IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES
ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 8, August 2022

An Analysis of Climate Change, Mitigation and Adaptation

Rishi Saxena, Assistant Professor,
College of Computing Sciences and Information Technology, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India
Email Id- rishisaxena25@gmail.com

ABSTRACT: A shift in the long-term weather patterns that define the world's regions is referred to as global climate change. The planet is, without a doubt, warming, according to scientists. This pattern cannot be explained only by natural climatic fluctuation. Human activities, particularly the burning of coal and oil, have significantly increased the quantities of heat-trapping gases in the atmosphere, resulting in global warming. The more of these gases people release into the atmosphere, the warmer the planet will get in the next decades and millennia. Rising sea levels, melting snow and ice, and altering weather patterns are all examples of the effects of global warming. Ecosystems, freshwater resources, and human health are already being impacted by climate change. Although climate change cannot be completely prevented, the most severe effects may be mitigated by drastically decreasing the quantity of heat-trapping gases emitted into the atmosphere. However, the window of opportunity for taking meaningful action to prevent catastrophic global repercussions is rapidly closing. This article examines the effects of climate change on different ecosystem components such as air, water, plants, animals, and humans, with a focus on the economics. The most pressing issue, global warming, is also addressed. This study goes through the mitigation options in more detail, with an emphasis on carbon sequestration and clean development mechanisms (CDM). The significance of synergy between mitigation and adaptation to climate change has been addressed. A summary of the economy's connection with emissions, including Carbon Tax and Emission Trading, as well as policies, is also provided.

KEYWORDS: Carbon, Climate, Global, Greenhouse, Warming.

1. INTRODUCTION

Climate change is defined as a statistically significant shift in the climate's mean state or variability that lasts for a prolonged period of time (typically decades or longer). Climate change may be caused by natural internal processes, external forcing, or long-term human changes in atmospheric composition or land use. Climate change is no longer just a scientific curiosity, but rather one of many environmental and regulatory issues. Man-made activities have been adding substantial amounts of greenhouse gases (GHGs) to the atmosphere since the Industrial Revolution started approximately 150 years ago. According to the Intergovernmental Panel on Climate Change's Third Assessment Report on Climate Change, carbon dioxide, methane, and nitrous oxide concentrations in the atmosphere increased by 31%, 151%, and 17%, respectively, between 1750 and 2000 [1], [2].

A rise in GHG levels may result in more heat, which could have an effect on the world's climate, resulting in the phenomena known as climate change. Indeed, scientists have discovered that the average global surface temperature rose by 0.6 degrees Celsius throughout the twentieth century. They also noted that the 1990s were the hottest decade since 1860 (the year temperature was first consistently measured using a thermometer) [3]. It's a developing issue with implications for the economy, health and safety, food supply, security, and other areas. Shifting weather patterns, for example, endanger food production by increasing precipitation unpredictability, rising sea levels contaminate coastal freshwater reserves and increase the risk of catastrophic flooding, and a warming atmosphere aids the poleward spread of pests and diseases once restricted to the tropics [4].

The news has been terrible so far, and it's just going worse. Ice loss from glaciers and ice sheets has continued, resulting in an ice-free passage across Canada's Arctic islands for the second year in a row, and increasing rates of ice loss from ice sheets in Greenland and Antarctica. The melting of ice sheets and glaciers across the globe, along with thermal expansion (warm water occupies more volume than cold), is contributing to rates and an eventual extent of sea-level rise that may significantly exceed those predicted in the most current global scientific assessment. Important tipping points, leading to irreversible changes in key ecosystems and the global climate system, may have already been reached or exceeded, according to worrying data. Warming and drying may be nearing tipping points in ecosystems as varied as the Amazon rainforest and the Arctic tundra, for example. Mountain glaciers are retreating at an alarming rate, and the downstream impacts of decreased water availability during the dry months will have long-term consequences. Climate feedback loops and cumulative environmental impacts are forming throughout Earth systems, displaying unpredictable tendencies [1], [5].

1.1 Assessing the impacts of climate change:

Increasing greenhouse gas emissions from different sources have resulted in catastrophic climatic changes, including well-documented "global warming." Serge Plantonet al. provides an overview of the expected change in climate extremes due to greenhouse gas and aerosol anthropogenic emissions during this century, including a decrease in the number of days of frost, an increase in the length of the growing season, trends in drought duration, and changes in wind-related extremes . Macdonald et al. investigated the dramatic changes in the arctic over the last decade, including atmospheric sea-level pressure, wind fields, sea-ice drift, ice cover, length of melt season, change in precipitation patterns, change in hydrology, change in ocean currents, and water mass distribution. In permafrost areas, the near-surface temperature regime may shift dramatically as a result of human climate change. Bershadskii proposed a model including a sequence of transitions in the solar convective zone to explain the observed rise in sunspot number, as well as a prediction for global warming based on this scenario.

a. Air, water, plants and animals:

The future development of near-surface pollution concentrations influencing air quality at a scale that affects human health and ecosystems is a hot topic in science. Using two models, the full ecosystem model PCLake and a minimal dynamic model of lake phosphorus dynamics, researchers found that climate change will increase the dominance of cyanobacteria and that climate change will affect shallow lakes through changing hydrology and climate change-induced eutrophication.

b. Economy:

GHG emissions and the consequent climate change have a significant economic effect on the world. The Futures of Global Interdependence (FUGI) global modelling system was created as a scientific policy simulation tool for providing global information to human society and determining policy coordination possibilities among countries in order to achieve sustainable global economic development while dealing with the constraints of a rapidly changing global

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 8, August 2022

environment. The FUGI global model M200 divides the world into 200 countries/regions, with each national/regional model being globally interdependent in terms of oil prices, energy needs, international trade, export/import prices, financial flows, official development assistance, private foreign direct investment, exchange rates, stock market prices, and global policy coordination, among other things.

Akira Onishi investigated the global economy's future prospects under the limitations of energy demand and CO2 emissions up to 2020, as well as a plan for the interdependent global economy's long-term growth. In order to reduce global CO2 emissions, it is essential to address the global economy's sustainable development problem. Limits to Growth (1972) presented an unexpected proposal: world economic growth should be zero. If the world economy experiences zero growth, global catastrophes such as the Great Depression of the 1930s are likely to occur. Zero growth may reduce CO2 emissions, but it will not resolve the trade-off between environmental concerns and the global economy's desired expansion.

Alternative simulations using the FGMS (FUGI global modeling system) showed that worldwide CO2 emissions reductions are necessary to combat global warming. It should be necessary for international cooperation and coordination of development plan in order to reduce global CO2 emissions. Even if the EU and Japan cooperate and coordinate policies to reduce CO2 emissions through technological innovations for developing alternative energy and energy savings, they will not be able to meet global targets without the cooperation of major CO2 emitting countries such as the United States, China, and the Russian Federation. To reduce global CO2 emissions, developing nations should band together and encourage official development aid (ODA), particularly technical support to developing countries. Technology transfer from developed to developing nations is required to meet the goal of reducing global CO2 emissions.

c. Health:

Climate change has the potential to have a major impact on human health, ranging from direct consequences such as heat stress and floods to indirect effects such as changes in disease transmission and hunger as a result of increased competition for agricultural and water resources. Huntingford et al. argued that greater cooperation between the climate modeling and health communities is necessary, and that climate–health model simulations would give the requisite estimates of the probable effects of climate change on human health.

Global warming, according to Khasnis and Nettleman, would alter the epidemiology of infectious illnesses, and vector-borne diseases will become more prevalent as the planet heats. Francesco Bosello et al. Investigated the economic effects of climate change-induced changes in human health, such as cardiovascular and respiratory diseases, diarrhea, malaria, dengue fever, and schistosomiasis. In summer, a rise in global surface temperature (global warming) was shown to have an effect on death due to illness, especially among the elderly, while Preti et al. investigated the impact of global warming on suicide mortality using data from Italy.

1.2 Global warming:

Global warming is an issue caused by the burning of coal, oil, and other fossil fuels, which results in higher levels of greenhouse gases (GHGs) such as carbon dioxide in the atmosphere.

As a consequence, global air temperatures are rising, contributing to climate change. Global warming, in particular, will result in a rise in sea levels, changes in rainfall patterns, and other issues. There are worries that emerging nations' fast growth would accelerate global warming and aggravate resource shortages. However, Yasuhiro Murota and Kokichi Ito argued that, on the contrary, these nations' rapid growth might very likely lead to a long-term solution to the global warming issue. The global warming process is modelled as a dynamic commons game in which the players are countries, their actions at each date produce GHG emissions, and the state variable is the current stock of GHGs. The best equilibrium is given a complete theoretical characterization, and it is shown to have a very simple structure, involving a constant emission rate through time.

a. Global warming potential:

A global warming potential (GWP) index has been used to quantitatively compare the greenhouse effect of different greenhouse gases. The GWP index is based on the ratio of the radioactive forcing of an equal emission of two different gases, integrated either over time or up to an arbitrarily determined time horizon. The Global Warming Potential (GWP) index is similar to the Ozone Depletion Potential (ODP) indicator. Danny Harvey proposed an alternative GWP index that explicitly accounts for the duration of capital investments in the energy sector and is less sensitive to uncertainties in atmospheric lifespans and radiative heating than the standard GWP index for time horizons longer than the lifespan of capital investment. The effect of this alternate GWP index proposed here is that, when compared to the standard GWP index, it is less sensitive to uncertainties in atmospheric lifespans and radiative heating. GWPs were used by the Intergovernmental Panel on Climate Change (IPCC) to standardize inputs of various gases with varying radiative forcing and atmospheric lifetimes [6]–[8].

1.3 Mitigation:

The Triptych approach is a technique for distributing future GHG emission reductions across nations under a post-2012 international climate mitigation regime based on sector-level technical criteria and accounting for structural variations. Michel van Elzen et al. proposed a new Triptych method, which is a modification of an earlier version in terms of improved transparency and enabling poor nations to participate later. Although the doubling of atmospheric methane over the last two centuries may have contributed to global warming, enhanced tropospheric ozone formation, suppressed OH, and influenced stratospheric ozone, Thompson et al. calculated that stabilizing CH4 could reduce projected temperature increases and possibly mitigate background tropospheric ozone increases due to increasing CH4 levels Michel van Elzen et al. provided a set of technically viable multi-gas emission paths (envelopes) for stabilizing GHG concentrations at 450, 550, and 650 ppm CO2 equivalent, as well as their trade-offs between direct abatement costs and the likelihood of meeting temperature goals.

Tim Jackson provided a technique for evaluating the cost-effectiveness of several technological alternatives for reducing GHG emissions, which allows for the assessment of the degree to which each technology can contribute to abatement by a certain date. Consumer participation is required to mitigate global climate change, and the qualitative data examined by Semenza et al. revealed that there are a variety of cognitive, behavioral, and structural barriers to voluntary mitigation. The results of Stoll-Kleemann et al. indicated that greater attention should be paid to the social and psychological reasons for why people construct obstacles to their personal commitment to climate change mitigation, even when they express concern about the future of the planet.

a. *Economy of mitigation:*

Recent disputes about the possibility of economic and environmental double dividends have been added to discussions over the existence of a negative cost potential, making the debate over the costs of GHG emission reduction more complicated. If industrialized nations punish fuels not just on the basis of their carbon intensity, but also on the basis of their import–export, they may be able to decrease their costs of fulfilling carbon restrictions. Hadi Dowlatabadi investigated the sensitivity of mitigation cost estimates to how technological change is represented in energy economics models using basic representations of endogenous and induced technical change. Chandler et al. compiled a list of research that looked at the possibilities and costs of carbon emission mitigation methods in post-planned economies. Alexander Roehrl and Keywan Riahi looked at long-term GHG emissions and reduction under a set of high economic and energy demand growth scenarios where technology development takes different paths depending on the route taken.

1.4 Carbon sequestration:

Carbon sequestration is a critical technique for maintaining an optimal CO_2 level in the atmosphere, which helps to mitigate climate change. Atushi Kurosawa conducted a sensitivity analysis of carbon sequestration costs and the relative importance of sequestration technology in a long-term carbon management framework, and concluded that carbon recovery through ocean and geological sequestration could be included among the available carbon abatement technologies, and that its abatement potential is sensitive to carbon translocation. David Gerard and Wilson looked at a particularly thorny issue: how to guarantee sufficient long-term monitoring and maintenance of carbon sequestration sites, with a focus on bonding processes. Lionel Ragot and Katheline Schubert analyzed the asymmetry of the sequestration/de-sequestration process at a micro level and the implications at a macro level, specifically accounting for sequestration's temporality, and demonstrated that sequestration must be permanent under these assumptions.

1.5 Clean development mechanism:

The clean development mechanism (CDM) of the Kyoto Protocol was created in 1997 with the twin goal of helping non-Annex I parties in achieving sustainable development and assisting Annex I countries in meeting their quantified GHG reduction obligations. Erik Haites and Farhana Yamin examined the CDM as defined by the Kyoto Protocol, as well as the substantive, procedural, and institutional issues raised by the CDM in light of decisions made by the UN Framework Convention on Climate Change's fourth Conference of the Parties in Buenos Aires, and proposed practical options for the CDM's operation and governance in a credible and cost-effective manner. Jane Ellis et al. examined the CDM portfolio's evolution as well as the CDM's achievements to date in the context of broader private and public investment flows into developing countries, and outlined the changes that will be required to expand the CDM concept after the first commitment period ends in 2012. Larry Carp and Xuemei Liu examined and analyzed the arguments for and against the CDM, as well as presenting fresh empirical data on its potential advantages [9].

2. DISCUSSION

Climate change has the potential to have a major impact on human health, ranging from direct consequences such as heat stress and floods to indirect effects such as changes in disease transmission and hunger as a result of increased competition for agricultural and water resources. It alters the epidemiology of infectious illnesses, and vector-borne diseases will become more prevalent as the planet warms, resulting in increased mortality from illness, especially among the elderly, throughout the summer.

R&D for CO2 absorption and fixation, in addition to energy-related R&D, is critical for a fundamental solution to global warming [10]. Various mitigation methods are discussed, as well as their economic consequences. Carbon sequestration, one of the most efficient mitigation methods, is divided into three types: ocean, geological, and agricultural soil and forest sequestration. The future research focus should be on long-term monitoring and management of carbon sequestration sites utilizing bonding processes. The Kyoto Protocol's clean development mechanism (CDM), one of the most suggested and potential mitigation technologies, is examined. CDM that is both cost-effective and quick to deploy is the need of the hour. For tackling the global climate change issue, funding for GHG reduction initiatives in poorer nations is critical.

3. CONCLUSION

'There is new and stronger evidence that most of the warming seen over the past 50 years is due to human activity,' according to the IPCC's Third Assessment Report, released in 2001. As a result, human beings may ameliorate climate change and GHG emissions to a certain extent, but not entirely. There are proof facts regarding the effect of climate change on different biosphere components such as air, water, plants, animals, and humans, which, if not addressed, may result in disasters. Climate change affects air quality, promotes cyanobacteria dominance in water bodies, affects drinking water quality, changes the hydrological cycle, has consequences for fluvial geomorphology, plant range limitations, and has negative effects on animals. The critical issue that the world faces today, global warming, is addressed, as well as the global warming potential (GWP) and its economic impact. Climate change has an impact on fisheries, which has an impact on the marine economy, the wool industry, which is primarily affected by forage, water resources, land carrying capacity, and animal health, tourism, which will affect GDP by 0.3–0.5 percent in 2050, and agriculture, which is influenced by temperature rise, water quality, and availability.

REFERENCES:

[1] M. M. Rojas-Downing, A. P. Nejadhashemi, T. Harrigan, and S. A. Woznicki, "Climate change and livestock: Impacts, adaptation, and mitigation," *Climate Risk Management*. 2017, doi: 10.1016/j.crm.2017.02.001.

[2] C. Bellard, C. Bertelsmeier, P. Leadley, W. Thuiller, and F. Courchamp, "Impacts of climate change on the future of biodiversity," *Ecology Letters*. 2012, doi: 10.1111/j.1461-0248.2011.01736.x.

Research paper © 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 11, Iss 8, August 2022

[3] A. E. Cahill *et al.*, "How does climate change cause extinction?," *Proceedings of the Royal Society B: Biological Sciences*. 2013, doi: 10.1098/rspb.2012.1890.

[4] X. Wu, Y. Lu, S. Zhou, L. Chen, and B. Xu, "Impact of climate change on human infectious diseases: Empirical evidence and human adaptation," *Environment International*. 2016, doi: 10.1016/j.envint.2015.09.007.

[5] S. Vijayavenkataraman, S. Iniyan, and R. Goic, "A review of climate change, mitigation and adaptation," *Renewable and Sustainable Energy Reviews*. 2012, doi: 10.1016/j.rser.2011.09.009.

[6] R. Zimmerman and C. Faris, "Climate change mitigation and adaptation in North American cities," *Current Opinion in Environmental Sustainability*. 2011, doi: 10.1016/j.cosust.2010.12.004.

[7] C. Demski, S. Capstick, N. Pidgeon, R. G. Sposato, and A. Spence, "Experience of extreme weather affects climate change mitigation and adaptation responses," *Clim. Change*, 2017, doi: 10.1007/s10584-016-1837-4.

[8] C. M. Duarte, J. Wu, X. Xiao, A. Bruhn, and D. Krause-Jensen, "Can seaweed farming play a role in climate change mitigation and adaptation?," *Front. Mar. Sci.*, 2017, doi: 10.3389/fmars.2017.00100.

[9] C. L. Walsh *et al.*, "Assessment of climate change mitigation and adaptation in cities," *Proc. Inst. Civ. Eng. Urban Des. Plan.*, 2011, doi: 10.1680/udap.2011.164.2.75.

[10] J. T. Abatzoglou and A. P. Williams, "Impact of anthropogenic climate change on wildfire across western US forests," *Proc. Natl. Acad. Sci. U. S. A.*, 2016, doi: 10.1073/pnas.1607171113.