ISBN: 978-93-90847-55-6

11. Climate Changes

Preeti Mehta

Department of Microbiology,
Govt. Nagarjuna P G College of Science,
Raipur (C.G.).

Sadhana Jaiswal

Department of Microbiology,
Govt. Nagarjuna P G College of Science,
Raipur (C.G.).

Deepali Rajwade

Department of Biotechnology,
Govt. Nagarjuna P G College of Science,
Raipur (C.G.).

Abstract:

Climate change refers to long-time period changes in environmental issue consisting of temperature, precipitation, wind styles, and other weather indicators that stand up over several years or greater. It has intense consequences on our health, meals production, housing, security, and jobs. Increasing sea degree and saltwater intrusion have caused entire cities emigrate, and persistent droughts are setting human's lives in threat. The climate change is laid low with natural in addition to human activity. Foremost natural variables which reasons the climate alternate are volcanic pastime and sun output. Climate change is predominantly as a result of human activity. The predominant cause pressure of climate exchange is the greenhouse effect. Carbon dioxide, a greenhouse gas, is produced when fossil fuels are burned. Because it causes a "greenhouse effect," it is known as a greenhouse fuel. Urbanization and industrialization is growing the concentrations of some of greenhouse gas with inside the surroundings. Carbon dioxide and different chemical substances act as climatic forcers, forcing or pushing the climate in the direction of a warmer or less warm state. Reduced global green house gas emissions are the only option to halt climate change. Switching from fossil fuels to renewable such as solar and wind will lower the emissions that cause climate change Almost every government on the planet signed a pact in 2015 vowing to reduce greenhouse gas emissions. The goal was to keep world average temperatures 2°C above pre-industrial levels. Countries agreed to aim for a 1.5°C limit if at all possible.

11.1 Introduction:

The term climate can be defined as such weather conditions which vary from one particular location to another. It can be inferred based on numerous factors such as difference in

temperature level, flora and fauna, the amount of rainfall, etc. Take an example of the North and South Pole, where temperature levels are lowest, and the African countries through which pass the line of Equator. It can also be defined in terms of shift in the temperature levels between different months, for a particular location. Take the example of the Indian Sub-continent, where the temperature rises to its peak between the months of May- June, and goes to the lowest between December-January.

Unlike weather, which can change within spam of a few hours, a Climatic Change can take a million years. Such a change can also be explained as a change in the Earth's average temperature. This type of change is the basic nature of the climate, which will sustain for a long period of time, 30 years at its minimum. For studying the science behind the phenomena of climate change evolution, the World Meteorological Department and the United Nations Development programme established the Intergovernmental Panel of Climate Change (IPCC) in the year 1988, with the objective of providing the government with significant information at all levels in order to improve its local weather policy.

The phenomena of Climate Change have affected each and every living being. But different species has been affected at different levels. Once we penetrate further into the subject matter, the variation can be found among different group of the same species as well. For example, people who come from poor under developed countries and who have been raised in an economically weak background are the most affected to the climate change.

11.2 Climate Change and Global Warming:

Global Warming can be defined as continuous change in the Earth' average temperature. It is one of the major reasons behind the phenomena of Climate Change. A per the recent IPCC report, 2018, different activities of humans have resulted in the rise in the global average temperature from 0.8 to 1.2 °C. The atmosphere of the atmosphere has been designed in such a manner that it traps the heat energy coming from the sun, and facilitates life of different species of flora and fauna.

This is possible because of the different greenhouse gases present in the atmosphere, which are responsible for maintaining the balance of the Earth's ecosystem. However, because of the global warming, this natural balance of gases has got disturbed as different gases such as Carbon Dioxide and Methane has artificially increased, causing a constant rise in the Earth's average temperature. Industrialization has a major contribution in this, various industrial gases such as Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulfur hexafluoride (SF_6), and Nitrogen trifluoride (NF_3) are causing problems such as Ozone layers' depletion, because of which a large amount of sunlight which was earlier reflected by the earth's surface is now getting absorbed.

Then the surface releases infrared radiation (IR), these radiations are reflected back to the space from where they disperse in different directions, even come back to the surface and hit it ever more brutally causing harm to the health of the soil. Different studies suggest that temperature of the Earth will rise even higher up to 1.5°C and will even rise to 2°C, if no steps will be taken by the government and the general public all around the globe to make a unified effort in order to control global warming.

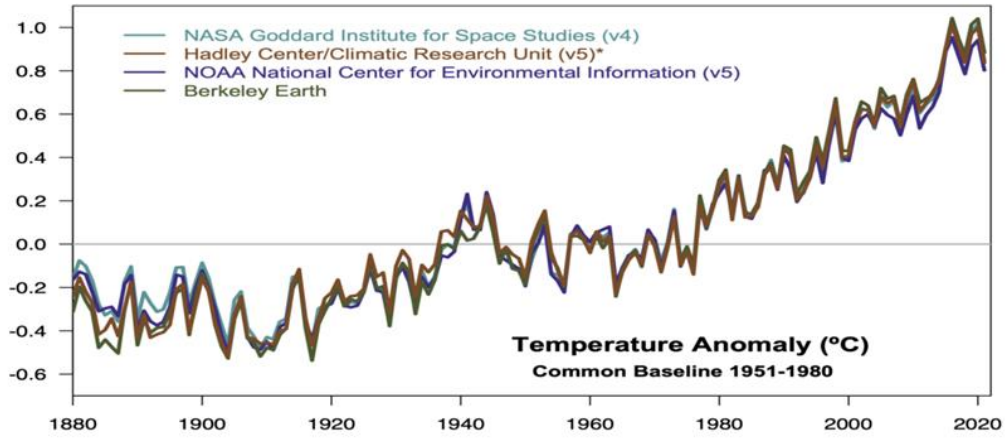


Image source-https://climate.nasa.gov/scientific-consensus

11.3 What Is the Cause behind the Change in The Earth's Climate?

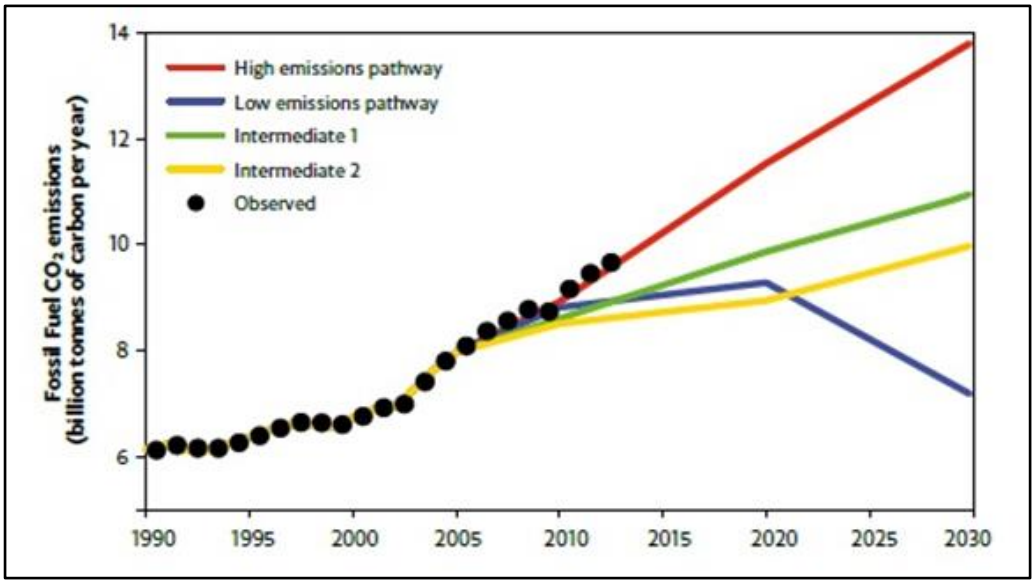
The changes which have been faced by the balance of greenhouse gasses due to industrialization and other human activities. Drying of rivers, cutting down forest, hunting and poaching, increase in forest fires are a few examples of other activities responsible behind the increase in Earth's average temperature.

The movement and rotation of earth around their axis are considered to be historically most important reasons behind the climate change. The variance in sunlight of the North Hemisphere is said to be caused due to change in the earth Orbit causing cycle of temperature change during the ice ages, where long periods of cold temperature has been experienced by the earth, and the shorter interglacial periods. Changes which occur in the sunlight production capacity of the Sun decide the change in the amount of sunlight received by the surface of the Earth. Even though this can vary the temperature of the Earth, it has a very low impact on the phenomena of climate Change. Volcanoes also have a major contribution to the climate change of the Earth. They have been making their contribution by releasing large amounts of Carbon Dioxide in the recent pasts. They can also release partials of elements such as Sodium Oxide, which can reflect the sunlight in the air itself making the climate cold for a considerable period of time. Volcanic partials do not have a long term effect on the climate, as they come out in a volcanic eruption only which happens very less, and the amount of CO2 released by the human activities is much greater than the amount of CO2 released by a volcanic eruption.

Human activity are major cause which increase the concentration of greenhouse gas in environment Deforestation is important reason behind the climate change. Forests are a very vital component of the earth as they assist in both causation as well as "mitigation" of the "greenhouse gas emissions". Deforestation depletes around 30 million acres of these forests annually. 25% of the total area of the Earth is covered by land, which makes it the 2nd largest greenhouse gas emitter. The amount of Carbon dioxide which is naturally produced by decomposition of plants and animals is naturally balanced by its elimination in the process of photosynthesis. Excessive use of vehicle has been silently contributing to one of the

world's most serious crises: climate change. Road traffic will be the largest source of global warming in the next 50 years, according to new study from NASA's Goddard Institute for Space Science. Automobile release large amount of nitrous oxide and carbon dioxide, which contribute to global warming. Many of these old cars emit poisonous gases, exposing people to high amounts of pollution, and they are frequently unsafe to drive, resulting in increased accidents and fatalities. Since last few decades' greenhouse gas released by use of means of transportation have been gradually increases.

Fossil fuels are the major CO_2 contributor of atmosphere. For generation of electricity fossil fuels like coal is burn which release significant amount of CO_2. CO_2 emissions from coal burning are much higher than those from oil or natural gas combustion. Any serious global climate change mitigation approach must start with reducing reliance on coal combustion.

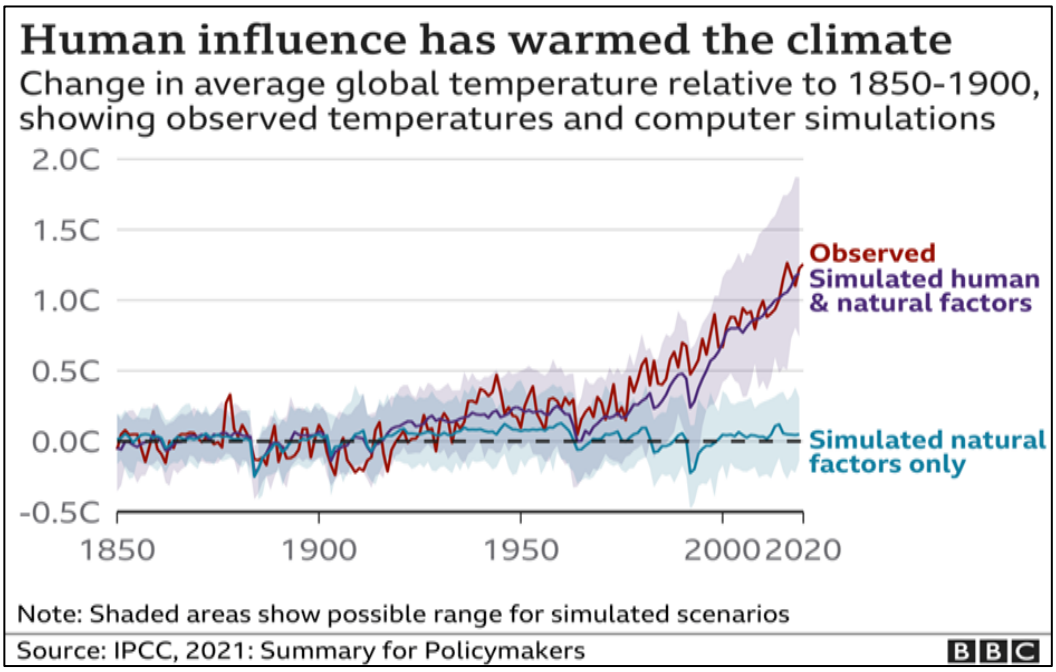


Source-https://www.science.org.au/learning/general-audience/science-climate-change/3-are-human-activities-causing-climate-change

Agriculture is both a contributor to and a victim of climate change. Methane and nitrous oxide are two major greenhouse gases releases after agriculture practices. Nitrogen based chemical fertilizers are the primary sources of Nitrous oxide. Grazing Animals like cow, cattle, sheep and goat produce methane after digestion, which is then released in atmosphere. It can also get out of landfills that store manure and organic waste. Between 2001 and 2011, global emissions from grain and animal production increased by 14%. The growth was primarily due to increased agricultural production in emerging countries. Expanding the use of nitrogen-based fertilizers, which generate nitrous oxide and contribute to global warming as a result of intensive agricultural practices, nitrates are discharged into soils and aquatic bodies.

The development of industries especially during the age of industrial revolution was considered to very developmental and highly prospective in nature. Even thought it has

made significant contribution on uplifting the living standards of people and improving their life style. Industrialization has given serious beating to the environment and has caused great amount of damage to the environment. Many scientists studied that if the climate issue is not solved, overpopulated location considered too hot for human existence. The Intergovernmental Panel on Climate Change claims that human activities from high-income nations, are to blame for much of the warming during last few years, and has highlighted population expansion as an urgent source of emissions. India and China, the world's two most populous countries, are among the most significant contributors to global climate change. While population growth in India and China is currently slow, people born today in these countries are expected to grow rapidly.



Source- https://www.bbc.com/news/science-environment-58130705

11.4 Impact of Climate Change on Environment:

The temperature of the environment is gradually expected to grow, as the concentration of the gases will increase. The situation is expected to get much worse in the South East Asia as per the IPCC forecasts made for the year 2021 and 2022. The Indian Institute of Tropical Meteorology also conducted its own study keeping the Western Indian Ocean and the Bay of Bengal as its subject matter for the time period of 11982 to 2018. They discovered around 190 heat waves, which were related to different calamities such as storms, droughts, cyclones, etc. A warm atmosphere has the potential to attract, gather and hold a large amount of water, hence causing alterations in the weather patterns, keeping the places wetter and dry places drier. Although the scientist is not sure about the theory of heat increasing the speed of the storms, it can definitely increase their impact and severity. “Hurricanes Harvey, Irma, Maria and Michel in 2017 and 2018 drew a lot of attention for the rapid strengthens in speed. A metric that considers intensity as well as other elements like storm length and

frequency shows an increase in hurricane activity in the North Atlantic in recent decades. The extending of the wildfire season and worsening of drought are both results of increased evaporation on land brought on by climate change. As the atmosphere warms, there is a correlation between increases in the air's ability to hold moisture and larger precipitation events like rain and snowstorms. Melting of glaciers rise the sea level is and the thermal expansion of saltwater brought on by this warming. If the earth continues to warm, the ice sheet in Greenland will probably melt more quickly. The Carbon dioxide is absorbed by the water and prevented from reaching atmosphere, which in turn puts a negative impact on aquatic flora and fauna.

11.5 Impact of Climate Change on Human:

Continuously increasing climate change has given a severe impact to the human society. Changing precipitation patterns, constantly rising temperature, colder winters, etc have given rise different kind of health issues. The people such as children, elderly people and outdoor workers are the one most vulnerable to different health problems. As a result of the changing climate, the volume and distribution of outdoor air pollutants such as ground level gas and fine particles has altered, affecting weather patterns as well. Finally, as pollutants and aeroallergens enter homes, schools, and other structures, these changes in outdoor air quality and aeroallergens have an impact on interior air quality. Poor air quality has a deleterious influence on the human vascular and metabolic systems, whether indoors or out While global climate change has an impact on the spread of vector-borne diseases, these changes are also likely to interact with a number of other factors, such as host accessibility, pathogen adaptation and change, pattern development and land use, demography, human behavior, and accommodative capacity.

Global climate change is anticipated to pose a threat to food delivery networks, pricing, and some elements of food quality, as well as food production. Various crop yields are expected to decrease as a result of the combined effects of changes in rainfall, harsh weather, and increasing competition from weeds and pests on agricultural plants. As projected, less farm animals and seafood will be produced. Costs are anticipated to increase as a result of factors like the rising price of crude oil and related trends like a declining food supply (used for agricultural inputs like pesticides and fertilizers). Temperature extremes and average temperatures both rise together with the concentration of greenhouse gases.

11.6 Impact of Climate Change on Biodiversity:

The area of biodiversity and ecosystem can be explained as the most affected area as a result of Climate Change. It has put numerous numbers of species into great threat. Climate change have profound effect on distribution and rearrangement of terrestrial and aquatic ecosystems. It has affected the behavioral pattern of the individual species as well as their interaction with other individual species, which has further affected the structural pattern of the ecosystem, as well as the product as well as services naturally by the ecosystem. Climate change may cause organisms to lose their ability to adapt to a particular location's collection of environmental factors, causing them to stray outside of their climatic niche. Global warming is the biggest danger to the Polar Regions. The melting of the ice caps will result in habitat loss, which will put polar bears, penguins, puffins, and other Arctic animals under

persistent threat. For instance, smaller species like fungus and insects are more susceptible to environmental changes. These same species support many of nature's environmental processes, including soil polanization and aeration. Thus, the gradual extinction of microfauna would have a domino effect, speeding up the loss of biodiversity. Other man-made causes that interact to make ecosystems more vulnerable to climate change include deforestation, fisheries, invasive species, and habitat loss. Range adjustments for marine.

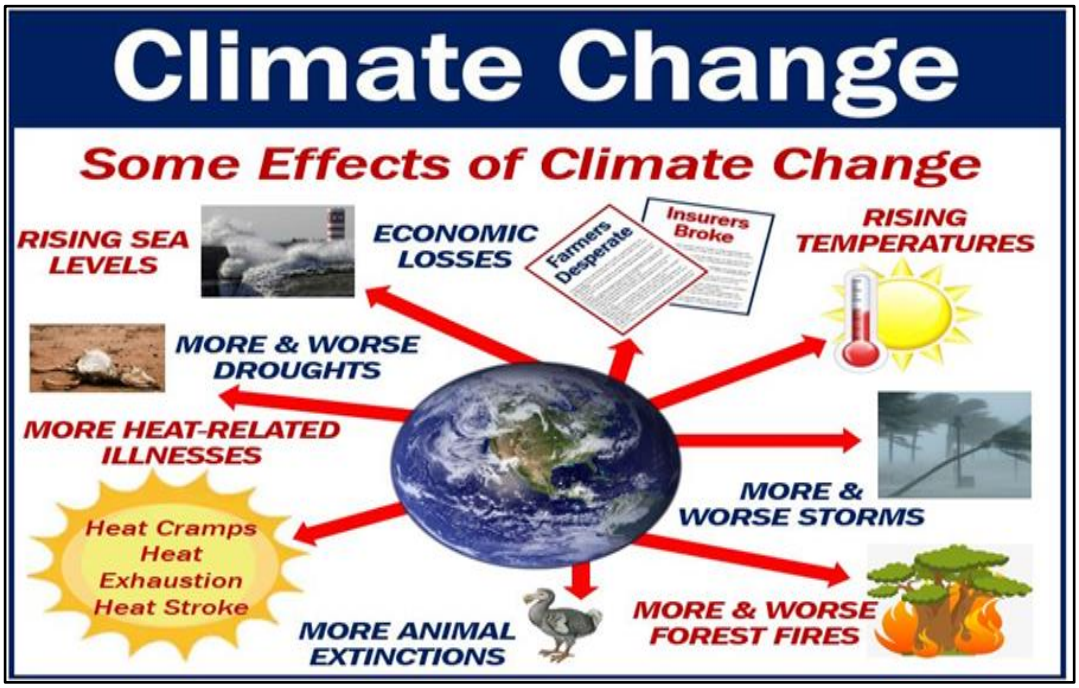
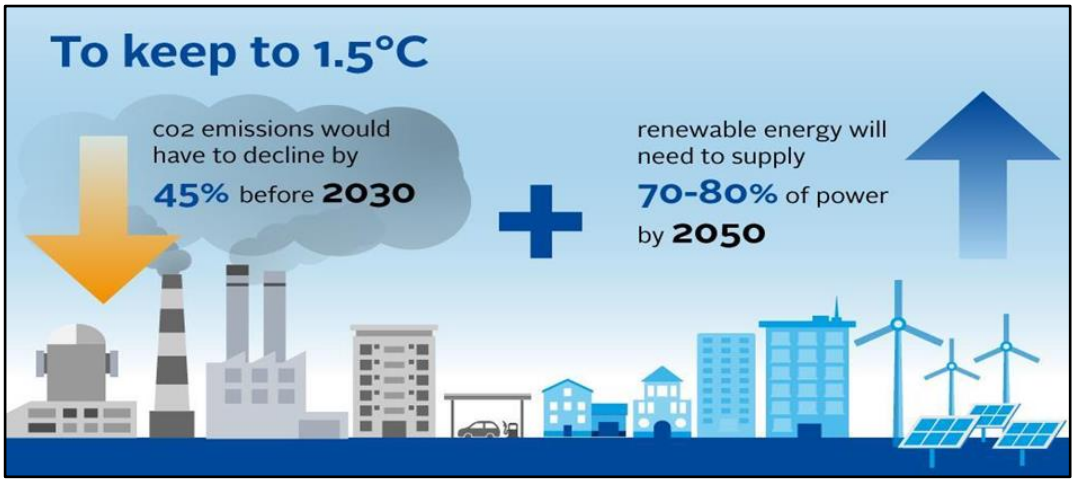


Image source- https://marketbusinessnews.com/financial-glossary/climate-change/

11.7 International and National Policy for Climate Change:

Climate change is one of the most difficult issues we face today. Climate change affects the society at political, economical, moral and ethical level. The IPCC under the leadership of united Nation publishes assessment reports on a regular basis. The International Council for Local Environmental Initiatives (ICLEI) at which was founded in 1990, is an international non-governmental organization that encourage sustainable development for green economy and smart infrastructure. It has over 1,500 cities, towns, and regions from over 86 countries as members. In December 2015 the UNFCCC's Paris Agreement was ratified and went into effect in November 2016. The Paris Agreement, often known as the Paris Accords or the Paris Climate Accords deal with climate change mitigation, adaptation, and financing. At the 17th Conference of this agreement which was held in 2011 in Durban where all the country commit to reduce greenhouse gas (GHG) emissions. Based on data from 48 national climate plans, which represent 40% of the parties to the Paris Agreement, total greenhouse gas emissions are expected to be 0.5 percent lower in 2021 than in 2010, falling short of the 45 percent and 25 percent reduction goals to keep global warming below 1.5 degrees Celsius and 2 degrees Celsius, respectively.



Source-https://www.unpri.org/news-and-press/the-ipcc-special-report-on-15c-key-takeaways-for-pri-signatories-/3818.article

In 2008 the government of India start the National Action Plan for Climate Change (NAPCC) with the goal of mitigating and adapting to the negative effects of climate change. It focuses on the following eight missions:

- National Solar Mission
- National Mission for Enhanced Energy Efficiency
- National Mission on Sustainable Habitat
- National Water Mission
- National Mission for Sustaining Himalayan Ecosystem
- Green India Mission
- National Mission for Sustainable Agriculture
- National Mission on Strategic Knowledge for Climate Change

Prime Minister of India announced a five-point plan named panchamrita at the 26th Conference of Parties (CoP26) to attain this goal. These five points are as follows:

1. India's non-fossil energy capacity will reach 500 gigawatts (GW) by 2030.
2. By 2030, India will have met 50% of its energy needs using renewable energy.
3. From now until 2030, India will lower overall estimated carbon emissions by one billion tones.
4. By 2030, India's economy will have reduced its carbon intensity by less than 45 percent.
5. As a result, India will attain Net Zero by the year 2070.

11.8 How Do We Stop Climate Change?

The only way to stop climate change is the reduction of emission of green house gases. By conserving forests and wetlands, employing sustainable farming practices, and planting trees, we can unleash nature's full power to regulate the climate.

Use of Renewable energy is one of the most powerful weapons we have in the battle against climate change. Carbon dioxide (CO_2) and other damaging greenhouse gases and pollutants are produced significantly less by renewable energy. Some forms of renewable energy, such as biofuels, can be used to power vehicles or provide heating and cooling for buildings (e.g. geothermal). The majority of renewable energy, on the other hand, is utilized to generate electricity. Renewable energy sources provided 26% of global electricity in 2018, and the percentage is increasing every year. 1 Hydropower, which has been widely employed since the inception of the electric grid, accounts for more than 60% of renewable electricity worldwide, although wind and solar power are increasing at the highest rates today. In 2012, the Climate and Clean Air Coalition (CCAC) was established to encourage governments to include short-lived climate pollutants (SLCPs) in climate and other related policies. Minimum use of transportation means, improve health and reduce the emission of CO_2. While electric cars still require fossil fuels to generate energy, they assist to reduce air pollution and emit substantially fewer greenhouse gases as compare to petrol and diesel vehicles. Consumption of vegetables, fruits, whole grains, legumes, nuts, and seeds while consuming less meat and dairy can have a major influence on the environment. Plant-based food production produces less greenhouse gas emissions and uses less energy, land, and water. Every stage of manufacturing, from getting raw materials to creating and delivering the items to market, produces carbon dioxide in the electronics, apparel, and other commodities we buy. Purchase less, buy old, repair what you can, and recycle to save the environment. Every purchase we make has an impact on the environment. You have the power to choose which products and services you want to support. To reduce your environmental effect, buy local and seasonal foods and products from companies that use resources responsibly and are committed to reducing emissions and waste. Speak up and enlist the help of others. It's one of the most cost-effective and efficient ways to make an impact.

11.9 Reference:

1. Abbass, K., Qasim, M. Z., Song, H., Murshed, M., Mahmood, H., & Younis, I. (2022). A review of the global climate change impacts, adaptation, and sustainable mitigation measures. *Environmental Science and Pollution Research*, 1-21.
2. Change, I. P. O. C. (2007). Climate change 2007: The physical science basis.
3. Fahad, S., Sonmez, O., Saud, S., Wang, D., Wu, C., Adnan, M., & Turan, V. (Eds.). (2021). *Climate change and plants: biodiversity, growth and interactions*. CRC Press
4. Hartmann, H., Bastos, A., Das, A. J., Esquivel-Muelbert, A., Hammond, W. M., Martínez-Vilalta, J. & Allen, C. D. (2022). Climate change risks to global forest health: emergence of unexpected events of elevated tree mortality worldwide. *Annual Review of Plant Biology*, *73*, 673-702.
5. Lahsen, M., & Ribot, J. (2022). Politics of attributing extreme events and disasters to climate change. *Wiley Interdisciplinary Reviews: Climate Change*, *13*(1), e750.
6. Misiou, O., & Koutsoumanis, K. (2021). Climate change and its implications for food safety and spoilage. *Trends in Food Science & Technology*
7. Olabi, A. G., & Abdelkareem, M. A. (2022). Renewable energy and climate change. *Renewable and Sustainable Energy Reviews*, *158*, 112111.
8. Peng, J., Jiang, H., Liu, Q., Green, S. M., Quine, T. A., Liu, H. & Meersmans, J. (2021). Human activity vs. climate change: Distinguishing dominant drivers on LAI dynamics in karst region of southwest China. *Science of The Total Environment*, *769*, 144297.

9. Zhongming, Z., Linong, L., Xiaona, Y., Wangqiang, Z., & Wei, L. (2021). AR6 climate change 2021: The physical science basis.
https://www.ipcc.ch
https://climate.nasa.gov
https://www.nationalgeographic.org/encyclopedia/climate-change/
https://www.worldbank.org/en/topic/climatechange
https://www.who.int/health-topics/climate-change
https://royalsociety.org/-/media/Royal_Society_Content/policy/projects/climate-evidence- causes/climate-change-evidence-causes.pdf
https://www.nature.com/nclimate
https://www.oecd.org/env/cc/2482270.pdf
https://vikaspedia.in/energy/policy-support/environment-1/climate-change#:~:text=The%20National%20Action%20Plan%20on,of%20the%20National%20action%20plan.
https://dst.gov.in/climate-change-programme.