

Natural Resources

Life on there is dependent on the following factors: 1) Temperature 2) Water 3) Food

Basic requirement of life on earth is: 1) Resources of the Earth 2) Energy from Sun.

- **Lithosphere:** The outer crust of the earth is called Lithosphere.
- **Hydrosphere:** Earth has 75% water and underground water. These comprise the hydrosphere.
- **Atmosphere:** The blanket of air that covers the earth is called atmosphere.
- **Biosphere:** The zone of interaction between the lithosphere, hydrosphere and atmosphere is called as biosphere.

Air: Composition of air:-

- **Nitrogen** = 78%, **Oxygen** = 20%; **Carbon Dioxide and other gases** = 0.03%; **Argon** = 0.97%; **Water Vapour** = 1 %

Carbon Dioxide makes up **95 – 97%** of atmosphere on Venus and Mars.

How CO₂ is added to atmosphere: **1) Cellular Respiration:** Eukaryotic and Prokaryotic cells use oxygen to break glucose and get energy. This also releases CO₂ **2) Combustion:** Oxygen is used up and CO₂ is released while burning fuels etc.

How CO₂ is fixed in atmosphere: **1) Green plants** convert CO₂ into glucose in presence of sunlight in photosynthesis. They also release O₂

2) Many marine animals use carbonated dissolved in sea water to make their shells.

Atmosphere and Climate Control

- Air is an insulator of heat. It prevents sudden increase in temperature during day and also prevents escape of heat into space at night. Hence it maintains the average temperature of Earth steady over the day or year.
 - Since moon has not atmosphere its temperature ranges from -190°C – 110°C
- Winds are moving air. Winds are formed due to differential heating and cooling of land and water bodies. Water takes long to get heated and retains heat for longer than land. In coastal regions:-
 - **Land Breeze:** During the day, the land gets heated up faster than the sea. Hence the land is comparatively warmer than the sea. Because of this the air above the land rises up hence creating a low pressure region above land. Now cooler air from above the seas moves towards the land to fill up the low pressure region created.
 - **Sea Breeze:** During the night, land gets cooled down faster than the sea. Hence land is cooler than the sea. The warm air above the sea rises up and creates a low pressure region. Cooler air from the land moves towards the sea to fill this low pressure region.
 - Winds are affected by: **1) Uneven heating 2) Rotation of Earth 3) Mountains** in its path
 - **Rain:** When water bodies get heated a large amount of water evaporates and there is water vapour in air. Even biological processes like transpiration release water vapour into air. As air gets heated it rises up and also carries this water vapour up with it. When air rises it cools down and expands and also water vapour condenses to form water droplets. Dust particles in air act as a nucleus for these droplets to form around as clouds. When clouds grow big and heavy the water droplets fall to earth as rain and snow/hail if temp. is low.

Air Pollution: Addition of harmful substances into air

Causes:

Sources	Pollutants released
Burning of fossil fuels	Oxides of nitrogen and sulphur, unburnt carbon particles or suspended particles
Burning of wood, automobile exhaust	Carbon monoxide, smoke
Combustion	Carbon dioxide
Refrigerants (freon), aerosol sprays	Chlorofluorocarbons (CFCs)
Nuclear explosions, leakage of radioactive materials	Radioactive pollutants

Effects:

- 1) Fossil fuels have small amounts of Nitrogen and Sulphur. When they are burnt they release oxides of nitrogen and Sulphur. **These are dangerous if we inhale** them. When these oxides dissolve with rain water they form **acid rain**.
- 2) SPM that unburnt particles of carb or hydrocarbons are also released. In cold weather, SPM mixes with condensed water vapour and forms **smog** that reduces visibility.
- 3) Diseases like allergies, cancer and heart problems are caused
- 4) Global Warming
- 5) Ozone layer depletion.

Natural Resources

Water Distribution: 98% of water is saline. 2% is freshwater. Within this 2% , 79% is frozen in icecaps at poles and mountains. 20% is groundwater. Only 1% is accessible. Within this 1% there is 53% in lakes and rivers, 8% in atmosphere as water vapour, 38% in soil and 1% in living organisms.

Why water is important: **1)** All life processes in living organisms need water **2)** All reactions in most living cells takes place in water medium **3)** The reactions in living cells are b/w substances dissolved in water. **4)** Substances that are transported within are body are in dissolved form **5)** All terrestrial life forms need to maintain a certain level of water within their body to live.

Availability of water decides: 1) Number of individual species in an area 2) Diversity of life forms in that area

Water Pollution

Mercury salts are released by paper industries.

Causes:

1) Addition of fertilizers and pesticides from farms due to their excessive use get leached. **2)** Sewage from towns, cities etc. is dumped **3)** Harmful chemicals from factories **4)** Disease causing microorganisms **5)** Changes in the amount of oxygen dissolved in water **6)** Changes in the temperature of water.

Effects:

1) Change in temperature: Industries use water as coolant and then dispose the hot water back into the water bodies. Dams also bring about temp. change. The water stored in the reservoir would be colder than the water at the surface which gets heated by the Sun.

2) Eutrophication: When fertilizers and pesticides seep into water they cause Algal Bloom i.e. increase in algae. This excess algae causes the surface of the water to be covered. They consume and reduce the oxygen in water hence aquatic life languishes.

3) Spread of diseases like cholera dysentery etc.

4) The change in temp. affects aquatic life. Aquatic animals are used to a certain range of temp. when there is a sudden increase in temp. it is dangerous for them and their eggs or larvae.

5) Contaminated water seeps and mixes with groundwater. People consuming this will get kidney or liver problems.

Weathering: It is a process by which rocks get worn away or altered by long exposure to the atmosphere.

Soil: Soil is the outer crust of the earth that has a variety of nutrients that are used by different life forms. The rocks on or near the Earth surface are worn out and broken by the following factors:

1) The Sun: During day the rock expands due to Sun's heat. At night, it contracts. But all parts of the rock do not expand and contract at the same rate which leads to cracks and eventually the rock is broken into smaller pieces.

2) Water: 1) Water can get into the cracks on rocks and then if they freeze they will expand and widen the crack. 2) Fast flowing water wears away big rocks over long periods. They carry pieces of rocks with them and when these pieces rub against each other they become smaller and smaller. The water deposits these small particles far away from parent rock along their path.

3) Wind: Strong winds rub against rocks and erodes them. It also carries soil particles/ sand to other places.

4) Living organisms: 1) Lichen grow on rock surface. They release substance that cause rock surface to powder and form thin soil layer. 2) Other small plants like mosses, break the soil more. 3) The roots of big trees go into rock cracks and when the root grows bigger the crack widens.

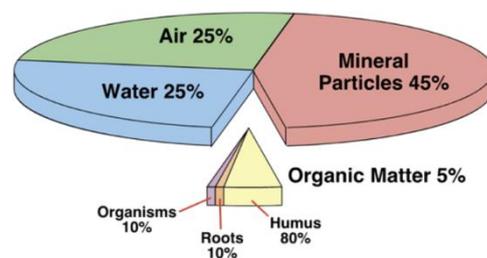
Factors that decide which plant will grow on the soil:

1) Amount of humus 2) Nutrient content 3) Depth of soil.

Humus: Bits of decayed living organisms is called humus.

Characteristics of soil:-

- **Type of soil:** Average size of particles.
- **Quality of soil:** Amount of humus and microorganisms in soil.
- **Soil structure:** Humus as it makes it porous and allows water and air to penetrate through soil
- **Soil nutrient value:** Parent rock.



Natural Resources

Topsoil: Topmost layer of soil which has humus and microorganisms and is suitable for plant growth.

Soil Pollution: Removal of useful substance and addition of harmful ones in soil.

Causes:

- Excessive use of fertilizers, pesticides etc.
- Garbage disposal in landfills.
- Improper irrigation methods
- Acid Rain affects soil over time.
- Industrial Wastes.

Effects:

- Reduces fertility of soil
- Kills microorganisms living in soil.
- Kills organisms like earthworms: Aerate soil and create humus.

Soil Erosion: Carrying away of soil particles from one place to another by flowing wind or water. It is caused mainly by deforestation. Soil erosion is fast in hilly and mountainous regions.

Prevent soil erosion: Increase vegetative cover/Afforestation, Terrace farming, Creating bund walls or retaining walls near rivers.

Biochemical Cycles

There is constant interaction b/w biotic and abiotic components of biosphere that makes it dynamic but stable. These interactions consist of transfer of matter and energy and are called BGC cycles.

Water Cycle: Process in which water evaporates and falls back to land in the form of rain and reaches seas via rivers.

- 1) Evaporation:** Waterbodies heated → Water vapour and rises
- 2) Condensation:** Water vapour condenses → Water droplets → Clouds
- 3) Precipitation:** Clouds → Rain or Hail etc.
- 4) Surface Runoff:** Rainwater replenishes rivers, lakes, oceans etc. The process in which the rainwater flows over land before entering water bodies is called Surface Runoff.
- 5) Infiltration:** Some of the rainwater seeps into soil and becomes a part of groundwater. This groundwater may come to the surface in places like springs etc. or we bring it to the surface using wells or tube wells

Another aspect of what happens to water other than above processes: During surface runoff the water flows over rocks that contain soluble minerals. Water dissolves some of these minerals and hence carry these nutrients to the sea. These are used by marine organisms.

Nitrogen Cycle

How Nitrogen is important for us: **1)** Major component of biological molecules like proteins, nucleic acids (DNA and RNA), vitamins and hormones. **2)** Major component of compounds like urea and alkaloids.

1) Nitrogen Fixation: Conversion of atmospheric nitrogen into nitrates (NO_3^-) and nitrites (NO_2^-) which can be used by organisms.

Why Nitrogen Fixation: Nitrogen is 78% of air and is the element form of N_2 molecule. Even water has nitrogen. Plants can't use the elemental form of nitrogen. This atmospheric nitrogen must be converted into NO_3^- / NO_2^- for their consumption.

Types of Nitrogen Fixation

Biological Fixation: Certain forms of bacteria are able to convert atmospheric nitrogen into nitrates and NO_2^- . These bacteria can be free living like *Azobactor* or symbiotically associated with the roots of dicot plants. Nitrogen fixing bacteria like *Rhizobium* are found in root structures called root nodules of legumes.

Physical Fixation: During lightning and thunder, the high pressure and temp. in air convert nitrogen into oxides of nitrogen. These oxides dissolve in water to give nitric and nitrous acids and fall on land with rain and are utilized by plants.

Industrial Fixation: Industrial chemical processes for production of fertilizers also add nitrates and NO_2^- to soil.

2) Assimilation: Plants take up the NO_3^- and NO_2^- convert them into amino acids to make proteins and other organic compounds. Animals eat plants and get the protein and other complex organic compounds.

3) Ammonification: Once the animal or plant dies other bacteria like *putrifying bacteria* and also *fungi* act on it, decay it and convert them into ammonia. Therefore it is the process of converting complex organic compounds like proteins into ammonia.

4) Nitrification: Process of conversion of ammonia into NO_3^- and NO_2^- is called Nitrification.

Nitrification has 2 steps: $\text{NH}_3 \rightarrow \text{NO}_2^-$ (*Nitrosomonas*) and $\text{NO}_2^- \rightarrow \text{NO}_3^-$ (*Nitrobacter*)

Natural Resources

5) Denitrification: The process of conversion of nitrate salts present in the soil and water to free nitrogen gas by *Pseudomonas*.

Carbon Cycle

How carbon is present on Earth: ♦ Elemental form in graphite and diamond. ♦ Combined form in atmosphere as CO₂ and as carbonates and hydrogen-carbonates in minerals.

Why carbon is important to us: ♦ Integral part of organic compounds in protoplasm like proteins, carbohydrates, fats, nucleic acids and vitamins. ♦ Endoskeleton and exoskeleton of various animals is made from carbonate salts.

- 1) Through photosynthesis plants take CO₂ and H₂O and with the presence of sunlight convert it into glucose
- 2) Animals consume plants and get the glucose stored in them. In respiration glucose is utilized to provide energy in the presence/absence of oxygen. Respiration releases CO₂ back to the atmosphere.
- 3) When these plants and animals die CO₂ is again released back to the atmosphere during decomposition.
- 4) Sometimes the dead plants and animals are deposited and form fossil fuels like coal and petroleum.
- 5) Carbon is also in water in the form of dissolved carbonates. These carbonates form limestone.
- 6) Aquatic animals also use the carbonates in water to make their shell in the form of inorganic carbonates.

Other process through which carbon is added to atmosphere: ♦ Volcanic Eruption ♦ Erosion of rocks containing carbonates by living organisms and roots ♦ Carbon in rocks and underground deposits is released to atmosphere slowly.

Greenhouse Effect

- Greenhouses are glass enclosures used in places having low temperature to grow plants. The glass walls trap the sun's heat and allow the plants to grow.
- Greenhouse Effect is an atmospheric phenomenon in which some gases like methane, CFCs, CO₂ etc. prevent the escape of heat from Earth. Increase in the percent of such gases would cause increase in temperature of earth.
- Since CO₂ is a greenhouse gas, an increase in CO₂ means that the more heat will be trapped in earth and will lead to a phenomenon known as global warming i.e. increase in temp. of earth.

Oxygen Cycle

How oxygen is present on earth: ♦ **Elemental form:** Oxygen in atmosphere ♦ **Combined form:** CO₂ in air; In the crust as oxides of metals and silicon and carbonate, nitrate, sulphate.

Why it is important: ♦ It is part of biological molecules like carbohydrates, protein, nucleic acids and fats/lipids.

How oxygen from atmosphere is used: 1) Combustion 2) Respiration 3) Formation of oxides of nitrogen.

How oxygen is returned to atmosphere: Photosynthesis

Some life forms known as **anaerobic organism** are poisoned by elemental oxygen. Nitrogen fixation by bacteria doesn't take place if there is oxygen.

Ozone Layer: High above in the atmosphere a layer of ozone is found. Ozone is poisonous therefore we are lucky it is not stable near earth's surface.

The ozone layer is 1-3 mm thick but it absorbs harmful UV radiations of the Sun and prevents it from reaching earth.

Formation of Ozone

O₃ is highly unstable. It is constantly being destroyed and formed again. When UV rays strike O₃ it dissociates into O₂ + O. The single oxygen atom combines with atmospheric oxygen O₂ to form O₃ again. Sometimes the oxygen atoms may combine to form atmospheric O₂.

Ozone Depletion: Various manmade compounds like CFCs. CFCs are very stable and are not degraded by biological processes. When they reach the stratosphere the UV rays disintegrate them and free chlorine is released. The following reaction takes place: $Cl + O_3 \rightarrow ClO + O_2$. The resultant

Natural Resources

Chlorine oxide reacts with oxygen atom which is produced during the natural destruction and replenishment of ozone layer. $\text{ClO} + \text{O} \rightarrow \text{Cl} + \text{O}_2$. The chlorine produced here again reacts with ozone and these reactions continue. This shows that the ozone is depleted. This creates an ozone hole.

Tips while learning the chapter:-

1. Learn the flowcharts provided in the textbook thoroughly.
2. Include flowcharts in answers according to the marks.
3. Learn the types of Nitrogen Fixation properly.
4. Learn the causes and effects of different types of pollution especially air and water pollution.
5. Study the process of Ozone depletion in detail as given in this study material.

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