Environmental Science

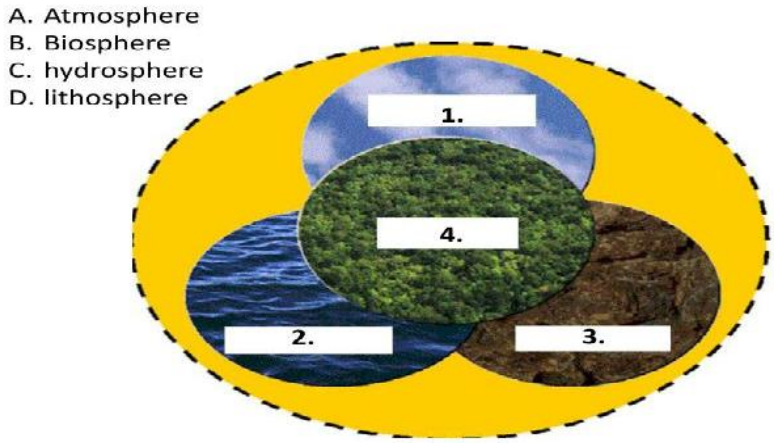
Natural resources (Unit-I)

*** Environment:** It is sum total of all biotic and abiotic factors that surround and potentially influence on organisms is called environment.

*** Environmental science:** The study of the environment, its biotic and abiotic components and their interrelationship.

* Basic components of the environment/Segments/Parts of the environment

Components of the Environment



The environment consists of four main components.

1. **Lithosphere (Land):**
    - The lithosphere is the solid outer layer of the Earth made up of rocks, soil, and landforms.
    - It includes mountains, valleys, plateaus, and plains.
    - It provides natural resources like minerals, forests, and fertile soil for agriculture.
2. **Hydrosphere (Water):**
    - The hydrosphere is the total amount of water present on Earth in all forms.
    - It includes oceans, seas, rivers, lakes, glaciers, and groundwater.
    - It is essential for drinking, irrigation, transport, and supports aquatic life.

3. **Atmosphere (Air):**
    - The atmosphere is the layer of gases that surrounds the Earth.
    - Major gases are nitrogen (78%), oxygen (21%), and carbon dioxide and others (1%).
    - It protects life by blocking harmful solar radiation and controls the Earth's climate.
4. **Biosphere (Living World):**
    - The biosphere is the zone of Earth where life exists.
    - It includes all living organisms—plants, animals, and humans.
    - It maintains balance in nature through food chains, photosynthesis, and recycling of nutrients.

*Types of natural resources

Natural resources: Nature provides goods and services that are useful to all living organisms. These are called natural resources.

Based on their availability or how human activities affect them, natural resources are classified into two types.

1) Renewable natural resources

2) Non-renewable natural resources

1) Renewable natural resources: These resources are capable of being regenerated by ecological process within a reasonable time period.

Eg: Air, Water, Soil, Wild life, Natural vegetation etc.,

2) Non-renewable natural resources: These resources are not capable of being regenerated by ecological process.

Eg: Coal, Crude oil, Natural gas, Minerals etc.,

Forest Resources

*Uses of Forest

Forests are very important for the survival of life on Earth. They give us many benefits, which can be grouped into **ecological uses** and **commercial uses**.

1. Ecological Uses of Forest:

- **Oxygen supply:** Forests act as the "lungs of the Earth." Trees take in carbon dioxide and release oxygen, which all living beings need.
- **Climate regulation:** They keep the air cool, control rainfall, and reduce global warming by storing carbon.
- **Soil conservation:** Tree roots hold the soil tightly and prevent soil erosion by wind and water.
- **Water cycle:** Forests help clouds to form and bring rainfall. They also recharge underground water.
- **Habitat for wildlife:** Forests are homes to animals, birds, insects, and thousands of plants.
- **Biodiversity:** They support a rich variety of life forms and maintain balance in nature.

2. Commercial Uses of Forest:

- **Timber and wood:** Used for building houses, furniture, ships, and tools.
- **Fuelwood:** Firewood and charcoal are used for cooking and heating in many areas.
- **Paper and pulp:** Wood from trees is used for making paper, cardboard, and packaging.
- **Medicinal plants:** Many plants like neem, tulsi, and cinchona are used in making medicines.
- **Resins, gums, and latex:** These are useful in industries, medicines, and rubber production.
- **Food products:** Fruits, nuts, honey, and spices come from forests.
- **Employment:** People working in forestry, logging, and forest-based industries earn their livelihood.

*Deforestation

Definition: Deforestation is the process of removal or elimination of forest resources due to many natural or manmade activities. In general deforestation means destruction of forest.

Causes of deforestation:

The following are the causes of deforestation.

- **Agricultural expansion:** Forests are cleared to make land for crops and livestock. In many areas, shifting cultivation also destroys trees.

- **Urbanization and industrialization:** Cities, roads, factories, and dams are built on forest land, leading to massive tree loss.
- **Logging and timber cutting:** Trees are cut for wood, furniture, paper, and construction purposes.
- **Mining activities:** Forest areas are cleared to extract minerals, coal, and oil.
- **Overgrazing by livestock:** Excessive grazing prevents young trees from growing, damaging the forest.
- **Forest fires:** Natural fires or fires started by humans can destroy large forest areas.

Effects of deforestation:

The ill-effects of deforestation are summarized below.

- **Loss of biodiversity:** Many animals, birds, and plants lose their homes, leading to extinction of some species.
- **Climate change:** Fewer trees mean less carbon dioxide is absorbed, increasing greenhouse gases and global warming.
- **Soil erosion:** Without tree roots, topsoil washes away during rain, reducing soil fertility.
- **Water cycle disruption:** Forests help in rainfall formation. Deforestation reduces rainfall and can cause rivers to dry up.
- **Desertification**: Land becomes barren due to loss of trees and soil degradation.
- **Floods and droughts:** Trees control water flow; without them, floods during rains and droughts in dry periods increase.
- **Impact on tribal communities:** People who depend on forests for food, medicine, and livelihood face difficulties.

Preventive measures (or) avoid of deforestation:

The following are the strategies to prevent or avoid deforestation.

- **Afforestation and reforestation:** Planting new trees to restore lost forests.
- **Social forestry & agroforestry:** Encouraging people to grow trees around villages, farms, and cities.
- **Strict forest laws:** Preventing illegal logging, land encroachment, and deforestation activities.

- **Protected areas:** Creating national parks, wildlife sanctuaries, and biosphere reserves to protect forests.
- **Sustainable resource use:** Using wood, fuel, and forest products responsibly without over-exploitation.
- **Awareness programs:** Educating people about the importance of forests for life and climate.
- **Alternative resources:** Using substitutes like bamboo recycled wood and solar energy to reduce pressure on forests.

Water Resources

*Uses of Water

Water is one of the most important natural resources. It is essential for life and has many uses which can be divided into **domestic, agricultural, industrial, and ecological uses**.

1. Domestic Uses:

- **Drinking:** Water is needed for survival.
- **Cooking:** Used to prepare food.
- **Cleaning:** Washing clothes, utensils, and homes.
- **Personal hygiene:** Bathing and maintaining health.

2. Agricultural Uses:

- **Irrigation:** Water is used to grow crops.
- **Livestock:** Animals need water for drinking and feeding.
- **Aquaculture:** Water is essential for fish farming.

3. Industrial Uses:

- **Manufacturing:** Industries use water in production of goods like paper, steel, and textiles.
- **Cooling:** Machines and factories need water for cooling.
- **Cleaning:** Water is used to clean industrial equipment.
- **Energy production:** Water is used in hydroelectric power plants to produce electricity.

4. Ecological/Environmental Uses:

- **Maintaining ecosystems:** Rivers, lakes, and wetlands support fish, birds, and other wildlife.

- **Climate regulation:** Water bodies help in maintaining temperature and rainfall patterns.
- **Transportation:** Rivers, canals, and seas are used for transport of goods and people.
- **Recreation:** Swimming, boating, and tourism depend on water.

*Floods

Definition: A **flood** is the overflow of large amounts of water beyond its normal limits, especially over land that is usually dry.

Causes of Floods:

- **Heavy rainfall** – When it rains very heavily in a short time, rivers and drains cannot hold the water, so it spreads over the land.
- **Overflow of rivers** – Rivers and streams may get more water than their banks can hold, leading to overflow.
- **Melting of snow and glaciers** – In hilly areas, when snow melts quickly, it adds a large volume of water to rivers, causing floods.
- **Cyclones and storms** – Strong winds and heavy rain from cyclones push sea water onto land (storm surge), causing coastal floods.
- **Dam failure** – If a dam breaks or releases too much water suddenly, it can flood large areas.
- **Poor drainage system** – In cities, blocked drains or too much concrete prevent water from soaking into the ground, leading to waterlogging and urban floods.
- **Deforestation** – Cutting down trees reduces the soil's ability to absorb water, so rainwater quickly flows into rivers, causing floods.
- **Climate change** – Rising global temperatures cause unpredictable heavy rains and rising sea levels, increasing flood chances.

Effects of Floods:

- **Loss of life** – Many people and animals may die due to drowning or diseases after floods.
- **Damage to houses** – Houses and buildings may collapse or get badly damaged.
- **Destruction of crops** – Farmlands get covered with water, destroying crops and reducing food supply.
- **Spread of diseases** – Flood water mixes with sewage and waste, leading to diseases like cholera, diarrhoea, and malaria.

- **Loss of property** – Shops, factories, vehicles, and personal belongings get destroyed.
- **Disruption of transport** – Roads, railways, and bridges get damaged, cutting off transport and communication.
- **Economic loss** – Huge money is needed for rescue, relief, and rebuilding after floods.
- **Soil erosion** – Strong floodwaters wash away fertile soil, making land less productive.
- **Displacement of people** – Flood-affected people lose their homes and are forced to move to relief camps or other places.
- **Psychological impact** – Flood victims suffer from stress, trauma, and mental health problems due to loss and destruction.

Control Measures of Floods:

- **Construction of dams and reservoirs** – Dams help store excess rainwater and release it slowly to prevent floods.
- **Embankments and levees** – Strong walls are built along rivers to stop water from overflowing onto land.
- **Improving drainage system** – Proper drains in cities help rainwater flow out quickly and reduce urban flooding.
- **Afforestation** – Planting more trees increases water absorption by soil and reduces sudden water flow into rivers.
- **Flood forecasting and warning systems** – Using weather reports and technology to alert people early can save lives.
- **River management** – Dredging (deepening) rivers and removing silt allows them to carry more water.
- **Zoning and planning** – Avoid building houses in flood-prone areas and keep those lands for farming, parks, or wetlands.
- **Rainwater harvesting** – Collecting rainwater reduces surface runoff and helps recharge groundwater.
- **Community awareness** – Educating people about flood safety measures and rescue plans reduces damage.
- **Emergency relief measures** – Quick rescue operations, shelters, and medical support reduce suffering after floods.

*Drought

Definition:

A **drought** is a long period with little or no rainfall, leading to a shortage of water for people, animals, plants, soil, and rivers.

Causes of Drought:

- **Low or no rainfall** – When an area receives very little rain for months or years, water in rivers, lakes, and soil becomes very less, leading to drought.
- **High temperature** – Hot weather increases evaporation of water from soil, lakes, and rivers, making the land dry quickly.
- **Deforestation** – Trees bring rainfall and help the soil hold water. Cutting trees reduces rain and makes land dry, increasing drought risk.
- **Overuse of water** – If farmers, industries, and cities use too much groundwater and river water, it causes water shortage during dry seasons.
- **Climate change** – Due to global warming, rainfall patterns are changing. Some places get too much rain (floods) while others get too little (droughts).
- **Poor irrigation and farming practices** – Using too much water in agriculture without conservation reduces groundwater and worsens drought in dry seasons.

Effects of Drought:

- **Water scarcity** – Drinking water becomes very limited, and people have to travel long distances to fetch water.
- **Crop failure** – Without water, crops dry up, leading to food shortages and poverty among farmers.
- **Death of animals** – Domestic animals (cows, goats, sheep) die due to lack of grass and water.
- **Famine** – Severe drought causes hunger, malnutrition, and sometimes starvation in affected areas.
- **Soil degradation** – Land becomes hard, cracked, and infertile, making farming difficult even after rain.
- **Economic loss** – Farmers lose income, industries depending on water shut down, and overall economy suffers.
- **Migration** – People move to other places in search of jobs, food, and water, leaving villages deserted.

- **Forest fires** – Very dry forests easily catch fire, destroying plants, animals, and homes.
- **Health problems** – Lack of clean water leads to diseases like diarrhoea, dehydration, and poor hygiene.

Control and Prevention Measures of Drought:

- **Rainwater harvesting** – Collecting and storing rainwater in tanks, ponds, or wells can provide water during dry periods.
- **Afforestation** – Planting trees improves rainfall, keeps the soil moist, and prevents desert-like conditions.
- **Efficient irrigation methods** – Techniques like drip irrigation and sprinklers save a lot of water compared to traditional flooding methods.
- **Water conservation** – People should use water carefully in homes, farms, and industries to avoid wastage.
- **Watershed management** – Building small dams, check dams, bunds, and ponds helps store water, recharge groundwater, and improve soil moisture.
- **Cloud seeding** – Artificially creating rainfall by spraying chemicals into clouds in very dry regions.
- **Drought-resistant crops** – Growing crops like millet, sorghum, and pulses that need less water reduces crop loss.
- **Public awareness** – Educating people about how to save water and prepare for drought helps reduce its impact.
- **Government support** – Providing relief camps, food supply, employment schemes, and financial help to farmers in drought-affected areas.

Mineral Resources

*Uses of Minerals

The following are the uses of mineral resources.

- **Industrial use** – Minerals like coal, petroleum, and natural gas are used as fuel for industries. Iron, copper, aluminum, and zinc are used for making machines, tools, and vehicles.
- **Construction** – Minerals like limestone, granite, marble, and sand are used for building houses, roads, bridges, and dams.
- **Agriculture** – Minerals like phosphates, nitrates, and potash are used in fertilizers to improve crop growth.

- **Energy production** – Coal, petroleum, uranium, and natural gas are important sources of power generation.
- **Transport** – Minerals like iron, aluminum, and petroleum are used in making cars, buses, airplanes, trains, and ships.
- **Household use** – Minerals like salt (halite) are used in food, mica in electrical appliances, and clay in making utensils and tiles.
- **Jewellery and ornaments** – Precious minerals like gold, silver, diamond, and platinum are used to make jewellery.
- **Medicinal use** – Minerals like calcium, iron, magnesium, and zinc are essential for health and are used in medicines and supplements.
- **Electronics and technology** – Minerals like silica, copper, lithium, cobalt, and rare earth elements are used in mobiles, computers, batteries, and satellites.
- **Cultural and decorative use** – Minerals like marble, jade, and granite are used for sculptures, monuments, and decoration.

*Environmental Effects of Over-Exploitation of Mineral Resources

The following are the effects of over-exploitation of mineral resources

- **Land degradation** – Mining destroys the natural landscape, removes topsoil, and leaves large pits, making the land unfit for farming or vegetation.
- **Deforestation** – Large areas of forests are cut down for mining operations, leading to loss of trees and wildlife habitats.
- **Loss of biodiversity** – Plants and animals lose their natural homes due to mining and land clearance, leading to extinction of species.
- **Soil pollution** – Chemicals used in mining (like mercury, cyanide) contaminate the soil, reducing fertility and harming crops.
- **Water pollution** – Toxic substances from mines enter rivers, lakes, and groundwater, making water unsafe for drinking, irrigation, and aquatic life.
- **Air pollution** – Mining activities release dust, smoke, and harmful gases, which pollute the air and cause diseases like asthma and lung problems.
- **Noise pollution** – Use of blasting, drilling, and heavy machinery produces loud noise, disturbing both humans and animals.
- **Climate change** – Burning of mineral fuels like coal and petroleum releases carbon dioxide, contributing to global warming and climate change.
- **Health hazards** – Miners are exposed to harmful dust and chemicals, causing serious health problems like silicosis, cancer, and respiratory diseases.

- **Disturbance of groundwater table** – Excessive mining lowers the groundwater level, causing water scarcity in surrounding areas.

*Types of Energy Resources

Energy resources are sources from which we get energy for various human activities like electricity, transport, heating, and industry. They are mainly classified into **renewable** and **non-renewable** sources.

1. Non-Renewable Energy Resources

These are energy sources that **cannot be replenished easily** once used. Non-renewable resources are limited and may run out if overused.

Examples and uses:

1. **Coal** – Used in power plants to generate electricity and in industries like steel.
2. **Petroleum (crude oil)** – Used as fuel for vehicles (petrol, diesel), heating, and making plastics.
3. **Natural Gas** – Used for cooking, electricity, and industries.
4. **Uranium (Nuclear energy)** – Used in nuclear power plants to produce electricity.

2. Renewable Energy Resources

These are energy sources that **can be replenished naturally** and are sustainable.

Examples and uses:

1. **Solar energy** – Energy from the sun, used to generate electricity, heat water, and for solar cooking.
2. **Wind energy** – Wind is used to drive turbines and produce electricity.
3. **Hydro energy (Water energy)** – Flowing water in rivers and dams produces electricity.
4. **Biomass energy** – Energy obtained from plants, wood, crop waste, and animal dung, used for cooking, heating, and electricity.
5. **Geothermal energy** – Heat from inside the Earth is used for electricity generation and heating.
6. **Tidal and wave energy** – Energy from ocean tides and waves is converted into electricity.

Difference between conventional sources of energy and non-conventional sources of energy.

Aspect	**Conventional Sources of Energy**	**Non-Conventional Sources of Energy**
Definition	Energy sources that have been traditionally used for a long time.	Modern or alternative energy sources that are sustainable and eco-friendly.
Examples	Coal, petroleum, natural gas, hydroelectricity, nuclear energy	Solar, wind, biomass, geothermal, tidal, wave energy
Availability	Limited and may run out (non-renewable)	Renewable and can be replenished naturally
Environmental Impact	Causes pollution (air, water, soil) and greenhouse gas emissions	Eco-friendly, produce little or no pollution
Cost of Setup	Often cheaper to extract initially, but fuel cost can be high	Initial setup may be costly, but operating cost is low
Sustainability	Not sustainable in the long term due to depletion	Sustainable and can be used for a long time
Usage	Mainly used for electricity generation, transport fuels, and industries	Used for electricity, heating, cooking, and small-scale power needs
Dependence on Technology	Requires less sophisticated technology	Requires advanced technology and infrastructure

Ecosystem (Unit-2)

An ecosystem is a community of living organisms (plants, animals, and microorganisms) interacting with each other and with their non-living environment (air, water, soil, and climate) in a particular area.

Biotic components of an ecosystem are broadly classified in to three types.

1) Producers

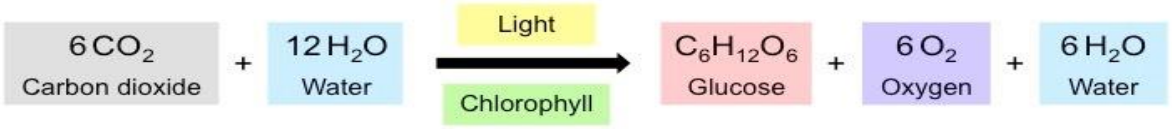
2) Consumers

3) Decomposers

1) **Producers (Autotrophs):** Producers synthesize their food themselves through photosynthesis.

Ex: All plants.

Photosynthesis: The green pigments called chlorophyll, present in the leaves of plants convert CO_2 and H_2O in the presence of sunlight in to carbohydrates.



This process is called photosynthesis.

2) Consumers (Heterotrophs): Consumers are organisms which cannot prepare their own food and depend directly or indirectly on the producers.

Ex: **Plant eating species:** Insects, rabbit, goat, deer, cow etc.,

Animal eating species: Fish, lions, tigers etc.,

Consumers are broadly classified in to three types.

a) Primary consumers (Herbivores or Plant eaters): Primary consumers are also called herbivores, they directly depend on the plants for their food. So they are called plant eaters.

Ex: Insects, goat, deer, cow, horse etc.,

b) Secondary consumers (Primary carnivores or meat eaters): Secondary consumers are primary carnivores, they feed on primary consumers. They directly depend on the herbivores for their food.

Ex: Frog, cat, snake, foxes etc.,

c) Tertiary consumers (Secondary carnivores or meat eaters): Tertiary consumers are secondary carnivores, they feed on secondary consumers. They directly depend on the primary carnivores for their food.

Ex: Tigers, lions etc.,

3) <u>Decomposers:</u> Decomposers attack the dead bodies of producers and consumers and decompose them in to simpler compounds. During the decomposition inorganic nutrients are released. These inorganic nutrients together with other organic substances are then utilized by the producers for the synthesis of their own food.

Ex: Microorganisms like bacteria, fungi, algae etc.,

* Food chain

The sequence of eating being eaten in an ecosystem is known as food chain.

The biotic factors of the ecosystem are linked together by food. For example, the producers form food for the herbivores. The herbivores form food for the carnivores.

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

Owing to repeated eating being eaten, the energy is transferred from one trophic level to another trophic level. This transfer of energy from one trophic level to another is called energy flow.

A typical food chain can be seen in a pond ecosystem. The algae and phytoplankton are eaten by the zooplankton. The zooplankton is eaten by fishes. The fishes are eaten by snakes.

Ex: Phytoplankton → Zooplankton → Fish → Snake

The food chains are of two types, namely 1. Grazing food chain and 2. Detritus food chain.

1. Grazing food chain:

This food chain starts from green plants, goes through herbivores and ends in carnivores.

This type of food chain depends on the autotrophs which capture the energy from solar radiation. A few chains are given below:

Grass → Rat → Snake → Eagle

Grass → Grasshopper → Frog → Snake → Eagle

2. Detritus food chain:

It starts from dead organic matter and ends in inorganic compounds. There are certain groups of organisms which feed exclusively on the dead bodies of animals and plants. These organisms are called detritivores.

The detritivores include algae, bacteria, fungi, insects, ducks etc.. These organisms ingest and digest the dead organic materials.

Some amount of energy is trapped and the remainder is excreted in the form of simple organic compounds. These are again used by another set of detritivores until the organic compounds are converted in to inorganic compounds.

Ex: Dead organic matter → Decomposer → Inorganic matter

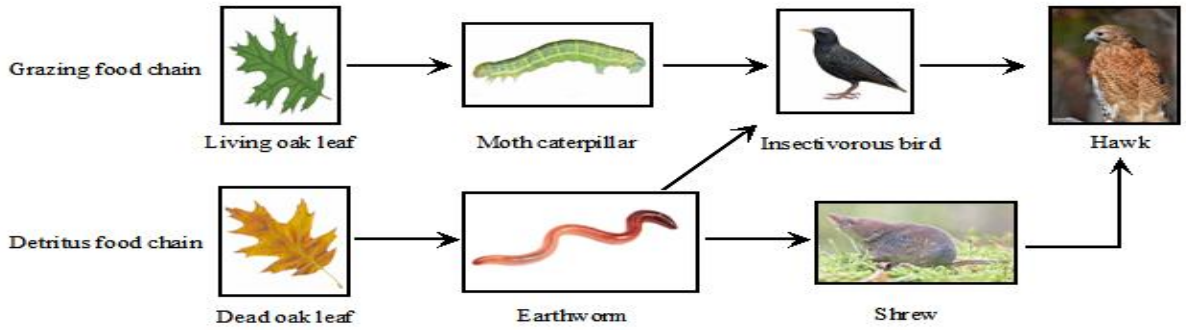
*** Linking of Grazing and Detritus food chain**

The two main food chains cannot operate independently. They are interconnected at various levels.

According to Wilson and Bossert, the stability of the ecosystem is directly proportional to the number of such links.

The detritus feeders obtain energy from the dead bodies of animals and plants which are components of the grazing food chain.

Again some of the detritus feeders are eaten by the consumers of the grazing food chain. For example, in a pond ecosystem earthworms belonging to the detritus food chain are eaten by fishes belonging to the grazing food chain.



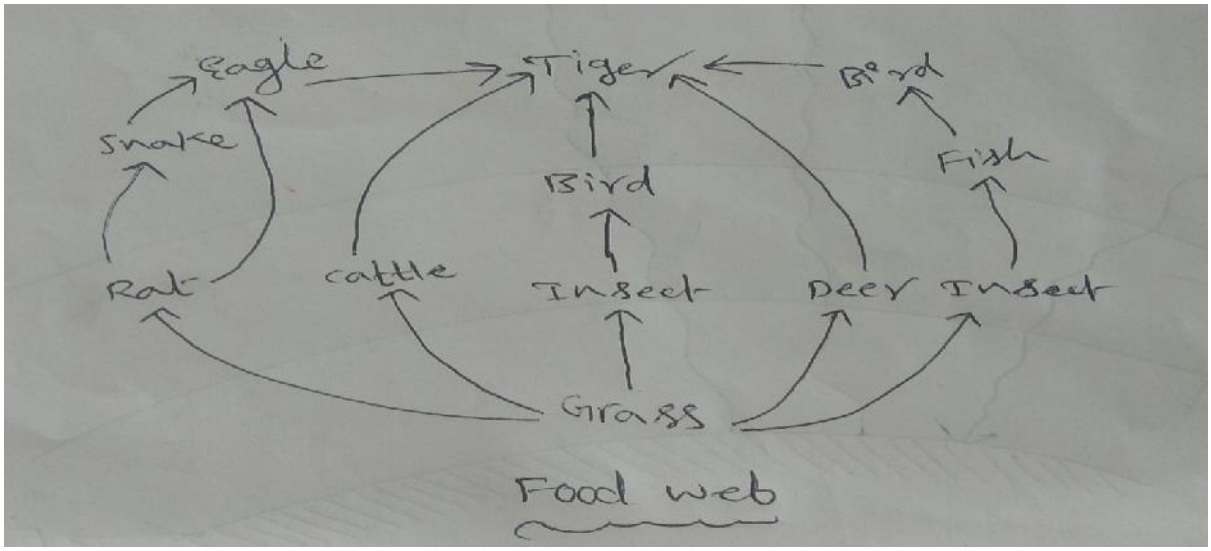
Linking of Grazing and Detritus food chain

* Food web

The interlocking of many food chains is called food web.

In a food web many food chains are interconnected, where different types of organisms are connected at different trophic levels, so that there is a number of opportunities of eating and being eaten at each trophic level.

For example: In a grassland ecosystem, grass is eaten by insect, cattle, deer and rat. Insect is eaten by fish, bird which is eaten by tiger. Cattle, deer and eagle is eaten by tiger. Rat is eaten by eagle. Rat is eaten by snake which is eaten by eagle. In addition, eagle also directly eats rat. Thus five linear food chains which are interconnected to form a food web.



This is a very simple food web. But in any ecosystem the food web is more complex. For example, in the grassland ecosystem itself, in addition to eagle, there are many other carnivores such as vulture, crow, wolf, fox, man etc.....

*** Difference between Food chain and Food web**

In a linear food chains, if one species get affected (or) becomes extinct, then the species in the subsequent trophic levels are also affected.

But, in a food web, if one species gets affected, it does not affect other trophic levels so seriously. There are number of options available at each trophic level.

*** Significance of Food chains and Food webs**

1) Food chains and Food webs play a very important role in the ecosystem. Energy flow and nutrient cycling takes place through them.

2) They maintain and regulate the population size of different trophic levels, and thus help in maintain ecological balance.

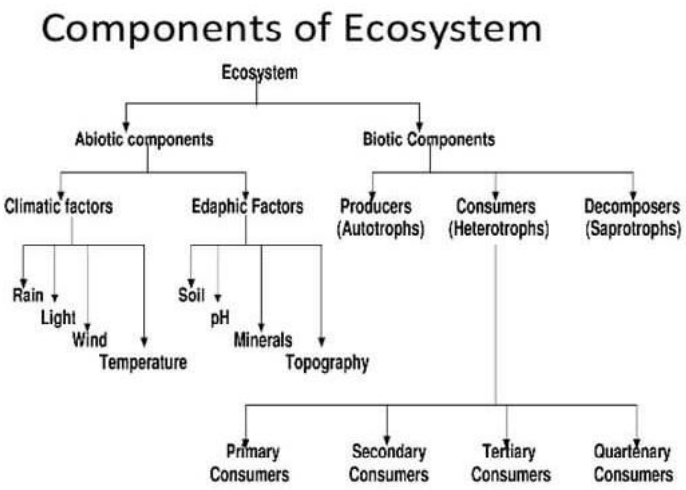
* Structure or Components of an ecosystem

The term structure refers to the various components. So the structure of an ecosystem explains the relation between the abiotic (non-living) and the biotic (living) components.

An ecosystem has two components.

1) Biotic (living) components.

2) Abiotic (non-living) components.



A) Biotic components:

The living organisms in an ecosystem collectively form its community called biotic components (or) biotic community.

Example: Producers, Consumers and Decomposers

Biotic components of an ecosystem are broadly classified in to three types.

1) Producers

2) Consumers

3) Decomposers

1) **Producers (Autotrophs):** Producers synthesize their food themselves through photosynthesis.

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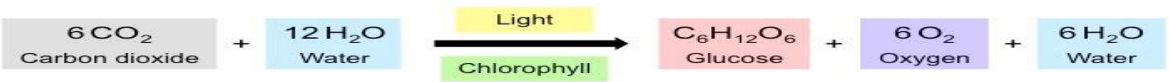

This process is called photosynthesis.

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Ex: Frog, cat, snake, foxes etc.,

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Ex: Tigers, lions etc.,

3) Decomposers: Decomposers attack the dead bodies of producers and consumers and decompose them in to simpler compounds. During the decomposition inorganic nutrients are released. These inorganic nutrients together with other organic substances are then utilized by the producers for the synthesis of their own food.

Ex: Microorganisms like bacteria, fungi, algae etc.,

B) Abiotic components:

The non-living components (physical and chemical) of an ecosystem collectively form a community called abiotic components (or) abiotic community.

Examples: Climate, soil, water, air, energy, nutrients etc.,

i) Physical components: They include the energy, climate, raw materials and living space that the biological community needs. They are useful for the growth and maintenance of its member.

Example: Air, water, soil, sunlight etc..

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

- **Organic substances:** Proteins, lipids, carbohydrates etc.
- **Inorganic substances:** All micro (Al, Co, Zn, Cu) and macro elements (C, H, O, P, N, P, K) and few other elements.

* Function of an ecosystem

To understand clearly the nature of an ecosystem, its functioning should be thoroughly understood. The function of an ecosystem is to allow flow of energy and cycling of nutrients.

Types of Functions:

Functions of an ecosystem are of three types.

i) Primary function: The primary function of all ecosystems is manufacture of starch (Photosynthesis).

ii) Secondary function: The secondary function of all ecosystems is distributing energy in the form of food to all consumers.

iii) Tertiary function: All living systems die at a particular stage. These dead systems are decomposed to initiate the third function of ecosystems namely cycling of nutrients.

The functioning of an ecosystem may be understood by studying the following terms.

a) Flow of energy

b) Cycling of nutrients

c) Food chains

d) Food webs

e) Food pyramids (or) Ecological pyramids

*Ecological Pyramids

Definition: An ecological pyramid is a graphical representation that shows the number, biomass, or energy of organisms at different trophic levels in an ecosystem.

Ecological pyramids are classified on the basis of what they represent at different trophic levels. There are three main types of ecological pyramids.

Types of Ecological Pyramids

1. **Pyramid of Number**
    - Shows the **number of organisms** at each trophic level.
    - Usually **upright**, e.g., many grass plants support fewer herbivores, which support even fewer carnivores.
    - Can be **inverted**, e.g., one large tree (producer) supports many insects (herbivores).

2. **Pyramid of Biomass**
    - Shows the **total mass of living matter (biomass)** at each trophic level.
    - Usually **upright**, e.g., mass of producers is more than herbivores, and herbivores more than carnivores.
    - Can be **inverted** in aquatic ecosystems because tiny producers (phytoplankton) have less biomass than the herbivores that feed on them.
3. **Pyramid of Energy**
    - Shows the **energy content** at each trophic level.
    - Always **upright**, because energy decreases at higher trophic levels due to energy loss as heat and metabolism.

* Forest Ecosystem

Introduction:

A forest ecosystem is one in which a tall and dense trees grow, that support many animals. The forests are found in undisturbed areas receiving moderate to high rainfall. The forest occupies nearly 40% of the world's land area. In India it occupies only 21% of its total land area.

Types of Forest Ecosystem:

Depending up on the climatic conditions forests are broadly classified in to following types.

1) Tropical forests: They are found near the equator. They are characterised by high temperature, high humidity, high rainfall and climate is constant throughout the year. The trees have broad leaves.

2) Temperate forests: They are found in areas with adequate rain fall. Seasonal climate is found in temperate forests. Monsoons play important role in temperate forests. They have broad leaves. They shed leaves during winter season.

3) Alpine forests or Taiga: They have needle like leaves. They are also called coniferous forests. They contain pine trees and are evergreen. They occur in low rainfall areas.

Characteristics of Forest Ecosystem:

The following are the characteristics of forest ecosystem.

- **Dense Vegetation** – Forests have a large number of trees, shrubs, and plants.
- **Diverse Wildlife** – Many animals, birds, and insects live in forests.
- **Multiple Layers** – Forests have canopy, understory, and forest floor layers.
- **High Biodiversity** – Forests contain a wide variety of species.
- **Influence on Climate** – Forests help regulate temperature, rainfall, and air quality.

- **Soil Protection** – Tree roots prevent soil erosion and maintain fertility.
- **Source of Resources** – Forests provide timber, fuel, fruits, and medicinal plants.
- **Water Conservation** – Forests help recharge groundwater and prevent floods.
- **Ecological Balance** – Forests maintain the balance of plants, animals, and decomposers.
- **Cultural and Recreational Importance** – Forests are used for tourism, spiritual, and cultural activities.

Structure of the Forest Ecosystem:

1) Abiotic components: The minerals present in the forest and all organic (litter, debris) and inorganic substances present in the soil and the atmosphere constitute the abiotic components.

Eg. Nutrients, minerals, climatic factors (temperature, light, rainfall).

2) Biotic components: All living organisms, viz. producers, consumers and decomposers constitute the biotic components of the forest.

a) Producers: The plants absorb sunlight and produce food through photosynthesis.

Eg; Trees, shrubs, herbs and ground vegetation.

b) Consumers:

i) Primary consumers (Herbivores-Plant eaters): They directly depend on the producers for their food.

Eg. Insects, mice, deer, rabbit etc.

ii) Secondary consumers (Primary carnivores-Meat eaters): They directly depend on the herbivores for their food.

Eg. Snakes, birds, fox, wolf etc.

iii) Tertiary consumers (Secondary carnivores-Meat eaters): They directly depend on the secondary consumers for their food.

Eg. Tiger, lion etc.

c) Decomposers: They decompose the dead plant and animal matter. During the decomposition inorganic nutrients are released in to the soil which is again used by the producers.

Eg. Bacteria, fungi, earthworms etc.

Function of the Forest Ecosystem:

To understand clearly the nature of an ecosystem, its functioning should be thoroughly understood. The function of an ecosystem is to allow flow of energy and cycling of nutrients.

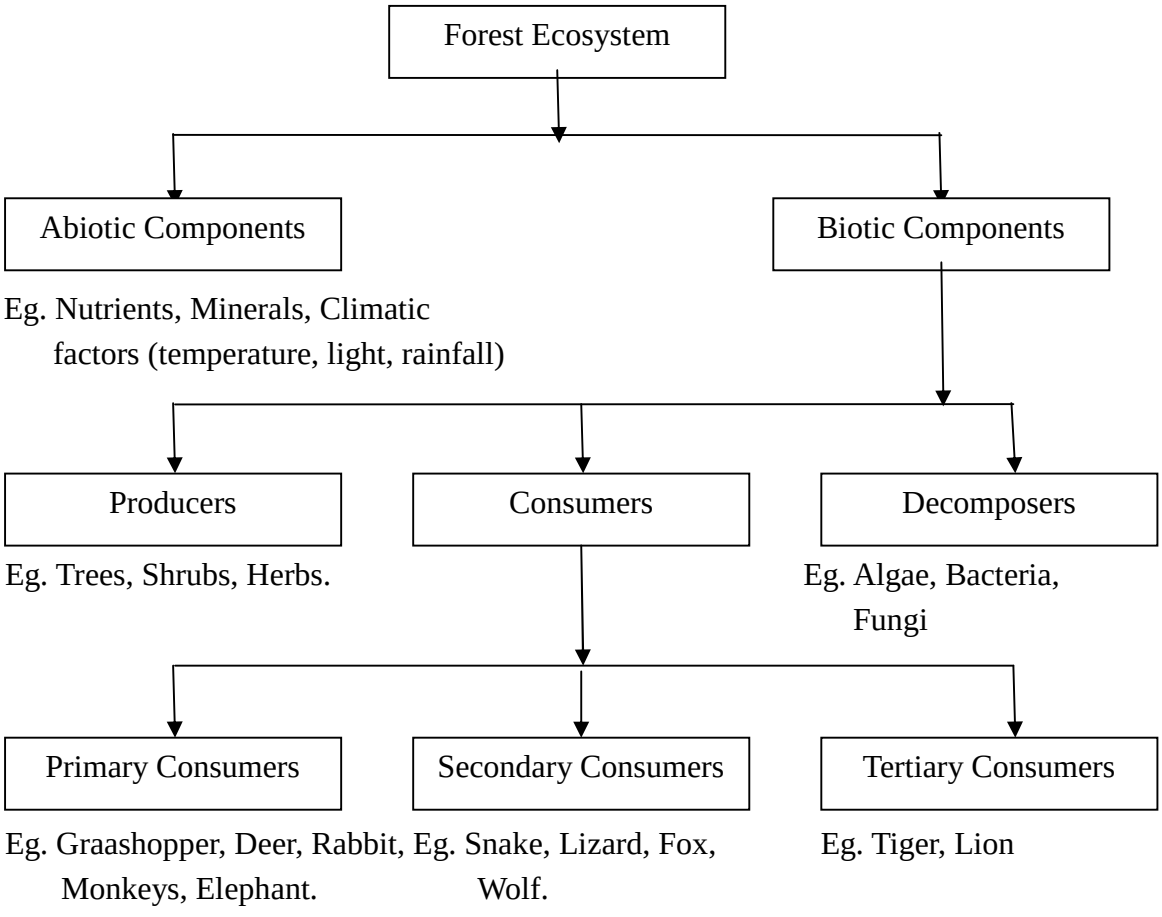
Types of Functions:

Function of an ecosystem is of three types.

i) Primary function: The primary function of all ecosystems is manufacture of starch (Photosynthesis).

ii) Secondary function: The secondary function of all ecosystems is distributing energy in the form of food to all consumers.

iii) Tertiary function: All living systems die at a particular stage. These dead systems are decomposed to initiate the third function of ecosystems namely cycling of nutrients.



Structure and Function of Forest Ecosystem

* Lake Ecosystem

Introduction:

A lake ecosystem is a freshwater ecosystem found in a depression on land where water collects naturally. It consists of living organisms like fish, plants, and microorganisms interacting with the non-living environment such as water, soil, sunlight, and minerals. Lakes play an important role in providing water, supporting biodiversity, regulating climate, and serving human needs like fishing, irrigation, and recreation.

Types of Lake Ecosystems: Some important types of lakes are,

1) Oligotrophic lakes: They have low nutrient concentrations.

2) Eutrophic lakes: They are overnourished by nutrients like N and P.

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

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

5) Meromictic lakes: They rich in salts.

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

Characteristics of Lake Ecosystem:

- **Standing Water** – Lakes have still or slow-moving water compared to rivers.
- **Biodiversity** – Lakes support plants (like algae, water lilies) and animals (like fish, frogs, insects, birds).
- **Nutrient-Rich Water** – Lakes contain dissolved nutrients like nitrogen and phosphorus that support plant growth.
- **Interaction of Organisms and Environment** – Plants, animals, and microorganisms depend on water, sunlight, and nutrients for survival.
- **Self-Sustaining Ecosystem** – Lakes can maintain ecological balance through food chains and energy flow.

Structure of the Lake Ecosystem:

1) Abiotic components: Minerals, Inorganic nutrients, organic substances, oxygen, carbon dioxide, water, temperature, light etc., are abiotic components of a lake ecosystem.

Eg. Nutrients, minerals, temperature, light etc.

2) Biotic components: All living organisms, viz. producers, consumers and decomposers constitute the biotic components of the lake.

a) Producers: They are green plants, submerged, free floating and amphibious plants.

Eg; Phytoplanktons, algae etc.

b) Consumers:

i) Primary consumers (Zooplanktons-Plant eaters): They directly depend on the phytoplantons for their food.

Eg. Protozoans, copepod etc.

ii) Secondary consumers (Primary carnivores-Meat eaters): They directly depend on the primary consumers for their food.

Eg. Small fishes etc.

iii) Tertiary consumers (Secondary carnivores-Meat eaters): They directly depend on the secondary consumers for their food.

Eg. Large fishes etc.

c) Decomposers: They decompose the dead plant and animal matter in to inorganic nutrients which is again used by the producers.

Eg. Bacteria, fungi etc.

Function of the Lake ecosystem

To understand clearly the nature of an ecosystem, its functioning should be thoroughly understood. The function of an ecosystem is to allow flow of energy and cycling of nutrients.

Types of Functions:

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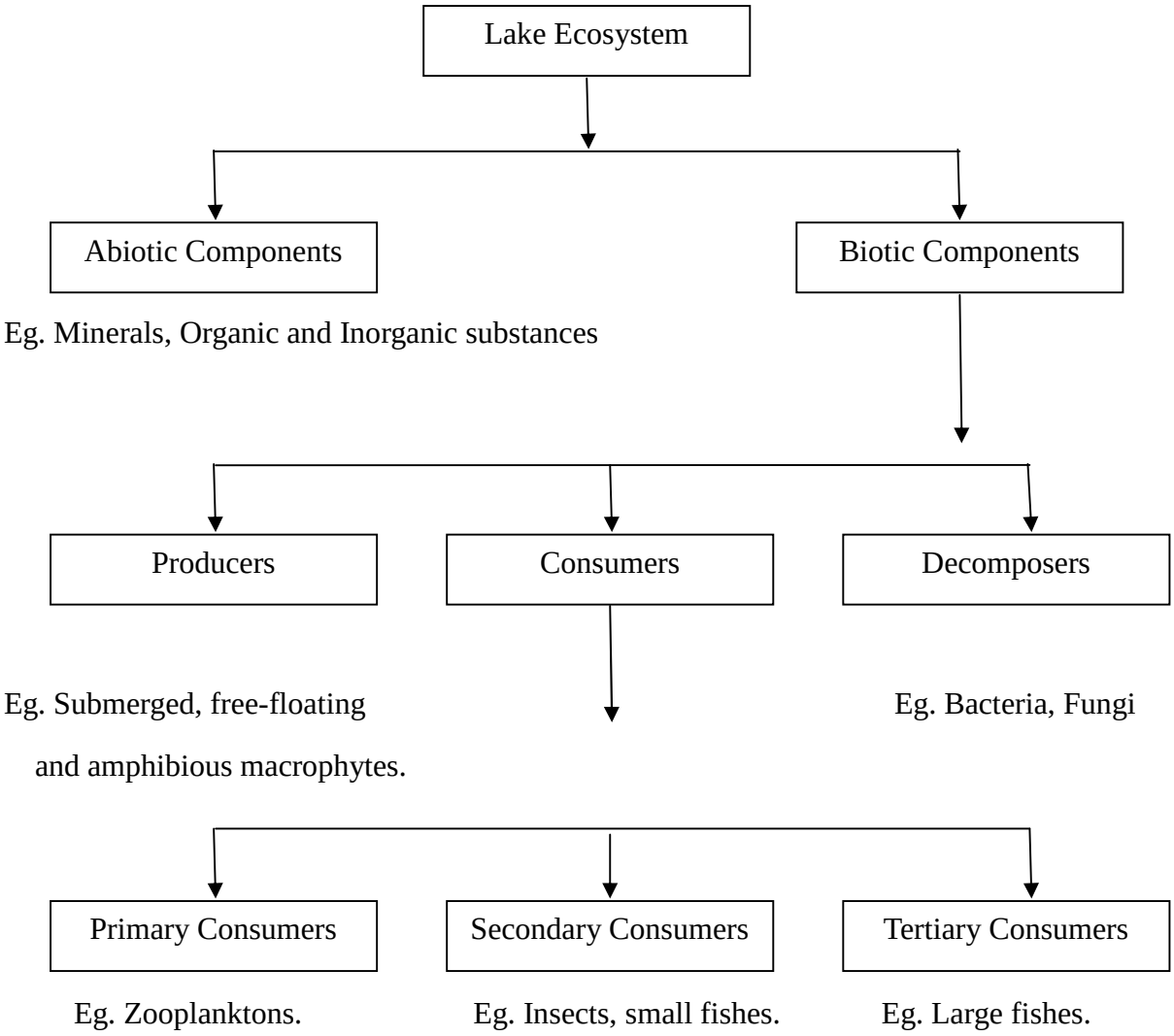


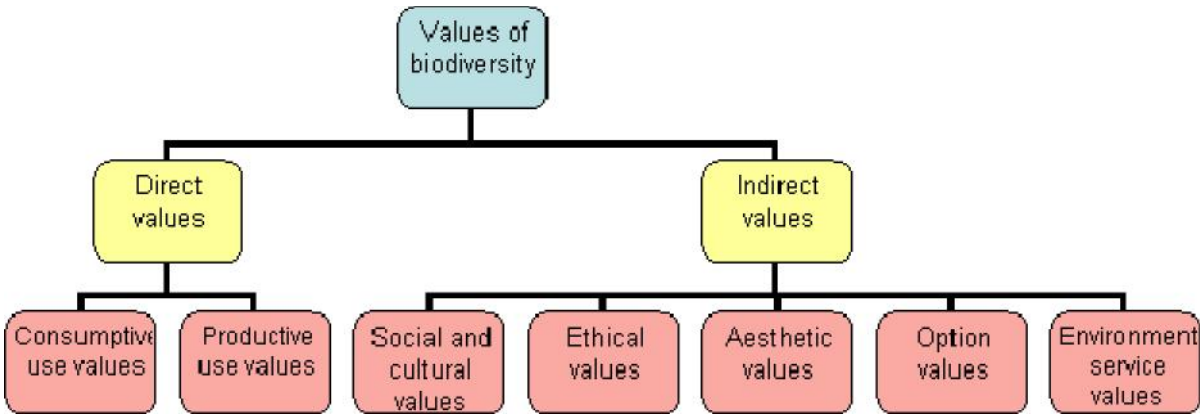
Structure and Function of Lake Ecosystem

Biodiversity and its conservation (Unit-2)

Biodiversity: The variety and variability among all groups of living organisms and the ecosystem in which they occur is called Biodiversity.

* Values of Biodiversity

Biodiversity has direct and indirect values, which are categories of benefits it provides to humans. Direct values are derived from the consumptive and productive use of biological resources, such as food, medicine, and timber. Indirect values come from ecosystem services that support human life and economies, such as nutrient cycling, water purification, climate regulation, and pollination.



Direct values

- **Consumptive use value:**

The direct consumption of resources harvested from nature.

- **Examples:** Food, fuel, and traditional medicines.

Productive use value:

Products that are commercially harvested and sold.

- **Examples:** Timber, cotton, dyes, and rubber.

Indirect values

- **Ecosystem services:**

Benefits that are provided by the functioning of ecosystems, which are often difficult to measure but are essential for life.

- **Examples:**
  - Nutrient cycling

- Waste disposal
- Air and water purification
- Climate regulation
- Pollination
- Soil formation and erosion control

Social values:

Benefits related to social life, culture, and well-being.

- **Examples:** Aesthetic beauty, spiritual significance, recreation, and education.

Option value:

The value of a resource that is held in reserve for its potential future use.

- **Examples:** The possibility of finding a new drug or a new crop variety from an unstudied species.

Bequest value:

The value that people place on preserving biodiversity for future generations to enjoy and use.

Existence value:

The value of knowing that a particular species or habitat exists, even if it is never directly used.

* Hot-spots of biodiversity

Definition: The area which is rich in plant and animal species of which many are endemic and endangered species is called hot-spots of biodiversity.

The concept of identifying biodiversity hotspots was introduced in the year 1988 by British ecologist Norman Myers. These hot-spots were selected on basis of the number of threatened endemic species (Species that are found nowhere else) within them. At the global level, these are the areas of high conservation priority, if these species lost, they can nerve be replaced (or) regenerated.

Two hotspots are found in India. These are two distinct areas.

1. The Eastern Himalayas

2. The Western Ghats

* Threats to biodiversity

Definition: The causes for loss of biodiversity is said to be threat to biodiversity.

Any disturbance in an natural ecosystem tend to reduce its biodiversity. Any change in the system leads to a major imbalance and threatens the biodiversity. Causes for loss of biodiversity (or) various threats to biodiversity are

i) Habitat loss

ii) Poaching of wildlife

iii) Man-wildlife conflicts

i) Habitat loss: The loss of species is caused by habitat loss. Habitat loss threatened a wide range of animals and plants.

Factors influencing habitat loss are,

a) Deforestation: The forests are the natural homes of thousands of species, which disintegrate due to loss of their natural habitat (loss of forest).

b) Destruction of wetlands: The wetlands, estuaries and mangroves are destroyed due to draining, filling and pollution, which causes huge biodiversity loss.

c) Habitat fragmentation: Sometimes the habitat is divided into small and scattered patches. This phenomenon is known as habitat fragmentation. Due to this many wild species are vanishing.

d) Raw materials: For the production of hybrid seeds, the wild plants are used as raw materials. As a result many plant species become extinct.

e) Production of drugs: Many pharmaceutical companies collect wild plants for the production of drugs. As a result many plant species become extinct.

f) Illegal trade: Illegal trade on wild life also reduce the biodiversity.

g) Developmental activities: Construction of massive dams in the forest areas, discharge industrial effluents which kill the biodiversity.

ii) Poaching of wild life: poaching means killing of animals (or) commercial hunting. It leads to loss of animal biodiversity.

a) Subsistence poaching: Killing animals to provide enough food for their survival is called subsistence poaching.

b) Commercial poaching: Hunting and killing animals to sell their products is called commercial poaching.

iii) Man-Wildlife conflicts:

Human–wildlife conflict refers to the interaction between wild animals and people and the resultant negative impact on people or their resources, or wild animals or their habitat. It occurs when growing human populations overlap with established wildlife territory, creating reduction of resources or life to some people and/or wild animals.

* Conservation of biodiversity

Definition: The maintenance and preservation of biodiversity is called conservation of biodiversity.

Biodiversity is one of the important tool for sustainable development. The enormous value of biodiversity due to their commercial, medical, genetic, aesthetic and ecological importance emphasizes the need to conserve biodiversity.

There are two types of biodiversity conservation.

i) In-situ conservation (within habitat, on-site)

ii) Ex-situ conservation (Outside habitat, off-site)

i) In-situ conservation: It involves protection of different species within its natural habitat, where the species normally occurs is called in-situ conservation.

In-situ conservation methods:

a) Biosphere reserves

b) National parks

c) Wildlife sanctuaries

d) Gene sanctuary

ii) Ex-situ conservation: The protection of different species outside their natural habitats is called Ex-situ conservation.

Important methods of Ex-situ conservation: Botanical gardens, Zoological gardens, seed banks, microbial culture collections, museums etc...

Environmental pollution (Unit-3)

Environmental pollution: Any undesirable change caused in the physical, chemical or biological characteristics of any component of the environment (air, water, soil) which can cause harmful effects on various forms of life (or) property is called Environmental pollution.

Pollutant: The substance released in to the environment and which effect the environment is called pollutant.

* Air pollution

The undesirable changes occurring in the air which harmfully affects the life activities of living organisms is called air pollution.

Sources of Air pollution:

Sources of air pollution are of two types. **Natural sources** and **artificial sources.**

Natural sources: Natural sources of pollution are those that are caused due to natural phenomena. Ex: Volcanic eruptions, Forest fires, Biological decay, Pollen grains, Marshes, Radioactive materials etc...

Artificial sources: Artificial sources are those which are created by man. Ex: Thermal power plants, Vehicular emissions, Fossil fuel burning, Agricultural activities etc.

Classification of Air Pollutants:

Depending on the form of pollutants present in the environment**,** they are classified as:

1. Primary pollutants and
2. Secondary pollutants

1. Primary pollutants: Primary pollutants are those that are directly emitted in to the atmosphere.

Ex: CO, NO, CO_2, SO_2 etc.

2. Secondary pollutants: Secondary pollutants are those that are formed by reacting with other components or some basic component of the atmosphere to form new pollutants.

Ex: Nitric acid, Sulphuric acid, PAN, PBN,

Reasons that cause Air Pollution:

❖ Burning of fuels like wood, cow dung, coal and kerosene pollute the air.

❖ Exhaust gases emitted by motor vehicles which pollute the air are the major source of air pollution in cities.

❖ Industries pollute air by releasing various types of pollutants such as sulphur dioxide, oxides of carbon, nitrogen oxides, chlorine, asbestos dust and cement dust.

❖ Thermal power plants pollute air by emitting sulphur dioxide and fly-ash.

❖ Nuclear power plants pollute air by releasing radioactive rays.

❖ Use of fertilisers and pesticides in agriculture pollute the air.

❖ Mining activities releases particulate matter into the air and pollutes it.

❖ Indiscriminate cutting of trees and clearing of forests increases the amount of carbon dioxide in the atmosphere and thereby pollutes air.

❖ Use of chlorofluorocarbons in refrigeration, fire extinguishers and aerosol sprayers pollutes air by depleting the ozone layer.

Harmful Effects of Air Pollution:

- ❖ Air pollution affects respiratory system causing breathing difficulties and diseases such as bronchitis, asthma, lung cancer, tuberculosis and pneumonia.
- ❖ Breathing the high concentrations of CO reduces oxygen transport in the body leads to certain health effects that include headaches, increased risk of chest pain for persons with heart disease etc.,
- ❖ It causes depletion of ozone layer due to which ultraviolet radiations can reach the earth and cause skin cancer, damage to eyes and immune system.
- ❖ It causes acid rain which damages crop plants, trees, buildings, monuments, statues, metal structures and also makes the soil acidic.
- ❖ It causes greenhouse effect and global warming which leads to excessive heating of earth's atmosphere.
- ❖ Air pollution from pesticides causes serious ailments.
- ❖ Certain metals cause problem in kidney, liver, circulatory system and nervous system.

Prevention and Control of Air Pollution:

- ❖ **Methods of controlling gaseous pollutants-**The air pollution caused by gaseous pollutants like hydrocarbons, sulphur dioxide, ammonia, carbon monoxide, etc can be controlled by using three different methods-Combustion, Absorption and Adsorption.

- ❖ **Methods of controlling particulate emissions-**The air pollution caused by particulate matter like dust, soot, ash, etc can be controlled by using fabric filters, wet scrubbers, electrostatic precipitators and certain mechanical devices.

- ❖ Tall chimneys should be installed in factories.
- ❖ Better designed equipment and smokeless fuels should be used in homes and industries.
- ❖ Renewable and non-polluting sources of energy like solar energy, wind energy, etc should be used.
- ❖ Automobiles should be properly maintained and adhere to emission control standards.
- ❖ Cheap devices for controlling air pollution should be developed.
- ❖ More trees should be planted along roadsides and houses.
- ❖ Implementing strict laws to prevent and control of air pollution.
- ❖ Public awareness regarding the importance of air to control air pollution.
- ❖ Green belts should be created around industries, bus stands, railway stations and air ports.
- ❖ Industrial areas should be located at a safe distance from the residential areas.

* Water pollution

The undesirable changes occurring in the water which harmfully affects the life activities of living organisms is called water pollution.

Sources of water pollution: There are two types of sources for water pollution.

1) Point sources and

2) Non-point sources of water pollution

1) Point sources: These are pollutants that are discharged at specific locations through pipes, ditches or sewers into bodies of surface waters.

Ex: Factories, sewage treatment plants, abandoned underground mines and oil tankers.

2) Non point sources: These pollutants cannot be traced to a single point of discharge. They are large land areas or air-sheds that pollute water by runoff, subsurface flow or deposition from the atmosphere.

Ex: Acid deposition, runoff of chemicals into surface water from croplands, urban streets etc.,

Causes of water pollution:

There are numerous causes of water pollution. The main ones are listed below.

- **Industrial process: Industries** are simply allowed to pour toxic chemicals into water bodies before treatment, the water becomes polluted.
- **Agricultural fertilizers and pesticides:** Agricultural chemicals such as fertilizers and pesticides can wash into rivers and lakes, poisoning them.
- **Untreated sewage from households:** Untreated sewage from households can pollute different water bodies.
- **Garbage:** Dumping of garbage in to water bodies pollute water.
- **Urbanization:** Urbanization is a key factor in increasing the amounts of water pollution.
- **Dumping solid waste:** Humans often carelessly dump their trash in the sea or near rivers.
- **Oil spills:** Accidental oil spills have a devastating effect on seas.
- **Dissolved gases:** Polluting gases in the air can dissolve into marine and fresh water and pollute it.
- **Boat fuels:** Fossil fuels used in the shipping industry are one of the largest causes of both air and water pollution.
- **Heated water from power plants:** Some power plants release the heated water into water bodies leads to water pollution.

Effects of water pollution:

The following are the effects of the water pollution.

- **Water becomes dangerous to drink:** Polluted water affects the health of the humans.
- **Less clean water for agriculture:** We need unpolluted water to irrigate crops, too.
- **Economic costs:** When water has been polluted, there is money needed to purify water, remove pollutants from water bodies and so on.
- **Change in water colour:** Polluted water becomes visibly different that affect human health.
- **Water-borne diseases:** When sewage combines with drinking water, they might suffer from diseases such as typhoid, cholera, dysentery etc.,
- **Genetic mutations:** The genes of marine and freshwater plants and animals mutate and show effect on entire biodiversity.

❖ **Algal bloom**: An excess of nutrients in water due to a change in the chemical composition causes algae to bloom in overabundance and block out the light in pools and river.

❖ **Damage to the ecosystems:** Ecosystem is the interaction of living things, depending on each other for life. When their habits become polluted, marine and freshwater organisms are at risk of extinction. When aquatic life is threatened the entire ecosystem is disturbed.

Control measures of water pollution:

It is in our power to halt water pollution. Some of the key solutions that can be applied are outlined below.

1. **Stop using harmful chemicals at home:** Opt for environmentally friendly household cleaners to protect water bodies.
2. **Prevent industrial waste reaching water:** Dispose of industrial waste by burying or neutralizing it instead.
3. **Sewage treatment:** Household water should be properly treated to make it environmentally safe. Effective sewage treatment processes should be put in place.
4. **Treatment of industrial wastes before discharge:** Factories should treat wastes before discharge and toxic substances should be converted into harmless materials.
5. **Recycle:** Recycle domestic and commercial waste safely rather than dumping it in the sea or near rivers.
6. **Promote a love for waterways:** That way, everyone in the community will be motivated to stop pollution. When we all work together, we can achieve great things.
7. **Go organic:** Organic agriculture uses far fewer chemical pesticides and fertilizers.
8. **Adherence to water laws.** Laws and legislation regarding water pollution should be strictly followed.
9. **Avoid using plastic bags:** Carry a shopping bag whenever you expect to go shopping. This will minimize the chances of you using a plastic bag.
10. **Improve oil tanker safety:** Avoiding oil spills would remove a key cause of environmental pollution.
11. **Routine cleaning:** Wells and lakes should be regularly cleaned and treated to ensure that they remain safe for human use. There should also be system of regularly testing pond and lake water.

* Soil Pollution

The undesirable changes occurring in the soil which harmfully affects the life activities of living organisms is called soil pollution.

Causes of soil pollution:

The following are the causes of soil pollution.

1. Soil erosion: Soil erosion can be defined as the movement of top soil from one place to another. Soil erosion is a natural process due to wind, flood and due to human activities like-construction, overgrazing, farming and deforestation.

2. Industrial wastes: Various pollutants exist in environment from industrial wastes. Discharge from Chemical industries, Fertilizer Company, Pharmaceutical companies is highly polluting the soil.

3. Urban wastes: Because of modern life style and eating habits generate the urban wastes more and dumping urban waste pollutes the soil.

4. Agricultural practice: Use of strong fertilizers, pesticides and inorganic chemicals for increasing productivity of the crops leads to soil pollution.

5. Biological agents: Soil gets a large amount of human, animal and bird excreta which constitute a major source of land pollution by biological agents which spread infectious diseases.

6. Radioactive pollutants: Radioactive substances resulting from explosions of nuclear testing laboratories and industries giving rise to radioactive wastes penetrate the soil and accumulate giving rise to soil pollution.

Effects of Soil Pollution:

The harmful effects of soil pollution are briefly described below:

- Reduction in the fertility of soil.
- Water absorbing capacity of soil becomes low that affects biodiversity and water resources.
- Obstruction in the public passage (road, railway lanes etc.,) by solid waste.
- Contamination of underground and surface drinking water.
- Emission of toxic gases (from dumped solid wastes on land) is detrimental to health.
- The unpleasant smell and spread of insects cause inconvenience to people.

- ❖ Poisoning of the ecosystem take place by soil pollution.
- ❖ Damage to health: Soil pollutants enter our body through the food chain, causing illnesses.
- ❖ Soil pollution affects the quality of air and water.

Control measures of soil pollution:

Some of the key solutions that can be applied are outlined below.

1. Soil erosion can be controlled by a variety of forestry and farm practices.

2. Proper dumping of unwanted materials by adopting suitable methods.

3. Bio-pesticides and Organic fertilizers should be used in place of toxic chemical pesticides and synthetic fertilizers.

4. Proper hygienic condition: People should be trained regarding sanitary habits.

5. Public awareness: Informal and formal public awareness programs should be imparted to educate people on health hazards by environmental education.

6. Recycling and Reuse of wastes: To minimize soil pollution, the wastes such as paper, plastics, metals, glasses, organics, petroleum products and industrial effluents etc., should be recycled and reused.

7. Ban on toxic chemicals: Ban should be imposed on chemicals and pesticides like DDT, BHC, etc which are fatal to plants and animals.

8. Nuclear explosions and improper disposal of radioactive wastes should also be banned.

9. Formulation and effective implementation of laws also helps in controlling soil pollution.

10. Proper treatment of liquid wastes from industries and mines must be done.

11. Faulty sanitation practices must be improved.

* Thermal Pollution

The degradation of water quality by any process that changes ambient water temperature is called thermal pollution.

Causes of thermal pollution/Sources of thermal pollution:

The following are the causes for thermal pollution.

1. Industrial and power plant discharges:

Industries, especially power plants and manufacturing facilities, use large amounts of water for cooling. This water is then released back into natural water bodies at a much higher temperature, a common cause of thermal pollution.

2. Urban runoff:

Urban areas with a lot of concrete and asphalt create an "urban heat island effect." Rainwater flowing off these surfaces is warmer than natural runoff, and this heated water can be channelled into nearby rivers and lakes.

3. Deforestation:

The removal of trees and other vegetation along riverbanks and streams eliminates their natural shade, allowing more direct sunlight to heat the water and increase its temperature.

4. Agricultural practices:

Certain agricultural activities, such as irrigation and the use of fertilizers, can alter water temperature through land-use changes and runoff.

5. Natural Causes:

Natural causes like volcanoes and geothermal activity under the oceans and seas can trigger warm lava to raise the temperature of water bodies. Lightening can also introduce massive amount of heat into the oceans. This means that the overall temperature of the water source will rise, having significant impacts on the environment.

Effects of Thermal Pollution:

The following are the effects of thermal pollution.

1. Oxygen content decreases in water.

2. Warm water prevents the penetration of oxygen into deep cold waters.

3. The toxicity of pesticides and detergents increases with increase in temperature.

4. Metabolic activities of organisms increase in warm water; but warm water contains less oxygen. Hence organisms are affected.

5. Warm water disturbs the spawning of animals.

6. Young fishes are killed by warm water.

7. Fish migration is affected by warm water.

8. Blue green algae dominate in water bodies due to thermal pollution.

9. Decrease of zooplankton.

10. Fishes move away from areas polluted by warm water.

Control measures of thermal pollution:

- For minimizing thermal pollution, hot water should be cooled before release from factories: 1. Use of Cooling Towers 2. Cooling Ponds 3. Spray Ponds 4. Artificial Lakes.
- Use less electricity
- Reduce temperature
- Reduce volume of discharge
- Store and reuse heated water
- Discharge in less vulnerable zones
- Plantation of trees upon the banks of rivers and other water bodies.
- Use of better technologies
- Spreading awareness among people.

* Noise pollution

Noise is defined as, "the unwanted, unpleasant or disagreeable sound that causes discomfort to all living beings".

Causes of noise pollution:

The following are the causes of noise pollution.

Vehicular Noise

Industrial Noise

Commercialization of residential areas

Domestic Noise

Construction activities

Social gatherings

Fire crackers

Load speakers

Kitchen appliances

Generators

Workshops

Effects of noise pollution:

The following are the effects of noise pollution

1. Noise diminishes the power of hearing.
2. It gives pain to the ear.
3. It interferes with communication systems.
4. It causes stress.
5. Noise increases the secretion of adrenaline, the hormone of flight and fright.
6. It causes fright.
7. It increases the rate of heart beat.
8. It causes the constriction of blood vessels.
9. It causes headache, nausea and dizziness.
10. It causes emotional upsets.
11. It causes deafness.
12. Noise causes physical and mental fatigue and lack of concentration.
13. Noise disturbs sleep.

Control of noise pollution:

Noise pollution can be controlled in the following ways.

- Noisy automobiles should be banned.
- Wheels of automobiles should be oiled properly.
- Industrialists must take necessary steps to control noise.
- Loudspeakers should be set at a low sound.
- Trees absorb noise and thus reduce noise pollution. So thick vegetation must be grown around industries, cities and on the sides of roads.
- Noise producing machines should be placed in closed rooms.
- The sources that generate unwanted sound should be reduced.
- Residential houses should be constructed far away from industries, factories and airports.
- Legislation should be framed and implemented.
- Public should be aware to control noise pollution.

* Nuclear hazards (Radioactive pollution/Radiation pollution)

The undesirable change caused by the release of radiations into the environment from radioactive substances is called radioactive pollution.

Causes of radiation pollution:

The following are the sources of the radiation pollution. Causes may be natural or manmade activities.

1. Nuclear power plants

2. Radio-active wastes

3. Nuclear explosions and

4. Radio-isotopes

1. Nuclear Power Plants:

Nuclear power plants emit radiation to a very smaller extent except accidental leaks.

2. Radio-active Wastes:

The nuclear power plants produce a lot of nuclear radio-active wastes. The disposal of these wastes has become a global problem. Some countries producing large quantity of nuclear wastes dump them in ocean near other countries causing pollution.

3. Nuclear Explosion:

During nuclear explosion, a large number of radio-nuclides are generated in the atmosphere causing pollution.

4. Radio-isotopes:

Radio-isotopes are also prepared artificially either by nuclear fusion or by nuclear fission. If these radio-isotopes are not properly handled, these emit radiations causing pollution.

Effect of Radiation Pollution:

The following are the effects of radiation pollution.

1. Radiation splits the molecules of the tissues into ions and free radicals and causes mutation by breaking DNA (Deoxy ribonucleic acid) molecules in the nucleus.

2. Radiation in bone marrow may cause leukemia.

3. Radiation may cause skin burns which may lead to skin cancer.

4. Radiation at pelvic regions of pregnant ladies, cause damage to the foetus.

5. Still birth- Birth of dead babies.

6. Congenital deformities – defects in new born babies.

7. Microcephaly – Abnormal small head in babies.

8. Destruction of cities.

9. Destruction of plants and animals.

10. It causes radiation sickness.

11. Cumulative radiation damage and death.

12. Cataract in the eye.

13. Reduced fertility.

14. Damage to liver, spleen, thyroid etc.

15. Carcinoma (cancer)

16. Leukaemia (blood cancer)

17. General malaise (discomfort)

18. Nausea, vomiting, headache, Anaemia, mental retardation, thyroid cancer, bone cancer,

19. Inhibition of mitosis (Cell division)

20. Inhibition of enzyme secretion.

Control of Radiation Pollution:

Radiation pollution can be controlled in the following ways:

1. Care should be taken to check manmade radiation pollution at source.

2. Nuclear reactor should be perfectly maintained to avoid accidental leakage.

3. Nuclear tests should be banned.

4. **Waste disposal:** Radioactive waste must be stored in underground tanks where they gradually decay in a harmless manner.

5. **Protective garments:** Workers in atomic power plant and industries using radioactive materials should wear protective garments and should be screened from radioactive materials by radiation resistant walls or cases.

6. **Radiation indicators:** The workers should wear radiation indicators to know the total amount of radiation to which they have been exposed.

7. **Exposure to visible light:** Visible light neutralizes UV damage considerably. Therefore exposing the UV radiation affected persons to sunlight can treat him.

8. **Glass spectacles:** Use of glass spectacles will protect the eyes from ultraviolet light because UV light cannot penetrate the glass.

9. Public awareness

10. Implementation of strict laws.

* Marine pollution

The undesirable changes occurring in the sea which affects the living organisms is called marine pollution.

Causes of Marine pollution:

Marine pollution is caused by the following factors:

1. Industries release effluents in to the sea through pipes cause marine pollution.

2. Municipal wastes and garbage are dumped into the sea cause marine pollution.

3. The fishing boats and ships discard old and useless fishing nets into the sea.

4. The passengers of ships and the fish farmers throw plastic waste into the sea.

5. The fertilizers and pesticides applied on agricultural fields washed into the sea by surface run off.

6. Oil spilling due to leaks in the oil tanker ships, oil rigs, oil refineries and pipelines cause marine pollution.

7. Loading and unloading of oil in ships cause oil spill which leads to marine pollution.

8. Accident of cargo ships carrying toxic substances such as oil, gas, pesticides, fertilizers, industrial waste etc., causes marine pollution.

9. Offshore oil extraction also causes marine pollution.

Effects of marine pollution:

The following are the effects of marine pollution.

1. Deplete oxygen content in sea which affects marine living organisms such as plants, animals.

2. Toxic chemicals make the sea more acidic. Acidic condition of the sea is poisonous to marine life and causes harm to fish and animals as well as marine plants and corals.

3. Pollutants such as oil or litter can block out the sunlight, sea plants which need sunlight for photosynthesis.

4. Industrial and agricultural wastes include various poisonous chemicals that are considered hazardous for marine life. Chemicals from pesticides can accumulate in the fatty tissue of animals, leading to failure in their reproductive system.

5. Coral reefs, the garden of the sea are damaged by oil slick.

6. The sea birds are much affected by oil pollution and die.

7. The thin film of oil on the surface of water is called oil slick. The oil slick damages the mangrove plants.

8. Animals from impacted food chain are then eaten by humans which affects their health.

9. The eutrophication leads to the complete depletion of the flora and fauna of the sea.

Control measures of marine pollution:

The following are the control measures of marine pollution.

1. The industries must contain waste water treatment plant before discharging effluents into the sea.

2. Domestic sewage should be treated with sewage treatment plant before discharging sewage into the sea.

3. Agricultural runoff should not enter into the sea.

4. Stop using plastic and littering garbage as they not only choke up the drains but also releases into the sea.

5. Ensure that chemicals are not used anywhere near the streams of water and try cutting down on the usage of such chemicals.

6. The oil slick can be removed by slick lickers which absorb oil from the surface of water.

7. Spreading a high density powder over the oil spill, so that oil can be sunk to the bottom.

8. The oil deposited on the rocks and harbour walls can be cleaned with high pressure.

9. Implementation of strict laws helpful to control pollution.

10. Public should be aware about the importance of sea in order to control marine pollution.

Social issues and the environment (Unit-4)

* From Unsustainable development to Sustainable development

Unsustainable development:

Unsustainable development refers to anything we **cannot continue** the development at its current rate, i.e., we **cannot keep it going**. Unsustainable development causes instability of environment and crossed the threshold limit of environmental damage.

Causes for unsustainable development:

- More Population growth
- More Energy consumption
- More Resource consumption

Sustainable development:

Sustainable development can be defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." It is effective use of resources for economic development while preserving the environment and ecosystem so that not only the needs of presents are fulfilled but also for the future generations. Sustainable development also interlinks the development and carrying capacity of environment and ecosystem.

Measures for sustainable Development:

a) Using appropriate technology:

It is one which is locally adaptable, ecofriendly, efficient and culturally suitable. It involves local labours, less resources and produces minimum waste.

b) 3-R Approach:

Reduce, Reuse and Recycle approach.

c) Promoting environmental education awareness:

Environmental education will help in changing the thinking and attitude of people towards environment.

d) Population stabilization:

We can achieve sustainable development by controlling population.

e) Conservation of non-renewable resources:

It should be conserved by recycling and reusing of materials.

f) Usage of renewable resources:

Usage of renewable resources should not be faster than their regeneration capacity.

* Rain water harvesting

The **storage of rain water for future use** is called rain water harvesting.

Need for rain water harvesting (Uses of rain water harvesting) / Objectives of Rain water harvesting.

1. To provide water for domestic purposes.
2. To reduce water scarcity.
3. To increase water resources.
4. To increase water table.
5. To increase the quality of water.
6. To reduce intrusion of sea water.
7. To reduce floods.

Methods of rain water harvesting:

There are many methods of rain water harvesting:

1. Collection in ponds
2. Collection in vessels
3. Rain water harvesting in tanks
4. Rain water harvesting in open place
5. Percolation pond
6. Percolation well
7. Percolation pit (Absorption pit)

1. Collection in ponds:

Rain water is harvested in surface water bodies like ponds, lakes, irrigation tanks, temple tanks etc. It is a traditional method.

2. Collection in vessels:

The rain water falling on the sloping roofs of houses fall down along the edge of the roof. This is collected in vessels.

3. Rain water harvesting in tanks:

The rain water collected on flat concrete roof is diverted through a pipe into a cement tank constructed near the house or under the house.

4. Rain water harvesting in open place:

In the open places, open polythene bags or asbestos sheets are arranged in a slanting manner.

The rain water, falling on this, is collected into vessels or tanks.

5. Percolation pond:

The rain water falling in the elevated areas is collected in small ponds. This water percolates through the soil and reaches the underground water table. This helps to raise the water table.

6. Percolation well:

Rain water from the terrace is diverted into an open well using PVC pipes through a filter chamber.

7. Percolation pit:

The rain water falling on the roof is diverted into the pit through PVC pipes. The rain water percolates in to the ground and increases the water table.

* Environmental Ethics

Environmental ethics is the scientific looking of various issues related to the rights of individuals on the environment.

It is the moral relationship of human beings with the environment. It is concerned with the do's and don'ts of the human beings to the environment.

It deals with the ecological rights of all creatures present today as well as those which will come next to live on the earth. Ethical standards are necessary for a long term conservation and maintenance of nature and its resources.

Environmental ethics is maintained by the following methods.

1. Equitable utilization of natural resources.
2. Equity among the Northern and Southern countries.
3. Equity among people of rural and urban areas.

4. Equity for males and females.

5. Conservation of resources for future generations.

6. Environmental rights of animals.

7. Environmental education.

9. Use of ecofriendly items.

10. Prevention of hunting and poaching.

11. Regulation of felling of trees.

12. Respecting animals and plants.

*Climate Change

Climate change refers to long-term shifts in temperature and weather patterns caused mainly by human activities, such as burning fossil fuels. It results in rising global temperatures, extreme weather events, sea-level rise, and impacts on ecosystems and human health. Addressing it requires global action to reduce emissions and adapt to changes.

* Global warming

The **overheating of the earth** by the **increased amount of green house gases** is called global warming.

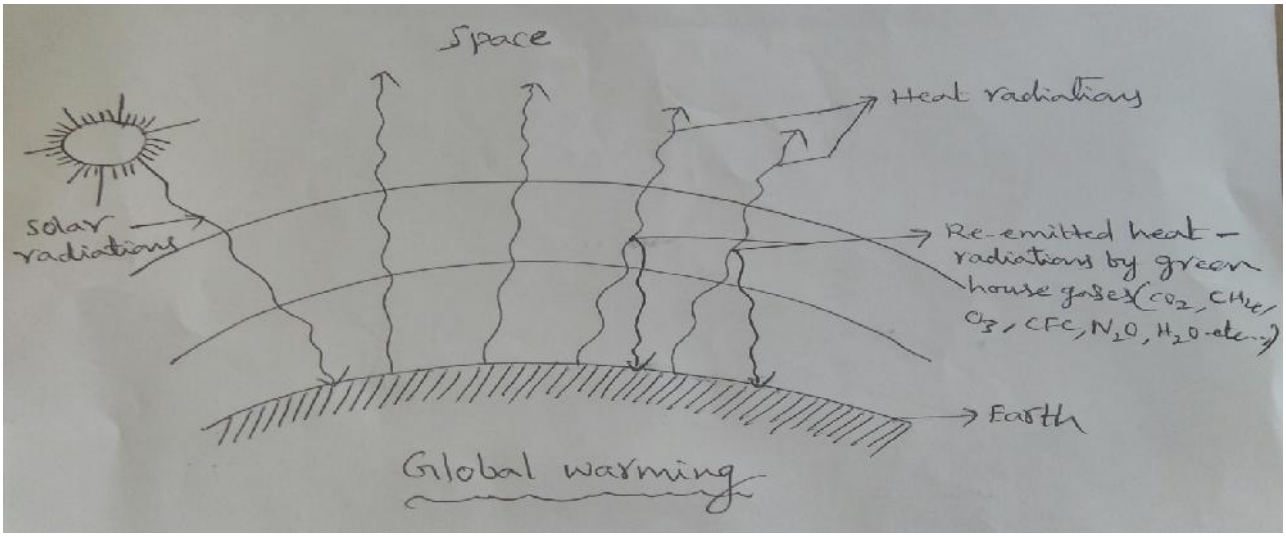
The earth is kept warm at an average of 15° C by the green house gases, such as **CO_2, methane, CFC, nitrous oxide, water vapour, ozone, SO_2, etc.**

The optimum amount of green house gases keeps the earth warm at the optimum level.



But now the **industries, automobiles, aircrafts, railways, forest fire and dairy farms** release high amount of green house gases. The increased green house gases, reflect

back more portion of the infrared rays to the earth and absorb the remaining portion. This leads to increase in the global temperature.



Harmful effects of global warming:

Green house effect increases global temperature. The increase in global temperature or global warming produces the following ill effects.

1. The polar ice caps will melt causing an increase in sea level. When the sea level increases, low lying coastal towns and cities will be swallowed by the sea.

2. The drastic changes in the global climate.

3. Melting of ice leads to floods in the river.

4. The rain fall will be affected.

5. Food production will be decreased.

6. The ozone umbrella will be depleted.

7. High temperature may be harmful to the life of man.

8. The agriculture and forestry will be affected.

9. Water resources are also affected.

10. It shows effect on human health.

11. It shows effect on both terrestrial and aquatic ecosystems.

Control measures to check global warming:

The following are the control measures to check global warming.

1. CO_2 emissions can be cut by reducing the use of fossil fuels.

2. Implement energy conservation measures.

3. Utilize renewable resources such as wind, solar, hydro power, etc.

4. Plant more trees.

5. Shift from coal to natural gas.

6. Adopt sustainable agriculture.

7. Stabilize population growth.

8. Efficiently remove CO_2 from smoke stacks.

9. Remove atmospheric CO_2 by utilizing photosynthetic algae.

10. Public awareness regarding reduction of global warming.

11. Implement strict laws to regulate human activities to control global warming.

* Acid rain

Presence of excess of acid in the rain water is called acid rain. The pH of acid rain is lower than 5.6.

Causes of acid rain:

The following are the causes of acid rain.

- Burning of fossil fuels like coal, crude oil, natural gas.
- Thermal power plants
- Industries
- Chemical inputs in agriculture
- Combustion of gasoline in automobiles
- Decomposition of organic matter
- Lighting
- Volcanic eruptions

Formation of acid rain:

Acid rain means the presence of excessive acids in the rain water. The thermal power plants, industries and vehicles release nitrogen oxides and sulphur dioxide into atmosphere due to burning of coal and oil. When these gases react with water vapour in the atmosphere, they form acids and descend on to the earth as acid rain through rain water.

$$2SO_2\,(g) + O_2\,(g) + 2H_2O\,(l) \rightarrow 2H_2SO_4\,(aq)$$
$$4NO_2\,(g) + O_2\,(g) + 2H_2O\,(l) \rightarrow 4HNO_3\,(aq)$$

Effects of acid rain:

The following are the effects of the acid rain.

1. The acid rain collect in ponds and the ponds becomes acidic. The acidic water kills the fishes in pond. Thus the ponds become fish grave yards.

2. The acid rain falling on the earth, leach aluminium. The dissolved aluminium is washed into the pond. In the pond, the aluminium clogs the gills, prevents respiration and caused death of fishes.

3. The bacteria and green algae are killed by acidified water.

4. Acid rain damaged the green leaves and hence the deforest.

5. The acid rain leached the soil nutrients such as calcium, potassium, iron, magnesium, etc. They are washed away from the soil. Hence the plant growth is affected.

6. Photosynthesis is reduced.

7. The yield in crop plants is reduced due to acidification.

8. The activity of nitrogen fixing bacteria present in the root nodules is inhibited and hence the fertility of the soil is reduced.

9. Pine trees are weakened due to acidity.

10. Acid rain damages buildings.

11. Acid rain corrodes monuments, statues, etc.

12. Acid rain causes corrosion of British Parliament Building.

13. Acid rain causes stone leprosy in Taj mahal.

14. Acid rain contaminates potable water and causes abnormality in the nervous system, respiratory system and digestive system.

Control measures of acid rain:

The following are the control measures of acid rain.

1. Improvement in technologies and switching to clear combustion technologies are highly essential in order to monitor the air pollution.

2. Emissions of SO_2 and NO_2 from industries and power plants should be reduced by using pollution control technologies.

3. Coal with low sulphur content is desirable to use in thermal power plants. Replacement of coal by natural gas would also reduce the problem.

4. Liming of lakes and soils should be done to correct the adverse effects of acid rain.

5. The real use of cut back on the use of fossil fuels by reducing our dependency on motor vehicles and unnecessary utility of motor vehicles.

6. Prefer to use renewable energy resources for heating and energy purpose

7. Plant more trees.

8. Implement strict laws to regularise human activities to control acid rain.

9. Public awareness regarding reduction of acid rain.

* Ozone layer depletion

Ozone is a gas found throughout the atmosphere, but most highly concentrated in the stratosphere between 10 to 50 km above sea level, where it is known as ozone layer.

Importance of ozone layer:

Without the ozone layer, life on the earth's surface would not be possible. It protects us from the damaging ultraviolet radiation of the sun. In particular it filters out UV-B radiations.

Causes of ozone layer depletion:

In 1970, it was found that the ozone layer was attacked by chloro fluoro carbons (CFCs) which are released in to the atmosphere by refrigeration units, air conditioning systems, aerosol sprays and cleaning solvents. Chloro fluoro carbons release chlorine which breaks ozone into oxygen.

Each chlorine atom is capable of attacking several ozone molecules. So that a long chain process is involved. A 1% loss of ozone results in a 2% increase in UV rays reaching the earth's surface.

Ozone depleting chemicals:

The ozone depleting chemicals essentially consists of chlorine or bromine atoms which are extremely reactive while they are in the free state. The following gases are accumulated in the atmosphere and are found to be instruments in ozone depletion.

1) Chloro Fluoro Carbon (CFC)

Sources: Refrigerants (Freon) in refrigerators, propellant in aerosol spray cans, blowing agent, foam plastic blowing agent.

2) Hydro Chloro Fluoro Carbon (CFC)

Sources: Refrigerants, blowing agents

3) Bromo Fluoro Carbons (BFC)

Sources: Fire extinguishers

4) Other chemicals

i) Certain halogen compounds are potential ozone destroyers upto ten times more powerful than the CFCs.

ii) Sometimes the atmospheric sulphur dioxide is converted into sulphuric acid which greatly increases the rate of ozone depletion.

Effects of ozone layer depletion:

As the ozone layer gets deteriorated the harmful UV rays will reach the ground and cause various adverse effects.

1) Effect on human health:

a) The UV-rays damage the genetic material in the skin cells which cause skin cancer.

b) For fair skinned people life long exposure to the high level radiation of UV rays increases the risk of non melamine skin cancer.

c) Prolonged human exposure to UV-rays may lead to slow blindness called actinic keratitis. Enhanced level of UV-rays could lead to more people suffering from cataracts.

d) Human exposure to UV-rays can suppress the immune responses in humans and animals. It also reduces human resistivity leading to a number of diseases such as cancer, allergies and some other infectious diseases.

2) Effect on Aquatic systems:

a) UV-rays directly affect the aquatic forms such as phytoplankton, fish, larval crabs.

b) The phytoplankton consumes large amounts of CO_2.

Decrease in population of phytoplankton could have more amount of CO_2 in the atmosphere which contributes to the global warming.

3) Effect on materials:

Degradation of paints, plastics and other polymeric material will result in economic loss due to effects of UV radiation.

4) Effect on climate:

The ozone depleting chemicals can contribute to the global warming i.e., increasing the average temperature of the earth's surface.

Control measures:

1) Replacing CFCs by other materials which are less damaging.

2) Use of gases such as methyl bromide which is a crop fumigant should be controlled.

3) Manufacturing and using of ozone depleting chemicals should be stopped.

4) Implement strict laws to regulate human activities.

5) Public awareness regarding the ozone depleting gases.

* Environmental Laws

Air (Prevention and Control of Pollution) Act – 1981

Water (Prevention and Control of Pollution) Act – 1974

Wildlife protection Act – 1972

Forest Conservation Act – 1980

Environmental Protection Act – 1986

*Air (Prevention and Control of Pollution) Act – 1981

The Air act was enacted in the year 1981. The Act provides for the prevention, control and abatement of air pollution. It also provides for the establishment of Boards with a view to carrying out the aforesaid purposes.

* Water (Prevention and Control of Pollution) Act – 1974

The act was introduced and incorporated into the Constitution of India in 1974. This is an act to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water through various management guidelines and restrictions. It is designed to assess pollution levels and punish polluters.

* Wildlife protection Act – 1972

This act was enacted in the year 1972. This Act was enacted for the protection of plants, birds and animal species. The Wildlife Protection Act is an umbrella Act to protect wild animals and plants; sanctuaries, national parks, and closed areas; restrict trade or commerce of wild animals or animal articles; and miscellaneous matters.

* Forest Conservation Act – 1980

The forest conservation act (1980) covers all types of forests including reserve forests, protected forests or any forested land irrespective of its ownership. The Act has made ample provisions to check deforestation and encourage afforestation of non-forest areas. This Law shall regulate forest conservation, protection, planning, utilisation and management of forests and forest lands, the supervision of the implementation of this Law, as well as other issues significant for forests and forest lands.

* Environmental Protection Act – 1986

The Environment (Protection) Act was enacted in the year 1986. It was enacted with the main objective to provide the protection and improvement of environment and the prevention of hazards to human beings, other living creatures, plants and property and for matters connected therewith.

Human population and the environment (Unit-5)

* Population explosion

The enormous increase in population due to low death rate and high birth rate is termed as population explosion.

Causes of population explosion:

The following are the causes of population explosion

Demographic factors

- **Declining death rate:**

  Improved medical care, vaccines, and public health measures have significantly lowered the death rate, especially for infants and children, leading to a higher life expectancy.

- **High birth rate:**

  Birth rates remain high in many parts of the world due to factors like a lack of family planning, education and services, social pressure to have many children, and cultural norms.

Social and economic factors

- **Poverty:**

  In poor areas, larger families are often seen as a source of labour and economic security, contributing to a higher birth rate.

- **Illiteracy:**

  A lack of education, particularly for women, is linked to higher birth rates.

- **Early marriage:**

  Marriages that occur at a younger age can lead to longer childbearing periods.

- **Cultural and religious beliefs:**

  Some cultural and religious beliefs encourage large families.

- **Immigration:**

  The movement of people from one country to another can add to the population of a region, especially if the destination country has a high birth rate or limited resources.

Effects of population explosion:

The following are the effects of population explosion

Environmental effects

- **Resource depletion:**

There is a higher demand for and depletion of natural resources like freshwater, forests, and fertile land.

- **Pollution:**

Increased industrial activity, transportation, and waste generation lead to higher levels of air, water, and soil pollution.

- **Habitat loss:**

Deforestation and the clearing of land for housing and agriculture lead to habitat destruction and loss of biodiversity.

Economic and social effects

- **Unemployment and poverty:**

Rapid population growth can surpass job creation, leading to higher unemployment and poverty rates, especially in developing nations.

- **Housing shortages:**

The demand for housing increases, resulting in overcrowded cities and the growth of slums.

- **Food and water scarcity:**

A larger population increases the demand for food and water, potentially leading to shortages and malnutrition.

- **Strain on services:**

Healthcare and education systems become overburdened, leading to overcrowded classrooms and a lower quality of care and education.

- **Increased conflict:**

Competition for scarce resources like water and land can escalate into conflicts and social tensions.

Measures to control population explosion:

Measures to control population explosion are as follows

Education & Awareness

- **Promote family planning and sex education:**

Informing people about contraception and family planning helps them make informed decisions about family size.

- **Raise awareness about consequences:**

Public awareness campaigns can highlight the impacts of overpopulation, encouraging smaller families.

Women's Empowerment

- **Increase female literacy and empowerment:** Empowering women through education and employment gives them more agency to control their reproductive health and choices.

Family Planning & Contraception

- **Provide access to contraceptives:**

Ensure affordable and easy access to various methods of contraception to prevent unwanted pregnancies.

- **Encourage smaller families:**

Promote the concept of smaller families through education and social support.

Government & Policy Measures

- **Implement incentives for small families:**

Governments can offer incentives to encourage families to have fewer children.

- **Set a minimum legal age for marriage:**

Enforcing a minimum age for marriage, such as 18, can help space out births.

- **Create national population policies:**

Develop comprehensive policies that address population growth and work to achieve an optimal population size.

Socioeconomic Development

- **Improve health and living standards:**

Investing in healthcare and improving living conditions can indirectly influence population growth by reducing maternal and infant mortality, thereby creating greater social security and economic stability.

- **Promote employment opportunities:**

Generating employment and balanced economic growth can improve standards of living and influence family size decisions.

* Family planning programmes

India became the first country in the world to initiate the family planning program in 1952 with the goal of lowering fertility and slowing the population growth rate.

Family planning refers to the planning of when to have children, and the use of birth control. It allows individuals and couples to anticipate and have their desired number of children, and to achieve healthy spacing and timing of their births.

The following are the importance of family planning programmes

Benefits for individuals and families

- **Improved health:**

Family planning ensures women have time to recover between pregnancies, lowering the risk of complications for both mother and child. It also reduces unwanted pregnancies, which can lower stress and lead to better mental health.

- **Economic stability:**

By allowing families to control their size, parents can better provide for their children's needs, such as food, shelter, clothing, and education. This can lead to a stronger financial situation for the family overall.

- **Women's empowerment:**

Access to family planning allows women to make informed choices about their reproductive health and bodies, which promotes gender equality and enables them to pursue education and employment opportunities.

Societal and public health benefits

- **Reduced population pressure:**

Family planning helps manage population growth, which in turn lessens the strain on natural resources and public services like healthcare and schools.

- **Lower mortality rates:**

Spacing births and avoiding unintended pregnancies leads to healthier infants and reduces the likelihood of pregnancy-related health risks.

- **Disease prevention:**

Integrated family planning services can include information on preventing diseases.

- **Sustainable development:**

Family planning is a key component of sustainable development, as it contributes to population stabilization, gender equality, and economic progress.

Following are some of the obstacles in the path of implementing family planning programme:

(i) Illiteracy

(ii) Poverty

(iii) Religious opposition

(v) Inadequacy of cheap and effective methods

(vi) Lack of finance

(vii) Shortage of trained staff

(viii) Lack of publicity

(ix) Lack of motivation

Following are some of the strategies for successful implementation of family planning programme:

(i) The family welfare programme be completely integrated and co-ordinated along with the public health measures.

(ii) Enrolment of more sincere, experienced and sympathetic personnel for the implementation of the programme.

(iii) Increasing production and free distribution of contraceptives among the poor people.

(iv) Raising the age of marriage for both male and female through both legal and social sanction.

(v) Offering higher incentives for sterilisation.

(vi) Liberalizing abortion for married women.

(vii) Withdrawing maternity benefits to those women violating two-child norm.

(ix) Introduction of disincentive schemes for those people who refuse to accept the small family norm.

(xi) To strengthen the monitoring of the entire programme

(xiii) Publicity.

(xiv) Spread of education and motivation.

* Environment and human health

The Environment is the most important resource for life. We get air, water, soil, food, power, minerals and many materials from the environment. It is a large habitat for living organisms.

Humans need to interact with the environment for their life and to obtain all. Advances in science and technology have helped us to exploit the environment for our benefit, but we have also introduced pollution and caused environmental damage.

Environment and human health are two inseparable entities. If environment is well human's health will be good. If environment gets disturb human's health will be automatically disturbed. Humans impact the environment by physical hazards, chemical hazards and biological hazards.

The environment significantly affects human health through factors like air, water and soil pollution, climate change and loss of biodiversity. Poor environmental conditions can lead to diseases and health issues, highlighting the need for sustainable practices and public health policies to protect both ecosystems and populations.

*Value education in relation to environment

Value education regarding the environment means developing a set of principles and practices that guide our behavior toward nature. It is about building a moral and ethical framework that shapes responsible actions, moving beyond simple knowledge to truly caring for the planet.

Here is how key concepts relate to value education for the environment:

- **Awareness and Sensitivity**: This involves educating oneself and others about environmental challenges like pollution, deforestation, and climate change. It fosters empathy towards all living things and helps people recognize the impact of their daily choices on the planet.
- **Ethical Responsibility**: It is our moral duty to protect the environment for both present and future generations. Value education teaches that humans have accountability to the planet and that our actions must be guided by a sense of fairness and justice towards all life.
- **Sustainable Practices**: This involves putting values into action by adopting eco-friendly habits in our daily lives. Simple examples include practicing the "3 Rs" (reduce, reuse, recycle), conserving water and energy, and choosing sustainable products.
- **Critical Thinking**: Environmental issues are often complex and filled with different viewpoints. Value education encourages people to analyze information critically, question assumptions, and evaluate the long-term consequences of actions to find effective solutions.

- **Community Engagement**: This encourages people to work together on local projects, such as clean-up drives, tree planting, and recycling programs. By involving the community, value education shows that collective action is essential for addressing environmental problems.
- **Holistic Development**: This means focusing on the overall growth of an individual—social, emotional, ethical, and environmental. Environmental value education ensures that academic learning is connected to a sense of purpose and responsibility, shaping students who are both knowledgeable and caring citizens.

By embedding these values into education, individuals can become proactive to protect environment, contributing to a more sustainable and equitable future.

* The role of information technology in environment and human health

The dissemination of information through satellites and computers is called information technology.

Information technology plays an important role for environment and human health. They are

1. News Broadcasting
2. Data bases
3. References for research
4. On-line meeting with experts
5. Emergency use
6. Geographic details
7. Educational tools

1. News Broadcasting:

Many of the web sites broadcast news from all over the world through internet services. Many web sites disseminate the information about environment which help to know about environment and solve environmental problems.

2. Data bases:

Information about environment and human health is collected and stored as data bases in information systems. The information system provides almost all sorts of information related to environment and health to the browsers to protect environment and human health.

3. Reference for research:

At national and international level many information systems have been established to provide research articles to researchers and anybody to protect environment and human health.

4. On-line meeting with experts:

With the aid of internet any person can meet and talk with experts to protect environment and human health.

5. Emergency use:

At the time of emergency people may contact any one through internet services to protect environment and human health.

6. Geographic details:

Geographic information system has been established to help the people to understand the details of area which help to protect environment and human health.

7. Educational tools:

Special softwares are designed in such a way that they analyze all aspects of the environment to protect environment and human health.