# CAUSES AND CONSEQUENCES OF CLIMATE CHANGE - A THEORETICAL APPROACH

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## Abstract

The study examines existing literature on issues of climate change challenges globally, with particular emphasis on mitigating and adapting to climate changes. The study discusses the causes and consequences of climate change, policies and initiatives being implemented by various countries, as well as potential trade-offs and synergies between mitigation and adaptation strategies. It also focuses on how specific sectors such as forestry and the agricultural sector can improve food security, rural livelihoods and carbon sequestration. The study emphases the need for increased investment in green technology, more effective legislation on climate, and improved cooperation internationally. Additionally, it provides some suggestions for incorporating and mitigation and adaptation techniques into an integrated sustainable development paradigm.

**Keywords:** Climate change, Greenhouse, Mitigation, Adaptation, Carbon sequestration
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## 1. INTRODUCTION

Climate change is one of the most pressing issues confronting the globe today. It is a worldwide issue that has persisted for thousands of years and affects a wide range of scientific, economic, social, political, moral, and ethical concerns (Wang & Horton, 2015). Carbon dioxide, a heat-trapping greenhouse gas, has been present in the atmosphere for thousands of years, therefore the Earth (particularly the oceans) will need time to adjust to warming. As a result, even if the world stops creating greenhouse gases today, the repercussions of global warming and climate change would harm future generations (Schaftel, 2022).

In order to combat climate change, people and organizations functioning at various geographic sizes, from local to global, must engage in a complex set of "geographical duties" that are intertwined and connected to the world issue (Massey, 2004). Combating climate change has always been envisioned as a geographical and social activity by urging people to "think globally and act locally" (Massey, 2005). In response to others who have underlined the limits of particular agencies in addressing the pressing sustainability challenges, Devine-Wright (2013) concentrated on micro and macro players, in order to create effective management efforts at the local level. This is vital to instil a wider global consciousness in addition to modifying individual behaviours.

This is true for localized programs that unite people in action as well as more comprehensive legislative measures like smart meters that aim to drastically alter consumer behaviour (Hoenkamp et al., 2011). Also, it is essential to implement policies and practices that can promote environmental sustainability, regional groupings must successfully navigate prevailing agendas and players at the regional, national, and international levels. Combating climate change needs both mitigation (lowering emissions) and adaptation (preparing for inevitable consequences) strategies. Changes in land use, industry, buildings, transportation, and energy infrastructure are all required to reduce greenhouse gas emissions. Planning for resilience and catastrophe management is necessary for adaptation given our understanding of the environment and catastrophic occurrences. There are several ways to make a difference, thus a variety of challenges might be seen as opportunities (Rolnick, et al. 2022). Therefore, the purpose of this research is to evaluate the literature on addressing the causes and challenges of climate change. In order to achieve this objective, a library-based research design was adopted.

## 2. CLIMATE CHANGE

The change in climate is the gradual alteration of a planet's or a region's typical weather patterns. Changes in temperature, precipitation, wind, storms, and other indicators are used to measure this (Suarez, 2022). Other key indicators, such as sea level rise, can also be used to track climate change. The average surface temperature is considered by experts to be the most significant indication of climate change. The average global temperature has increased by 0.65°C in the last 50 years. Another crucial aspect to take into account for its impact on surface temperature is

the temperature of the entire ocean. The ocean absorbs the majority of the heat contributed to the Earth's climate system, and as ocean cycles, a portion of this heat is released into the atmosphere, amplifying the warming impact over time (Shaw, et al. al., 2018).

Extreme weather events are becoming more often and intense as a result of climate change, affecting people's lives and activities (Hallegatte et al., 2016). Climate-related shocks are already a key contributor to food crises and are doing enough to reverse decades-long patterns of progressively falling undernutrition, which is especially connected with chronic poverty and vulnerability (FSIN, 2017).

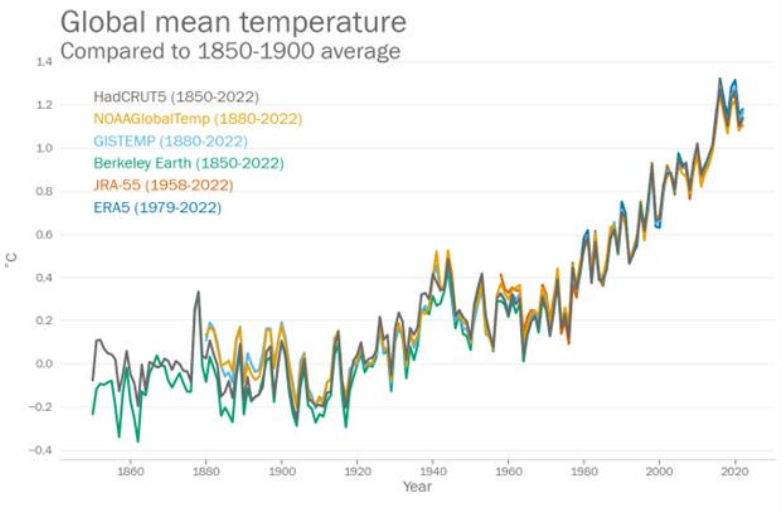


***Figure 1.*** *Change in global mean temperature*

*Source: World Meteorological Organization 2023*

Climate change is becoming more severe than ever, since 1993, the pace of sea-level rise has more than doubled. Since January 2020, it has climbed by around 10mm, hitting a new height this year. The previous two and a half years alone have contributed for 10% of overall sea level increase since satellite monitoring began nearly 30 years ago (World Meteorological Organization 2023). The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report was issued in 2014, forecasting that global mean surface temperature will rise by 0.85°C between 1910 and 2010, with the biggest increase in climatic activity occurring between 1951 and 2010. The research also identified an acceleration in the pace of warming, with the average rate from 1998 to 2012 being 0.05°C per decade greater than the average rate from 1951 to 2012 (Christis, et al. 2019). Since 2010, the global average surface temperature has been rising, and the five-year period from 2014 to 2019 was the warmest on record. The average rate of warming over this period was 0.14°C per decade, more than double the average rate from 1951 to 2012.

Unless emissions are drastically decreased, the IPCC predicts that global average surface temperature will climb by 1.5°C over pre-industrial levels by 2022.

In 2010, this equates to a 0.65°C increase. Changes in precipitation patterns, a rise in the frequency and severity of extreme weather events, and an increase in the frequency and intensity of heat waves are only a few of the negative repercussions of such changes on the environment and human health. The resulting damage to the Alps was a result of a massive fire that destroyed the Alps in the early 2022. For the 26th year in a row, the Greenland ice sheet has lost bulk, and in September it poured instead of snowed for the first time (Global Carbon Budget, 2020).

### 2.1. CAUSES OF CLIMATE CHANGE

The fundamental source of current climate change is human activity, which contributes to the build-up of greenhouse gases in the atmosphere. The heat emitted by the sun's radiation heats the globe. Certain atmospheric gases function as greenhouse gas by encasing this heat (Gerber, et al., 2013). Methane, carbon dioxide, and water vapor are the major gases responsible for global warming. When greenhouse gases absorb heat and release part of it into the atmosphere, surface temperatures rise. Sometimes this phenomenon is referred to as the greenhouse effect (Black, et al., 2017).

The greenhouse effect is amplified by human activities that raise atmospheric concentrations of greenhouse gases, notably carbon dioxide. Global warming results from an increase in the capacity of the atmosphere to hold heat due to rising greenhouse gas concentrations. The burning of fossil fuels (gas, oil, and coal) and other industrial activities are the principal producers of carbon dioxide. Anthropogenic climate change is the name given to climate change brought on by human activities (National Academy of Sciences, 2020).

### 2.2. MITIGATION OF CLIMATE CHANGE

Emissions of heat-trapping greenhouse gases can be reduced by lowering their sources (such as the use of fossil fuels for transportation, heating, or electricity) or "sinking" them through absorption and storage (Rolnick, et al., 2022). According to the United Nations Climate Change Mitigation Report in 2014, the prompt recovery of greenhouses helps ecosystems to adapt naturally to climate change, thereby keeping the effects of gas concentrations stable. The only way to avert climate change and avoid production disasters is to reduce the effect of human activity.

Regardless of the mitigation plan adopted, the inertia of socioeconomic and climatic systems depending on greenhouse gas emissions will unavoidably force the globe to endure some degree of climate change and related negative repercussions. Yet the less probable it will be affected; the sooner mitigation steps are started. Even mild climate change adaptation will be required to guarantee the livelihoods and food security of many of the world's poorest countries. Finding an efficient mix of adaptation and mitigation techniques to decrease the overall effects of climate change has therefore been recognized as a critical challenge for climate policy (Devine-Wright, 2013). This entails identifying a variety of connections between certain adaptation and mitigation measures that might result in a more effective distribution of "mitigation" resources. These synergies are especially prevalent in

forestry and agriculture, which are crucial for rural living in developing nations (Fortuny, 2022).

In the land sector, there is now a tremendous amount of untapped mitigation potential with relation to project activities not allowed under the "Clean Development Mechanism (CDM)". That is, preventing deforestation and enhancing agroforestation (Hoenkamp et al., 2011). Agricultural soil carbon sequestration, which is crucial for improving prospects for food security and rural livelihoods, may also be included, albeit to a much lesser extent. This can be accomplished either directly through project operations that enhance the quality of the soil and water in already susceptible regions or indirectly through chances for income diversification away from the high-risk cultivation of subsistence foods (United Nations Food Agricultural Organization [FAO], 2012).

By combining these sorts of projects into a revised post-2012 framework, it would be able to increase the sequestration capacity of CO2 by 10-15 billion tonnes per year by 2030. This would be enough to fully offset the greenhouse gas emissions produced by the combined agricultural and forestry sectors, making them carbon-neutral (Hayes, et al., 2018). Agroforestry and forestry-based mitigation techniques would also be very profitable. Funds released from less cost-effective mitigation measures might be utilized to pursue adaptation strategies that are necessary to safeguard food security and improve rural livelihoods in the face of climate change without being hampered by mitigation limitations at every step (Hayes, et al. 2018).

By focusing mitigation goals on significant cost-effective sectors, it is feasible to pick adaptation needs in significant food-producing activities while simultaneously providing mitigation. Many adaptation strategies that boost rural incomes and system resilience could still be highly successful in reducing the consequences of climate change, creating conditions where everyone wins without blame. For example, this would encompass the full spectrum of beneficial techniques that enhance the conservation of soil and water resources (Hallegatte, et al., 2016).

## Critique of Mitigation Measures

The United Nations Framework Convention on Climate Change (UNFCCC) is the most important international climate change agreement. It outlines principles and goals for global action to reduce greenhouse gas emissions and lessen the consequences of climate change. In December 2015, the UNFCCC was superseded by the Paris Agreement. The goal is to limit global warming to 1.5°C or less over pre-industrial levels and to stay below 2°C.

A key component of global efforts to tackle climate change was the Paris Accord. The objective is to enhance climate funding, strengthen capacity building, encourage adaptation to climate change, and reduce emissions. In accordance with the Paris Agreement, several nations have pledged to take the following actions, among others: establishing emissions goals, investing in renewable energy, and phase-out of fossil fuels (Meinshausen, et al., 2022; Masson-Delmotte, et al. 2021).

But there is mounting scepticism of how well these actions are working to combat climate change. The aforementioned investigation was conducted by the

National Institute of Standards and Technology (NIST) and was published in the Journal of the American Chemical Society. It brought attention to the need for more ambitious promises, especially from developed nations. In order to successfully combat climate change, it also stressed the need for more investment in green technology and stronger international collaboration (Eyring, et al. 2021).

Moreover, there is evidence to support the notion that the existing climate policies are ineffective. For instance, the Global Carbon Budget 2020 study revealed that despite the promises made by nations, global carbon dioxide emissions have risen since the Paris Agreement was signed. This shows that present emissions-reduction efforts are insufficient (Global Carbon Project, 2020).

### 2.3. ADAPTATION

Climate change is one aspect of adaptation to living in a changing environment, according to the National Academy of Sciences (2020). Less exposure to the harmful effects of climate change is the aim (rising sea levels, more extreme weather events, food insecurity, etc.). This entails making the most of the anticipated advantages of climate change, such as; longer growing season and better yields in some regions (Fortuny, 2022).

Throughout history, people and cultures have successfully learnt to adapt to changing climates and climatic extremes. Drought in particular has exacerbated climate change, which has influenced both the growth and collapse of civilizations. The Earth's climate has been comparatively stable for the last 10,000 years, enabling modern civilization and agriculture to flourish (FSIN, 2017). Fortuny (2022) contend that rather than a substantial temperature increase over the next 1000 years or more, the existing way of life is destined to this unchanging climate. The world must change, just as the climate does gets harder when the climate changes more quickly.

Although being a worldwide issue, climate change has an effect on neighbourhood communities. Local government organizations are thus leading adaption initiatives. Local communities worldwide are concentrating on identifying solutions to particular climate-related issues. Other objectives include improving drainage pavements to deal with floods and runoff, increasing water storage and consumption, preparing for heatwaves, constructing flood defences and high temperatures (Devine-Wright, 2013; Hoenkamp, et al., 2011).

According to the United Nations Intergovernmental Panel on Climate Change 2014 study, Effects of Climate Change, Vulnerability and Adaptation, governments at all levels are getting more effective at adapting. Managing the world's increasingly severe natural catastrophes, safeguarding coasts and addressing sea level rise, maintaining land and forests to the best of one's ability, coping with and preparing for drought, and creating new agricultural types, energy sources, and public infrastructure. Many facets of international security are impacted by climate change. (Shaw et al. 2018).

## 3. STRATEGIES FOR CLIMATE CHANGE MITIGATION AND ADAPTION

Seagrass, mangroves, and salt marshes are examples of distinctive coastal ecosystems that serve as marine habitats and natural water filters and they ought to be kept (Fawzy, et al., 2020). By soaking up storm surges and floods, it shields coastlines from the consequences of increasing sea levels. It also stores considerable amounts of carbon in plant roots and soil. More than two years' worth of global emissions are released by mangrove forest destruction, worsening the effects of climate change (Schaftel, 2022).

By 2050, CO2 emissions might be reduced by 1 gigatonne over three years by recovering 40% of the world's ecosystem cover and enlarging protected coastal wetlands. Communities that depend on these environments for their homes and means of subsistence require coastal wetlands to be protected (Cadez & Czerny, 2016). Nations like Fiji and Papua New Guinea have successfully preserved these wetlands and promoted the local population's growth via community-based conservation and education (Suarez, 2022).

The advantages of agroforestry that is sustainable should be promoted. There is an obvious need to alter current land management methods since land-use change in forestry and agriculture is responsible for about 25% of human greenhouse gas emissions. Agroforestry techniques combine various tree and shrub species with livestock and crops. Treeless meadows have the capacity to store five to ten times as much carbon as similar-sized treeless environments (Christis, et al., 2019). Farmers may be more productive while using considerably less land if they raise cattle and cultivate crops together. Farmers may enhance their revenue streams and lessen the danger that climate change and unpredictable weather pose to their livelihoods by diversifying their crops and rearing animals in those places. Farmers will be able to reap a US$699 billion economic benefit from revenue diversification by putting this plan into practice on their 554 million acres throughout the world (Dubash, et al., 2013).

Moreso, there should be decentralization of power distribution. Climate change has a significant impact on the infrastructure for electricity transmission and distribution. Together with population expansion and economic development, there is an increase in both energy demand and consumption (Tao, et al., 2021). A disturbance at one point in the system can have an impact on the entire grid, making central power networks with huge power plants and infrastructure connected across long distances particularly sensitive to climate change (Mi, et al., 2019).

Distributed systems are more equipped to adapt to climate change since they frequently employ renewable energy, have fewer transmission lines, and cover smaller distribution regions. Crises do not affect areas with their own independent, decentralized energy sources (Christis, et al., 2019) and it is easier to recover from calamities more quickly with the use of smaller, simpler power supply. Low-carbon technology like solar panels and batteries may also supply dependable, clean energy

for crucial services like hospitals in distant places without grid connection or with a history of outages (IFAD 2010).

More to 2.5 billion people worldwide are fed by indigenous peoples and groups, who possess more than 50% of the world's land. They have accumulated a large quantity of traditional knowledge to aid others in adapting to changing environmental conditions since they have implemented the adaptation principles to their lands for decades (Hasegawa & Matsuoka, 2015).

Moreover, when tribal people have strong property rights, such as in Bolivia, Brazil, and Colombia, deforestation is at least as low. 25% of terrestrial carbon is stored in tropical forests that are conserved by local communities and indigenous people. Just roughly 25% of this asset is really legally owned by these entities. Indigenous rights must be protected for them to keep their land claims, protect natural resources, and more successfully sustain their livelihoods in the face of climate change (Hasegawa & Matsuoka, 2015).

Also, there should be enhancement in local transportation. Until alternative, widely accessible, affordable, low-carbon transport choices are created, road transport's share of emissions from transportation will rise to 72%. Extreme weather-related grid interruptions might disproportionately affect low-income and other vulnerable urban people since they have few transit choices handled by dependable, low-carbon public transportation (Iacobuta, et al., 2018).

By 2050, public transportation could grow by 40%, fewer automobiles could be on the road, and 6.6 gigatons of CO2 could be avoided. If mass transport vehicles are adapted and built to endure climatic dangers including natural catastrophes, rising sea levels, and high heat, they will be safer and more dependable in the long run. These upgrades have an effect on consumption and are more prepared for potential developments (Fawzy, et al., 2020). Cities like Rome and Buenos Aires have made further improvements to enhance the travel experience, including the adoption of heat-resistant buses and environmentally friendly terminals and routes. Increasing public transportation also improves air quality and reduces accidents, fatalities, and traffic congestion.

## 4. CONCLUSION

One of the most urgent issues that humanity will face in the next few decades is creating efficient organizational frameworks and tactics to tackle climate change. This study contributes to the field by exploring the multi-scale difficulties that community groups have while advocating for sustainability initiatives at different scales.

Mitigation measures must be in line with the nation's broader development goals and be a part of the vision for how the sector should develop in order to receive support from policymakers. For developing countries to participate, where the majority of the potential for mitigation in the cattle industry is concentrated, it is essential to find solutions that may serve both development and mitigation objectives. From medium to short term, it is anticipated that greater adoption of techniques and technologies that can help accomplish both of these objectives will

reduce emissions from the cattle sector by up to one-third. Despite the fact that a sizeable amount of the industry's potential mitigation might be accomplished financially or with minimal effort (Moran et al., 2010; Schulte et al., 2012).

Also, in order to promote innovation and develop institutional ability to utilize and support new advancements, more money and cooperation are required. The most important policy measures to close the efficiency gap between more efficient farmers and their peers include networking, expansion, and other forms of knowledge exchange. Improved legislative frameworks are also required to make it easier for all mitigation measures to be adopted on a larger scale and to better balance the economic interests of the public and private sectors.

Yet, the adoption of efficient abatement technology continues to be a political and economic issue in the absence of strict, globally enforceable emission limits that take into consideration agriculture and the other sources of pollution. Furthermore, trade-offs between mitigation and other environmental and socioeconomic objectives must be taken into account and controlled. Efficiency-based GHG mitigation strategies can increase the effectiveness of use of other natural resources, even while legal protections are still required to prevent unexpected effects on the environment, human health, and the economy.

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