



Global Climate change and its effects

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ABSTRACT

An increase in the average global temperature and an overall change in the climate is referred to as Global Warming. Natural processes and anthropogenic activities are the main contributors to such an increase in the world's average temperature. Over the years, scientists and environmentalists have achieved a common consensus that the global warming scenario is being aggravated by the Green House Gases (released during the combustion of fossil fuels, which in turn causes pollution as well). These Green House Gases have given rise to an increased rate of global warming. This wouldn't have been the case if fossil fuels were not used. Scientists have come to another conclusion that the effects of global warming will be very long lasting and that they will not only affect the climate conditions but also will lead to erratic temperature changes, increase in the losses due to floods and storms, melting of ice caps, rising sea levels, damage to the biodiversity, increased mortality and frequent outbreak of diseases. Climatic change is the most dangerous environmental issue faced by the world today. It is one of the biggest challenges that the world is currently struggling to fight in the best way possible. The effect of global warming is prevalent in every part of the globe, affecting all types of societies, cultures, and geographies. This paper is aimed to review the climate changes and their impacts and implications on the world. Some of the possible remedies to minimize the further impact of global warming have been investigated and suggested.

Keywords: Climate, Global warming, Green House impact, ozone depletion, environment

Introduction

Climatic changes can lead to a variety of potential environmental, social, and economic impacts. In most of the scenarios these impacts will always be towards the negative side and in some rare cases they can also be favorable (increase in crop yield of a certain type). The severity of the impact will only increase with the rise in the average global temperature. Even if global warming is regulated to keep within the 2 degree Celsius range, relative to pre-industrial levels, adverse impacts will still be most likely to be visible and that would also call for measures to adopt to new climatic changes and new conditions. If this 2-degree Celsius threshold is overstepped, it has been analyzed that the consequences will be far more severe, more widespread, and eventually be irreversible. Climate changes bring with them extreme weather incidents, like heat waves, acute rainfalls, floods, storms, drought, and forest fires to begin with. In 1979, at the World Climate Conference, a scientific gathering, it was said that the climatic change is a problem and plans were endorsed to establish a world climate programme under the joint

responsibility of the WMO (World Meteorological Organization), UNEP (United Nations Environment Programme) and the ICSU (International Council of Scientific Unions). In 1988, IPCC was established by the WMO and the UNEP. The IPCC is a scientific establishment that is responsible to oversee the reviews and assess the most recent scientific, and socio-economic information produced at a global scale, relevant to the topic of climate change. In 1990, the IPCC released the first assessment report stating that the "emission resulting from human activities are substantially increasing the atmospheric concentrations of greenhouse gases, which in turn called for a global climate treaty". In 1992, a United Nations Framework Convention on climate change was adopted across 196 countries. The countries and parties of this organization meet on an annual basis at the Conference of Parties to negotiate multilateral responses to climate change. The conventions stated the ultimate goals to stabilize the concentration of greenhouse gases in the atmosphere to a level enough to prevent dangerous anthropogenic activities that harm the climate. In 1997, the Kyoto Protocol was adopted; making it the world's first Green House Gases Emissions Reduction Treaty based on the principle of commons but differentiated responsibilities. In Copenhagen (2009), it was formally accepted that the optimum change (increase) in the temperature around the globe must be kept within a 2 degree Celsius range. Currently, a very huge proportion of the energy need of the world is fulfilled by Fossil Fuels. To keep the Global Warming Levels within the regulated boundary of 2-degree Celsius, sincere efforts need to be made in the direction of generating power supply using renewable sources of energy. Inflicting a cost on Carbon will be one of the most impactful ways to make sure that the world moves towards a lower carbon era and

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eventually become a zero-carbon era. The rise in the concentration of the Greenhouse Gases such as CO₂, Methane, due to increased emissions doesn't remain localized for long, rather they have more of a uniform effect, as they get distributed from the impact area to the others in no time. The world is getting smaller, day after day, as we see the sea levels soaring. The level at which the globe is interconnected and interdependent makes it needless to say that no country can stay isolated from the impact of global warming without making endeavors in the direction of reduction of GHG's emissions into the atmosphere. This will not be possible without the coordinated cooperation from all the countries collectively, otherwise the progress will only be futile individually. There are still few regions where political ideologies have not come to an acceptance of this phenomenon and have not taken it seriously.

This paper has introduced global climate change (Global warming) elaborated the causes, and related impact of this phenomenon and mentioned as to how to go about its remediation. Above all, alternative sources need to be endeavored and persuaded, which will bring the most significant change to the current scenario and show results at the earliest.

Global Climate Change and its Effects

Environmental problems have resulted from anthropogenic activities and are now known to affect the Earth at the local, regional and global levels. The effects that lead to disturbances in terrestrial & aquatic biomes on a global scale are anticipated to have the greatest impacts in the future. Environmental scientists believe that changes in world climate will be the most environmental problem facing Earth's inhabitants in the twenty first century. To understand present and future global climate changes, it is first necessary to encompass how similar changes occurred since earth's atmosphere formed about 3 billions year ago. There are several causative factors which affect the climate in past, present & future. Properties of the Earth's orbit have been speculated to contribute to the alternating climatic cycles which cause very long glacial and inter glacial periods. They are as follows:

- Tilt of Earth axis: Current tilt of the Earth's Axis of Rotation is 23.5°. Evidence suggests that it shifts every 41000 years to a new tilt between 22 and 24.5 degrees.
- Earth's orbit: In a period of 95,000 years, Earth orbits around the sun vary from circular to elliptical and back to circular.
- Time of year: The 3rd orbital factor is the variance in the time of the year when Earth comes closer to the Sun.
- Tectonic Factors: Plate tectonics, the motion of earth's, continental blocks, is another factor which could have impacted persistent cooling and warming patterns in history. One recent hypothesis points out the effects of uplifting of the two major plateaus in the Northern Hemisphere. The mountainous plateaus in West part of North America and the Tibetan Plateau located in the south of Asia were thrust up in the past 45 Million years. This upheaval of landmasses initiated large weather calls that caused a deflection in both the prevailing west to east surface air flows and resulting in the jet stream moving northward.

The warming of atmosphere occurred during volcanic activities, integrated with the continental plate movements which caused creation of plateaus, injected vast amount of gaseous and particulate matter into the atmosphere. These

volcanic emissions in form of gases and ash could have unbalanced the earth's energy balance by enhancing the concentration of carbon dioxide and amplifying the greenhouse effect of these gases. On the contrary, volcanoes could also have been a major factor in bringing the last ice age to an end. Cooling resulted from the injection of SO₂ into the stratosphere during the volcanic eruptions. This SO₂, was converted into tiny droplets of sulphuric acid, which are shiny in appearance, which eventually increased in volumes, resulted in reflection of sun's incoming solar energy from the earth's atmosphere. This reduction due to reflection would have resulted in a trend of Global Cooling. To evaluate the current changes in the global climate, it is always necessary to know natural patterns that would have brought changes in the past which resulted in the present scenario.

Human Induced climatic changes: Global Warming

The intensity and rate of future climate change due to human factor is uncertain due to several feedbacks in the earth system, many of which involve interactions between the carbon cycle and climate (Cox et al. 2000; Gruber et al. 2004; Steffen et al. 2004; IPCC, 2001 1b, 2007b). The results of positive or reinforcing feedback processes are particularly significant because they lead to positive skewed probability distributions for the future climate change (Roe and Baker, 2007, Knutti and Hegerl, 2008) which include non-negligible probabilities for extreme outcomes. With reference to this the intergovernmental panel on climate change (IPCC) expressed vulnerability as 'the degree to which a system is susceptible to or unable to cope with, adverse effects of climate change, including climate variability and extremes' (IPCC, 2007a; p 883, p783, IPCC, 2001a, p995). Carbon-climate model inter-comparison experiments indicate significant enhancement of climate change by climate - induced effect on land as well as ocean CO₂ sinks, but with substantial variability between models, especially for the land sink (Friedlingstein et al. 2006; Sitch et al. 2008). A number of studies have discussed specific carbon pools which are vulnerable to disturbance by climate change and land use change, like organic carbon in soils that are frozen (Zimov et al, 2006; Schuur et al 2008; Tarnocai et al, 2009) as well as in tropical peatlands. (Hooijer et al, 2009).

Calculations around the orbital relation between the earth, sun and other planets in the solar system point out that the present tilt and orbital position of the Earth must have resulted in the smallest average fluctuation in the summer and winter temperatures in the earth's recent years. All the research and evidences show that the alpine glaciers and the arctic and Antarctic fields of ice are retreating and not advancing. Orbital theory and other natural phenomenon are not sufficient to explain the current Global Warming trends. The global surface temperature has risen by about 0.5 degree Celsius since 1975, a burst of warming that has increased the global temperature to its highest level in the past millennium (Hansen et al 2000). This abrupt increase in the global temperature, made the scientists to speculate that industrialization and other related advancements in use of fossil fuel burning has led to global warming but this was challenged by another group of scientists and inflicted that cosmic rays had a role in the new trends of global warming. Some school of thought states that environmentalists have undermined the contribution of the Sun's role, cosmic rays, volcanic activities, and ocean circulation in this global phenomenon.

Human activities, particularly in the past century have changed the atmospheric conditions by increasing the relative concentration of greenhouse gases, which cause an increase in the temperature due to the enhanced greenhouse effect. This impact is not restricted to an area but is prevalent throughout the globe, hence causing global warming.

The atmosphere behaves like a glass of a greenhouse surrounding the earth's surface. Before industrialization, the concentration of carbon dioxide in the atmosphere was approximated to 260 to 280 parts per million (ppm). Since then, the widespread use of fossil fuels has caused increase in the concentration of carbon dioxide in the atmosphere at a fast rate. Forest destruction also leads to increase in a large proportion of this CO₂ which only makes the situation worse, while burning makes it even more alarming. In the 25-year period starting from 1958, the concentration of carbon dioxide increased to 340 ppm from 315 ppm. US National Research Council has predicted in a recent study that carbon dioxide in the atmosphere would surpass 600 ppm, by the third quarter of the next century which could be expected as early as 2035. This eventually will simply an increase in the temperatures by 1.5 to 4.5 degree Celsius depending on the rate of deterioration caused by atmospheric global warming. Apart from carbon dioxide, other gases like methane, Chlorofluorocarbons and nitrous oxides also participate in absorption of infrared radiations and warm the planet. There is a difference in the level each gas absorbs this heat. Methane absorbs 20-30 times as much infrared and is increasing at a rate double than carbon dioxide. Methane comes from ruminant animal, wet-rice paddies, coal mines, landfills, and pipeline leak. As efforts have been made in the recent times and alternative strategies have been implemented, CFC release into the atmosphere has declined. The CFC concentration which is already present in the atmosphere will continue to be in the atmosphere for coming years. Cumulatively these greenhouse gases have heating impact almost equal to that of CO₂.

Hansen et al (2000;2005). Stated that rapid warming in recent decades has been driven mainly by known CO₂, greenhouse gases like chlorofluorocarbon, CH₄ and N₂O, not by the product of fossil fuel burning, CO₂ and aerosols, the positive and negative climate forcing of which are partially offsetting. Persisting warming trends now pose a serious risk to economy as well as the environment. Poorer countries will be impacted more as the capability to cope up remains proportional, but the impact will be evident in all the areas irrespective.

Industrialization, modernization and deforestation collectively lead to release of a variety of gases into the atmosphere which do not do any good to it.

- Carbon dioxide is released by land conversion, such as when tracts of tropical forests are logged & burned, burning of fossil fuel - coal, oil and natural gas.
- Nitrous oxide is also produced by various industries and by the use of fertilisers
- CFCs which are related to the depletion of stratospheric ozone layer, are released into the atmosphere. from old.
- Decomposition of carbon - containing - organic material by anaerobic bacteria.
- Methane production by Ruminant animals is a major source of methane.

Green House Effect

Green house effects is the process by which certain gases called the green houses gases (GHGs) present in the lower atmosphere trap the heat emitted by the earth surface thereby leading to the warming of the earth surface and lower atmosphere. The incoming radiation from the sun have relatively shorter wavelength, chiefly in the visible and near infrared (IR) spectrum and these radiations are freely allowed to pass through by the GHGs. Radiation absorbed by earth's surface are convected into heat which is, in Turn, re-emitted in the form of long - wave length IR radiation by the earth's surface. The GHGs present in the atmosphere absorb these radiations and prevent them from escaping into the upper atmosphere. Thus, the outgoing radiation do not match the incoming radiation and the radiation budget of the earth is disturbed. Trapping of heat by the GHGs will lead to the warming of the earth's surface and the lower atmosphere. Greenhouse effect is mainly caused by carbon dioxide (55%), chlorofluorocarbon effect by increasing the level of nature GHGs, like CO₂, as well as by increased the greenhouse effect by increasing the level of nature GHGs, like CO₂, as well as by introducing new GHGs, like CFCs. Increased emissions of these gases will lead to greater warming and global climate change. Global warming occur because these gases absorb infrared radiation - that is, heat in the atmosphere. This absorption slows the natural heat flow into spaces, warming the lower atmosphere. Some of the heat from the lower atmosphere is transferred to the oceans and sources its temperature as well. This creation of heat in the atmosphere is a national phenomenon that has made earth, habitable for its millions of species. However, as human activities increase the atmospheric concentration of these gases, the atmosphere and ocean may continue to warm, and the overall global temperature may rise. The climate is becoming warm rapidly, caused by human activities, including emission of greenhouse gases (GHGs) as well as aerosols and changes in land use (Houghton et al 2001 and Trenberth 2005). Meehl et al (2004) state that the increase in temperature is due to anthropogenic effects. Greenhouse gases have a longer time of persistence into the atmosphere as compared to aerosols. Hence, the short-term impact of pollution can be cooling followed by a long period of warming. Aerosols are expected to emit a lower percentage of greenhouse warming in most of the scenarios as their residing time is lower and the possibility of an accelerated warming in the future is reduced due to lower greenhouse gases (GHG) concentrations. The greenhouse effect comes through when solar energy comes in contact with the earth's surface and is retransmitted into the atmosphere in the form of infrared radiations. These radiations have a lower wave frequency than solar energy itself. GHG Molecules tend to absorb these thermal radiations at low frequencies, causing molecules to vibrate. This makes the molecules to emit energy up in the form of infrared photons, which return to the earth's surface, causing it to heat up. Non GHG Gases like oxygen and nitrogen do not absorb the thermal radiations. The Greenhouse Effect is measured in terms of RF: Radiative Forcing, in units of watts per square meter (w/m²). From industrial revolution, the RF estimates have increased by 2.3 W/m². (IPCC,2013)

Global warming is the steady rise in global average annual mean surface air temperature due to the greenhouse effect. The accumulation of carbon dioxide along with other greenhouse gases warms the atmosphere. The analogy between global warming and a greenhouse is only partially current but it is useful in explaining global warming to people without

background in meteorology. Because CO₂ and other gases trap the sun's radiation somewhat like glass does in a green house, the natural trapping of heat in the atmosphere is referred to as the greenhouse effect, and the gases which absorb infrared radiation are known as greenhouse gases. The additional warming that may be produced by increased level of gases that absorb infrared radiation is known as enhanced greenhouse effect. Society needs to think about model predictions of future climate change (Barnett et al., 2005). Recent detection and studies show that human influences have, over the past 35 years, caused both regional increase and decreases in temperature because of CHG and sulfate aerosols, respectively (Houghton et al. 2001; Barnett et al. 2005; Hansen et al. 1985; 2005).

The effects of Global Climate change (Global warming)

Now we will discuss some of the potential effects of global climate change (Global Warming), effects on biomes, sea level, precipitation pattern, weather, Biodiversity, human health and agriculture etc.

Effect on Biomes: Human induced global warming is expected to produce changes in general circulation patterns of the atmosphere and oceans. These changes could produce markedly different rainfall distributions that may result in the variations in global soil moisture. Major effects will probably occur in all biomes as each species responds to rapidly changing environmental conditions. Plant communities will suffer the greatest effects because plants are affected directly by changes in available moisture and unlike animals, plants cannot move. Temperate and boreal forests will probably be affected to a greater degree than tropical & subtropical forests. The coniferous forests belonging to Western North America will also undergo significant changes as their temperature and moisture regimes respond to greenhouse warming. The climate response differ fundamentally in the northern and southern hemisphere for diatoms and small phytoplankton biomass (Irina Marinovet et al 2013).

With moisture and temperature maximums shifting northward, major environmental changes are also expected in the short grass and tall grass prairie region of central North America. The warming trend will be greater at higher latitudes where extremes effects on numerous arctic tundra species are expected. Many species of migratory birds could be affected when rising sea level inundate their nesting sites. The massive insect blooms that occur in the Arctic each spring may appear much earlier, long before the birds arrive for their nesting season. Higher temperature, earlier seasonal changes, and melting of the permafrost will have major effects on many resident and migratory animal species and on seasonal progression in the growth of different plant species. If this continue for a long time many species will extinct in future. Model project these increases to continue well into this century under all plausible scenario of greenhouse gas emission (Houghton et al, 2001). It is well known that tropical cyclones form only over warm oceans by which they take their energy, mainly from the latent heat of condensation (Anthes 1982; Emanuel 1987; Holland 1997). Thus, it would not be surprising if a warmer and moisture world contained enhanced overall hurricane activity. Indeed a gathering of hurricane specialists concluded in 1988 that the most likely projection was that intensity would increase by the order of 10% for a doubled CO₂ environment (Henderson-sellers et al., 1998), Houghton et al 2001; Houghton, R.A 2003). Similarly they projected that tropical cyclones peak winds and precipitation were likely to increase during this century. Marine Reserves

permit for the rational and sustainable exploitation of resources (Fernandez and Castilla, 2005). Khutson and Tuleya, 2004 also confirmed that wind speed and rain fall are caused to rise cyclones.

The effect of climate warming on the Arctic and adjacent subarctic regions has been the focus of much interest for many important issues. The high latitudes present in the northern hemisphere will most probably warm more fast and to more extent than other areas of the globe (Callaghan et al., 2005; Hobday et al 2008; IPCC, 2007a; IPCC, 2007b; IPCC, 2007c). This effect is known as Arctic amplification. Global temperature variation from 1958 to 2008 show this typical pattern of Arctic amplification very well, with specifically enhanced warming over northern Asia and northwestern North America. In turn, some of the environmental variations caused by the warming of the Arctic could result in positive feedbacks that will lead to global warming (Foley et al., 2003). For instance, the albedo of boreal forest coverage can be 25-50% less than that of tundra (Bonan et al., 1995). The variation in albedo coupled with increased surface roughness mean that the boreal forest has a higher sensible heat flux than tundra regions.

Major changes in Arctic terrestrial environments as well as biota may already be present in response to current climate warming (Hinzman et al., 2005; Post et al., 2009). Some instances of such changes include increased radial growth and recruitment of conifers during the 20th century at many sites along the northern tree line (Hinzman et al., 2005; MacDonald et al., 2007 northward expansion of shrubs onto previously herb- dominated tundra in Alaska and the general pan-Arctic region (Hinzman et al., 2005; Tape et al., 2006), and declining populations of Arctic mammal species such as caribou (*Rangifer tarandus* L.) in several regions (Post and Forchhammer, 2008; 2009; Post et al., 2009).

There is enough evidence to support that global warming is responsible for frequent as well as intense heat waves over land thereby increasing the risk of severe and in few cases irreversible impacts. (Thomas L. Frolicher et al. 2016)

Effects on Glaciers, Melting Ice and Rising Sea Level:

Marine ecosystems are subject to a range of likely impacts from drivers of environmental change, including human-induced climate change that is warming sea surface temperatures, altering ocean chemistry and affecting run off of land-based pollutants and sediments. Such transformations will challenge the adequacy of governance and management regimes for conserving marine-biodiversity. (Michael Lockwood et al., 2012). Douglas et al. (2001) describe how even a minimal rise in sea level can have catastrophic consequences when intense storms strike. Tropical oceans have warmed about 0.6°C over the instrumental record, including about 0.5°C since 1970 and sea levels are rising (Canzenave and Nerem, 2004); Lombard et al., 2005).

Global and atmospheric temperature near the surface and aloft (Parker et al, 2004, Jones and Moberg 2003; Smith and Reynolds 2005; Santer et al, 2005) are increasing, as in water vapour (Trenberth et al, 2005). A global rise in sea level has occurred during the past century, and they continue to rise at an average rate in excess of 1 millimetre per year. Between 25 and 50% of this sea level rise can be attributed to thermal expansion of the ocean water caused by the global warming, because when is heated, its density decreases but its volume increase. Past and future extrapolation based on this 10-years altimetry pattern should be considered with caution

(Alixlombard et al., 2004). The remaining portion is thought to be due to melting of terrestrial glaciers and floating iceberg. If the greenhouse effect continues unabated, Earth's ocean is expected to continue to rise, and the salt water will flood important estuarine habitats and many low lying terrestrial areas. Integrated marine management, conservation and protection must maintain and protect the natural structure and functioning while at the same time ensure that the seas deliver the benefits required by society (Elliott, 2011).

As per predictions of IPCC (Intergovernmental Panel on Climate Change) sea level will rise by an additional 50 cm by 2100. Such a rise in sea level would flood low-lying coastal areas such as southern Louisiana and South Florida. Coastal areas that are not inundated will be more likely to suffer erosion and other damage from more frequent and more intense weather events such as hurricanes. These likely effects are certainly a cause for concern, particularly since about two third of the world's population lives within 150 km of a coastline.

In 1999 two uninhabited islands in the south pacific were submerged under rising water, and plans were made to relocate the people living on the nearby islands of Kiribati and Tuvalu, small island nations such as the Maldives, a chain of 1200 islands in the Indian Ocean, are considered highly vulnerable to a rise in sea level. 80% of the Maldives is within 1 meter above sea level, and the country's highest point is 2m above sea level. As sea levels rise, storm surges could easily sweep over entire Islands. Other countries that are vulnerable to a rise in sea level - Such as Bangladesh, Vietnam, and Mozambique have dense population's living in low-lying river deltas. There has been evidence that point that permafrost, the subsoil that was permanently frozen is melting in the areas of tundra and boreal forest of Alaska, Canada, Russia, China and Mongolia. Establishments are at risk due to this as this could lead to collapsing of buildings (Tarnocai et al, 2009) Near Fairbanks, Alaska, for example, hundreds of homes and telephone poles are sinking at odd angles into the ground.

Change in Precipitation Pattern: Precipitation patterns have transformed over thousands of years and it all started when the Earth was more warm. Computer simulation models were created keeping the factors same and later global warming was also integrated into the model. These models predicted that this will affect the precipitation patterns such that they might cause some areas to have more frequent droughts. While heavier snow and rainstorms will be causing flooding in other areas. Fresh water availability will also be impacted in some of the areas. NOAA (National Oceanic and Atmospheric Administration) has created some models that study how these changes will affect the storms and their change in intensity over time. The intensity is expected to only increase and make the situation worse as the precipitation cycles take a toll on conditions.

Effect on Biodiversity: Scientific community has come to a common place, where they believe that biological diversity will also be impacted worldwide as an adaptation to the change in climates. Varied effects will be seen across the globe, varying region to region. A loss of habitat will also come into place with the rapidly increasing human population. In 1992 the convention on Biological Diversity aim marine conservation targets, to protect at least 10% of all marine ecological regions by the year 2012 (Wells et al. 2007). Global warming stimulate stratification of the water column which tropical and mid-latitudes will exacerbate nutrient limitation in surface waters. This in turn will lead to variation in phyto-

planktons assemblage composition, primary productivity and sensitivity to UVB Radiation. (John Beard et al. 2009). The sea face myriad problems - climate change, development and the nutritional and other needs of a growing human population. (Ray Hilborn, 2016).

Coral reefs are species-rich and threatened ecosystems on Earth, yet the extent to which human stressors determine species occurrences, compared with biogeography or environmental conditions, remains largely unknown. (C. Mellin et al. 2016). Mangroves will continue into the future but more negative than positive impacts due to climate change will also continue (Daniel et al, 2015).

Biologists are studying effects of global warming across species, not only limited to human beings. Some have placed infrared heaters above the test plots in Rocky Mountains meadow to experiment with the future likely conditions. The impact was seen only within few months. Zooplankton were studied, usually around California Current, that flows from Oregon towards the southern direction along the California coast, and they have declined by 80% since 1951 due to warmer currents through the year. Every species would react in a certain way in reaction to these changes. Some species will turn extinct particularly those with narrow temperature adaptability. Fragile species are bound to perish. Some might see this change over a longer duration of time. Ecosystem is at a greater risk of loss of species in near times, specifically areas around polar seas, coral reefs, mountain ecosystem, coastal wetlands, tundra and boreal and temperate forests. Plants, due to their immobility will be impacted more easily and in shorter durations as climates become water. Every increase in degrees, will be reducing their population. Some species will come out of global warming as winners, with greatly expanded numbers and range. Those organisms considered most likely to prosper include certain weeds, insect pests and disease-carrying organisms that are already common in a wide range of habitats. According to biologists, 3°C increase in average surface temperature could allow the Mediterranean fruit fly, an economically important insect pest, to spread its range northward into northern Europe. Other biologists are concerned that a warmer ocean temperature could allow the alga *Caulerpa* the invasive species that is currently damaging the Mediterranean sea, to move up the Atlantic coast of Europe. Daniel et al (2018) explores the concept of "Other effective area-based conservation measures" OECMs in reference to the UN CONVENTION ON Biological Diversity (CBD) Aichi Biodiversity target 11 on marine protected areas and OECMs and its linkage to the sustainable development Goals (SDGs). They state that mainstreaming biodiversity through CBD Aichi Biodiversity target implementation of SDGs can lead to a more systemic implementation of SDG 14.5 on conservation of at least 10 percent of main and coastal areas Daniela Diz et al (2018).

Climate Change Effect on Weather: As climate changes, it might affect certain types of weather events. Changes have been seen in the amount, intensity, frequency, and type of precipitation. Increases in heavy precipitation are seen, even in places where total rain amounts have decreased. IPCC (2007d) concluded that human influence had, more likely than not (greater than 50% probability, based on experts), contributed to an increase in the frequency of heavy precipitation events. Future changes are predicted to show an overall increase in the precipitation, with substantial changes in the areas and ways in which precipitation is present. Climate models to forecast that precipitation at higher altitudes, tropics will increase, while

decreasing precipitation in the sub tropics. Storms and hurricanes have increased in intensity and frequency since the 1970s. There is sufficient evidence that global warming is responsible for frequent and intense heatwaves over land, increasing the risk of severe and in some cases irreversible impacts (Froolicher et al.2016).

Variations have been observed since late 20th century in the trend of some extreme weather and climatic events, one example being that of the heat waves observed. Human activities have played a role in the cause of such events. Forecast for the 21st century suggest it will only become worse than it is. Solomon et al. (2007), for instance, projected the following likely changes.

- an rise in the areas affected by drought.
- increased tropical cyclone activity.
- increased incidence of extreme high sea level (excluding tsunamis).

Ecosystem as well as human society will be facing adverse impact due to these extreme events.

Effect on Frequency of Earthquakes, Tsunamis and Volcanic Eruptions: Scientists are trying to obtain dramatic evidences that global warming puts a lot of threat to this planet in ways that we can't even imagine. Some of them being, it is triggering earthquakes, tsunamis, avalanches, and volcanic eruptions. It is predicted that the melting off, of the glaciers will lead to setting off avalanches, floods and mud floods in the Alps and other mountain terrains, torrential rainfall in the UK which would lead to widespread erosion, while disappearing Greenland and Antarctic ice sheets threaten to loose underwater landslides, triggering tsunamis which would strike seas around Britain leading to huge losses. As ice caps will disappear, it will cause a change in pressure acting on the Earth Crust and this will in turn set of volcanic eruptions, worldwide. A. Aphunv. GO. Nwabeze (2013) concluded that there is need for the active involvement of the stakeholders in developing policies about climate change mitigation and beneficial response strategies to global warming. Their study also revealed that respondents perceived low yield from fish culture to be a consequence of the negative impact of climate change. The synergy between climate change and habitat destructions would threaten many more species than either factor alone (Robert L. peters, 1990).

Effect on Human Health: Most of the evidences that link climate warming to disease outbreaks is consequential and scientists are yet to get to a cause and effect relationship. Though, data around this continues to be recorded and is open for critique. One of the scientific hypotheses, states that the increase in carbon dioxide in the atmosphere which result in heat waves during summer months, will lead to an increase in the number of heat related illness and deaths. 1300 deaths were caused in India by high temperatures during the 1998 summer heat wave. Human health can be impacted indirectly as well, by the changes in the climate, for example mosquitoes and other disease causing carriers could increase their range into newly warm areas and spread diseases like dengue, malaria, yellow fever, rift valley fever and viral encephalitis. As many as 50 to 80 million additional cases of Malaria are estimated to come up annually. According to WHO in 1998, the warmest year record was set for the incidence of Malaria, Rift Valley fever and Cholera. Developed countries have better preparedness mechanisms to regulate the numbers. Higher temperatures, heavier rainfall and high humidity have

reportedly increased the rate of human infections. In 2010, the American lung Association estimated that about 23 million Americans suffered from Asthma. It has been shown that the occurrence of Asthma in the United States has quadrupled in part due to climate-related.

Effect on Agriculture: The increase in the sea level will cause water to inundate river deltas, which are usually amongst the world's best agricultural lands. Particular agricultural pests and disease-causing organisms will probably proliferate and decrease yields. Scientists also speculate that Global Warming will also increase the frequency, duration and hence the impact of droughts which can turn very difficult for the countries with lesser number of water resources. The increase in the temperatures will result in the decline of soil moisture levels in agricultural soils as well. On a regional scale, current models of modest warming predict that the agricultural efficiency will increase in some areas while decreasing in the others. Mosel suggest that Canada and Russia may be able to increase their efficiency in warmer climates but tropical and subtropical regions where majority of the world's poor reside will be hardly impacted by a marginal decline in agricultural productivity.

Trenberth et al 2013;2014 stated that global warming may not be directly involved in the creation of droughts but may amplify by creating harsh conditions and these droughts will eventually lead to lesser yield.

International efforts on Global Climate change: Dealing with global warming is complicated because social, economics, and political factor vary from one country to another. How will the global community deal with the environmental refugees produced by the impacts of global warming, such as extreme weather condition which lead to the agriculture failure. It will be difficult for all countries to develop a consensus on dealing with global warming, partly because global warming will have greater effects on some nation than on other. However, all nation must cooperate if we are to effectively address global warming and its impact.

Although greenhouse gases are produced primarily by the highly developed countries, Pielkez their rate of production by certain developing countries is rapidly increasing. Many developing countries may experiences of the greatest impacts of global warming. Because developing countries possess less technical expertise and fewer economic resources, they are the ones that are least capable to respond to the challenge of global warming. In 2000, Mrs. Sajeeda Chaudhary, the Bangladesh (Environment Minister) estimated that rising sea level may displace perhaps 20 million people from coastal areas of Bangladesh. There are Tensions among nations, especially between the highly developed and developing countries over their differing self-interests. Most developing countries see increased use of fossil fuel as their means of industrial development and also resist pressure from highly developed nations to decrease fossil fuel consumption. India also ask why they should have to take actions to curb carbon dioxide emissions when the developed nations historically have been the main cause of the problem. Currently highly developed countries produce six times more carbon dioxide emission per person than developing countries. In contrast, highly, development countries argue that the booming economic growth and much greater number of people living in developing countries threaten to overwhelm the world with carbon dioxide emissions as the developing countries become industrialized. We (both industrialization and developing nation) now should examine some of the possible ways to

address rising concentration of greenhouse gases. India & other developing countries are highly vulnerable to climate change, India's food productions would be adversely affected and could also delay the progress in eradicating poverty. Thus the climate changes could aggravate social and environmental condition in India.

How we can tackle the Global Climate Change (Global Warming) : Despite certain gaps in our knowledge of global warming, our present understanding of the changing global climate and its major impact on human society and other species give us many legitimate reasons to develop strategies that will deal with this problem. Even if we were to immediately stop polluting the atmosphere with greenhouse gases (which we cannot), there would still be some climate warming because of the greenhouse gases that have accumulated during the past 100 years.. The severity of global warming depend on how much additional greenhouse gas emissions we add to the atmosphere. Many studies make the assumption that we will be able to stabilize atmospheric carbon dioxide at 550 ppm, which is about twice the concentration of atmospheric carbon dioxide that scientists estimate existed in the preindustrial world (Zickfeld,2009).

International efforts to reduce greenhouse gas emissions:

- The international community recognizes that it must stabilize carbon dioxide emissions. At least' 174 nations, signed the U.N. Framework Convention on Climate Change framed at the 1992 Earth Summit. Its ultimate goal was to reduce greenhouse gas concentrations in the atmosphere at levels low enough to stop dangerous human influences on the climate.

- At the 1996 U.N. Climate Change Convention held in Geneva, Switzerland, highly developed countries agreed to establish legally binding timetables to cut emissions of greenhouse gases. These Time tables for reducing greenhouse gas emissions were decided at a meeting of representatives from 160 countries held in Kyoto, Japan, in December 1997.

- An important international conference on global warming took place in Kyoto, Japan, in December 1997. After many negotiation session, 160 nations finally agreed on a new treaty called. "Kyoto Protocol". The Protocol commits 38 developed countries to cut their emissions of greenhouse gases to level that are 5.2% below 1990 below 1990 levels by 2012. Although the US has not ratified the Kyoto Protocol, several federal initiatives were announced in 1999 to decrease greenhouse gas emissions by promoting the transition to renewable energy sources.

Agreement to Operationalize the Kyoto Protocol: Bonn Meeting On July 23, 2001, signatories of the UNFCCS were able to agree at an agreement to operationalize the 1997 Kyoto Protocol; which is currently the only international instrument available to check the emission of greenhouse gases (GHSs) that cause global warming. Highlights of the Agreement are following:

- Countries which do not meet their commitments of reducing (GHGs (Green House Gases) to 5.2 per cent below 1990 levels by 2012 will have to subsequently (2013 - 2017) make emission reductions of an addition 30 per cent on their unfulfilled targets and also pay an unspecified financial penalty.

- Permission to count the carbon soaked from the atmosphere by new forestry ("carbon sinks") in meeting their targets for reducing the GHGs, means that the true reduction in emission of GHGs from the burning of fossil fuels will be

under 2 per cent, and not the 5.2 per cent target of the Protocol.

- European Union (EU) will provide additional funding from 2002 onward, of half a billion dollars a year to developing countries for adoption of cleaner technologies.

- Isolation of the US: Finally, analysts point out that the Bonn Agreement has demonstrated that the US stands isolated in the world on the approach to climate change.

- The Agreement at Bonn is not a good one, yet it is significant because another failure would have effectively finished the Kyoto Protocol.

Global climate change can be regulated by: Mitigation of global Warming & Adaptation to global warming.

Mitigation of global Warming:- Mitigation is the moderation of global warming, that provides us time to pursue other, long lasting solutions that prevent or rather reverse global warming. We can manage the risk the global warming by alternative methods, which are as follows:

- The development of alternatives to fossil fuels.
- Sequestering carbon in forests.
- Carbon Management.
- Feed the ocean with Iron.

The development of alternatives to Fossil fuels: As climatic changes come through as an energy issue, the development of alternatives to fossil fuels can be the solution to global warming brought through carbon emissions. Fossil fuels, being limited in quantity, make the search for an alternative even more critical at this hour. Solar energy, nuclear energy is some of the viable and in use alternatives to fossil fuels but have had limited use. Fossil fuel combustion, that generates energy, is accompanied with an emission of carbon dioxide into the atmosphere which in turn depends on the human population and its pace of consumption. Carbon dioxide emissions can be controlled if the population increase rate is regulated. Energy efficiencies of automobiles and appliances will also benefit in decreasing the emissions and collectively these measures will help in mitigating global warming. Because climate warming is essentially an energy issue, the development of alternative to fossil fuels offers a solutions to warming caused by carbon - dioxide emissions. Alternatives to fossil fuels are also necessary, because fossil fuels are present in limited quantity. Some alternatives to fossil fuel are solar energy and nuclear energy should be used. Combustion of fossil fuels with its accompanying carbon dioxide emission is largely function of human population size and level of consumption. It is very easy to stabilize carbon - dioxide emission if population growth is slowed.

Sequestering Carbon in Forests: The other alternative is removal of atmospheric carbon dioxide from the atmosphere by plantation and maintenance of forests. Trees, play the major role of fixing carbon into organic matter, be it in roots, stems or leaves during the process of photosynthesis. Trees, having a long life, the carbon in them, remains sequestered keeping the carbon dioxide from the atmosphere. As plants grow or trees grow, they absorb carbon dioxide from the atmosphere and turn it into sugar through photosynthesis. In U.S. forest absorb 13% of the nation's carbon emission globally, forest store almost one third of the world's emissions. Planting additional trees could remove more carbon from the atmosphere and store it for a long time.

Carbon Management: Additionally, steps have been taken to reduce the emissions of greenhouse gases and many countries have been investigating on Carbon Management, methods to separate and capture the carbon dioxide emitted in the course of combustion of fossil fuels, and eventually sequester it away from the atmosphere. Some power plants capture carbon dioxide emissions in their flue gases, but this is just scarcely used and limited to a particular region. Technology has made possible a lot of innovations that are more efficient in trapping this carbon dioxide and have helped the cause of reduction of global warming, while still using fossil fuels, in a better, efficient and eco-friendly manner. Governments should be actively providing support to such research so that the world gets a uniform technology that reduces the emissions and support the common cause. Nations have come forward and have imposed taxes on greenhouse gas emissions, to motivate the industrial emitters to work on their methodologies to reduce the carbon dioxide they emit or even make use of the carbon emissions to sequester in geological formations on the land as a liquid into the depth of the ocean. Carbon management is new and there still is a long way for it to go down the years. The feasibility and efficiency still remains in question. Timothy M. Lenton (2000) concluded that carbon loss from terrestrial ecosystem may significantly amplify global warming under "business as usual". Land and ocean carbon cycle feedback effect on global warming in a simple earth system model. (Tellus B. 2000)

Climate projections reveal global-mean surface warming increasing nearly linearly with cumulative carbon emissions. The sensitivity of surface warming to carbon emissions is interpreted in terms of a product of three terms: The dependence of surface warming on radiative forcing, the fractional radiative forcing from CO₂, and the dependence of radiative forcing from CO₂ on carbon emissions (Richard et al. 2016). Zickfeld et al 2009; Michael et al. 2010, both stated that the link between the carbon cycle, climate along with human societies are affected by several major vulnerabilities, which are broadly defined as factors leading to the risk of harm from human-induced climate change. They assessed five vulnerabilities: (1) effects of increasing CO₂ on the partition of anthropogenic carbon between atmospheric, land and ocean reservoirs; (2) effects of climate change (quantified by temperature) on CO₂ fluxes; (3) uncertainty in climate sensitivity; (4) non-CO₂ radiative forcing and (5) anthropogenic CO₂ emission.

Feed the Ocean with Iron: In 1987 an oceanographer proved a new way to remove carbon dioxide from the atmosphere by saturating the ocean with Iron. The Scientists reasoned that the addition of iron would, in effect, fertilize the ocean, stimulating large number of phytoplankton to grow. As they photosynthesized, the phytoplankton would be recharged by carbon dioxide from the atmosphere, thereby lowering the atmospheric carbon dioxide level. When the phytoplankton die, many sink to the ocean floor. Thus, the carbon in their cells will be stored for some time on the ocean floor. Although, the first test of the iron hypothesis was successful, most scientists reject this methods of removing carbon from the atmosphere because we do not understand the ecological consequent of such an action.

Adaptation to Global Warming: With the overwhelming majority of climate experts sought that human induced global warming is something that is bound and certain to happen, government planners and social scientists are working on strategies to support regions and sectors of society to get used

to climatic changes. One of the most alarming issue is rising of sea levels. People residing in and in close vicinity of coastal areas need to be moved inland, away from the dangers of storms surges. Shifting of agricultural zones is also one thing the system has to be adapted to. Many countries with temperate climates are experimenting with semitropical crops to determine the best ones to replace traditional crops as the climate heats up. As the sea levels continue to rise, the waterways need to be shut during several low tides, which will lead to the risk of flooding during storms. Public, private sectors and communities can attempt to adapt to the effects of global warming through disaster risk management, public health measures, livelihood diversification, coastal and water management, environmental protection, land planning, sea level rose planning etc.

Conclusion

Global warming is the process of climate change and is usually characterized by an increase in the average temperature of the planet earth. A list of factors is responsible for this increase in the temperature some of which are naturally occurring while others are caused owing to human activity, be it for development purposes or day to day activities. Natural factors include combined influence of volcanoes, changes in solar activity and so on, but this doesn't affect enough for the rate to be so high for global warming. It is the other set of non-natural processes and activities that make this rate accelerated. Global warming has turned out to be a big hazard for the whole planet and comprehensive measures should be taken to curb this problem, if not solve it in one go. This problem has not only affected Human Beings, but also, to plants and animals. Global Warming, in the coming times will only get worse if it continues at this pace, a significant change in the climates, rise in the sea levels, erratic behaviour of weather conditions and an overall impact on other natural, environmental and social fronts will be inflicted. Before the damage becomes irreparable, the continuous rise in temperature should be looked at as a threat and innovative solutions must be promoted to end this issue once and for all. Remediation must at least begin, immediately.

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