EFFECT OF CLIMATIC CHANGE ON HUMAN POPULATION, RESOURCES AND THEIR VEGETATION

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ABSTRACT

Climate change is a long-lasting change in the weather arrays across tropics to polls. It is a global threat that has embarked on to put stress on various sectors. 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 and vector-borne diseases, and a recent example is a coronavirus pandemic. Besides, the global tourism industry is devastated as climate change impacts unfavorable tourism spots. The methodology investigates hypothetical scenarios of climate variability and attempts to describe the quality of evidence to facilitate readers' careful, critical engagement. Secondary data is used to identify sustainability issues such as environmental, social, and economic viability. To better understand the problem, gathered the information in this report from various media outlets, research agencies, policy papers, newspapers, and other sources.. According to the findings, government involvement is necessary for the country's long-term development through strict accountability of resources and regulations implemented in the past to generate cutting-edge climate policy. Therefore, mitigating the impacts of climate change must be of the utmost importance, and hence, this global threat requires global commitment to address its dreadful implications to ensure global sustenance.

Key words; Environmental policy , climate change , human health

INTRODUCTION

Worldwide observed and anticipated climatic changes for the twenty-first century and global warming are significant global changes that have been encountered during the past 65 years. Climate change (CC) is an inter-governmental complex challenge globally with its influence over various components of the ecological, environmental, socio-political, and socio-economic disciplines (Adger et al. 2005; Leal Filho et al. 2021; Feliciano et al. 2022). Climate change involves heightened temperatures across numerous worlds (Battisti and Naylor 2009; Schuurmans 2021; Weisheimer and Palmer 2005; Yadav et al. 2015). With the onset of the industrial revolution, the problem of earth climate was amplified manifold (Leppänen et al. 2014). 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 (CC) on a sectoral basis (Izaguirre et al. 2021; Jurgilevich et al. 2017), which is evident by the emerging level of recognition plus the inclusion of climatic uncertainties at both local and national level of policymaking (Ayers et al. 2014).

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 (Lipczynska-Kochany 2018; Michel et al. 2021; Murshed and Dao 2020). Before the industrial revolution, natural sources, including volcanoes, forest fires, and seismic activities, were regarded as the distinct sources of greenhouse gases (GHGs) such as CO_2, CH_4, N_2O, and H_2O into the atmosphere (Murshed et al. 2020; Hussain et al. 2020; Sovacool et al. 2021; Usman and Balsalobre-Lorente 2022; Murshed 2022). United Nations Framework Convention on Climate Change (UNFCCC) 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 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 core goal of the Paris Agreement is to improve the global response to the threat of climate change by keeping the global temperature rise this century well below 2 °C over pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5° C (Sharma et al. 2020; Sharif et al. 2020; Chien et al. 2021.

Furthermore, the agreement aspires to strengthen nations' ability to deal with the effects of climate change and align financing flows with low GHG emissions and climate-resilient paths (Shahbaz et al. 2019; Anwar et al. 2021; Usman et al. 2022a). To achieve these lofty 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 Parties are required by the Paris Agreement to do their best through "nationally determined contributions" (NDCs) and to strengthen these efforts in the coming years (Balsalobre-Lorente et al. 2020). It includes obligations that all Parties 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 Parties' 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 Parties in early 2017. To fully operationalize the Paris Agreement, a work program was initiated in Paris to define mechanisms, processes, and recommendations on a wide range of concerns (Murshed et al. 2021). Since 2016, Parties have collaborated in subsidiary bodies (APA, SBSTA, and SBI) and numerous formed entities. The Conference of the Parties functioning as the meeting of the Parties to the Paris Agreement (CMA) 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 & expand international assistance for developing nations' adaptation.

However, anthropogenic activities are currently regarded as most accountable for CC (Murshed et al. 2022). Apart from the industrial revolution, other anthropogenic 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. (Huang et al. 2016). Consequently, these anthropogenic activities lead to climatic catastrophes, damaging local and global infrastructure, human health, and total productivity. Energy consumption has mounted GHGs levels concerning warming temperatures as most of the energy production in developing countries comes from fossil fuels (Balsalobre-Lorente et al. 2022; Usman et al. 2022b; Abbass et al. 2021a; Ishikawa-Ishiwata and Furuya 2022).

MATERIA AND METHODS

Aim and objective of this mini review is to high light global effects of climatic change therefore information from different sources were collected and emerged in This review aims to highlight the effects of climate change in a socio-scientific aspect by analyzing the existing literature on various sectorial pieces of evidence globally that influence the environment. Although this review provides a thorough examination of climate change and its severe affected sectors that pose 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 (CC) 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 review with an in-depth focus on its economic, social, and environmental aspects. Methods of data collection section are included in the supplementary information.

Natural disasters and climate change's socio-economic consequences

Natural and environmental disasters can be highly variable from year to year; some years pass with very few deaths before a significant disaster event claims many lives (Symanski et al. 2021). Approximately 60,000 people globally died from natural disasters each year on average over the past decade (Ritchie and Roser 2014; Wiranata and Simbolon 2021). So, according to the report, around 0.1% of global deaths. Annual variability in the number and share of deaths from natural disasters in recent decades are shown in Fig. 3. The number of fatalities can be meager—sometimes less than 10,000, and as few as 0.01% of all deaths. But shock events have a devastating impact: the 1983–1985 famine and drought in Ethiopia; the 2004 Indian Ocean earthquake and tsunami; Cyclone Nargis, which struck Myanmar in 2008; and the 2010 Port-au-Prince earthquake in Haiti and now recent example is COVID-19 pandemic (Erman et al. 2021). These events pushed global disaster deaths to over 200,000—more than 0.4% of deaths in these years. Low-frequency, high-impact events such as earthquakes and tsunamis are not preventable, but such high losses of human life are. Historical evidence shows that earlier disaster detection, more robust infrastructure, emergency preparedness, and response programmers have substantially reduced disaster deaths worldwide. Low-income is also the most vulnerable to disasters; improving living conditions, facilities, and response services in these areas would be critical in reducing natural disaster deaths in the coming decades.

The interior regions of the continent are likely to be impacted by rising temperatures (Dimri et al. 2018; Goes et al. 2020; Mannig et al. 2018; Schuurmans 2021). Weather patterns change due to the shortage of natural resources (water), increase in glacier melting, and rising mercury are likely to cause extinction to many planted species (Gampe et al. 2016; Mihiretu et al. 2021; Shaffril et al. 2018).On the other hand, the coastal ecosystem is on the verge of devastation (Perera et al. 2018; Phillips 2018). The temperature rises, insect disease outbreaks, health-related problems, and seasonal and lifestyle changes are persistent, with a strong probability of these patterns continuing in the future (Abbass et al. 2021c; Hussain et al. 2018). At the global level, a shortage of good infrastructure and insufficient adaptive capacity are hammering the most (IPCC 2013). In addition to the above concerns, a lack of environmental education and knowledge, outdated consumer behavior, a scarcity of incentives, a lack of legislation, and the government's lack of commitment to climate change contribute to the general public's concerns. By 2050, a 2 to 3% rise in mercury and a drastic shift in rainfall patterns may have serious consequences (Huang et al. 2022; Gorst et al. 2018).

Climate change and agriculture

Global agriculture is the ultimate sector responsible for 30–40% of all greenhouse emissions, which makes it a leading industry predominantly contributing to climate warming and significantly impacted by it (Grieg; Mishra et al. 2021; Ortiz et al. 2021; Thornton and Lipper 2014). Numerous agro-environmental and climatic factors that have a dominant influence on agriculture productivity (Pautasso et al. 2012) are significantly impacted in response to precipitation extremes including floods, forest fires, and droughts (Huang 2004). Besides, the immense dependency on exhaustible resources also fuels the fire and leads global agriculture to become prone to devastation. Godfray et al. (2010) mentioned that decline in agriculture challenges the farmer's quality of life and thus a significant factor to poverty as the food and water supplies are critically impacted by CC (Ortiz et al. 2021; Rosenzweig et al. 2014). As an essential part of the economic systems, especially in developing countries, agricultural systems affect the overall economy and potentially the well-being of households (Schlenker and Roberts 2009). According to the report published by the Intergovernmental Panel on Climate Change (IPCC), atmospheric concentrations of greenhouse gases, i.e., CH_4, CO_2, and N_2O, are increased in the air to extraordinary levels over the last few centuries (Usman and Makhdum 2021; Stocker et al. 2013). Climate change is the composite outcome of two different factors. The first is the natural causes, and the second is the anthropogenic actions (Karami 2012). It is also forecasted that the world may experience a typical rise in temperature stretching from 1 to 3.7 °C at the end of this century (Pachauri et al. 2014). The world's crop production is also highly vulnerable to these global temperature-changing trends as raised temperatures will pose severe negative impacts on crop growth (Reidsma et al. 2009). Some of the recent modeling about the fate of global agriculture is briefly described below.

Decline in cereal productivity

Crop productivity will also be affected dramatically in the next few decades due to variations in integral abiotic factors such as temperature, solar radiation, precipitation, and CO_2. These all factors are included in various regulatory instruments like progress and growth, weather-tempted changes, pest invasions (Cammell and Knight 1992), accompanying disease snags (Fand et al. 2012), water supplies (Panda et al. 2003), high prices of agro-products in world's agriculture industry, and preeminent quantity of fertilizer consumption. Lobell and field (2007) claimed that from 1962 to 2002, wheat crop output had condensed significantly due to rising temperatures.

Therefore, during 1980–2011, the common wheat productivity trends endorsed extreme temperature events confirmed by Gourdji et al. (2013) around South Asia, South America, and Central Asia. Various other studies (Asseng, Cao, Zhang, and Ludwig 2009; Asseng et al. 2013; García et al. 2015; Ortiz et al. 2021) also proved that wheat output is negatively affected by the rising temperatures and also caused adverse effects on biomass productivity (Calderini et al. 1999; Sadras and Slafer 2012). Hereafter, the rice crop is also influenced by the high temperatures at night. These difficulties will worsen because the temperature will be rising further in the future owing to CC (Tebaldi et al. 2006). Another research conducted in China revealed that a 4.6% of rice production per 1 °C has happened connected with the advancement in night temperatures (Tao et al. 2006). Moreover, the average night temperature growth also affected rice *indicia* cultivar's output pragmatically during 25 years in the Philippines (Peng et al. 2004). It is anticipated that the increase in world average temperature will also cause a substantial reduction in yield (Hatfield et al. 2011; Lobell and Gourdji 2012). In the southern hemisphere, Parry et al. (2007) noted a rise of 1–4 °C in average daily temperatures at the end of spring season unti the middle of summers, and this raised temperature reduced crop output by cutting down the time length for phenophases eventually reduce the yield (Hatfield and Prueger 2015; R. Ortiz 2008). Also, world climate models have recommended that humid and subtropical regions expect to be plentiful prey to the upcoming heat strokes (Battisti and Naylor 2009). Grain production is the amalgamation of two constituents: the average weight and the grain output/m_2, however, in crop production. Crop output is mainly accredited to the grain quantity (Araus et al. 2008; Gambín and Borrás 2010). In the times of grain set, yield resources are mainly strewn between hitherto defined components, i.e., grain usual weight and grain output, which presents a trade-off between them (Gambín and Borrás 2010) beside disparities in per grain integration (B. L. Gambín et al. 2006). In addition to this, the maize crop is also susceptible to raised temperatures, principally in the flowering stage (Edreira and Otegui 2013). In reality, the lower grain number is associated with insufficient acclimatization due to intense photosynthesis and higher respiration and the high-temperature effect on the reproduction phenomena (Edreira and Otegui 2013). During the flowering phase, maize visible to heat (30–36 °C) seemed less anthesis-silking intermissions (Edreira et al. 2011). Another research by Dupuis and Dumas (1990) proved that a drop in spikelet when directly visible to high temperatures above 35 °C in vitro pollination. Abnormalities in kernel number claimed by Vega et al. (2001) is related to conceded plant development during a flowering phase that is linked with the active ear growth phase and categorized as a critical phase for approximation of kernel number during silking (Otegui and Bonhomme 1998).

The retort of rice output to high temperature presents disparities in flowering patterns, and seed set lessens and lessens grain weight (Qasim et al. 2020; Qasim, Hammad, Maqsood, Tariq, & Chawla). During the daytime, heat directly impacts flowers which lessens the thesis period and quickens the earlier peak flowering (Tao et al. 2006). Antagonistic effect of higher daytime temperature d on pollen sprouting proposed seed set decay, whereas, seed set was lengthily reduced than could be explicated by pollen growing at high temperatures 40◦C (Matsui et al. 2001).

The decline in wheat output is linked with higher temperatures, confirmed in numerous studies (Semenov 2009; Stone and Nicolas 1994). High temperatures fast-track the arrangements of plant expansion (Blum et al. 2001), diminution photosynthetic process (Salvucci and Crafts-Brandner 2004), and also considerably affect the reproductive operations (Farooq et al. 2011).

The destructive impacts of CC induced weather extremes to deteriorate the integrity of crops (Chaudhary et al. 2011), e.g., Spartan cold and extreme fog cause falling and discoloration of betel leaves (Rosenzweig et al. 2001), giving them a somehow reddish appearance, squeezing of lemon leaves (Pautasso et al. 2012), as well as root rot of pineapple, have reported (Vedwan and Rhoades 2001). Henceforth, in tackling the disruptive effects of CC, several short-term and long-term management approaches are the crucial need of time. Moreover, various studies (Chaudhary et al. 2011; Patz et al. 2005; Pautasso et al. 2012) have demonstrated adapting trends such as ameliorating crop diversity can yield better adaptability towards CC.

Conclusion and future perspectives

Specific socio-agricultural, socio-economic, and physical systems are the cornerstone of psychological well-being, and the alteration in these systems by CC will have disastrous impacts. Climate variability, alongside other anthropogenic 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. On the other hand, their anthropogenic wiping is aggrandizing their existence. Undoubtedly, 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 international level. Still, much effort, research, and dedication are required, which is the most critical time. Some policy implications can help us to mitigate the consequences of climate change, especially the most affected sectors like the agriculture sector;

Seasonal variations and cultivation practices

Warming might lengthen the season in frost-prone growing regions (temperate and arctic zones), allowing for longer-maturing seasonal cultivars with better yields (Pfadenhauer 2020; Bonacci 2019). Extending the planting season may allow additional crops each year; when warming leads to frequent warmer months highs over critical thresholds, a split season with a brief summer fallow may be conceivable for short-period crops such as wheat barley, cereals, and many other vegetable crops. The capacity to prolong the planting season in tropical and subtropical places where the harvest season is constrained by precipitation or agriculture farming occurs after the year may be more limited and dependent on how precipitation patterns vary (Wu et al. 2017).

New varieties of crops

The genetic component is comprehensive for many yields, but it is restricted like kiwi fruit for a few. Ali et al. (2017) investigated how new crops will react to climatic changes (also stated in Mall et al. 2017). Hot temperature, drought, insect resistance; salt tolerance; and overall crop production and product quality increases would all be advantageous (Akkari 2016). Genetic mapping and engineering can introduce a greater spectrum of features. The adoption of genetically altered cultivars has been slowed, particularly in the early forecasts owing to the complexity in ensuring features are expediently expressed throughout the entire plant, customer concerns, economic profitability, and regulatory impediments (Wirehn 2018; Davidson et al. 2016).

Changes in management and other input factors

To get the full benefit of the CO_2 would certainly require additional nitrogen and other fertilizers. Nitrogen not consumed by the plants 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 (Barua et al. 2018).

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