

Global Warming & Climate Change

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ABSTRACT

Many researchers, engineers and environmentalists are expressing deep concerns about changes in the overall climate of the planet. Fossil fuels are being used to produce electricity. The burning of these fuel produces gases like carbon dioxide, methane and nitrous oxides and many more gases which lead to global warming. Deforestation is also leading to warmer temperatures. The hazard of global warming is continuously causing major damage to the Earth's environment. Most people are still unaware of global warming and do not consider it to be a big problem in years to come. What most people do not understand is that global warming is currently happening, and we are already experiencing some of its withering effects. It is and will severely affect ecosystems and disturb ecological balance. Because of the treacherous effects of global warming, some solutions must be devised. The paper introduces global warming, elaborates its causes and hazards and presents some solutions to solve this hot issue. Above all, alternative energy sources (solar, wind, hydro, geothermal, bio mass) need to be seriously pursued. Finding and using renewable sources of energy is one of the methods to combat the ever increasing global warming effectively.

KEYWORDS: Climate change, Global warming, Greenhouse gasses, Climate models, Temperature rise, Sea level rise, Extreme weather events, Mitigation strategies.

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, while is 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 (hot) up, this solar energy is radiated by thermal radiation and infrared rays, propagating directly out to space thereby lowering the temperature the Earth. Some of the outgoing radiation is reabsorbed by co₂, water vapours, ozone, methane and many other gases in the atmosphere and is radiated back to the surface of Earth. These gases are basically called 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. The planet has experienced the largest increase in surface temperature over the last 100 years. Between 1906 and 2006, the Earth's average surface temperature augmented between 0.6 to 0.9 degrees Celsius, however Nitrous oxide is released into the atmosphere by various nitrogen-based fertilizers including urea and diammonium phosphate and other soil management utilizations. When these gases are released, then these gases stay in the atmosphere for decades or even longer. According to Intergovernmental Panel on Climate Change (IPCC), co₂ and methane levels have increased by 35% and 148 % since the industrial revolution of 1750.

II. RELATED WORK

Today, we live an ordinary life in the beautiful digital, globalized world where climate change has a decisive role. What happens in one country has a massive influence on geographically far apart countries, which points to the current crisis known as COVID-19 (Sarkaret al. 2021). The most dangerous disease like COVID-19 has affected the world's climate changes and economic conditions (Abbass et al. 2022; Pirasteh-Anoshehet al. 2021). The purpose of the present study is to review the status of research on the subject, which is based on "Global Climate Change Impacts, adaptation, and sustainable mitigation measures" by systematically reviewing past published and unpublished research work. Furthermore, the current study seeks to comment on research on the same topic and suggest future research on the same topic. Specifically, the present study aims: The first one is, organize publications to make them easy and quick to find. Secondly, to explore issues in this area, propose an outline of research for future work. The third aim of the study is to synthesize the previous literature on climate change, various sectors, and their mitigation measurement. Lastly, classify the articles according to the different methods and procedures that have been adopted.

III. DATA AND SOURCES OF DATA

Table shows the data and sources related to global warming and climate-change, focusing on bold indicators and organizations.

Indicator	Data Source	Description/Notes
Global Temperature Change	NASA (.gov) & NOAA (.gov)	Tracks global surface temperature anomalies relative to pre-industrial levels (1850-1900).
Greenhouse Gas Concentrations	WMO & IPCC	Monitors atmospheric concentrations of CO ₂ , methane (CH ₄), and nitrous oxide (N ₂ O), key greenhouse gases.
Sea Level Rise	NOAA National Centers for Environmental Information (NCEI) (.gov) & Our World in Data	Measures the average global sea level and its rate of increase, influenced by thermal expansion and ice melt.
Sea Ice Extent	NASA (.gov) & NOAA (.gov)	Tracks the area covered by sea ice, particularly in the Arctic and Antarctic, and its seasonal changes.
Glacier Mass Balance	Ministry of Statistics and Programme Implementation (MOSPI) & IPCC	Monitors the changes in glacier size and mass, indicating the impact of warming on ice storage.
Extreme Weather Events	NOAA (.gov) & Our World in Data	Records the frequency and intensity of extreme events like heatwaves, droughts, floods, and storms, linked to climate change.
Greenhouse Gas Emissions	UNFCCC & U.S. Energy Information Administration	Tracks human-caused emissions of greenhouse gases from various sectors (energy, industry, agriculture, etc.).

IV. SYSTEM ARCHITECTURE

The system architecture of global warming and Climate change involves the intricate relationships between numerous gases and human-made factors that impact on the Earth's climate." This "model" refers to how many different processes, feedback-loops, and factors are interconnected and affect global temperatures, weather patterns, ecosystems, and human society. Below is a simplified model of the key components of this system:

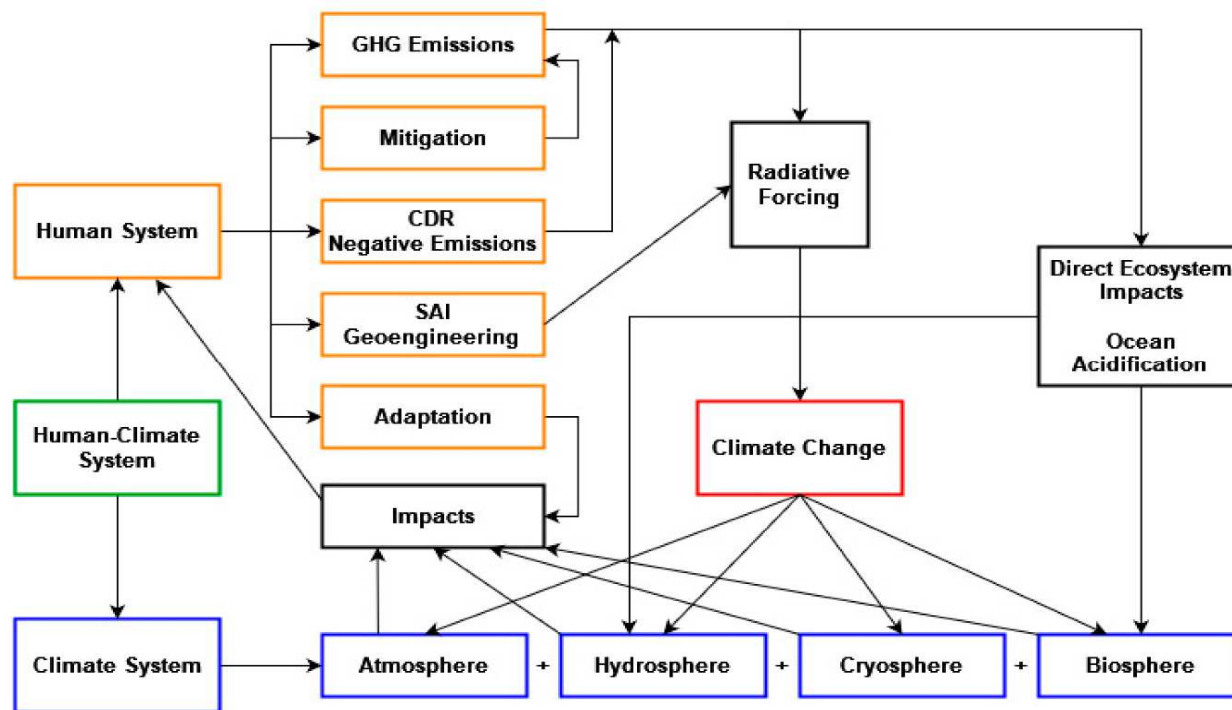


Fig. 1 Climate Change

1. Earth's Climate System

- Atmosphere: It composed of gases like (CO₂), (CH₄), nitrous oxide (N₂O), and water vapor. These gases creates heat in the atmosphere, leading to the greenhouse. Human works like burning fossil fuels (coal, oil, natural gas) increase the concentration of these gases, leading to rise global warming.
- Oceans: Oceans behave as heat Submerges, absorbing large amounts of energy coming from the sun. However, warming oceans can cause rise in sea level due to thermal expansion and melting ice caps. They also

contribute to extreme weather events like hurricanes and etc.

- Biosphere: The worlds ecosystems (forests, wetlands, grasslands, and oceans) Capture and throw greenhouse gases primarily CO₂. Deforestation, agriculture, and other human activity reduce the natural carbon sink, leading to higher concentrations of CO₂.

2. Human Activities

- Fossil Fuel Combustion: The burning of coal, oil, and natural gas for energy Formation is a primary source of

CO₂ emissions. This contributes directly to the greenhouse effect.

- Agriculture: Livestock farming produces methane (CH₄), a potent greenhouse gas. Additionally, agricultural practices, including the use of fertilizers, contribute to nitrous oxide (N₂O) emissions.
- Deforestation: Trees absorb CO₂, so cutting down forests for agriculture or urban development reduces the Earth's ability to sequester carbon.

3. Climate Impact and Consequences

- Extreme Weather Events: Global warming Results in more frequent and severe weather changes, including hurricanes, heatwaves, floods, and droughts etc.
- Rising Sea Levels: Dissolving ice caps and thermal expansion of seawater cause rising sea levels, threatening coastal cities and ecosystems.
- Ocean Acidification: Increased CO₂ in the atmosphere also leads to higher levels of CO₂ in seas, causing ocean acidification, which harms marine life, especially coral reefs and shellfish.

4. Global Climate Policy and Mitigation Efforts

- International Agreements: policies like the Paris Agreement aim to limit global temperature rise to below 2°C (preferably 1.5°C) above pre-industrial levels by reducing gas emissions.
- Renewable Energy Transition: The shift from fossil fuels to renewable energy sources like winds, solar, and hydropower is essential in reducing emissions.
- Carbon Capture and Storage (CCS): Technologies that capture CO₂ emissions from power plants and industrial sources and store them underground or get used them for other purposes.

5. Climate Change Adaptation

- Infrastructure Resilience: Designing entire cities, buildings, and transportation systems to withstand extreme weather events and rising sea levels.
- Water Management: Developing sustainable water management systems to address both droughts and floods etc.
- Disaster Preparedness: Early warning systems and emergency responses to protect communities from climate-related disasters.

V. RESEARCH METHODOLOGY

This review-based article followed systematic literature review techniques that have proved the literature review as a rigorous framework (Benita 2021; Tranfield et al. 2003). First, finalized the research theme to search literature (Cooper et al. 2018). Second used numerous research databases to search related articles and download from the database (Web of Science, Google Scholar, Scopus Index Journals, Emerald, Elsevier Science Direct, Springer, and Sciverse). We focused on various articles, with research articles, feedback pieces, short notes, debates, and review articles published in scholarly journals. Reports used to search for multiple keywords such as "Climate Change," "Mitigation and Adaptation," "Department of Agriculture and Human Health," "Department of Biodiversity and Forestry," etc.

The study searched 10 articles on a different database mentioned above based on the nature of the study. It excluded 5 irrelevant papers due to copied from a previous search after readings titles, abstract and full pieces. The criteria for inclusion were: (i) articles focused on "Global

Climate Change Impacts, adaptation, and sustainable mitigation measures," and (ii) the search key terms related to study requirements. The complete procedure yielded 15 articles for our study.

VI. RESULTS AND DISCUSSIONS

Global warming, Persistent by increased greenhouse gas emissions, is causing climate change, leading to rising temperatures, melting glaciers, and sea in level rise, with significant impacts on ecosystems and human societies.

➤ Rising Temperatures

The Earth's average surface temperature has increased by approximately 1 degree Celsius since the late 1950s.

➤ Melting Glaciers and Ice Sheets

Global warming causes glaciers and ice sheets to melt at an accelerated rate, contributing to rising sea levels.

➤ Sea-Level Rise

Melting of glaciers and thermal expansion of water due to warming oceans lead to a rise in sea levels, threatening coastal communities and ecosystems.

➤ Extreme Weather Events

Climate change is related with an increase in the frequency and intensity of extreme weather events, such as heatwaves, droughts, floods, storms etc.

➤ Ocean Acidification

The absorption of extra carbon dioxide by the oceans leads to acidification, which poses a threat in marine ecosystems, particularly coral reefs.

➤ Changes in Ecosystems

Climate change Repercussions ecosystems through shifts in temperature, precipitation patterns, and sea levels, leading to habitat loss, species displacement, and biodiversity decline.

VII. CONCLUSION

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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