

❖ NATURAL RESOURCES:

A resource has been defined as :

Any means of attaining given ends. It can be also defined as a source of supply or support generally held in reserve.

A resource satisfies human wants. Water, air sun shine, land soil, forests, wildlife, fishes, minerals and power resources all are useful to man. All basic needs of food, shelter and clothing are supplied by natural resources on earth. The stocks of nature , useful to man kind are called natural resources.

Natural resources are the components of atmosphere, hydrosphere and lithosphere.

❖ TYPES OF NATURAL RESOURCES:-

On the basis of abundance and availability natural resources can be broadly classified into

a) ***Inexhaustible***. These are present in plenty and cannot be exhausted by man's consumption viz. air, sand, clay, water, solar radiation etc. Although air will never become limiting, its quality can be affected due to continuous increase in human population.

b) ***Exhaustible***. The stock of these resources in nature is limited. Exhaustible resources are further divided into:

(i) Renewable (ii) Non-renewable.

I) ***Renewable resources***. Are those which are being continuously consumed by man but renewed by nature e.g. water, wood, natural pastures , soil and living organisms, forests, wild life etc. The resources reappear by the quick replacement, recycling and reproduction in a particular time.

II) ***Non-renewable resources***. They are not renewable after use and are not replenished by nature e.g. fossil fuels minerals viz. copper, iron, etc. Fossil fuels include coal, petroleum etc.

❖ ATMOSPHERE :-

The Gaseous envelope surrounding the earth is called atmosphere.

In atmosphere, about 95% of the total air is present upto the height of about 20 Km above earth's surface. The remaining 5% is present upto about 280 Km height. The earth upto the height of about 300 Km above earth's surface is surrounded by air. Air is formed of a mixture of different gases in different proportions. These various gases are nitrogen (78.08%), oxygen (20.9486%) and carbon dioxide (0.0318%).

Air besides these gases also contains water vapours, industrial gases, dust smoke particles, microorganisms etc.

❖ ROLE OF ATMOSPHERE:-

1. Air functions as a medium for locomotion insects, birds etc.
2. Ozone layer of atmosphere protects the living organisms from harmful radiations of sun.
3. Air is the source of oxygen, carbon dioxide and nitrogen required for various metabolic activities of living beings.
4. It helps in dispersal of spores, pollen, seeds etc.
5. Air maintains temperature on earth required for life.

6. Air transmits sound for communication.
7. Ionosphere reflects the radio waves back to earth for long distance communication due to presence of ions and free electrons in this zone.
8. Burning of fire takes place in presence of oxygen.
9. Specific climatic conditions and water cycle is maintained due to circulation of air.

❖ **ROLE OF ATMOSPHERE IN CLIMATE CONTROL:-**

The air is a bad conductor of heat. The atmosphere (envelope of air that surrounds the earth) acts as a protective blanket for the living organisms to exist in the following ways:

- (i) It keeps the average temperature of the earth fairly steady during the day and even during the course of the whole year. The atmosphere does so by preventing the sudden increase in temperature during the day light hours. Further, during the night, it slows down the escape of heat into the outer space. In contrast, the situation on the moon is quite different which is about the same distance from the sun that the earth is. Moon has no atmosphere and the temperature on the surface of the moon ranges from -190°C to 110°C .
- (ii) The ozone shield (high concentration of ozone layer about 18-26 km above the surface of earth) of the atmosphere absorbs most of the harmful UV radiations coming from the sun. the excessive heat and rays are reflected back into the outer space by dust particles, water vapours, clouds etc. this results in the earth receiving just the right amount of heat and sun rays, it helps in climate control and allows the living organisms to survive.

❖ **WINDS:-**

Moving air is called wind. Movement of air (wind) occurs due to heating of air overland and oceans. Due to more movement of air, exchange of air takes place in between neighbouring places and condition of inversion does not develop. Therefore condition of silent air is necessary. Inversion for air occurs due to difference of thermal conditions over the land surface and upper layers of atmosphere.

Air circulation or movement also occurs due to pressure gradient at two different places. Air movement occurs from high pressure region to low pressure region. Difference of air pressure at two places takes place due to difference of temperature at both places.

Movement of air takes place by two ways:

- 1) Longitudinal movement of air (air currents) takes place from high pressure region towards region of low pressure.
- 2) Movement of air (wind) parallel to the surface of earth.

❖ **HOW ARE CLOUDS FORMED:-**

When water bodies are heated with solar radiations during the day, a large amount of water evaporates and goes into the air. Some amount of water vapour also goes into the atmosphere because of various biological activities such as transpiration by plants. The air carrying water vapours also gets heated. This hot air rises up carrying water vapours with it. As the air rises it expands and cools. This cooling causes the water vapour in the air to condense in the form of tiny droplets. Such process of condensation of water is facilitated when dust and other suspended

particles act as the 'nucleus' for these droplets to form around. And enormous collection of tiny droplets of water appears in the form of clouds. These droplets of water, once formed, slowly grow bigger by the condensation of more water droplets. When the droplets have grown big and heavy, they fall down in the form of rain. Occasionally when the temperature of air is very low, precipitation then may occur in the form of snow, sleet or hail.

❖ POLLUTION:-

Pollution is an undesirable change in physical, chemical or biological characteristics of environment-air, water and soil .this harmfully affect the life or create a potential health hazards to living organisms. Thus pollution is direct or indirect change in any component of biosphere (Earth along with the atmosphere that sustains life is called biosphere.) that is harmful to the living organisms including man. Pollutants are substances that cause pollution. Pollutants may be solid, liquid or gaseous substance present in such concentration that is harmful to the environment.

❖ KINDS OF POLLUTIONS:-

Pollutants are of two types:-

1) **Biodegradable pollutants.** Those pollutants which decompose rapidly under natural conditions, e.g., domestic wastes. Their accumulation creates problem, causes bad odour.

2) **Non-degradable pollutants.** Those materials that do not degrade or degrade very slowly in nature, e.g. aluminium cans, mercuric salts, glass pieces, D.D.T. etc. they are not cycled in nature.

❖ 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.

In simple words, addition of unwanted and harmful substances in the air or increase in the quantities of constants of air beyond the normal level that affects the living organisms is called air pollution. Agents or substances that pollute the air are called air pollutants.

❖ SOURCES OF AIR POLLUTION:-

There are two main sources of air pollution:

1) Natural sources

2) Man-made sources.

1) **Natural sources of air pollution:-** Number of natural sources do cause air pollution. For instance, volcanic eruptions release toxic gases, ash, and heat in enormous quantities which pollute the air ; electric storms and solar flares produce harmful chemicals in the atmosphere; forest fires release harmful gases; dust storms put dust particles in the air and pollute it; decay organic matter produces toxic ammonia gas which pollutes the air ; decay of vegetation matter in marshy places and in coal mines produces marsh gas (methane, CH₄) which is a natural air pollutant ; pollen grains, spores, cysts, bacteria are also natural pollutants of the air.

2) **Man-made sources of air pollution:-** Man has been polluting the air ever since he started using fire. Urbanization, industrialization and invention of automobiles as means of transport, all these have speeded up the pollution of air. Over –population, deforestation, mining activities, thermal power plants, nuclear explosions and explosives used in wars, and fireworks on festivals are

also contributing to air pollution. Major harm is being done by burning of fossil fuels (coal, natural gas, petroleum) in automobiles, industries and thermal power plants. Burning of wood, cattle dung cakes, coal and kerosene soil in residential premises also pollute the air.

❖ HARMFUL EFFECTS OF AIR POLLUTION:-

Air is needed for breathing by humans, other land animals and many aquatic organisms. Its pollution can, thus, affect human health as well as human wealth (domestic animals, crop plants, cultural assets etc.) some common harmful effects of air pollution are :-

1) **Respiratory Problems:-** Various pollutants of air such as sulphur dioxide (SO₂) and oxides of nitrogen (NO_x) are acidic harmful gases. When inhaled alongwith air, these affect the respiratory passage leading to breathing difficulties. These may cause bronchitis, asthma and lung cancer. Similarly, inhalation of polluted air containing dust, cement dust, asbestos dust, pollens etc. may cause sneezing and allergy. Continuous inhalation of these pollutants can cause asthma and tuberculosis (T.B).

2) **Carbon monoxide poisoning:-** Another toxic air pollutant is carbon monoxide (CO). It is emitted from motor vehicles as one of the exhaust gases, and also from cigarette smoke. It affects the central nervous system. If it is present in large quantities in the air, then the polluted air can lead to 'carbon monoxide poisoning'.

3) **Acid rain:-** It literally means that the rain water contains excessive amounts of acids. Acid rain increases the acidity of the soil, thereby affecting land plants and animals. It also increases acidity of the water in water bodies thereby affecting aquatic life. Acid rain also corrodes metals, painted surfaces, and slate, stone and marble. Our heritage monuments, buildings and statues are threatened by the corrosive action of acid rain.

4) **Depletion of ozone Layer:-** Ozone layer or ozonosphere lies about 18-29 km above in the atmosphere. It has high concentration of ozone and is commonly called the ozone shield. This layer absorbs UV radiations and hence protects the life on the earth from harmful effects of UV radiations. Ozone layer is being depleted by air pollutants. The causes of depletion of ozone shield and the effects of ozone depletion are discussed later in this chapter.

5) **Global Warming (Green House Effect):-** This global warming phenomenon occurs due to green house effect. Man is adding large amounts of 'green house gases', particularly carbon dioxide, methane and oxides of nitrogen to the atmosphere by burning of fossil fuels in homes, industries, transport vehicles; burning associated with agricultural practices as well as by deforestation. These green house gases trap the infra-red radiations reflected by the earth. This heats up the atmosphere.

❖ WATER:-

Water is renewable resource. Water is vital to life since for all physiological activities of plants and animals, it is essential. Water is mainly present in two forms, i.e.

- i) Surface water
- ii) Ground water.

❖ TYPES OF WATER RESOURCES:-

Water resources can be classified into two types i.e.

- i) Fresh water resources
- ii) Salt water resources.

FRESH water is obtained by following three types of natural resources:

- 1. Rain water
- 2. Surface water
- 3. Ground water

1) **Rain water.** India gets near about 3 trillion m³ of water from rainfall (or precipitation which amounts for 1405-117 cm. annually).

2) **Surface water.** India has plenty of rivers, lakes, streams, and ponds. In India, surface flow of water takes place through 14 major river systems like Ganga, Godavri, Bahmani, Cauvery, Brahmaputra etc.

3) **Ground water.** Water which percolates into the ground through air spaces of soil.

❖ IMPORTANCE OF WATER:-

The importance of water to the life of plants can be emphasized best by enlisting its functions:

- a) Water is the main constituent of protoplasm.
- b) It is the solvent through which mineral salts are transported from one part of the plant to the other.
- c) Various metabolic reactions take place in a medium containing water.
- d) It acts as a reactant in numerous metabolic reactions.
- e) During photosynthesis, water releases oxygen.
- f) Turgidity of the growing cells is maintained with water.
- g) Various movements of plant organs live movements insensitive plant (touch-me-not) are controlled by water.
- h) The growth of the cells during elongation phase is mainly dependent on absorption of water.
- i) Metabolic end product of respiration is water.
- j) It acts as a temperature buffer as its specific heat is highest (only exception-liquid ammonia).
- k) It shows the properties of cohesion and adhesion which account for the capillary action of water.

❖ WATER POLLUTION:-

An undesirable change in the physical, biological or chemical qualities of water (due to addition for foreign organic, inorganic, biological or radioactive substances) that adversely affects the aquatic life, and makes water less fit or unfit for use, is called water pollution.

Agents or substances that pollute the water are called water pollutants.

❖ SOURCES OF WATER POLLUTION:-

The main sources of water pollution are;

- 1) Sewage and other wastes
- 2) Industrial effluents
- 3) Agriculture discharges

4) Industrial wastes of chemical industries, thermal power plants and nuclear power plants.

1) **Sewage and other wastes:** Sewage is the waste water from homes, animal houses or food producing plants. Sewage includes human excreta, paper, cloth pieces, soap and detergents etc. wastes of rural areas, towns and cities are dumped into ponds, lakes, rivers etc. due to large amounts of dumped waste, water loses its self purifying ability and thus becomes unfit for human consumption. Decomposition of sewage etc. is an aerobic process. It needs more oxygen in water.

2) **Industrial effluents:** Effluents from breweries, tanneries, dyeing textiles, paper and pulp mills, sugar mills etc., contain a variety of inorganic and organic pollutants such as oils, greases, plastics, plasticizers, DDT, acids, alkalies, dyes etc., are flown into rivers. These cause water pollution.

3) **Agricultural discharges:** These include chemicals of fertilizers and pesticides. Fertilizers and pesticides are used to increase crop yield and to protect crop from pests. These chemicals with waste are washed off through rainfall, drainage and irrigation etc., and enter into lakes, rivers etc. these disturb the natural ecosystem. Fertilizers used on crop seep into ground water making it unfit for human consumption. Phosphate, nitrate fertilizers along with sewage make water bodies rich in nutrients and thus, they become more productive. Nitrates combine with hemoglobin which damage the respiratory and vascular systems, causing blue colour of skin and also develop cancer.

4) **Industrial wastes:** Heat and radioactive substances are the pollutants of thermal and nuclear plants. Nuclear power plants are located close to water bodies. Their waste water affects the aquatic life causing death.

5) **Heavy metals:** Mercury is a byproduct of vinyl chloride production used in chemical industries. Methyl mercury is highly toxic substance. Source of lead in water is due to effluents of lead and lead processing industries. Copper, cadmium and arsenic are also pollutant and toxic to humans. More fluoride in water causes stiff bone joints and bending of legs outwards.

❖ SOIL:-

The top surface layer of the exposed, solid part of crust capable of supporting plant growth is called soil. Over millions of years of long periods of time, the rocks at or near the surface of the earth are broken down by various physical, chemical and some biological processes to form fine soil particles. Soil is a dynamic layer in which many complex physical, chemical and biological activities are going on constantly. It is an important resource that decides the diversity of life in an area.

The soil is a complex mixture. It consists of five components:

- (i) Mineral matter =45%
- (ii) Organic matter =5%
- (iii) Water =25%
- (iv) Air =25%
- (v) Living organisms.

1. **The Sun.** The sun heats up rocks during the day so that they expand. At night, these rocks cool down and contract. Since all parts of the rock don't expand and contract at the same rate, this results in the formation of cracks and ultimately the huge rocks break up into smaller pieces.

2. **Water.** Water helps in the formation of soil in two ways. One, water could get into the cracks in the rocks formed due to uneven heating by the sun. If this water later freezes, it would cause the cracks to widen. This should too, flowing water wears away even hard rock over long periods of

tome. Fast flowing water often carries big and small particles of rock downstream. These rocks rub against other rocks and the resultant abrasion causes the rocks to wear down into smaller and smaller particles. The water then takes these particles along with it and deposits it further down its path. Soil is thus found in places far away from its parent-rock.

3. **Wind.** In a process similar to the way in which water rubs against rocks and wears them down, strong winds also erode rocks down. The wind also carries sand from one place to the other like water does.

4. **Living organisms also influence the formation of soil.** The lichen that we read about earlier also grows on the surface of rocks. While growing, they release certain substances that cause the rock surface to powder sown and form a thin layer of soil. Other small plants like moss are able to grow on this surface now and they cause the rock to break up further. The roots of big trees sometimes go into cracks in the rocks and as the roots grow bigger, the crack is forced bigger.

❖ SOIL EROSION:-

The removal and transportation of top layer of soil from its original position to another place with the help of certain agents such as strong winds and fast running rain water, is called soil erosion.

❖ CAUSES OF SOIL EROSION:-

1) **Strong winds.** Uncovered loose soil gets eroded when it is exposed to strong winds. The winds carry away the soul particles to other places.

2) **Heavy rains.** When rain falls on the unprotected top soil, rain water washes it down into the streams and rivers etc.

3) **Improper farming and suspended cultivation.** Improper tillage (farming) is another cause of soil erosion and so is the suspended cultivation. Farmers loosen the top soil of the agricultural fields either for cultivation or for removing the weeds. Sometimes due to certain reasons, these agricultural fields remain fallow (not cultivated) for a long time .top loosened soil of these agricultural fields, thus, becomes prone to erosion by winds or rains.

4) **Human actions.** Human activities such as expansion of urban areas have led to the removal of vegetation from certain regions. The bare land, thus, has been exposed to external agencies (winds or rains) for soil erosion.

5) **Dust storms.** Dust storms shift huge amounts of loose soil from one place to other.

6) **Frequent floods.** Frequent flooding of rivers is another cause of soil erosion .fast moving water in the rivers removes the top soil of the fields near the river banks and carries it away.

❖ EFFECTS OF SOIL EROSION:-

1) **Loss of fertility and desertification.** Soil erosion results in movement of fertile top soil from one region to another thus reducing this fertility. When the top fertile soil is constantly removed from a region, only infertile sub-soil is left behind .in such a soil, only sparse vegetation can grow. This way, soil erosion gradually turns lush green areas into deserts.

2) **Landslides in hilly areas.** Barren hills/hills with sparse vegetation are constantly exposed to heavy rain falls. This makes the top surface of Rocky Mountains or top soil of hills loose. Due to soil erosion, rock pieces of various sizes or loosen soil from hills suddenly slide down the steep slope mountains/hills. This is called landslide. If these rock pieces and soil block the narrow river bed, it results in floods in lower areas causing tremendous losses to life and property.

3) **Flash floods.** Vegetation on the hilly terrain absorbs lot of rain water and keeps the top soil intact. However barren hill/hills with sparse vegetation cannot absorb much rain water and thus can not keep the soil intact. So, heavy rains result in rapid movement of water resulting in flash floods in lower areas causing tremendous losses to life and property.

4) **Famines.** Continuous soil erosion from a region removes the fertile top soil and only infertile sub-soil is left behind. texture change of eroded soil reduces its water holding capacity. Crops, thus, can not grow in such infertile dry soil leading to shortage of food grains in the region. Ultimately, it can result in famine (excessive shortage of food).

5) **Silting of water reservoirs.** Top soil, when washed away by water, clogs drains, water channels, etc, by its deposition. It pollutes the water also. Problem of silting in water reservoirs lowers the water level in them and it ultimately leads to shortage of power production by the hydroelectric power stations.

❖ PREVENTION OF SOIL EROSION:-

1) **Intensive cropping.** It means growing of more crops in the same fields and not leaving them unused. If the fields remain covered with crops throughout the year, top soil will not be exposed to winds or rains. Thus, no soil erosion will occur.

2) **Sowing grasses and planting xerophytes.** Sowing grasses on barren soil or planting of xerophytes (plants that grow in dry conditions) will bind the loose soil. This will reduce soil erosion.

3) **Terrace farming.** In hilly regions, small fields are formed in the form of steps or terraces for cultivation of crops. Such farming in hilly regions is called terrace farming. This technique reduces the flow of rain water down the slopes of hills. Moreover, eroded soil from upper regions of hills gets deposited in lower terraces. In this way, soil erosion can be prevented in hilly regions.

4) **Proper drainage canals around the fields.** This method involves the removal of excess rain water through small drainage canals formed around the fields without causing much harm to main fields.

5) **Making strong embankments along the river banks.** This method involves the formation of strong embankments of stones, sand bags, etc. on both the sides of the rivers particularly in erosion prone areas. This will check soil erosion by the fast moving river water.

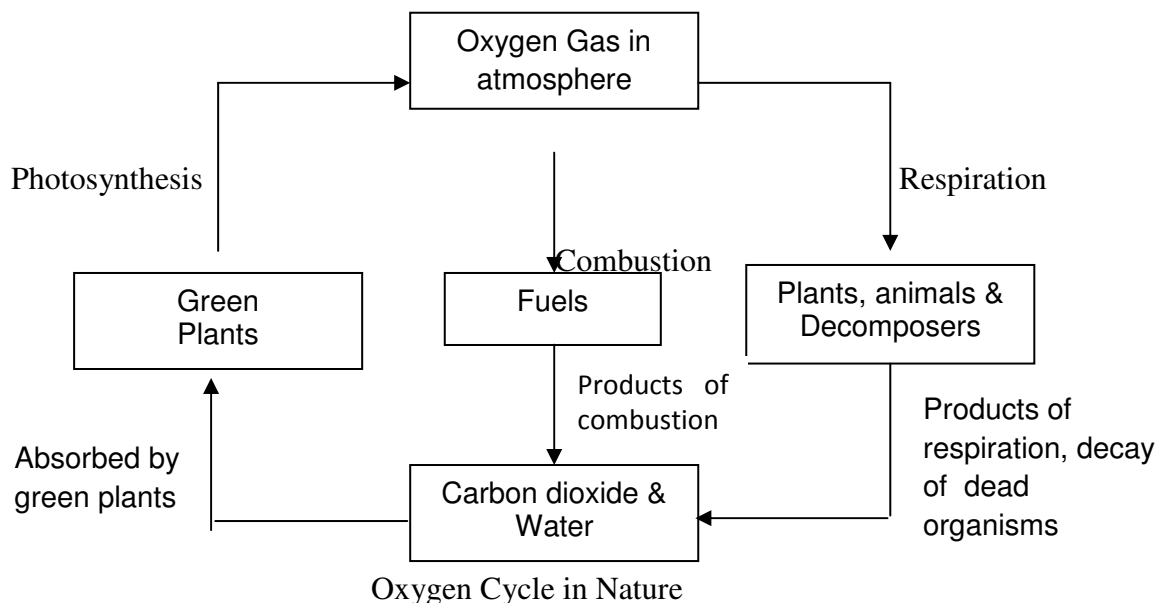
❖ BIOGEOCHEMICAL CYCLES:-

The movement of minerals occurs by the operation for different chemical cycles that keep on passing the materials from organisms to the environment and vice versa. Such a cyclic process, occurring in nature is called biogeochemical cycle.

OXYGEN CYCLE.

During the processes of respiration and combustion, oxygen reacts with carbon to form carbon dioxide gas. This gas is absorbed by green plants in the presence of sunlight. The photosynthesis takes place in the leaves of green plants with the formation of carbohydrates and oxygen. Thus, oxygen is liberated in atmosphere. In a way, oxygen cycles in nature through the agencies of respiration, combustion, and photosynthesis & hence its percentage in atmosphere air

remains constant. The combined process of respiration, combustion & photosynthesis due to which the amount of oxygen remains unaltered in atmospheric air is called oxygen cycle.

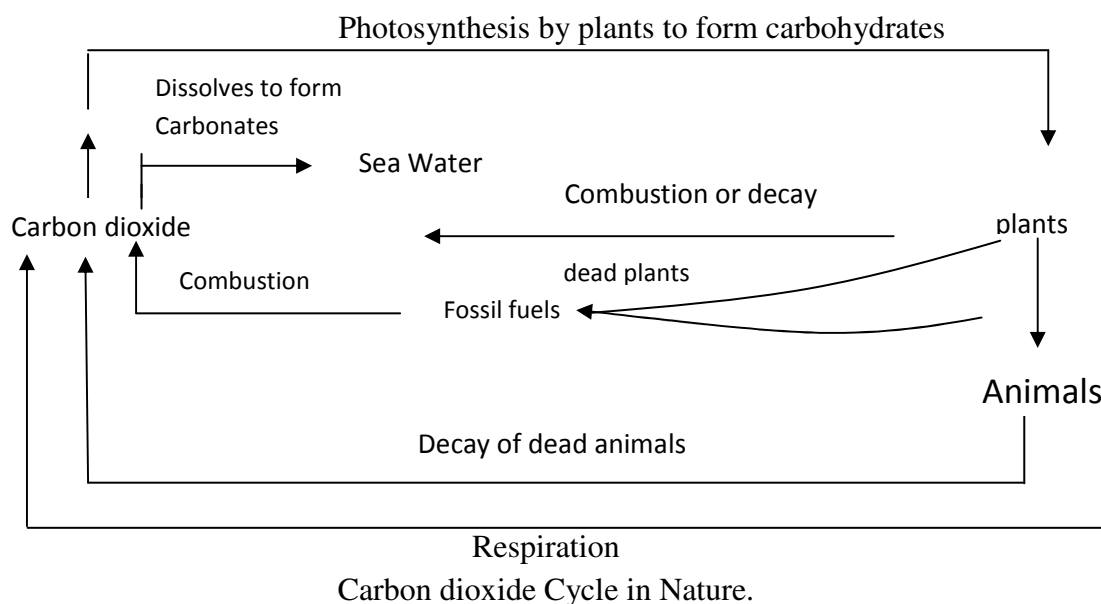


CARBON DIOXIDE CYCLE:-

Carbon dioxide gas is produced and added into the atmosphere by:

- Burning of fossil fuels.
- The respiration of plants & animals
- The decay of dead animals, plants or burning of dead plants

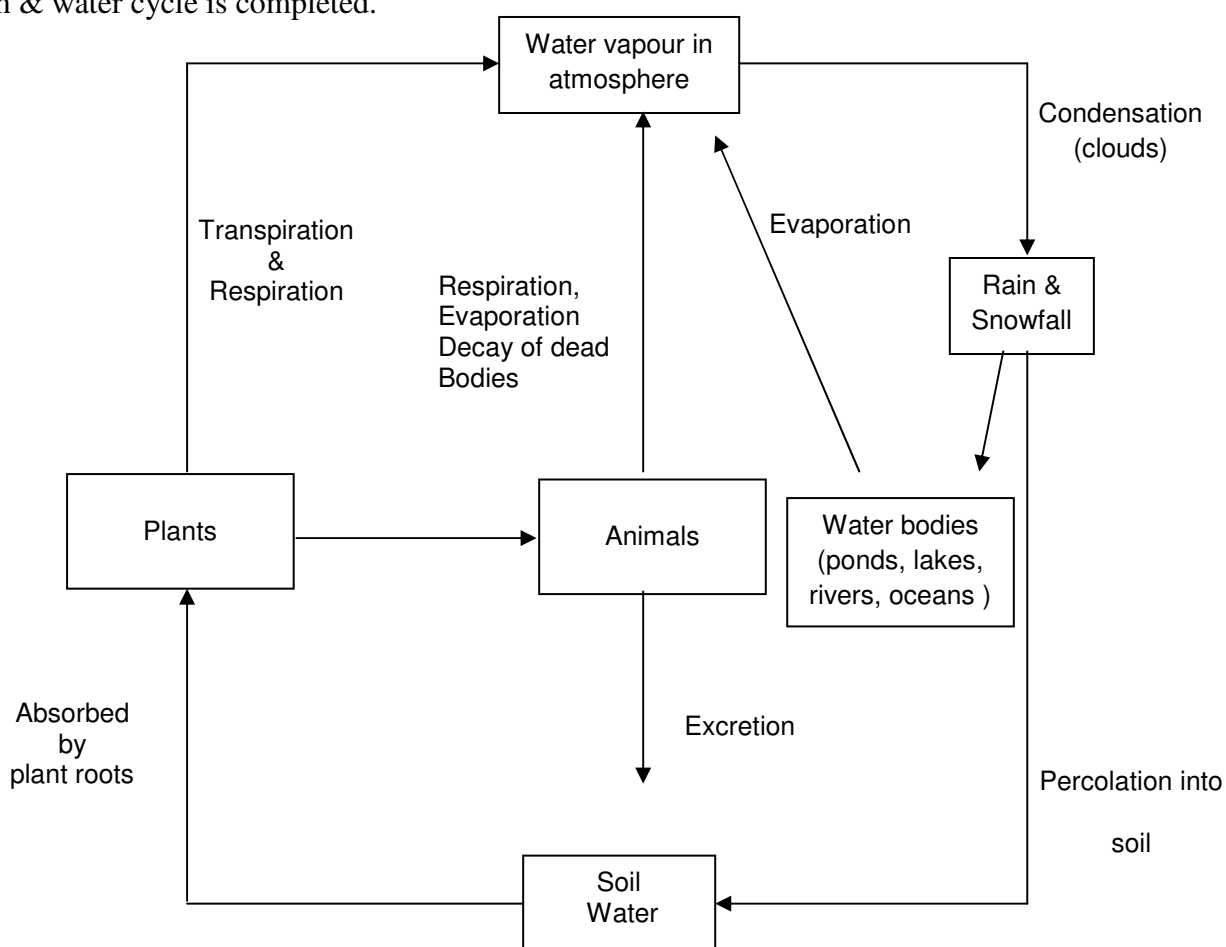
A large proportion of this carbon dioxide is re-absorbed by the plants during the process of photosynthesis when carbohydrates are formed with release of oxygen. Rest of carbon-dioxide is absorbed by sea water to form carbonates. Thus, the amount of carbon –dioxide, so formed, is almost equal to the amount of carbon dioxide consumed & hence, its concentration in air remains same.



WATER CYCLE:-

The water cycle in nature is also known as hydrological cycle. The various steps involved in the water cycle in the biosphere are :

1. When sun shines, then due to heat of the sun, water continuously evaporates from the water bodies on the earth & forms water vapour which being lighter than air rises up and goes into the atmosphere.
2. The plants continuously absorb water from the soil through their roots. Some of this water is utilized by the plants for photosynthesis. The excess water in the body of plants is added to the atmosphere in the form of water vapour from the leaves of plants through the process of transpiration. The water vapours produced also goes into the atmosphere. The respiration of living plants, decay of dead plants also produces water vapour, which also goes into the atmosphere.
3. As the water vapour rises up, it gets cooled. Finally, the water vapour condenses to form tiny droplets of water which float in the sky and form the clouds.
4. The tiny droplets of water in the cloud join together to form bigger drops of water which fall on the earth in the form of rain. The rain water passes into the water bodies & a part of it is absorbed by the soil & is retained as soil water. In this way water was taken from the earth, returns to the earth & water cycle is completed.



Water Cycle in Biosphere.

❖ NITROGEN CYCLE:-

Nitrogen is essential for the synthesis of proteins in plants and animals. Atmospheric air contains about 79 per cent nitrogen, but it is not of much use for plants and animals. Animals need nitrogen in the form of amino acids to form proteins, and plants in the form of soluble salts, nitrates for the synthesis of amino acids and proteins.

Nitrogen compounds from dead and organisms, animal excreta are broken down into ammonia by bacteria. These bacteria are chemosynthetic bacteria. Ammonia is converted into soluble ammonium compounds, which break down into NH_4 and NH_2 ions. Nitrifying bacteria (e.g., *Nitrosomonas*) convert ammonia into soluble nitrite in soil. Nitrobacteria convert nitrites into nitrates. These soluble nitrates dissolve in soil water and are absorbed by the roots of plants.

Nitrogen fixation in soil and plants provides nitrogen to the plants. All photosynthetic, chemosynthetic and heterotrophic micro-organisms help in the process of nitrogen fixation. Some bacteria live freely in the soil, some like *Rhizobium*, etc., are symbiotic live in the plants roots. These bacteria fix nitrogen into nitrates for the use of plants and bacteria on the other hand get food (carbohydrate) and O_2 .

❖ OZONE FORMATION:-

Ozone layer in the stratosphere protects humans from harmful effects of ultra-violet radiations (UVR) of sun. Ozone layer absorbs harmful radiations from the sun. Ozone is formed in the atmosphere by chemical reactions of certain pollutants like SO_2 , NO_2 , aldehydes on absorption of UV radiations.

An oxygen molecule (O_2) is ionized into two oxygen atoms.

$\text{O}_2 + \text{ionizing radiant energy} \rightarrow \text{O} + \text{O}$. If either of the atoms comes in contact with a unionized oxygen molecule, ozone O_3 is formed.

❖ OZONE DEPLETION:-

For sources of chemicals that may deplete ozone are: (i) fertilizers release nitrous oxides (N_2O). (ii) High flying air crafts release nitrogen and hydrogen molecules and disturb ozone. (iii) Release of chlorinated compounds and (iv) nuclear weapons.

CFCs enter stratosphere and remain there for years until they are converted to other products or are transported back to the atmosphere. They react with ozone and deplete it. This causes reduction of ozone layer.

❖ PROBABLE DAMAGES:-

Ozone layer absorbs UV light and thus protects life on earth from harmful effects of radiation. Increase in ozone concentration near earth's surface reduces crop yields. It has also adverse effects on human health.

Depletion of ozone would cause serious temperature changes on the earth. Life support systems would also get damaged. Reduction in ozone would also lead to rainfall failure on earth.

One percent reduction in ozone increases UV radiation on earth by 2%. Its best threat is cancer to mans. Hole in ozone layer causes cancer especially of skin. Further depletion in ozone layer would lead to more cancer cases, cateracts, destruction of aquatic life and vegetation and loss of immunity.