

## VII GLOBAL WARMING AND CLIMATE CHANGE

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**Abstract:** According to NASA and IPCC, Global temperature has increased by 1.4 o F since 1880, CO<sub>2</sub> levels has reached 400.71 parts per billion, loss of world's forest cover between the period 2000 and 2012 is 1.5 million square km, reduction of land ice 287 billion metric ton per year, sea level rise is 3.2 mm per year and loss of arctic ice cover at the rate of 13.3% per decade. Increasing risk of irreversible changes due to large scale shift in the climate system such as several sensitive species such as ocean corals, aquatic birds, reptiles such as sea turtles and amphibians are facing extinction, failing of crops cause famine in many East African countries, decrease in potable water in Mediterranean and Southern Africa and increasing intensity of extreme events such as forest fires (Australia and Indonesia), flooding(Bangladesh) , storm events (tornadoes and hurricanes in USA), droughts (Sahal region) and deadly heat waves (in India 2015) recorded in many parts of the world. Climate change issue can be handled either adapting to the change or disaster risk reduction. UNDP has suggested a three step method to work on Carbon finance consist of removal of barriers to climate friendly technologies, establishing efficient host country procedures for clean development mechanism (CDM) and develop projects via millennium development goal (MDG) carbon facility. An Integrated Territorial Climate Plan (ITCP) was designed for regional governments to plan their activities including financing climate change mitigation process. This paper briefly evaluates anthropocene global climate change and its human solutions.

**Key words:** Climate change, global warming, climate change mitigation, carbon capture, sequestration of carbon,

**I. Introduction:** The continuous rise in temperature of the planet is really upsetting. The root cause for this is global warming. Global warming begins when sunlight reaches the Earth. The clouds, atmospheric particles, reflective ground surfaces and surface of oceans then sends back about 30 % of sunlight back into the space, whilst the remaining is absorbed by oceans, air and land. This consequently heats up the surface of the planet and atmosphere, making life feasible. As the Earth warms up, this solar energy is radiated by thermal radiation and infrared rays, propagating directly out to space thereby cooling the Earth. However, some of the outgoing radiation is re-absorbed by carbon dioxide, water vapors', ozone, methane and other gases in the atmosphere and is radiated back to the surface of Earth. These gases are commonly known as greenhouse gases due to their heat-trapping capacity. It must be noted that this re-absorption process is actually good as the Earth's average surface temperature would be very cold if there was no existence of greenhouse gases. The dilemma began when the concentration of greenhouse gases in the atmosphere was artificially increased by humankind at an alarming rate since the past two centuries. As of 2004, over 8 billion tons of carbon dioxide was pumped thermal

radiation is further hindered by increased levels of greenhouse gases resulting in a phenomenon known as human enhanced global warming effect. Recent observations regarding global warming have substantiated the theory that it is indeed a human enhanced greenhouse effect that is causing the planet to heat up.

**II. Greenhouse Effect:** While other planets in the solar system of the Earth are either roasting hot or bitterly cold, Earth's surface has relatively mild, steady temperatures. Earth enjoys these temperatures because of its atmosphere, which is the thin layer of gases that cover and protect the planet. However, 97 % of climate scientists and researchers agree that humans have changed the Earth's atmosphere in dramatic ways over the past two centuries, resulting in global warming. To understand global warming, it is first necessary to become familiar with the greenhouse effect. The natural greenhouse effect normally traps some portion of heat in such a way that our planet is safe from reaching freezing temperatures while human enhanced greenhouse effect leads to global warming. This is due to burning of fossil fuels which increase the amount of greenhouse gases (carbon dioxide, methane and oxides of nitrogen) present in the atmosphere.

The trade of incoming and outgoing radiation that heats up the Earth is often referred to as the greenhouse effect because a greenhouse works in a similar way. Incoming ultraviolet radiation easily passes through the glass walls of a greenhouse and is absorbed by the plants and hard surfaces inside. Weaker infrared radiation, however, has difficulty passing through the glass walls and is trapped inside, therefore, warming the greenhouse. This effect lets tropical plants prosper inside a greenhouse, even during a cold season.

**III. Greenhouse Gases:** A Hazard There are many greenhouse gases which are mainly emitted by human activity. The first and foremost in the list is carbon dioxide. Excessive burning of fossil fuels like coal and oil is the major factor for producing this gas. Moreover, deforestation i.e. removal of trees for acquiring lands also causes large amount of carbon dioxide in the atmosphere. Cement manufacture also contributes carbon dioxide to atmosphere when calcium carbonate is heated generating lime and carbon dioxide. The second culprit gas is methane, commonly known as natural gas. It is produced as a result of agricultural activities such as livestock digestion, paddy rice farming and use of manure. Methane is also produced due to improper management of waste. Nitrous oxides are generated mainly by fertilizers. Moreover, fluorinated gases such as chlorofluorocarbons (CFCs) are chiefly a result of various industrial processes and refrigeration. These gases are playing their negative part in increasing the havoc of global warming. They are continuously causing an increase in the earth's temperature.

**IV. Causes of Global warming:** The major cause of global warming is the greenhouse gases. They include carbon dioxide, methane, nitrous oxides and in some cases chlorine and bromine containing compounds. The build-up of these gases in the atmosphere changes the radioactive equilibrium in the atmosphere. Their overall effect is to warm the Earth's surface and the lower atmosphere because greenhouse gases absorb some of the outgoing radiation of Earth and re-radiate it back towards the surface. The net warming from 1850 to the end of the 20th century was equivalent to nearly 2.5 W/m<sup>2</sup> with carbon dioxide contribution about 60 % to this figure, methane about 25 per cent, with nitrous oxides and halocarbons providing the remainder. In

1985, Joe Farman, of the British Antarctic Survey, published an article showing the decrease in ozone levels over Antarctica during the early 1980s. The response was striking: large scale international scientific programmes were mounted to prove that CFCs (used as aerosol propellants in industrial cleaning fluids and in refrigeration tools) were the cause of the problem. Even more important was abrupt international action to curb the emissions of CFCs. The second major cause of global warming is the depletion of ozone layer. This happens mainly due to the presence of chlorine containing source gases. When ultraviolet light is present, these gases dissociate releasing chlorine atoms which then catalyses ozone destruction. Aerosols present in the atmosphere are also causing global warming by changing the climate in two different ways. Firstly, they scatter and absorb solar and infrared radiation and secondly, they may alter the microphysical and chemical properties of clouds and perhaps affect their lifetime and extent. The scattering of solar radiation acts to cool the planet, while absorption of solar radiation by aerosols warms the air directly instead of permitting sunlight to be absorbed by the surface of the Earth. The human contribution to the amount of aerosols in the atmosphere is of various forms. For instance, dust is a by-product of agriculture. Biomass burning generates a mixture of organic droplets and soot particles. Many industrial processes produce a wide diversity of aerosols depending on what is being burned or generated in the manufacturing process. Moreover, exhaust emissions from various sorts of transport produce a rich mixture of pollutants that are either aerosols from the outset or are transformed by chemical reactions in the atmosphere to form aerosols.

**V. Global Warming:** The Effects predicting the consequences of global warming is one of the most difficult tasks faced by the climate researchers. This is due to the fact that natural processes that cause rain, snowfall, hailstorms, rise in sea levels is reliant on many diverse factors. Moreover, it is very hard to predict the size of emissions of greenhouse gases in the future years as this is determined majorly through technological advancements and political decisions. Global warming produces many negative effects some of which are described here. Firstly, extra water vapors which is present in the atmosphere falls again as rain which leads to floods in various regions of the world. When the weather turns warmer, evaporation process from both land and sea rises. This leads to drought in the regions where increased evaporation process is not compensated by increased precipitation. In some areas of the world, this will result in crop failure and famine particularly in areas where the temperatures are already high. The extra water vapors content in the atmosphere will fall again as extra rain hence causing flood. Towns and villages which are dependent on the melting water from snowy mountains may suffer drought and scarcity of water supply. It is because the glaciers all over the world are shrinking at a very rapid rate and melting of ice appears to be faster than previously projected. According to Intergovernmental Panel on Climate Change (IPCC), about one-sixth of the total population of the world lives in the regions which shall be affected by a decrease in melting water. The warmer climate will likely cause more heat waves, more violent rainfall and also amplification in the severity of hailstorms and thunderstorms. Rising of sea levels is the most deadly affect of global

warming, the rise in temperature is causing the ice and glaciers to melt rapidly. This will lead to rise of water levels in oceans, rivers and lakes that can pilot devastation in the form of floods.

**VI. Effects on Living Beings:** Global warming can severely affect the health of living beings. Excess heat can cause stress which may lead to blood pressure and heart diseases. Crop failures and famines, which are a direct consequence of heating up of earth, can cause a decline in human body resistance to viruses and infections. Global warming may also transfer various diseases to other regions as people will shift from regions of higher temperatures to regions of comparatively lower temperatures. Warmer oceans and other surface waters may lead to severe cholera outbreaks and harmful infections in some types of sea food . Moreover, it is an established fact that warmer temperatures lead to dehydration which is a major cause of kidney stones. A medical team from The Children's Hospital of Philadelphia examined the health proceedings of more than 60,000 Americans alongside weather records. They discovered that individuals were most likely to be hospitalized with kidney stones three days after a temperature rise. Since 1994, kidney stone incidence has risen from about one in 20 people to one in 11. This trend is likely to increase as the globe gets hotter. According to Luis Ostrosky, M.D. of the Division of Infectious Diseases at The University of Texas Health Science Centre at Houston Medical School and medical director for epidemiology at Memorial Hermann-Texas Medical Centre: “One infection that is definitely making a weird pattern is valley fever”. In his words, “This is a fungal infection we used to see only in California, Arizona, New Mexico and a little in Texas, but last year we found it for the first time in Washington State.”This potentially deadly condition caused apprehension in California when the number of cases increased drastically during 2010 and 2011. Valley fever infections have been on the rise, probably because of warming climates and drought causing dust storms. Dry soil and wind can carry spores that spread the virus. Hotter and drier climates are projected to increase the amount of dusting carrying this disease. Researchers have already noticed rise in mosquito-borne disease like dengue fever and malaria due to warmer and longer summers. Perhaps the most prominent mosquito-borne disease.

Global warming is also affecting animals. They need to move to cooler places in order to survive. This process has been observed in various places, for instance, in the Alps, in mountainous Queensland in Australia, and in the misty forests of Costa Rica. Fish in the North Sea have been reported to move northwards too .The impacts on species are becoming noteworthy to such an extent that their movements can be used as a sign of a warming world. They are the silent witnesses of the swift changes being inflicted on the Earth. Scientists and researchers predict that global warming is gradually damaging the ecosystems of various species and is playing a very unconstructive role in making them extinct.

**VII. Alternative Energy Sources:** The hazards caused by global warming are tremendous. Excessive use of fossil fuels such as coal, natural gas and oil play a part in it too. The usage of fossil fuels should be discontinued immediately. The most significant solution to put an end to this disaster is the use of alternative energy sources. They include wind, solar, bio mass, geothermal and hydro. The most noteworthy point in using these sources is their clean nature.

They do not produce any sort of pollution or toxic gases that can lead to global warming. They are environmentally friendly and pose no threat to ecological balance. However, their high installation and setup costs may drive energy companies away from them at first but in the long run they are surely beneficial for everyone. Most importantly, fossil fuels will deplete one day and sooner or later, we have to turn to renewable energy sources for energy production. Thus, the eventual solution to end global warming is to use alternative energy sources. Fig. 9 depicts in a pictorial way that earth can be saved from the hazards of global warming if we utilise renewable energy sources.

**VIII. Other Solutions:** As elaborated earlier, toxic emissions are a major cause of global warming, A likely solution to reduce harmful emissions is to cut the usage of vehicles which produce them. This has not been met with much success as many people refuse to cut down their practice of using cars. No doubt, some people have started to use bicycles and public transport, whereas some other prefer to walk but these numbers are relatively small. It should be noted that fuel economy and emission rates are chief factors to consider regarding the car choice. Hybrid cars have higher efficiency and lower emission rates. Keeping the tires inflated will help improve mileage and air filters should be frequently replaced to cut down harmful emissions. People should share the ride with friends or co-workers to reduce the total number of vehicles on the road. Print and social media can play an effective role in curbing the problem. It should use the philosophy of automobile advertisements to encourage drivers to conserve energy and reduce pollution. Awareness campaigns can be started using placards, posters and logos.

**IX. Conclusions:** The scientific and environmental community is on the same page regarding the bitter reality of global warming and the involvement of human factor in it. The paper discussed here has only dented the surface of what is a very intricate line of scientific and engineering exploration. Global warming is a big hazard and appropriate measures must be taken to tackle this serious problem. This problem is not only causing trouble to the human beings but also to animals and plants. Melting of polar ice caps will lead to floods which can cause mayhem everywhere. Rise of sea levels will devastate agricultural and fishing activities. To embark upon these problems, some remedial steps must be timely taken which include but are not limited to the use of renewable sources of energy and stopping deforestation. Innovative solutions must be brought forward to end this hazard once and forever.

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