# NATURAL RESOURCES

**CONTENTS**



The materials present in natural environment & useful to living organism are called natural resources.

Natural Resources can be classified into two groups.

- **Physical resources :** E.g, Air, water, soil, minerals, coal etc.
- **Biological resources :** E.g. Microorganisms, plants & animals.

## ➢ THE BREATH OF LIFE : AIR

Air is a mixture of gases which is odourless, tasteless & invisible. Air also holds water vapour & dust particles.

### ◈ Atmosphere :

The envelop of air that surrounds the earth is called Atmosphere.

**Role of atmosphere in climate control :**

Air is a bad conductor of heat. It act as a protective blanket for the living organisms to exist in the following way -

- Atmosphere prevent the sudden increase in temperature during the day hours. During night it slow down the escape of heat into the outer space. Thereby preventing excessive cooling during night.
- The ozone shield of atmosphere absorb most of the harmful UV radiations coming from the sun. The excessive heat & sun rays are reffected back into the outer space by dust particles.

### ◈ Movement of Air :

- Heating of air occur due to reradiation of solar radiations by the land & water bodies. In fact, when the solar radiation fall on the earth, some are absorbed & majority of these are reflected back or reradiated by the land & water bodies. These solar radiations heat up the atmosphere from below. As a result, convection currents are set up in the air. But since the land gets heated faster than the water, the air over land also gets heated faster than the air over water bodies. Hot air on land rises upwards thereby producing an area of the low air pressure. Air from region of high pressure will move towards this region of low pressure producing breez or wind.

### ◈ Rain :

- The air carrying water vapour also get heated. This hot air rises up in the atmosphere carrying water vapour with it. As the air rises. it expands & cool. This cooling cause the water vapour to condense in the form of tiny droplets. Suspended particles of dust & other materials act as nuclei to facilitate the process of condensation of water around them. A collection of tiny droplets of water appear in the form of 'clouds'. These droplets of water slowly grown bigger by the condensation of more water droplets.

  When the droplets have grown big & heavy they fall down in the form of 'rain'.

## AIR POLLUTION

- An undesirable change in the physical, chemical or biological characteristics of the air making it harmful for the living organisms (including man) is termed air pollution. Common pollutants of air are **particulate matter** and gaseous pollutants. Particulate matter is also called suspended particulate matter (SPM) because it remains suspended in air for a reasonable period of time. Common examples of SPM are dust, soot (unburnt, carbon, particles), smoke, flyash etc. **Gaseous pollutants** include carbon monoxide, excess of carbon dioxide, sulphur dioxide, oxides of nitrogen, hydrocarbons, chlorofluorocarbons (CFCs), hydrogen sulphide, methane and ammonia. Besides, asbestos dust, stone dust, cement dust, pollen grains of plants, radioactive rays etc. are other common air pollutants.

### ◈ Sources of Air Pollution :

**Some common harmful effects of air pollution are -**

- Respiratory problems, *e.g.*, sneezing, allergy, bronchitis, asthma,, tuberculosis and lung cancer.
- Carbon monoxide poisoning.
- Acid rain.
- Depletion of ozone layer.
- Global warming (green hourse effect).
- Serious ailments produced by certain metals and pesticides.
- Smog.

## WATER : A WONDER LIQUID

- Water is one of the basic necessities of life. It is an inexhaustible natural resource which is liquid between 0ºC and 100ºC. We need water for various activites such as drinking, cooking of food, bathing and washing. It is also needed for irrigation of crop in agriculature, as an essential requirement in industries, and for navigation.
  Water plays a vital role in the metabolic reactions taking place within the organism's body. It acts as a universal solvent, providing a medium for the chemical reactions to occur. In fact, all the chemical reactions that occur within body cells involve substances that are dissolved in water. Substances are also transported from one part of the body to the other in dissolved form.
  97.5% of the water on the planet earth is found in seas and oceans as saline water and is not available to us for use directly. Only 2.5% of the total water resources of the world consist of **fresh water**. Majority of it (about 2%) is found frozen in the ice-caps at the two poles and on snow-covered mountains. Remaining (0.6% of the total) is available to support terrestrial life. Majority (90%) of this fresh water is found underground as **ground water** and only 10% occurs as **surface water** in lakes, ponds, streams, rivers etc. Limited amount of fresh water is available to us as a renewable souce through water cycle but its distribution is uneven.

## WATER POLLUTION

- An undesirable change in the physical, biological or chemical qualities of water (due to addition of foreign organic, inorganic, biological or radioactive substances) that adversely affects the aquatic life, and make the water less fit or unfit for use, is called water pollution.
  Agents or substances that pollute the water are called **water pollutants**. These can be classified into three categories.
- **Physical pollutants :** These include heat and oil spills.
- **Chemical pollutants :** These include organic wastes, detergents, pesticides (e.g. DDT, BHC). polychlorionated biphenyls (PCBs), inorganic chemicals (*e.g.*, arsenic, cadmium mercury, lead, nickel, phosphates, nitrates, fluorides), and radioactive wastes. Common inorganic impurities in water are compounds of calcium and magnesium.
- **Biological pollutants :** These include pathogens such as viruses, bacteria, protozoa, helminthes, algae, fungi, etc.

**Main sources of water pollution are -**

- **Sewage :** It is the filthy matter carried in large underground drains called sewers. It is the main water pollutant in towns and cities. It mainly includes organic wastes.
- **Industrial wastes :** The industrial wastes contain large quantities of harmful chemicals including acids and alkalies that are discharged into water bodies. These include both organic and inorganic chemicals.
- **Synthetic soaps and detergents :** Water containing soaps and detergents is called gray water. These pollutants are discharged form houses and certain factories. Their excessive use during washing produces a lot of foam.

- **Fertilization and pesticides :** Fertilizers and pesticides are being used excessively in the fields to increase crop production. These are washed by rain water into water bodies and pollute them.
- **Petroleum oil :** Drilling and shipping operations are common in the oceans. Leakage of petroleum oil during such operations or due to accidents results in water pollution.
- **Heat** is another source of water pollutions as high temperature of water reduces its dissolved oxygen content.

## ➢ SOIL

The top surface layer of this exposed, solid part of crust containing weathered minerals and humus and capable of supporting plant growth is called soil.

### ◈ Soil Formation

The process of soil formation is so slow that the soil is regarded as a non-renewable resource.

- **Pedogenesis**

It is the process of formation of soil from rocky earth's crust. It involves following two processes:

- **Weathering**
- **Decomposition of organic matter and subsequent humification and mineralization.**

**Main factors that influence the formation of soil from the rocks are –**

- Temperature variations due to radiactions of the sun.
- Rain water
- Winds
- Living organisms

- **Weathering :**

It is the process of breaking down of rocks into small, fine mineral particles. It may occur due to physical, chemical or biological means.

- **Physical weathering :** It involves pulverisation of rocky matter caused by **physical** (climatic changes such as heating, cooling, wetting-drying, frost action) and **mechanical forces** (abrasion by rain and hail, rolling stones, wave action, wind action)

  **Sun :** Under the influence of solar radiations, the rocks heat up and expand. At night, these cool down and contract. Since all parts of the rocks do not expand and contract at the same rate, cracks appear in the rocks and ultimately the large rocks break up into smaller pieces.

  **Water :** Water infuences the formation of soil in two ways : -

  - It gets into the cracks in the rocks formed due to uneven heating of different parts of the rocks by the sun. On freezing, the water expands in rock crevices and breaks the rocks.
  - Flowing water wears away even hard rocks over long periods of time. Fast flowing water generally carries various-sized particles of rocks downstream. On the way, these moving rock particles rub against other rocks. The resultant abrasion forms still smaller particles. The water takes these particles of rocks and deposits them down its path. In this way, soil is found in places far away from its parent rock.

  **Wind :** Strong winds influence the formation of soil by continuosly rubbing against rocks and eroding them. These also carry sand from one place to other.

  - **Living organisms (biological weathering) :** Lichens, mosses (bryophytes) and other plants also influence the formation of soil. The lichens live on the rocks and produce acids. The latter corrode the surface of rocks to form thin layer of soil. Other small plants, *e.g.*, mosses later grow on such surfaces and cause the rocks to break up further. Roots of trees sometimes enter the cracks and provide anchorage. As the trees grow, roots also grow bigger and force of cracks to widen. The whole process of weatherning of rocks involving living organisms is called **biological weathering**.
  - **Chemical weathering** of rocks involves a number of chemical processes such as hydrolysis, hydration, oxidation and reduction. For instance, complex compounds present in the rocks are broken down by the action of carbonic acid present in water or by acidic substances derived from the decomposition of organic matter in soil. The end products of chemical weathering are silica, hydrated oxides, inorganic salts etc.

- **Decomposition of Organic Matter and Subsequent Humification and Mineralization :**

It involves stepwise degradation of organic materials by bacteria and fungi of decay and subsequent **humification** and **mineralization**. Dead remains of plants and animals are called **detritus**. The decomposition involves stepwise degradation of detritus. The process of decomposition of detritus is vital in any ecosystem because it involves release of the

nutrients from the dead organic matter. Without this process, all the nutrients would remain locked in the dead remains of plants and animals and will not be available for recreation of living matter.

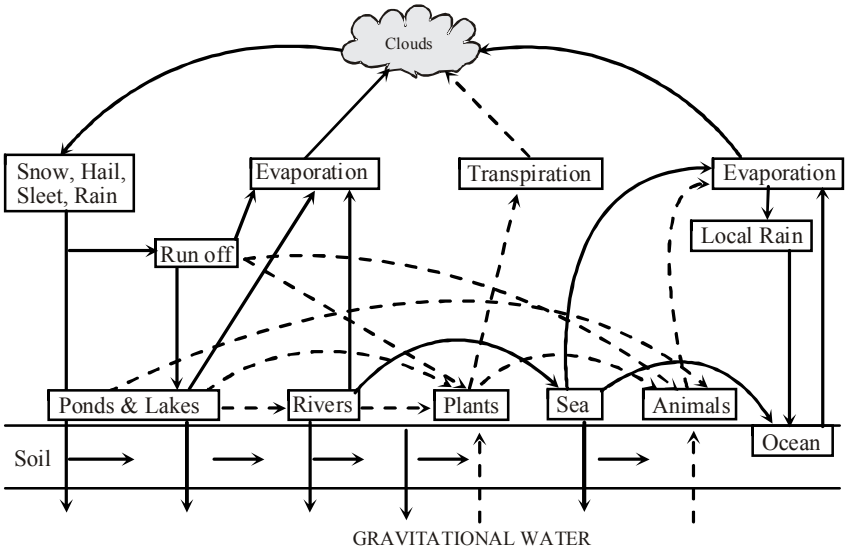
- **Humification :** It is the process by which simplified detritus (partially decomposed organic mater) gets converted into dark coloured amorphous substance called **humus** in the soil. Humus is the reservoir of nutrients.
- **Mineralization :** It is the process which results in the release of inorganic substances such as $CO_2$, $H_2O$ and nutrients (*e.g.*, $NH_4^+$, $Ca^{++}$, $Mg^{++}$, $K^+$ etc.) in the soil.

Humus binds the weathered rock particles into aggregate called **crumbs**. The latter absorb water and hold air in spaces.

Detritivores such as nematodes, earthworms, centipedes, millipedes, mites and ants consume organic matter and add excretory nitrogen to it. It is, thus, the final step in the formation of soil.

## ➢ BIOGEOCHEMICAL CYCLE

- Biogenic elements (macro-, micro- & other elements) flow from the environment into and out of the plant in a cyclic manner.
- This flow of nutrients from abiotic to biotic components of the ecosystem and vice-versa constitute the biogeochemical cycles.




**The Water Cycle**

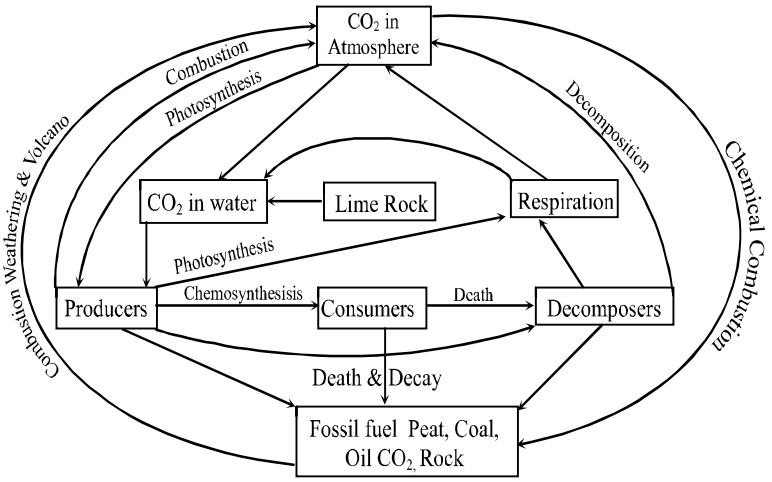
### Hydrological or Water Cycle :

**A Wonder Liquid -**

- Water on earth is cycled by two processes, **evaporation** and **precipitation**.
- The atmospheric precipitation occurs in the form of snow, hail or sleet etc. The run off water is finally collected in ocean through rivers.
- Some water remains solid in the form of snow which gradually melts and reaches the sea.
- Soil water is used by plants and most of it again reaches the atmosphere through transpiration.
- Animals consume water directly from water bodies & also the gravitational water.
- By evaporation, the water returns to atmosphere and cycle is repeated.

### Carbon Cycle :

- $CO_2$ is 0.03% in atmosphere, which is utilized by producers in photosynthesis for making food.
- From producers, it goes to consumers and then through decomposers into atmosphere.
- The producers, consumers & decomposers may be converted into fossil fuel (petrol, coal etc.) or form carbonate rock after death.
- By way of respiration the biotic component returns $CO_2$ to atmosphere.

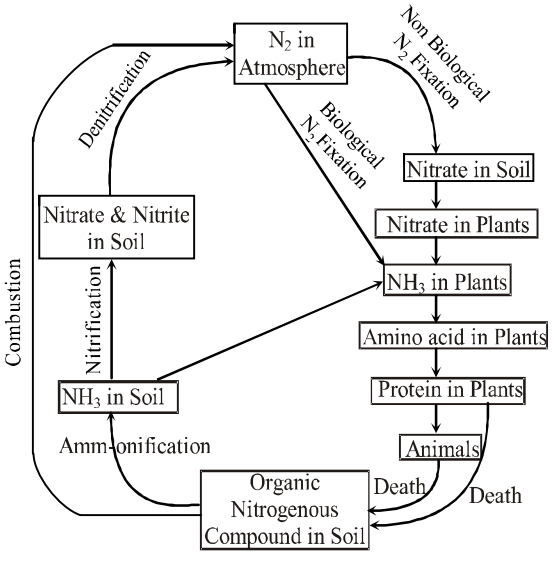



**The Carbon Cycle**

- $CO_2$ may get dissolved in water. The lime rocks also contribute to $CO_2$ in water. The aquatic producer use this $CO_2$ for photosynthesis and return it by respiration.
- By combustion of fossil fuel & also by volcanic activity, $CO_2$ is returned to the atmosphere.

**Nitrogen Cycle :**

- The atmosphere is the source of $N_2$ where it is about 79%. Plant cannot use $N_2$ directly.
- In living organisms nitrogen is important constituent of protein and nucleic acid.
- The $N_2$ cycle has five important steps –




**The Nitrogen Cycle**

**Nitrogen Fixation :**

- Conversion of $N_2$ gas into its compounds like nitrates & nitrites is called $N_2$ fixation. It is done either non-biologically by lightening or biologically by symbiotic or free- living bacteria. $O_2$ is harmful for $N_2$fixing bacteria.

**Assimilation of Nitrogen :**

- $N_2$ cannot be used by plants directly. They absorb it in the form of nitrate. Nitrate later on reduced to ammonia which provide amino ($–NH_2$) group. It is important part of proteins.

**Ammonification :**

- Dead plant & animal protein and their waste like urea & uric acid converted to ammonia by some ammonifying bacteria in soil. e.g. *Bacillus mycoides, B. vulgaris & B. ramosus* etc.

**Nitrification :**

- Ammonia is converted into nitrite by *Nitrosomonas* bacteria, and *Nitrobacter* convert nitrite into nitrate. This nitrate again can be absorbed by plant & thus cycled back.

**Denitrification :**

- Some denitrifying bacteria like *Pseudomonas* reduce nitrate into nitrogen gas in soil. This gas is again back to environment.