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Climate Change - Global Warming

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The Oxford Learner's Dictionary defines climate as the consistent weather conditions in a specific location. These weather conditions may be categorized as mild, temperate, warm, or wet based on either the season or location. However, definitive proof indicates a shift from the usual weather patterns to a more damaging and detrimental trend, as climate change is now understood to have a harmful impact on the environment and ecosystems, living and non-living.

Climate change causes changes in weather temperature, rainfall pattern, landslides, cloudburst, thunderstorm, etc. and all these factors are visible and causing damage to lives and major shifts on weather pattern in earth. Climate change is a burning issue of recent origin which may be catastrophic for living kingdom. Green house gases (GHG) play an important role on climate change of earth. These include water vapours, carbon dioxide, methane, nitrous oxide and ozone. When sunlight reaches the surface of the earth, some amounts are absorbed and warm the earth. In the turn, the earth emits long wave radiation towards the atmosphere, fraction of which is absorbed by the green house gases. The green house gases then emits long wave radiation both towards space and back to the earth. The energy emitted downward further warm the surface of the earth. The process of absorbing long wave radiation by the earth is called as green house effect. When the concentration of green house gases in the atmosphere increases, temperature at the earth's surface is also expected to increase. During last century, an increase in the temperature of 0.8^0C has been observed. Climate models developed during 90's have been shown that air temperature of global surface may increase by 1.4^0-5.8^0C at the end of century.

Carbon dioxide (CO_2) is one of the main abundant green house gases and primary agent of global warming that leads to climate change. It constitutes 72% of the total anthropogenic green house gases. It has been reported that the amount of carbon dioxide in the atmosphere has increased from 280 ppm during the pre-industrial era (1750) to 379 ppm in 2005, and increasing by 1.5 ppm every year. Dramatic rise in carbon dioxide concentration is attributed largely to human activities. Over the last 20 years, majority of the emission is due to burning of fossil fuel, while 10-30% is attributed to land use change and deforestation. Increase in carbon dioxide concentration, along with other green house gases, raised concerns over global warming and climate change.

The natural Greenhouse effect is essential as many of the gases enable life by trapping heat, preventing it from escaping into space and keeping the Earth's average temperature higher. Yet, with the intensification of the greenhouse effect, an excess amount of heat is being retained, causing Earth to become increasingly inhospitable for humans, plants, and animals. Therefore, it can be deduced that global warming is primarily caused by the capacity of greenhouse gases to trap sunlight. While not the most powerful, carbon dioxide (CO2) is the most important greenhouse gas. As shown in Figure 1, it is emitted into the air through animal breathing and the combustion or decomposition of wood and fossil fuels. When trees are cut down for building purposes, the carbon remains trapped in the wood even after it has died. However, if the wood is burned or rots, the carbon stored in the wood is released back into the atmosphere as CO2.

Trees act as a sink for carbon dioxide by fixing carbon during photosynthesis and storing excess carbon as biomass. The net long term carbon dioxide source/sink dynamics of forests change through time as trees grow, die and decay. In addition, human influences on forests can further affect carbon dioxide source/sink dynamics of forests through such factors as fossil fuel emissions and harvesting/utilization of biomass. As the tree biomass experience growth, the carbon held by the plant also increases. The rate of carbon storage increases in young stands, but then declines as the stand ages.

Carbon sequestration is the process of removing carbon from the atmosphere and depositing it in a reservoir. When carried out deliberately, this may also be referred to as carbon dioxide removal, which is a form of geo-engineering. The term carbon sequestration may also be used to refer to the process of carbon capture and storage, where carbon dioxide is removed from the flue gases, such as on power stations, before being stored in underground reservoirs. The term may also refer to natural biogeochemical cycling of carbon between the atmosphere and reservoirs, such as chemical weathering of rocks. Carbon sequestration describes long-term storage of carbon dioxide or other forms of carbon to either mitigate or defer global warming. It has been proposed as a way to slow down the atmospheric and marine accumulation of green house gases, which are released by burning fossil fuels.

Carbon dioxide is naturally captured from the atmosphere through biological, chemical or physical processes. Some anthropogenic sequestration techniques exploit these natural processes, while some use entirely artificial processes.

Carbon sequestration in the agriculture sector refers to the capacity of agricultural lands and forests to remove carbon dioxide from the atmosphere. Carbon dioxide is absorbed by trees, plants and crops through photosynthesis and stored as carbon in biomass in tree trunks, branches, foliage, roots and

soils. Forests and stable grass land are referred as carbon sinks because they can store large amounts of carbon in their vegetation and root systems for long periods of time. Soils are the largest terrestrial sink for carbon on the planet. The ability of agricultural lands to store or sequester carbon depends on several factors, including climate, soil type, type of crop or vegetation cover and management practices. The amount of carbon stored in soil organic matter is influenced by the addition of carbon from dead plant material and carbon losses from respiration, the decomposition process and both natural and human disturbance of the soil**.**

Climate change may have beneficial as well as detrimental consequences for agriculture. Some research indicates that warmer temperature lengthen growing season and increased carbon dioxide in the air results in higher yields for some crops. A warming climate and decreasing soil moisture can also affect in production patterns and an increasing need for irrigation. Changes, however, will likely vary significantly by region. Geography will play a larger role for benefit from climate change. Benefits to agriculture might be offset by an increased likelihood of heat waves, drought, severe thunderstorms and tornadoes.

Forest ecosystem plays a very important role in the global carbon cycle. It stores about 80% of all above ground and 40% of all below ground terrestrial organic carbon. During productive season, carbon dioxide from the atmosphere is taken up by vegetation stored as plant biomass. For this reason, the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol recognized the role of forests in carbon sequestration. Specially, the Kyoto Protocol pointed out forests as potential carbon storage. Disturbances in the forest due to natural and human influences lead to more carbon release into the atmosphere than the amount used by vegetation during photosynthesis. Sustainable management strategies are, therefore, necessary to make the forest a carbon sink rather than source. However, the state of tropical forests continues to deteriorate. Land conversion is the main reason for 93.4% of the annual net forest loss, while conversion to plantation forest explains the remaining 6.6%. Land conversion resulted from forest mismanagement, such as illegal forest practices and lack of sound policies and regulations for sustainable forestry. It has been suggested that the concentration of green house gases like carbon dioxide in the atmosphere can be controlled by planting suitable tree species having higher growth rate and carbon sequestration potential on wastelands and degraded lands. This will definitely minimize climate change-global warming and save our environment.

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