Chapter 14 - Natural Resources

Materials provided by nature on earth which can be used by living organisms are termed to be natural resources. These are the land, the water and the air. The solid outermost layer of the earth's crust is called the lithosphere. The water that is found on the earth's surface, as groundwater, is called the hydrosphere. The air that covers the whole of the Earth like a blanket is called the atmosphere. The region on earth comprising of both biotic and abiotic components is called as biosphere.

The Breath of life: Air

Air is a mixture of gases like nitrogen, oxygen, carbon dioxide and water vapour. Nitrogen is used to produce a number of organic molecules like proteins. Nitrogen is fixed in plants and is transferred to animals through food chain. Oxygen is used by plants and animals in the process of respiration. The combustion of fossil fuels also requires oxygen. Carbon dioxide is used by plants in the process of photosynthesis. Many marine animals use carbonates dissolved in sea water to make their shells.

The role of the atmosphere in climate control

The atmosphere keeps the average temperature of the Earth fairly steady during the day and even during the course of the whole year. The atmosphere prevents the sudden increase in temperature during the daylight hours. It slows down the escape of heat into outer space during the night.

The movement of air: winds

In coastal regions during the day the air above the land gets heated faster and starts rising. As this air rises, a region of low pressure is created and air over the sea moves into this area of low pressure. The movement of air from one to other creates winds. During the day the direction of the wind would be from the sea to the land. During night, since soil cools faster than water, the air above the land is cooler than the air above the sea. Now, the air moving from the high pressure area over land to the low pressure area over the sea creates land breeze.

Rain

Water bodies get heated during the day and evaporate into the air. As the vapour rises, it cools. This causes the vapour to condense into tiny water droplets, which fall down as rain by the process of precipitation. Rainfall patterns are decided by the prevailing wind patterns.

Air pollution

The contamination of air with chemicals, smoke, dust particles and disease-causing agents is called air pollution. When fossil fuels are burnt they produce different oxides of nitrogen and sulphur that dissolve in rain to give rise to acid rain. The combustion of fossil fuels also increases the amount of hydrocarbons. Presence of high level of pollutants causes visibility to be lowered.

Regularly breathing air that contains any of these substances increases the incidence of allergies, cancer and heart diseases.

Water: A wonder liquid

Water is found on the Earth's surface, under the ground and in the atmosphere as water vapour. Maximum amount of water available is marine water which is salty. Most of the fresh water available on the earth is in the form of frozen ice. Water is essential for the survival of plants and animals, as cellular processes take place in a water medium. Substances are transported from one part of the body to the other in a dissolved form. Hence, organisms need to maintain the level of water bodies in order to stay alive.

The availability of water decides not only the number of individuals of each species that are able to survive in a particular are, but it also decides the diversity of life there.

Water pollution

The addition of undesirable substances to water bodies is called water pollution. Undesirable substances could be the fertilizers, pesticides, sewage, chemicals and detergents. Increase in water temperature due to pollutants decreases the amount of dissolved oxygen. Dissolved oxygen is the source of oxygen for aquatic organisms. Reduction of dissolved oxygen results in the death of many aquatic organisms.

Mineral riches in the soil

Soil is another important natural resource that supports life. Soil contains soil particles, humus and living organisms. It also contains some amount of water in the form of droplets or air in between the soil particles. The sun, water, wind and living organisms form the soil. Uneven contraction and expansion of rocks, cracks and breaks them into smaller particles of soil. Frozen water logged in the cracks of rocks, cracks and breaks the rocks into soil. Lichens growing on the surface of rocks release chemicals which powder the rocks into soil. Flowing water in rivers breaks hard rocks into soil particles. Strong winds erode rocks and carry sand particles.

Soil contains bits of decayed living organisms which is called humus. It is a major factor in deciding the soil structure because it causes the soil become more porous and allows water and air to penetrate deep underground. The topmost layer of the soil that contains humus and living organisms in addition to the soil particles is called the topsoil.

Soil pollution

The addition of substances that adversely affect soil fertility is called soil pollution. Use of fertilizers killed lot of useful microorganisms and reduced soil fertility. Deforestation has lead to erosion of topmost fertile layer of the soil. Overgrazing by animals also led to the soil erosion. Fine particles of soil are also carried away by wind and water.

Biogeochemical cycles

The cycling of chemicals between the biological and the geological world is called biogeochemical cycle.

Water cycle

The whole process in which water evaporates and falls on the land as rain and later flows back into the sea via rivers is known as the water cycle. Water is capable of dissolving a large number of substances. As water flows through or over rocks containing soluble minerals some of them get dissolved in the water. Thus rivers carry many nutrients from the land to the sea, and these are used by the marine organisms.

The nitrogen cycle

The nitrogen cycle is the process by which nitrogen is converted between its various chemical forms. This transformation can be carried out through both biological and physical processes. Important processes in the nitrogen cycle include fixation, ammonification, nitrification, and denitrification. Nitrogen makes up 78 percent of the earth's atmosphere. The percentage of nitrogen in the atmosphere is maintained by nitrogen cycle.

Plants and animals cannot utilize atmospheric nitrogen readily. It has to be fixed by some organisms called as nitrogen fixers. Nitrogen-fixing bacteria like Rhizobium live in symbiotic association in the root nodules of certain leguminous plants. These bacteria convert atmospheric nitrogen into ammonia, which is utilized readily by plants. Nitrogen-fixing bacteria along with free living bacteria in the soil achieve 90 percent of nitrogen fixation. During lightening, the high temperatures and pressures created in the air convert nitrogen into oxides of nitrogen. These oxides dissolve in water to give nitric and nitrous acids and fall on land along with rain. Plants convert these nitrates and nitrites into amino acids. Ammonification is the process by which soil bacteria decompose dead organic matter and release ammonia into the soil. Nitrification is the process by which ammonia is converted into nitrites and nitrates. Denitrification is the process by which nitrates are converted into atmospheric nitrogen.

The carbon cycle

Carbon occurs in the elemental form as diamonds and graphite. The carbon cycle starts in plants. Plants use carbon dioxide in the atmosphere to synthesize glucose in the presence of sunlight by the process of photosynthesis. Living things break these glucose molecules to produce energy and release carbon dioxide through respiration. Burning of fuels for various needs like heating, cooking, transportation and industrial processes adds carbon dioxide to the atmosphere.

The green house effect

Some gases prevent the escape of heat from the earth. An increase in the percentage of such gases in the atmosphere would cause the average temperatures to increase worldwide and this is

called the green house effect. CO_2 is one of the green house gases. An increase in the CO_2 content in the atmosphere would cause more heat to be retained by the atmosphere and lead to global warming.

The oxygen cycle

Oxygen from the atmosphere is used up in three processes, namely combustion, respiration and in the formation of oxides of nitrogen. Oxygen is returned to the atmosphere in only one major process that is photosynthesis.

Ozone layer

The ozone layer is present in stratosphere, one of the layers of the atmosphere. Each molecule of ozone is made up of three oxygen atoms. It is poisonous but it prevents harmful radiations from reaching the earth's surface, where they may damage many life forms. Chlorofluorocarbon compounds (CFCs) results in the depletion of ozone layer.