-spots in India. (5) (May 09) (OR) What are the various hot spots of Bio-diversity in India? (8) (Dec 08) (OR) What do you understand by hot spots of biodiversity? Name and briefly describe two hot spots of biodiversity that extend in India. (8) (May 08) (OR) Describe the term hot spot in biodiversity. (8) (Dec 07) (OR) Explain the biodiversity of India. (8) (May 06)

20. Compare (1) Extinct & Endangered (2) Vulnerable and Rare with an example. (6) (May 2011)

22. Write a note on ecological succession and ecological pyramids. (8) (Nov 2010)

23. Explain the features of **ecological pyramids** including inverted pyramids. (8) (Nov 2010) (OR) Illustrate the ecological pyramids. (5) (May 09) (OR) Write a note on ecological pyramids and their types. (8) (Dec 08, Dec 06) (OR) Discuss the concept of ecological pyramid. (8) (Dec 07) (OR) Explain ecological pyramids. (4) (May 07)

25. What are the **threats to biodiversity**? Discuss. (8) (Nov 2010) (OR) Summarize the major threats to biodiversity. (8) (Dec 09) (OR) Identify and explain the major threats to

biodiversity. (8) (May 08) (OR) What are the major causes of degeneration of

biodiversity? (8) (Dec 07) (OR) What is biodiversity and explain the reasons for its decline. (8) (May 07, Dec 06) (OR) Write short notes on threats to biodiversity. (5) (May 06) (OR) What are the causes for loss of biodiversity? (4) (Dec 06) (OR) Discuss the threat faced by Indian Biodiversity. (8) (Dec 05)

26. Explain the components, structure and functions of a **desert ecosystem**. (8) (Nov 2010)

27. What are biogeochemical cycles? Discuss **Carbon cycle**. (8) (Nov 2010) (OR) Explain the biogeochemical cycles in brief. (16) (Dec 06) (OR) Write a note on Carbon cycle. (6) (Dec 05)

28. Describe the **biotic component** of an ecosystem. (8) (Dec 09, Dec 08) (OR) State the components of ecosystem. (10) (May 07) (OR) What are the major **biological components of ecosystem**? Explain their activities. (8) (Dec 09)

29. Discuss the importance of biodiversity. (8) (Dec 09, Dec 08)

30. Write a note on endangered and endemic species of India. (8) (Dec 09, Dec 08)

31. How is water cycled in the biosphere? Explain how human activities affect the **water cycle**. (8) (Dec 09) (OR) Write a note on hydrological cycle. (Dec 06)

32. Discuss the major types of deserts, grass lands and forests. (8) (Dec 09)

33. Describe the major parts of the earth's life support system. (8) (Dec 09)

34. What do you understand about "Biodiversity"? Discuss the different levels of hierarchical levels to understand the concept of biodiversity. List out the major threats to biodiversity. (4+6+6=16) (Dec 09)

36. Briefly discuss the characteristic features of the various **bio geographical zones** in India. (6) (May 06)

37. Describe the salient features of tropical rain forests and temperate deciduous forests. (5) (May 09)

38. Explain the different components of an ecosystem with the help of **pond ecosystem**. (8) (Dec 07, May 06)

39. Why conservation in parks, sanctuaries and nature reserves is considered inadequate and the only sensible way is to conserve the entire ecosystem or habitats. Discuss (10)(Dec 07)

40. Explain how fat-soluble pollutants like DDT get biomagnified. (8) (Dec 07)

41. Discuss the most important advantages of ecosystems. (8) (May 07)

42. Discuss the four kinds of diversity. (4) (Dec 06)

45. Write a note on measuring biodiversity. (4) (Dec 06)

46. Why biodiversity rich in tropics? (4) (Dec 06)

47. Explain the following: (i) Forest ecosystem (ii) Ecological succession (4+4) (May 06)

48. What are the **different types of ecosystem** and explain them with an example. (16) (May 06)
49. Explain briefly the **structure of atmosphere**. (6) (Dec 05)
50. Explain the various threats to biodiversity and the measures recommended for conservation of biodiversity. (16) (May 05)
51. Explain: Ecosystem, energy flow in ecosystem, food chain, food webs and ecological pyramids. (3+3+3+3+4) (May 05)
52. Explain in detail the scope of environmental sciences. (16) (May 10)

