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Impact, Mitigation and Adaptation: The Global Warming and Climate Change

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Abstract

Climate change is a long-lasting change which imposes an existential threat to humanity. It is a global threat that has embarked on and put stress on various sectors. It is now indisputable that the primary cause of this threat is human and natural activities resulting in Green House Gas emissions from fossil fuel combustion, deforestation, and agricultural practices have led to global warming and climate change. Observed and anticipated changes in the climate include increasing in temperatures, changes in rainfall patterns, changes in the frequency and distribution of weather events such as droughts, storms, floods and heat waves, sea level rise and consequent impacts on human and natural systems which began during the Industrial revolution and have continued to rapidly accelerate. This study is aimed to conceptually engineer how climate variability is deteriorating the sustainability of diverse sectors worldwide. Specifically, the agricultural sector's vulnerability is a globally concerning scenario, as sufficient production and food supplies are threatened due to irreversible weather fluctuations. In turn, it is challenging the global feeding patterns, particularly in countries with agriculture as an integral part of their economy and total productivity. Climate change has also put the integrity and survival of many species at stake due to shifts in optimum temperature ranges, thereby accelerating biodiversity loss by progressively changing the ecosystem structures. Climate variations increase the likelihood of particular food and waterborne. Climate change draws attention to the relationship between science and society, challenges global governance institutions, and triggers new social movements.
Keywords: Climate change, Mitigation, greenhouse gas, Biodiversity, ecosystem.

Introduction

As we have globally observed about the climatic changes for the twenty-first century and global warming are noteworthy global changes that have been encountered during the previous years. Climate change impact on numerous components of the ecological, environmental, socio-political, and socio-economic disciplines[1]. Climate change involves increasing temperature globally[2]. With the development of industrial revolution, the problem of earth's climate has been amplified multi times [3]. It is reported that the immediate attention and due steps might increase the probability of overcoming its devastating impacts. It is not plausible to interpret the exact consequences of climate change on various sectoral basis[4], which is evident by the emerging level of recognition and inclusion of climatic uncertainties at both local and national level of policymaking[5]. Climate change is characterized based on the comprehensive long-haul temperature and precipitation trends and other components such as pressure and humidity level in the surrounding environment. Besides, the irregular weather patterns, retreating of global ice sheets and the corresponding elevated sea level rise are among the most renowned international and domestic effects of climate change[6]. Before the industrial revolution, natural sources, including volcanoes, forest fires, and seismic activities, were regarded as the distinct sources of greenhouse gases, (such as CO_2, CH_4, N_2O, and H_2O) into the atmosphere[7].

United Nations Framework Convention on Climate Change (UNFCC) struck a major agreement to tackle climate change and accelerate and intensify the actions and investments required for a sustainable low-carbon future at Conference of the Parties (COP-21) in Paris on December 12, 2015. The Paris Agreement expands on the Convention by bringing all major nations together for the first time in a single cause to undertake ambitious measures to prevent climate change and adapt to its impacts, with increased funding to assist developing countries in doing so. As so, it marks a turning point in the global climate fight. The major goal of the Paris Agreement is to improve the global response to the threat of climate change by keeping the global rise in temperature, this century well below 2°C over pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C [8]. Furthermore, the agreement aspires to strengthen nation's ability to deal with the effects of climate change and align financing flows with low green-house gas emissions [9]. To achieve these goals, adequate financial resources must be mobilized and provided, as well as a new technology framework and expanded capacity building, allowing developing countries and the most vulnerable countries to act under their respective national objectives. The agreement also establishes a more transparent action and support mechanism. All nations are required by the Paris Agreement to do their best through "nationally determined contributions" and to strengthen these efforts in the coming years [10]. It includes obligations that all nations regularly report on their emissions and implementation activities. A global stock-take will be conducted every five years to review collective progress toward the agreement's goal and inform the nations future individual actions. The Paris Agreement became available for signature on April 22, 2016, Earth Day, at the United Nations Headquarters in New York. On November 4, 2016, it went into effect 30 days after the so-called double threshold was met (ratification by 55 nations accounting for at least 55% of world emissions). More countries have ratified and continue to ratify the agreement since then, bringing 125 nations in early 2017. To fully operationalize the Paris Agreement, a work program was initiated in Paris to define mechanism, processes, and recommendations on a wide range of concerns [11].

The Conference of the nations functioning as Paris Agreement convened for the first time in November 2016 in Marrakesh in conjunction with COP22 and made its first two resolutions. The work plan is scheduled to be finished by 2018. Some mitigation and adaptation strategies to reduce the emission in the prospective of Paris agreement are following firstly, a long-term goal of keeping the increase in global average temperature to well below 2°C above pre-industrial levels, secondly, to aim to limit the rise to 1.5 °C, since this would significantly reduce risks and the impacts of climate change, thirdly, on the need for global emissions to peak as soon as possible, recognizing that this will take longer for developing countries, lastly, to undertake rapid reductions after that under the best available science, to achieve a balance between emissions and removals in the second half of the century. On the other side, some adaptation strategies are; strengthening societies' ability to deal with the effects of climate change and to continue and expand international assistance for developing nation's adaptation.

However, man-made activities are currently regarded as most accountable for climate change [12]. Apart from the industrial revolution, other man made activities include excessive agricultural operations, which further involve the high use of fuel-based mechanization, burning of agricultural residues, burning fossil fuels, deforestation, national and domestic transportation sectors, etc. [13]. Consequently, these activities lead to climatic catastrophes, damaging local and global infrastructure, human health, and total productivity. Energy consumption has mounted green-house gas levels concerning warming temperatures as most of the energy production in developing countries comes from fossil fuels [14].

This paper aims to highlight the effects of climate change in a socio-scientific aspect by analysing the existing literature on various sectorial pieces of evidence globally that influence the environment. Although this discussion provides a thorough examination of climate change and its major affected sectors that impose a grave danger for global agriculture, biodiversity, health, economy, forestry, and tourism, and to purpose some practical prophylactic measures and mitigation strategies to be adapted as sound substitutes to survive from climate change impacts. The societal implications of irregular weather patterns and other effects of climate changes are discussed in detail. Some numerous sustainable mitigation measures and adaptation practices and techniques at the global level are discussed in this paper.

1. IMPACT OF CLIMATE CHANGE:

1.1. **Global warming:** Early decades of the twenty-first century will see a moderate warming of 1-2^{o}C, resulting in reduced crop yields in seasonally dry and tropical regions, while crop and pasture yields in temperate regions may benefit. Further warming in the second half of the century will negatively affect all regions, although agriculture in many developing countries in semi-tropical and tropical regions[15] will bear the brunt of the effects.

1.2. **Extreme climate events:** Increased frequency and severity of extreme climate events, such as more heat stress, droughts and flooding[16], is expected in coming decades due to climate change. It will increase negative impacts on agriculture, forestry and fisheries in all regions. In particular, it will modify the risks of fires, and pest and pathogen outbreaks, with negative consequences for food, fibre and forestry.

1.3. **Undernourishment:** The number of undernourished is likely to increase by 5 to 100 million people by 2050, with respect to a baseline with no climate change. Even small amounts of warming will increase risk of hunger in poor developing countries, due to negative impacts on food production[17] and availability.

1.4. **Food stability, utilization and access:** Additional negative impacts of climate change [18] on food security, with the potential of reducing access to and utilization of food in many regions already vulnerable today, are expected but have not been quantified. In particular, stability of food supply is likely to be disrupted by more frequent and severe climate extremes. Utilization of food may be affected negatively by increases in crop, livestock and human pests and diseases, as well as by reduced water availability and water quality, of importance for food preparation.

2. AGRICULTURE AND GLOBAL CLIMATE CHANGE:

Agriculture is not only a fundamental human activity at risk from climate change, it is a major driver of environmental and climate change itself. It has the largest human impact on land and water resources. About 1.4 billion ha of arable land (10 percent of total ice-free land) are used for crop cultivation and an additional 2.5 billion ha are used for pasture. Roughly four billion ha are forested land, five percent of which is used for plantation forestry. Two billion tonnes of grains are produced yearly for food and feed, providing two-thirds of total protein intake by humans. About ten percent of total world cereal supply is traded internationally. In addition, 150 million tonnes of fish and other aquatic products are consumed annually[19]. Aquatic products contribute 50 percent or more of total animal protein intake in some small islands and other developing countries.

In addition to land resources, agriculture is a major user of water. Over 200 million ha of arable land is under irrigation, utilizing 2 500 billion cubic metres of water annually, representing 75 percent of fresh water resources withdrawn from aquifers, lakes and rivers by human activity. Irrigation sustains a large portion of total food supply – about 40 percent in the case of cereals. Finally, significant quantities of chemical inputs are applied to achieve high yields in intensive production systems including about 100 million tonnes of nitrogen used annually, leading to significant regional pollution.

As a result of these large-scale activities, agriculture is a significant contributor to land degradation and, in particular, a major emitter of greenhouse gases. It emits into the atmosphere 13-15 billion tonnes CO_2 e per year, about a third of the total from human activities. Overall, agriculture is responsible for 25 percent of CO_2 (by deforestation), 50 percent of methane (rice and enteric fermentation), and more than 75 percent of N_2 O (by using fertilizer)[20] emitted annually by human activities.

If emissions of greenhouse gases, including those from agriculture, are not controlled in the coming decades, continued growth of their atmospheric concentrations is projected to result in severe climate change throughout the twenty first century. If “dangerous anthropogenic interference” with the climate system is to be avoided in coming decades and warming is to be limited to “acceptable” temperature increases, then stabilization of atmospheric concentrations must be achieved. This will require significant cuts in global emissions, starting now and certainly no later than 2020-2030.

In particular, a number of mitigation strategies in the agriculture and forestry sectors have been identified as useful in achieving the goal of stabilization of atmospheric concentrations between 450-550 ppm CO_2. These include reduced deforestation and degradation of tropical forests, sustainable forest management and forest restoration, including afforestation and reforestation. In agriculture[21], they involve reduction of non-CO_2 gases through improved crop and livestock management and agroforestry practices, enhanced soil carbon sequestration in agricultural soils via reduced tillage and soil biomass restoration.

3. GLOBAL CHALLENGES AND PERSPECTIVES:

Climate change brings critical new perspectives to important global challenges relevant to food security and rural livelihoods. Mainstreaming climate change issues into development is a necessary step of overall development policy, but it is not sufficient. To be sufficient, sustainable development policies must also be reformulated in order to include important new temporal and spatial scales that have become relevant only because of climate change. Actions to limit damage from climate change need to be implemented now in order to be effective. Mitigation actions involve direct reduction of anthropogenic emissions or enhancement of carbon sinks that are necessary for limiting long-term climate damage [22]. Adaptation is necessary to limit potential risks of the unavoidable residual climate change now and in coming decades. Importantly, there are significant differences in the policy nature underlying adaptation and mitigation actions. The benefits of adaptation choices will be realized almost immediately but will matter most under moderate climate change, perhaps up to about mid-century. By contrast, benefits of mitigation may only be realized decades from now, becoming relevant towards the end of the century.

It follows that a significant challenge of climate policy is to identify and then develop instruments that allow for a portfolio of adaptation and mitigation strategies that are effective in time and space and focus on balancing actions across the most appropriate sectors, and within the chosen scope of specific climate response policies. In the case of a focused priority on food security and rural vulnerability, a number of limitations on the usefulness of certain mitigation strategies may emerge with respect to adaptation requirements. One important example is related to bioenergy and biofuel production [23] which, as a mitigation strategy, may have benefits for rural incomes and thus development. However, in order to prevent serious negative repercussions on food prices, ecosystem functions including biodiversity and carbon cycling, and local food availability, they need to be planned at the appropriate regional and local scales, and in conjunction with

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focused rural development policy. All four dimensions of food security will be negatively affected by climate change in the coming decades. While adaptation strategies that minimize expected impacts on access, stability and utilization of food resources involve largely local- to regional-scale actions, safeguarding food availability also requires a global perspective. Climate change adaptation strategies should aim at maintaining, or even increasing, food production in key exporting developed and developing regions, or in regions key to regional food security. Any significant change in food production in these areas, including change resulting from climate change impact, has potential to affect global and regional availability, stability and access to food through direct and indirect repercussions on international and local markets.

4. MITIGATION AND ADAPTATION OF CLIMATE CHANGES:

The mitigation and adaptation are the crucial factors to address the response to climate change[24]. Environmentalists define mitigation on climate changes, and on the other hand, adaptation directly impacts climate changes like floods. To some extent, mitigation reduces or moderates greenhouse gas emission, and it becomes a critical issue both economically and environmentally [25]. Researchers have deep concern about the adaptation and mitigation methodologies in sectoral and geographical contexts. Agriculture, industry, forestry, transport, and land use are the main sectors to adapt and mitigate policies [26]. Adaptation and mitigation require particular concern both at the national and international levels. The world has faced a significant problem of climate change in the last decades, and adaptation to these effects is compulsory for economic and social development. To adapt and mitigate against climate change, one should develop policies and strategies at the global level.

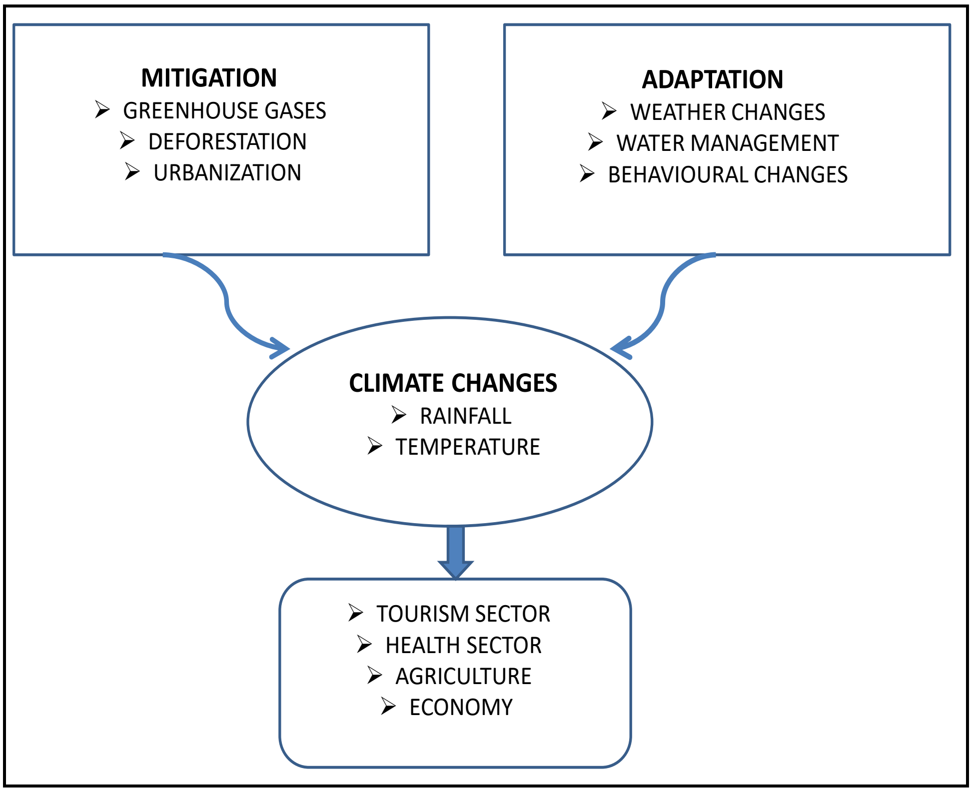

Fig: Sectorial influence of climate change with mitigation and adaptation measures.

5. Barriers to mitigation:

5.1.**Maximum storage.** Carbon sequestration in soils or terrestrial biomass may saturate after 15 to 60 years, depending on management practice, management history and the system being modified.

5.2.**Reversibility**. A subsequent change in management can reverse the gains made in carbon sequestration over a similar period of time. However, many agricultural mitigation options are not reversible, such as reduction in N_2O and CH_4 emissions, avoided emissions as a result of agricultural energy efficiency gains or substitution of fossil fuels by bioenergy.

5.3.**Reference:** The greenhouse gas net emission reductions need to be assessed relative to a reference baseline. The selection of an appropriate baseline to measure management-induced soil carbon changes is still an obstacle in some mitigation projects.

5.4.**Uncertainty**. Uncertainty about the complex biological and ecological processes in agricultural systems makes investors more wary of land-based mitigation options compared to more clearcut industrial mitigation activities. This barrier can be reduced by investment in research. In addition, high variability at the farm level can be reduced by increasing the geographical extent and duration of the project.

5.5.**Unclear leakage.** Adopting certain agricultural mitigation practices may reduce production within implementing regions, leading to increased production and emissions outside the project region.

5.6.**Transaction costs.** Under an incentive-based system such as a carbon market, the amount of money farmers receive is not the market price, but the market price less brokerage cost. This may be substantial and a serious entry barrier for smallholders. Pooling many activities together can serve to lower transaction costs of participating farmers.

5.7.**Measurement and monitoring costs.** Measurement costs per carbon credit sold decrease as the quantity of carbon sequestered and area sampled increase. Methodological advances in measuring soil carbon may reduce costs and increase the sensitivity of change detection. Development of remote sensing may offer opportunities to reduce costs.

5.8.**Property rights.** Property rights, landholdings and the lack of clear single-party land ownership in certain areas may inhibit implementation of management changes.

5.9.**Other barriers**. Other barriers include availability of capital, rate of capital stock turnover, rate of technological development, risk attitudes, need for research and outreach, consistency with traditional practices, pressure for competing uses of agricultural land and water, demand for agricultural products, high costs for certain enabling technologies.

6. Actions needed to facilitate adaptation responses

6.1.**Climate monitoring efforts and communication of information**: essential to convince farmers that climate changes projections are real and require response actions. Information services should include surveillance of pests, diseases and other factors of importance to production systems.

6.2.**Policies that support research, systems analysis, extension capacity, industry and regional networks:** need to be strengthened in order to provide managers with understanding, strategic and technical capacity to protect their enterprises.

6.3. **Investment in new technical or management strategies:** required so that, where existing technical options are inadequate, options necessary to respond to the projected changes become available. These include improved crop, forage, livestock, forest and fisheries germplasm.

6.4.**Training for new jobs based on new land uses, industry relocation and human migration:** needed where climate impacts lead to major land use changes. This may be achieved through direct financial and material support, alternative livelihood options with reduced dependence on agriculture, community partnerships for food and forage banks, development of new social capital and information sharing, ensuring food aid and employment for the more vulnerable, and development of contingency plans.

6.5. **New infrastructure, policies and institutions:** may be needed to support the new management and land-use arrangements, such as investment in irrigation infrastructure and efficient water-use technologies, appropriate transport and storage infrastructure, revising land tenure arrangements and property rights, and establishing accessible, efficient markets for products, financial services including insurance, and inputs including seed, fertilizer and labour. Policy must maintain the capacity to make continuing adjustments and improvements in adaptation through "learning by doing" with targeted monitoring of adaptations to climate change and their costs, benefits and effects.

7. **CONCLUSION**:-

Specific socio-agricultural, socio-economic, and physical systems are the milestone of psychological well-being, and the alteration in these systems by climate change will have disastrous impacts. Climate variability, alongside other man-made and natural stressors, influences human and environmental health sustainability. Food security is another concerning scenario that may lead to compromised food quality, higher food prices, and inadequate food distribution systems. Global forests are challenged by different climatic factors such as storms, droughts, flash floods, and intense precipitation. The vulnerability scale of the world's regions differs; however, appropriate mitigation and adaptation measures can aid the decision-making bodies in developing effective policies to tackle its impacts. Presently, modern life on earth has tailored to consistent climatic patterns, and accordingly, adapting to such considerable variations is of paramount importance. Because the faster changes in climate will make it harder to survive and adjust, this globally-raising enigma calls for immediate attention at every scale ranging from elementary community level to global level. As we all aware about the use in plenty of agricultural fertilizers in agriculture sectors results which nitrogen is not consumed by the plants and may be excreted into groundwater, discharged into water surface, or emitted from the land, soil nitrous oxide when large doses of fertilizer are sprayed. Increased nitrogen levels in groundwater sources have been related to human chronic illnesses and impact marine ecosystems. Cultivation, grain drying, and other field activities have all been examined in depth in the studies.

The technological and socio-economic adaptation, The policy consequence of the causative conclusion is that as a source of alternative energy, biofuel production is one of the routes that explain oil price volatility separate from international macroeconomic factors.. Finally, resource-rich and oil-exporting countries can convert to non-food renewable energy sources such as solar, hydro, coal, wind, wave, and tidal energy. By doing so, both world food and oil supplies would be maintained rather than harmed. It is firmly believed that achieving the Paris Agreement commitments is doubtful without undergoing renewable energy transition across the globe . Policy instruments play the most important role in determining the degree of investment in renewable energy technology. This study examines the efficacy of various policy strategies in the renewable energy industry of major nations. Although its impact is more visible in established renewable energy markets, a renewable portfolio standard is also a useful policy instrument. The cost of producing renewable energy is still greater than other traditional energy sources. Furthermore, All policy measures aim to reduce production costs while increasing the proportion of renewables to a country's energy system. Meanwhile, long-term contracts with renewable energy providers, government commitment and control, and the establishment of long-term goals can assist developing nations in deploying renewable energy technology in their energy sector.

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