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Socio – economic Impacts of Climate Change: an Overview on Mitigation Approaches

Sonali Kumari[1], Vikram Singh[2]
[1]Ph.D. Scholar, Soil and Water Conservation Engineering, SHUATS, Prayagraj
[2]Associate Professor, Soil and Water Conservation Engineering, SHUATS, Prayagraj

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Abstract

Globally, climate change is becoming a real and palpable threat to people's lives. It poses a serious threat to rural livelihoods, food security, and agriculture. Although the effects of climate change are seen worldwide, nations like India are particularly vulnerable because of their large agricultural population, which depends on the monsoon season. India has the difficulty of maintaining its fast economic expansion in the face of the growing global threat posed by climate change. India has already demonstrated its willingness to contribute to the global effort to combat climate change, and the Indian government has made solving these issues a key priority. The policy problem of climate change is intricate and has significant financial ramifications. Costs are a necessary component of all strategies and solutions to mitigate the negative effects of climate change. In order to plan and carry out adaptation and mitigation programs, funding is essential in developing nations. NABARD is currently implementing a number of measures to address the problems brought about by climate change, especially with regard to the rural economy and agricultural sectors. To support adaptation and mitigation efforts in India, NABARD seeks to direct financial resources from the public, private, and international sectors.

Keywords:- climate change, NABARD, mitigation, adaptation.

Introduction

A shift in the statistical distribution of weather throughout epochs ranging from decades to millions of years is referred to as climate change. A shift in the distribution of weather events around an average (for instance, more or less extreme weather occurrences) or a change in the average weather are two possible outcomes. Climate change can happen all around the planet or just in one particular area. It can be brought on by more isolated occurrences like the Dust Bowl or by cyclical, recurrent climatic trends like the El Niño-Southern Oscillation. Nowadays, the term "climate change" typically refers to modifications to the current state of the climate, particularly when discussing environmental policy. Anthropogenic climate change, or "global warming" or "anthropogenic global warming" (AGW), may apply to it.

In the current scientific and technological period, global climate change is a major problem on a worldwide scale (Zhang and Liu, 2012). The amount of natural resources as well as the quality of the global environment has drastically changed in the current period of science and technology due to the quick speed of industrialisation and urbanisation (Rai, 2008a; Rai, 2008b; Rai and Tripathi, 2009). The Environmental Protection Agency-USA (USEPA) states that as the world's population rises, more and more nations have to deal with the issue of environmental change brought on by the significant growth of the industrial sector. Population expansion and the production of agrochemicals to support agriculture will go hand in hand. Population growth will also raise the demand for resources from industry.

The majority of scientists believe that anthropogenic global warming has either already started or will manifest in the very near future, with average global temperatures predicted to rise by 1.5–4.5°C by the middle

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of the next century (IPCC, 1990). This is if the views held by the Intergovernmental Panel on Climate Change (IPCC) are an accurate indicator of global scientific opinion. There is broad consensus that since the industrial revolution, the main greenhouse gases—carbon dioxide (CO2), nitrous oxide (N20), methane (CH4), and chlorofluorocarbons (CFCs)—have been released into the atmosphere at greater rates and accumulated there. This warming is the result, despite our incomplete understanding of the processes at play (GHGs). There have been increasing calls to start enacting strict legislative measures to reduce GHG emissions due to anticipation in certain sectors of a number of unfavourable effects of such warming (Wirth and Lashof, 1990).

2. Evidence for Climate Change

2.1 Rising Global Temperatures

The global average temperature has risen by approximately 1.1°C since the pre-industrial era. The past decade was the hottest on record.Data are from NASA 2020, NOAA, and the Intergovernmental Panel on Climate Change, 2021 (IPCC).

2.2 Melting Ice Sheets and Glaciers

Satellite observations show significant ice loss from Greenland and Antarctica, contributing to sea-level rise. Glaciers around the world are retreating at an accelerated pace.This leads to rising sea levels, which threaten coastal areas and small islands.Studies from NASA's GRACE satellites, IPCC reports, and regional studies in the Himalayas, Alps, etc.

2.3 Sea-Level Rise

Global sea levels have risen by about 20 cm since the late 19th century, with an accelerated rise in the last two decades. There is flooding of coastal cities, displacement of populations, and increased risk from storm surges.Studies from NOAA and the IPCC's Fifth and Sixth Assessment Reports.

2.4 Ocean Warming and Acidification

Oceans have absorbed over 90% of the excess heat generated by greenhouse gas emissions, leading to warmer waters. Increased CO2 absorption is also making oceans more acidic.This threatens marine life, coral reefs, and global fisheries.Studies from IPCC reports, NOAA, and studies on coral reef degradation.

2.5 Extreme Weather Events

Increased frequency and intensity of heatwaves, droughts, hurricanes, and heavy rainfall are linked to climate change. Events like wildfires in Australia and California, and severe hurricanes in the Atlantic, demonstrate this trend.Observational studies from NOAA, World Meteorological Organization,2019 (WMO), and IPCC.

2.5 Changes in Precipitation Patterns

Some regions are experiencing more intense rainfall and flooding, while others are facing prolonged droughts.This affects agriculture, water supply, and ecosystems.Studies from regional climate studies, IPCC reports.

2.6 Shifting Ecosystems and Species Migration

Many species are shifting their ranges toward the poles or higher elevations in response to changing temperatures. Seasonal patterns like flowering, migration, and breeding are also changing.Biodiversity loss, changes in ecosystems, and the disruption of food chains.Research from the World Wildlife Fund (WWF), IPCC reports, and ecological journals.

2.7 Carbon Dioxide Levels

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Atmospheric CO2 levels have increased from about 280 ppm in the pre-industrial era to over 420 ppm today, the highest in at least 800,000 years. Data are from the Mauna Loa Observatory and IPCC reports.

2.8. Permafrost Thawing

Permafrost in the Arctic and sub-Arctic is thawing; releasing methane, a potent greenhouse gas, into the atmosphere.This accelerates global warming and affects local ecosystems and infrastructure.Arctic studies, NASA, and IPCC reports.

3. Climate Change and Its Impact

Predictions and recent data suggest that climate change is advancing and will cause significant changes in a variety of climatic variables. The average and variance of temperature and precipitation, extreme weather, the production and pricing of food and agriculture, the accessibility and availability of water, nutrition, and health status will all change. Due to their geographic exposure, reliance on industries that are susceptible to climate change, low incomes, and limited capacity for adaptation, developing countries are expected to have the greatest negative effects. Although socioeconomic effects are often poorly understood, they are probably going to have a significant effect on people in a number of ways, both directly and indirectly (Stern, 2006; IPCC, 2007; Cline, 2007; Tyler, 2010; Zhang and Liu, 2012). Climate catastrophes have the potential to trigger poverty traps and permanent losses of people and physical wealth.

Climate change may increase climatic unpredictability and extremes, and the experience with managing existing climatic variability does not portend well for future events.Fluctuation in temperature and rainfall already contributes to fluctuation in agricultural productivity and food security in many regions of Africa and beyond (Molua, 2002). Research has shown how expensive, difficult, and successful it may be for the impoverished to adapt to climatic extremes such storms, droughts, and floods (Kates, 2000). Extreme weather-related natural disasters frequently erase the benefits of progress, claiming lives and ruining livelihoods. (Sen 1981) noted that famines are man-made catastrophes brought on by climate threats and human inaction in the face of ensuing drops in food supply.

Responses to climate change have been observed in many different systems and geographical areas. Significant changes related to warming have also been studied in coastal processes, marine and freshwater biological systems, agriculture, and forestry (Matthews et al., 2011; Wilby and Keenan, 2012). Changes related to regional warming have been documented primarily in terrestrial biological systems, the cryosphere, and hydrologic systems. The hydrology of Indian River basins has been negatively impacted by climate change (Gosain et al., 2006).

The activities of humans that alter the environment are known as anthropogenic factors. The direct and clear causal relationship between human activity and climate change exists in certain situations, while it is less evident in others. There has been debate about several theories regarding climate change caused by humans for a long time. Presentlythe scientific consensus on climate change is that human activity isvery likely the reason for the fast increase in global averagetemperatures over the past several decades. As a result, the discussion has mostly centred on how to lessen future human effect and figure out how to adjust to existing change. The increase in CO2 levels brought on by the burning of fossil fuels is the most concerning of these human influences, followed by aerosols (particulate particles in the atmosphere) and cement manufacturing.Concerns about additional factors that impact climate, microclimate, and measurements of climatic variables include land use, ozone depletion, animal agriculture, and deforestation. These factors can affect these variables alone or in combination with other causes.

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Hess et al. (2008), Keim (2008), Kinney (2008), and Ebi and Semenza (2008) all make reference to the close connection between human health and climate change. According to estimates from the World Health Organisation, throughout the previous 30 years, the warming and precipitation trends brought on by human climate change have already claimed over 150,000 lives yearly. Climate variations are associated with a number of common human disorders, including starvation from crop failures, altered spread of infectious diseases, and cardiovascular and respiratory problems brought on by heat waves.

The increase in global surface temperature for the 100 years ending in 2005 was 0.74 ± 0.18 °C (1.33 ±0.32°F). The majority of the temperature increase that has occurred since the middle of the 20th century, according to the Intergovernmental Panel on Climate Change (IPCC), is "very likely" caused by an increase in the quantities of greenhouse gases that are produced by humans (Table 1). Singh 2005 also included the Centre for International and Environmental Research report, which is located in Oslo, while talking about the effects of climate change (Rahish Singh, 2005).

Table 1 Annual green house gas emission by sector

Sector	GHG gases (%)	CO2 (%)	Methane (%)
Power Stations	21.3	29.5	-
Industrial Processes	16.8	20.6	-
Transportation fuels	14.4	19.2	-
Agricultural bi-products	12.5	-	40
Fossil fuel retrieval, processing and distribution	11.3	8.4	29.6
Residential, commercial and other sources	10.3	12.9	4.8
Land use and bio-mass burning	10.0	9.4	6.6
Waste disposal and treatment	3.4	-	18.1

Source: IPCC Report

Human societies have a long history of adjusting to changing climatic conditions and hazards. The requirement to manage climate risks influences household asset portfolios and livelihood decisions, particularly for low-income and rural families. Climate-related disasters nevertheless cause destruction.

According to forecasts from climate models, over the twenty-first century, the global surface temperature is expected to rise by an additional 1.1 to 6.4 °C (2.0 to 11.5 °F). This estimate is questionable since several models with varying degrees of climate sensitivity were used, as well as different projections of future greenhouse gas emissions. How global warming and its effects will differ in different parts of the world is another unknown. Even if greenhouse gas levels are stabilised, warming is predicted to last for more than a thousand years, even though most studies only include the years up to 2100. This is a result of the oceans' high heat capacity.

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Sea levels will increase as a result of rising global temperatures, which will also alter the amount and pattern of precipitation, probably affecting large areas of the subtropical desert. The severity of extreme weather events rising, altered agricultural yields, altered trade routes, glacier retreat, extinctions of species and expansions in the areas of disease vectors are among the other anticipated repercussions.

4. Issues & Mitigating Steps of Climate Change: Indian Perspective on Legal as well as Related Polities

In the past several years, the most discussed subjects in journals, newspapers, and magazines have been climate change and global warming. It cleared the path for studies to lessen the effects of climate change on a global scale (Desai, 2012; Zhang and Liu, 2012). The significance of this occurrence was brought to light in 2007 when Al Gore and R K Pachauri, the chairman of the Intergovernmental Panel on Climate Change (IPCC), were jointly given the Nobel Peace Prize. The presidents of four other developing economies—China, Brazil, Mexico, and South Africa—as well as the Prime Minister of India, Dr. Manmohan Singh, went on the attack in the climate change discussion, demanding that the developed world cut greenhouse gas emissions significantly first (K. Venugopal,2007).

In advance of the G-8 Summit, which will take place in Japan, Dr. Manmohan Singh recently launched the "National Action Plan on Climate Change" in India. The National Action Plan focusses on eight objectives that will be pursued as essential elements of the strategy for sustainable development, while also encompassing a wide variety of initiatives. These include missions on solar energy, increased energy efficiency, sustainable habitat, saving water, supporting the Himalayan ecosystem, developing a “Green India,” sustainable agriculture and, lastly, constructing a strategic knowledge platform for climate change.

"India is ready to play its role as a responsible member of the international community and make its own contribution," Dr. Singh continued. In the global discussions held under the auspices of the United Nations Framework Convention on Climate Change (UNFCCC), we are already doing this, and the result we want must be efficient, just, and equitable. He went on to say that each and every person on the earth has to have an equal portion of the global atmosphere. Therefore, the only just foundation for a global climate change compact was the long-term convergence of per capita emission. The Prime Minister said that attaining the growth targets should not conflict with ecologically sustainable development, given the imperative of swift economic growth to combat the pervasive poverty in the nation. In actuality, a more comprehensive viewpoint on growth is required. It must encompass a higher level of living in addition to the quantity of commodities and services acquired. (The Hindu, Aarti Dhar, 2008).

Prior to this, India had chastised the United States for raising reservations about the agreement's clause that fixed a 2009 deadline for negotiating a new climate change accord. This was disclosed to The Hindu by Science and Technology Minister and head of India's mission to the Bali climate change summit, Kapil Sibal (17 December 2007).
Saifuddin Soz, the Union's minister of water resources, has also demanded quick action in order to do a realistic evaluation of the impact of climate change on water supplies. "Agriculture, ecology, and health-related issues will undoubtedly be impacted by the effect of climate change on water," he said during the "Kshitij 2008," an annual techno-management festival held at the Indian Institute of Technology, Kharagpur.

5. Conclusion- Climate change is defined as variations in the global temperature that occur in addition to the natural variations in the climate that are seen over comparable time periods and that are either directly or indirectly caused by human activities changing the composition of the atmosphere. Nevertheless, the United States of America has yet to ratify the Kyoto Protocol, which aims to cut greenhouse gas emissions in the

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atmosphere and environment. Despite this, the country emits 20% of all carbon dioxide. The scientist has surveyed using 1750 A.C. as the base year. Their study indicates that the globe's average temperature has climbed by around 1 degree Celsius.

The socio-economic impacts of climate change are profound and far-reaching, affecting communities, economies, and ecosystems worldwide. As extreme weather events intensify, agricultural productivity declines, water resources become strained, and vulnerable populations are disproportionately affected. The rising cost of adaptation and mitigation efforts is placing additional pressure on governments, businesses, and individuals.

Mitigation approaches such as transitioning to renewable energy, improving energy efficiency, and adopting sustainable agricultural practices are critical to curbing greenhouse gas emissions and reducing the adverse effects of climate change. Additionally, global cooperation through frameworks like the Paris Agreement, along with local adaptation strategies, is essential for building climate resilience.

Ultimately, addressing the socio-economic challenges of climate change requires a holistic approach that balances economic growth with environmental sustainability, prioritizes vulnerable communities, and fosters innovation in low-carbon technologies. By investing in mitigation and adaptation measures now, we can safeguard both our environment and economy for future generations.

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