

# 1. Natural Resources - Air, Water and Land

## Environment

- **Environment**-natural surroundings and external conditions of an organism, which include all living and non-living factors that affect the organism
- **Organism**- is the basic unit of an ecological hierarchy, can be unicellular such as *Amoeba* and *paramecium* or multicellular such as humans
- **Population**- a group of individuals of the same species inhabiting a given geographical area at a particular time and functioning as a unit
- **Community**- includes all individuals of different species living within a certain geographical area
- **Ecosystem**- includes both living and non-living components of an area
- **Biosphere**- The sum total of all ecosystems and their interactions

## Components of an ecosystem

- **Abiotic factors**- non living components like light, temperature, water, air etc.
- **Biotic factors**-living organisms
- **Autotrophs or producers**- organisms that can manufacture their own food from inorganic raw materials, also known as producers
- **Heterotrophs**-cannot synthesize their own food; dependent on other organisms for their food requirements.
- **Herbivores or primary consumers** - feed only on plants e.g., deer, horse, sheep etc.
- **Carnivores or secondary consumers** - eat other animals e.g., frog, cat, spider etc.
- **Omnivores**- feed on both plants and animals e.g. bear, man etc.
- **Decomposers**-obtain nutrients by breaking down remains of dead plants and animals, includes some bacteria and fungi.

## Functions of an ecosystem

- **Productivity**- rate of production of organic matter (food) by producers
- **Decomposition or recycling of nutrients** - breakdown of organic matter or biomass with the help of decomposers

## Energy flow through an ecosystem

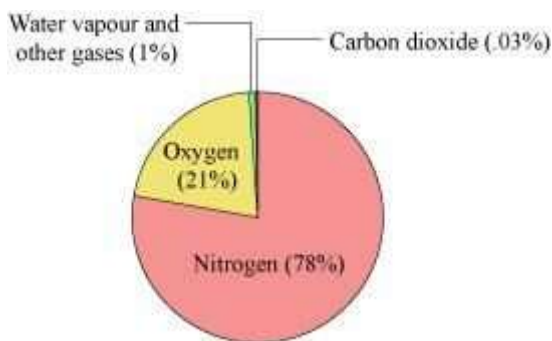
- **Trophic level** - level of species in an ecosystem on the basis of the source of nutrition
- **Producers**- form the first trophic level, they manufacture food trophic levels are connected through food chains
- **Food chain**- a linear sequence of organisms in which each organism is eaten by the next member in the sequence e.g., plants → grasshopper → frog → eagle
- **Generalised Food chain**

Producers → Herbivores or primary consumers → Carnivores or secondary consumers → Omnivores or tertiary consumers → Decomposers



- **Food web**-interconnected network of food chains
- **10% law of energy transfer**- only 10% energy is transferred from a lower trophic level to a higher trophic level, which means that energy keeps on decreasing as one moves up different trophic levels
- The graphical representation of energy exchange in the ecosystem is known as "**Pyramid of energy**".
- Since so little energy is available for the next trophic levels of consumers, food chains generally consists of three or four trophic level.
- **Biomagnification**-increase in the concentration of pollutants or harmful chemicals with each step up in the food chain

- **Composition of air**



- Main composition of air are Nitrogen and oxygen, they together constitute 99% of the air.
  - Nitrogen is the largest constituent of air.
  - An object can burn only in the presence of **oxygen**.
  - About four-fifth of air is **nitrogen**. It does not support burning.
  - **Dust** and **smoke** are also present in air.
  - **Smoke** is released from vehicles and from burning.
  - Traffic policemen wear a mask in order to **filter out smoke**.
  - Dust can be seen as a **streak of light** when sunlight enters a dark room through a slit.
  - Air also contains **water vapour**.
  - Gases can be converted into liquid state by the lowering the temperature and increasing the pressure
  - This conversion of gases into liquid is known as liquefaction of gases.
  - Air is a mixture of gases and not a compound.
  - LPG is an example of liquid gas
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- **Ozone layer**
    - Ozone ( $O_3$ ) is a form of oxygen and is more stable than the two-atom oxygen ( $O_2$ ).
    - The ozone layer protects and prevents these ultraviolet radiations from reaching the Earth's surface.
    - The pollutants that are responsible for depleting the ozone layer are gases such as chlorine and fluorine.
    - As a result of ozone depletion, a hole has developed in the ozone layer over Antarctica and its size has been steadily increasing over the years.
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- **Ozone depletion**
    - Ozone can be classified as good ozone and bad ozone.
    - Good ozone is present in the stratospheric region of the atmosphere while bad ozone is produced by the interaction between the various primary pollutants in the tropospheric layer.
    - The thickness of ozone is measured in terms of Dobson units (DU).
    - The thinned layer of ozone over Antarctica region is referred to as the ozone hole.

Chlorofluorocarbons or CFCs have caused damage to the stratospheric layer, leading to the formation of the ozone hole.

- High dose of UV-B radiations causes corneal cataract and inflammation of cornea in human beings. The inflammation of cornea is known as snow blindness or sunburn of cornea.
- **Montreal Protocol** is an international treaty signed for controlling the emission of ozone-depleting substances. It was signed in the year 1987.
- **Sources of water:** The common sources of water are ponds, lakes, rivers, wells, and reservoirs.
- **Water cycle:** Water undergoes different processes in the environment and is found in different states during these processes. This cyclic process through which water circulates in the environment is called the **water cycle**.
- **Importance of water**
  - Water is necessary for germination of seeds, transportation of nutrients from soil and food from the leaves to different parts of the plant, in preparation of food through photosynthesis.
  - Aquatic animals and plants get their nutrients as well as oxygen supply from the water. These substances are present in water in dissolved form.
  - Water is used for many other purposes such as in cooking, cleaning, industrial work, running hydroelectric and thermal electric power plants. Sea water is also used as a medium of transportation.
- A solution has two components, namely the solvent and the solute.
- **Solvent** is that part of the solution in which the other component is dissolved. In other words, solvent is that component of a mixture that is present in large amounts.
- **Solute** is that part of the solution that is dissolved in the solution. This is present in a lesser quantity as compared to the solvent. Also, more than one solute can be present in a solution.
- **Properties of a solution**
  - It is a homogeneous mixture of solutes and solvents
  - The solute particles in a solution are extremely small in size. They are less than 1 nm ( $10^{-9}$  m) in diameter.
  - Solute particles are not visible to the naked eye.
  - As a result of the small size of the solute particles, a solution does not scatter light.
  - Solute particles being small in size get dissolved in the solvent. Hence, the solute cannot be separated from the solution by filtration.
  - Solute particles do not settle down when left undisturbed.
  - The addition of harmful substances to water which causes its physical, chemical and biological properties to change is called **water pollution**.
- **Uses of Water**

Water is used for many purposes like drinking, washing clothes and utensils, generating electricity, bathing, irrigation etc.

- Water is essential for life.
- About 71% of the earth's surface is covered with water. It is present as ground water, in seas, oceans, rivers, lakes, ice caps, and in atmosphere.
- Wells, rivers, ground water reservoirs or lakes are sources of fresh water.
- Ocean and sea water is not potable because they contain large amount of dissolved salts.
- Water is a necessity for every form of life. It is used for domestic activities, irrigation, industrial purposes, etc.
- 22<sup>nd</sup> March is celebrated as World Water day.



## Water pollution

- The common sources of water pollution are domestic sewage, industrial effluents, thermal wastewater discharge.
- **Eutrophication:** It is the natural ageing process of a water body due to nutrient enrichment. It increases the ecosystem's primary productivity.
- **Domestic sewage** is rich in nitrogen and phosphorus. These compounds act as nutrients for the growth of algae in contaminated water bodies. This accelerates the rate of eutrophication in the water bodies.
- **Oil Spills** - The accidental discharge of oil or petroleum in water bodies is called oil spills. This results in the death of a lot of marine lives.
- The algal bloom causes the microbial population to increase, which consumes larger amount of oxygen dissolved in the water bodies. As a result, the level of dissolved oxygen in the water bodies decreases, and biological oxygen demand of the water bodies increases.
- **Industrial effluents** contain inorganic toxic substances, which may undergo **biomagnification**.
- Thermal wastewater discharge involves release of heated water from thermal power plants that increase the temperature of the water body. It causes damage to the indigenous biodiversity of the water body.
- Biological magnification: It is the increase in the concentration of pollutants or harmful chemicals with the increase in each trophic level. DDT shows the phenomenon of biomagnification.
- Integrated wastewater management is the possible solution for controlling water pollution. In this approach, the water is first treated by conventional means such as filtration, sedimentation, and chlorine treatment, followed by bioremediation.

- **Water resources**

- Basic need of life
- Most of the Indian agriculture is dependent on monsoons
- Local people have adopted traditional methods to conserve water

- **Traditional water-harvesting systems**

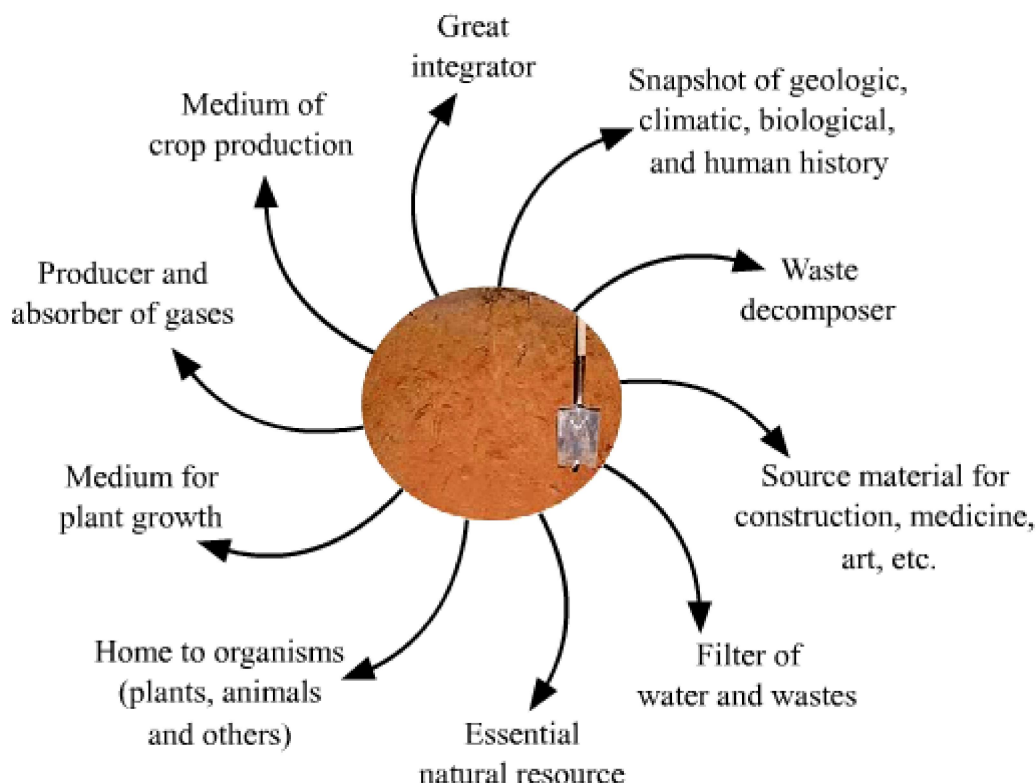
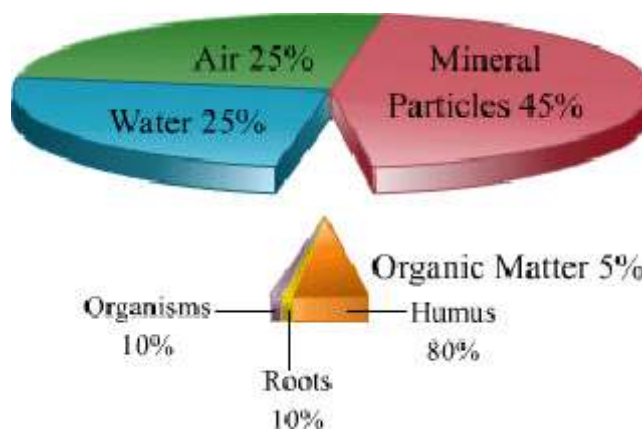
- Khadins and nadis in Rajasthan
- Bandharas and tals in Maharashtra
- Bundhis in Madhya Pradesh and Uttar Pradesh
- Ahars and Pynes in Bihar
- Kulhs in Himachal Pradesh
- Ponds in Jammu
- Eris in Tamil Nadu
- Surangamo in Kerala
- Kattas in Karnataka

- Traditional water-harvesting structures use crescent-shaped earthen embankments or low-strait check dams, built across seasonal flooded gullies, for storing monsoon water and allowing it to seep into the ground.
- After the arrival of Britishers, large dams and canal system were introduced for irrigation purposes.
- Although canal system has benefits, it causes inequitable distribution of resources.
- Major river-valley projects like Sardar Sarover Dam on Narmada has resulted in social crises due to relocation of large number of people and has also resulted in environmental degradation.
- Soil is a naturally occurring substance that is valuable in sustaining life on earth.
- **Humus** – It is a component of soil that is formed from the dead and decayed organic matter.



- **Weathering** – It is the process of formation of soil by breaking down of rocks. It occurs by the action of wind, water, and climate.
- **Soil profile** – It is a vertical section through various layers of soil. These various layers are known as horizons.
- There are four types of horizons.
  - **A-horizon or topsoil**– It is the top most soil, which is dark in colour and rich in humus. It is soft, porous, and has the ability to retain water.
  - **B-horizon** – It is the middle next layer of the soil profile. It has lesser humus and more minerals. The layer is harder and more compact.
  - **C-horizon** – It is the third layer made up of small lumps of rocks with cracks and crevices.
  - **Bedrock** – It is the lowermost hard layer and difficult to dig with a spade.
- Soil is the layer of earth that results from the degradation of the basement rock— also known as bedrock—due to certain physical, chemical and biological processes. The quality of a soil is influenced by the microscopic organisms found in it.

- **Components of soil:**
  - Small particles of rock
  - Humus
  - Microscopic life
  - Nutrients
- **Factors influencing formation of soil:**
- **Importance of soil:**



- **Soil Erosion** - The removal of the top layer of soil

- **Soil Pollution** - The introduction of the substances like toxic compounds, chemicals, salts, radioactive materials in the soil
- **Prevention of soil erosion:**
  - - Parent material
    - Climate
    - Topography
    - Organisms
    - Time
    - Afforestation
    - Terrace farming
    - Proper irrigation techniques
    - Construction of proper embankments
  - Rivers carry the soil during their course. When moving rapidly over the surface of the land, the rivers wash away the topsoil. This washing away of the valuable topsoil is called **erosion**.
  - Erosion occurs not only because of water but also by the action of wind and ice.
  - The cutting of trees and deforestation increases the rate of erosion

**Afforestation (planting of trees)** and prevention of the cutting of trees are two important measures to help control soil erosion.