

A Comprehensive Review on Climate Change and its effects

Abstract:

Organizations of all life forms from species to ecosystems are impacted by the global process of Climate Change. Human civilizations are also vulnerable to changing climatic conditions. Scientific evidence shows that anthropogenic activities have resulted in global warming of 1.1 degrees Celsius. This is increasingly impacting nature so also human life everywhere. Despite efforts to adapt to the changing climate extreme events such as heatwaves over land and in the ocean droughts and flooding have caused widespread and pervasive impacts on cities and infrastructure and limit the chances of a livable future for all. In a naturally occurring process of climate change, destructive impacts have become more likely due to human interventions. The extent and magnitude of climate change impacts are larger for each additional fraction of warming than estimated so are the risks projected for the future. The impact involves severe and widespread disruptions to nature and to society, reducing our ability to grow nutritious food or provide clean drinking water. Multiple climate hazards are also occurring simultaneously with often cascading impacts. These impacts are becoming increasingly complex and challenging to manage. How these will affect nature and people depends on the speed and level. After the study of almost 100 review articles on climate change, we have shared an overview of what exactly happening to our environment and what are repercussions the future generation is going to face.

Keywords: Climate Change, Global Warming, Consequences, Socioeconomic Impacts, Diseases, Mitigation, Adaptation, Greenhouse Gases, Emission, Carbon Footprint, Blue Carbon

1. Introduction:

Picture yourself confined in a chamber void of any openings, wherein combustion transpires and greenhouse gases are enclosed. This is akin to the Earth's atmosphere, where detrimental gases have no means of escape. Climate change refers to long-term shifts in temperature and weather patterns. Since the 18th century, human activities, particularly the burning of fossil fuels, have been the primary cause of climate change,

although natural shifts do occur. The Earth's temperature has increased by 1.5 degrees Celsius after the ice age, reaching a record high in the past 10,000 years. Since the pre-industrial era, global CO₂ concentration increased by 40% in 65 years. (Royal Society, n.d.) Interconnectedness within the ecosystem means that modifications in one area can have a significant impact on other areas. (Kaur & Pandey, 2021) Anthropogenic effects caused by human activity result in intense drought, rising sea levels, catastrophic storms, water scarcity, flooding, declining biodiversity, severe wildfires, and melting polar ice caps, all of which are the main consequences of climate change. (Jamet & Corfee-Morlot, 2009) Climate change is unequivocally causing a multitude of health issues for individuals. (Dubash et al., 2018) Vector-borne and airborne diseases on Earth have become increasingly prevalent. It is imperative that we take action to restrict emissions and shift towards renewable energy sources such as solar, hydroelectric, and wind power in order to attain carbon neutrality by the middle of this century. The rise in global temperature levels is a cause for serious concern and poses a significant threat to the delicate balance of our planet's ecosystem. The consequences of such a phenomenon could potentially lead to widespread destruction, making it imperative for us to take immediate and decisive action to mitigate its impact. The process of climate change can be clearly defined in five crucial steps. The first step involves the emission of greenhouse gases, which leads to an excessive concentration of these gases in the atmosphere. This concentration traps heat, causing a rise in global temperature. The resulting effects are detrimental to both human health and the planet as a whole. Furthermore, climate change also has a significant impact on the world economy. To make matters worse, the environmental damage caused by the change in temperature is irreversible. The establishment of the Intergovernmental Panel for Climate Change (IPCC) during the 1979 World Climate Conference held in Geneva, along with the creation of the United Nations Framework Convention on Climate Change (UNFCCC), marked a significant step towards addressing the pressing global issue of climate change. (Jamet & Corfee-Morlot, 2009) This issue has already affected numerous areas such as South Georgia Island's Newmayer Glacier, Lake Powell in Arizona and Utah, Camp Fire in California, Northern Europe, the Tigris River, the Columbia Glacier in Alaska, South Africa's Theewaterskloof Reservoir, the Pine Island Glacier in Antarctica, Chile's Lake Aculeo, Hurricane Harvey Aftermath in Houston, Sudirman Range in New Guinea, and Iceland's Okjokull Glacier. (Harper et al., 2021)

2. The impacts of climate change.

According to the study, not attaining zero carbon emissions by 2030 will lead to significant ramifications. These include the melting of polar ice caps, droughts, wildfires, coral reef deterioration, inflation in food prices, allergies caused by pollen, deforestation, melting of mountain glaciers, rising sea levels, and migration of animals.(Sharma et al., 2022) Human activities have caused visible signs of increasing temperature. Our civilization prioritized convenience and luxury over sustainability and now we're changing our way of life for the worse. In today's world, our dependence on electrical and electronic devices, motor vehicles, and industries that consume massive amounts of fossil fuels to cater to our unnecessary desire for a luxurious lifestyle is undeniable.(Seymour, 2008) Our focus should be on sustainable development that meets human needs without harming nature, rather than leaving a large carbon footprint. Electric and electronic devices rely on the electricity generated from coal combustion in thermal power plants, causing the release of carbon into the atmosphere during the extraction process. The ramifications of global warming are severe and require immediate action to be taken.(Lolaksha Nagaveni & Anand, n.d.) Without intervention, we risk compromising the health of our planet and the well-being of future generations. It is imperative that we act now to reverse this trend and ensure a sustainable future for all. It is imperative that swift action be taken to prevent catastrophic destruction in the coming century by relinquishing conveniences that cast a dark shadow on the future. The escalating global temperature is resulting in a surge in sea level, which has the potential to inundate thousands of kilometres of landmass and impact major coastal cities that are the backbone of the world economy.(Sharma et al., 2022)

3. The food system is a major contributor to climate change.

It's widely recognized that everyday foods have a considerable influence on the environment because of the substantial amount of carbon dioxide that's emitted throughout their manufacturing process. Included in this list are various types of fats and oils, such as lard, beef tallow, dry milk products, and palm oil. Additionally, meats such as beef, lamb, pork, veal, chicken, and turkey and dairy products like butter and cheese are also encompassed in this category. The natural process of food production is disrupted by human intervention, leading to large-scale food production that has detrimental effects on the environment. Considering the projected population growth of 9.7 billion by 2050, it's imperative

that we evaluate the sustainability of our current food system.(Bommaraboyina et al., 2020) Therefore, changing our food system is of utmost importance. It's a fact that malnutrition is a widespread problem, affecting one out of every three people globally. This translates to a whopping 794 million individuals who suffer from hunger and an additional 2 billion who lack access to essential vitamins. In contrast, 1.9 billion people tend to overeat, leading to various health issues such as type 2 diabetes. Our diet, which contains high levels of fat, sugar, salt, and meat, has far-reaching negative effects on both health and the environment.(López-Carr, 2012) For instance, it's associated with heart disease, while meat production is responsible for significant greenhouse gas emissions It's worth noting that a mere 12 types of plants and 5 types of animals provide 75% of our food. It's also concerning to realize that a third of the food we produce is wasted and simply tossed aside.(Kaur & Pandey, 2021) Our planet's precious natural resources are currently confronting a number of complex challenges, ranging from water scarcity and soil degradation to biodiversity loss and the endangerment of various plant and animal species. These issues are only being compounded by the growing impact of climate change. It is imperative that we revamp the food system to guarantee the provision of nutritious food and decrease greenhouse gas emissions to cater to a burgeoning population. Collaboration between all stakeholders, including government health authorities, producers, and consumers, is imperative for a successful transformation of the existing food system towards a better future. The role of climate cannot be underestimated in ensuring food safety, spanning from oceans to farms and homes. The safety of our food is being jeopardized by climate change as warmer seas are causing marine biotoxins that can have an adverse effect on the safety of seafood to thrive Increased soil temperature can result in the release of higher levels of heavy metals, which can then be absorbed by crops. In addition, elevated temperatures can attract pests, thus making plants more vulnerable to fungal infections The challenges related to food safety due to climate change are becoming more severe, and it is affecting livelihoods, economies, and trade worldwide Resilient practices and policies are necessary for our food supply chains to effectively tackle challenges within the regulatory system. To guarantee food safety in the future, we must adopt a proactive approach that encompasses various sectors, including health, agriculture, trade, and the environment. By taking the necessary steps to protect our food now, we can secure the lives and livelihoods of future generations.

Health issues arising from climate change.

The global consequences of climate change are becoming increasingly evident respiratory diseases have witnessed a significant increase owing to climate change, which has led to an increase in air pollution, in addition to its impact on the environment.(Kaur & Pandey, 2021) Although the effects of increasing temperature and air pollution on these diseases are well known, their interaction remains unclear. A group of researchers has now described the complex synergistic effects of climate change.(Kaur & Pandey, 2021) they show how an increase in temperature in average temperature can directly affect the respiratory tract, and natural disasters like tornados, wildfires, and landslides can also increase air pollution and distribution of airborne allergens, exacerbating allergic respiratory diseases.(Royal Society, n.d.) Their work highlights the urgent need for strategies aimed at preventing these diseases, especially among vulnerable populations like urban residents and children. Simple urban planning measures like air quality buffer zones around residential areas and weather and air quality warning systems could help reduce public exposure to air pollutants. Research, development, and advocacy by healthcare professionals and cooperation from governments could help reduce the health impact of respiratory allergic diseases (asthma, rhinitis, and Hay fever) offering a sustainable solution to this looming public health problem. (“Introduction and Framing,” 2023)

2. Socioeconomic Impacts of Climate Change:

We are underestimating the impact of climate change on global stability? What could be the ripple effects on the global economy? If a country with deep global ties is hit by a large climate shock? And what can we do about it? In this article we tried to answer these questions what are the real impacts on the world’s economy due to climate change? The window to tackle climate crisis is closing fast climate related disasters are becoming more frequent and more damaging. The rise in global temperature continues to accelerate while global economy losses from climate-related natural disasters have reached a staggering high. And when climate shocks hit systems in countries, they could spill over across the border and even affects the global economy.(Discussion Paper Climate Change Finance, Analysis of a Recent OECD Report n.d.) Therefore, we decided to study the impacts of climate shocks on the global economy through the lens of global trade and financial networks. Our study covers 40 major economies of the world, which together account for 75% of

global GDP. Using the Notre Dame Global Adaptation Initiative Index, we identified six countries that are large in terms of GDP and highly vulnerable to climate change. Three of these countries are systemic, that is they are deeply interconnected through global networks. (Meng, 2019) Research shows that large-scale climate shock in one of these countries this could result in a substantial increase in external financing needs by over 300 billion dollars. (Roy et al., 2016) This result is broadly in line with what other countries' teams reported. Climate shocks in the form of storms and heavy rains have already lowered the country's real GDP, damaged its fiscal capacity, and worsened its current account. So, let's assume that these countries wouldn't be able to access financial markets and even had to suspend the payments on their external debt. (Galarraga & Markandya, 2009) This would trigger spillover to other countries through direct trade and financial links, in turn increasing their external financing needs. If these countries also face financial constraints, this spillover can cascade to more economies, even those without direct links to the country originally hit by climate shock. Moreover, two factors could amplify the contagion. First, as financing these increase sovereign risk premia increase, making borrowing more costly for these countries, second, investors may perceive countries with similar risk of profits as a bad investment, depressing the value of their assets and as a result, further increasing financing needs; research shows that in a tail risk scenario where a systemic country hit by climate shock defaults. Their increasing carbon prices, green infrastructure investment, and compensation for households can help reach net zero emissions by 2050. While boosting growth during the past pandemic recovery. Sound macroeconomic policies help reduce contagion, including flexible exchange rates to absorb shocks and smooth external adjustment. Countries can tap the global financial safety net. There are many financial organizations that can handle the economic fallout and prevent the worst-case scenario.

3. Blue Carbon Mitigation:

Climate change breakdown is here, now. Natural systems are in free fall, species are in decline and despite all efforts, in 2020 global greenhouse gas emissions increased. But in the last decade, a golden mitigation opportunity has been gaining international recognition. Protecting the blue carbon in the coastal and ocean ecosystem could play a key role in our salvation, blue carbon is carbon that is captured and stored by the oceans but when most people refer to blue carbon ecosystems, they're referring to seagrass meadows, tidal

marshes or mangrove forests and that's because these three ecosystems are doing a lot of the heavy lifting when it comes to blue carbon. They occupy about 0.2% of the sea floor, yet they sequester more than half the ocean's carbon. We all know that trees absorb CO₂ and when we look towards the marine environment blue carbon habitats also absorb CO₂ but they do so at a rate of 40 to 50 times faster than tropical rainforests. Our climate allies are also in the deep ocean phytoplankton, the primary producers of the sea supply at least half of the world's oxygen and absorb immense quantities of carbon, locking it away on the seafloor when they die or become part of the ocean food chain. Ocean and coastal ecosystems are among the most biodiverse habitats on earth and alongside vital cuts in carbon emissions across all sectors, offer a unique opportunity to tackle climate breakdown on many fronts. By addressing the health of those natural ecosystems, we can help to reach the greenhouse gas emissions reduction targets but we simultaneously provide much wider environmental and human well-being benefits. We increase biodiversity, support fisheries, and also provide defence from coastal erosion. Fisheries provide valuable nutrition for hundreds of millions of people.

They also alternate extreme weather events like storms, tsunamis, and that sort of thing. A major risk when it comes to global emissions. So, the loss of coastal wetlands not only limits their potential to sequester carbon but also makes them a source of greenhouse gas emissions. Remember that they're sitting on carbon that they've drawn down and preserved in the ground for thousands of years. It's a bit like setting off a carbon bomb. 25-50% of vegetated coastal habitats have already been lost, equating to the release of up to 1 billion tonnes of CO₂ annually. (van den Brink et al., 2019) They're declining at a very fast rate so if we are serious about climate mitigation the act would be now to help preserve these environments. The ocean is the blue beating heart of our planet. It absorbs around a third of all the CO₂ we pump out, and has absorbed 90% of the excess heat produced by global warming. Our largest active sink oceans are the most important part of the ecosystem, which is already vulnerable and which needs to be protected and fixed. We don't have the Kyoto Protocol for the ocean we don't have the Paris Agreement for the ocean. This is a very important priority. Globally ocean protection is severely lacking every day coastal ecosystems are pushed further into decline and marine wildlife is exploited beyond sustainable levels. And although coastal blue carbon habitats can play a key role in reducing emissions, their incorporation into national climate policies lags far behind, less than 20% of all countries with blue carbon habitats along their coastlines reference the protection and restoration of

these areas in their climate mitigation plans while integrated regulations at the national level are urgently needed, community-led projects, with the rights and livelihood needs of local communities respected, will be key in future blue carbon restoration efforts (Meng, 2019). The community-led conversation is to give communities full power to preserve and protect their natural resources. We are running out of time to start to limit warming. But conservation we're probably not having enough of is about the amazing nature-based solutions. What we need to do is to regenerate our ocean and redefine our relationship with the ocean. It's playing a vital role in our survival. We should include it as part of our solutions to fight climate warming. Blue carbon is a fantastic opportunity and a real win-win situation in terms of climate change mitigation and ecosystem enhancement. But it's not a silver bullet, it's not going to solve the problem of climate change. Let's also be talking about renewable energy. Let's be attacking this issue on a number of fronts. It's the only way we're going to be able to move to low carbon future.

4. Carbon footprint influencing climate change:

Carbon footprint refers to the total amount of greenhouse gases released into the earth's atmosphere as the result of the activity of an individual or all urbanization. Remember, greenhouse gases trap heat inside the atmosphere and increase global warming conditions of the earth. If we want to work on our own carbon footprint then we need to know the amount of greenhouse gases like carbon dioxide, carbon monoxide, ozone, methane etc, we are emitting on a daily basis. Although it's a difficult thing to measure this precisely because there is different best way to calculate it. There is a direct impact of using energy on travel, to power our households and there is also an indirect impact on the energy that we use or we consume. In the developed world, transport is a big part of our carbon footprint, cutting the use of fossil fuels cars, and taking fewer flights is an effective way of producing it. The place we live in also produces our own personal footprint. To avoid it you can use more sustainable energy like solar power, wind power, and hydroelectric power or we cut emissions by the appliances we use at home also contributing to creating less carbon footprint. Daily useable like cardboard, plastics, and paper are also important to find alternative sustainable

products. Then there is our diet, red meat makes more carbon footprint because cow produces methane which is again a greenhouse gas. A huge number of trees are being cut down to make food for cattle on which they can graze. In the developing world, domestic stoves are the major problem. It's important to replace them with a more efficient way of cooking people living in poor countries produce a small amount of greenhouse gases than the people in richer countries do. If you look at what actually different country produces, the average amount of greenhouse gases emission in the United Nation per person is 16.1 tonnes per year, in China it's 7.1 tonnes per year, in the UK it's 5.1 tonnes per year, on the other hand in the Democratic Republic of Congo it's only 0.03 tonnes per year. Now that's just production, not about how much we consume. The more money you have the more luxuriously you want to live. So, in richer countries, if people want to reduce their carbon footprint, they need to make huge changes in their lifestyles. It can be done to make new technology to make the world greener, declaration of many countries going to be carbon neutral in the middle of this century means a revolution in the way of living.

5. Sustainable Development Approach Towards Climate Change

The objective of sustainable development goals is to take urgent action to combat climate change and its impact. Climate change is caused by anthropogenic emissions of CO₂ and other greenhouse gases. Scientists are calling the present age as Anthropocene a period in geological history where humans (Anthropos) and their activities are changing nature more than natural processes that have remained stable for millions of years. Climate change impacts natural and human systems globally. It will and already does impact people's livelihood. The 2015, conference of parties COP21, in Paris was undoubtedly a key milestone in fighting climate change. The message was clear; we need to reduce global carbon emissions to keep warming below the 2 degrees Celsius threshold.(Fawzy et al., 2020) The evidence for rapid climate change is compelling in the past 100 years, the global average temperature has increased by 1.4 degrees Celsius between 1901 and 2000.(Lolaksha Nagaveni & Anand, n.d.) Most of the warming occurred in the past 35 years with 16 of the 17 warmest years occurring since 2001. The ocean has absorbed much of this increased heat. As a result, ocean acidification has increased by about 30% since the beginning of the Industrial Revolution. All over the world,

glaciers are melting at a very fast rate on average glaciers have thinned by over 10 meters since 1080. In the summer of 2009, the minimum level of ice cover in the Arctic was 24% below the 1979-2000 average. Scientists expect the melting to continue in the coming decades. Global sea level is expected to rise between 20 and 90 cm globally by the end of this century. Out of the 352 natural disasters in 2009, 325 of these were climate-related disasters that killed 8700 people only in 2009. To build resilience and limit climate-related hazards and natural disasters.(Seymour, 2008) Three primary key targets have been defined: 1. strengthen, resilience and adaptive capacity to climate-related hazards and natural disasters in all centuries. 2. Integrate climate change measures into national policy, strategies and planning. 3. And improve education awareness, raising human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning. What can businesses do with regard to the issue of climate change? Companies can contribute to sustainable development goals by decarbonizing their operations and supply chains through continuously improving energy efficiency, reducing the carbon footprint of their products and services, and setting ambitious, emissions, and reduction targets in line with climate science, as well as scaling up investment in innovative low carbon products and services. In addition, companies should build resilience in their operations supply chains and the communities in which they operate. An example of a business can do; it can source all electricity that the company consumes at its facilities from renewable resources such as wind, solar, or hydro or install renewable energy generation capacity on site.(Harper et al., 2021) That can increase investment in innovation to improve the efficiency of companies' products, and portfolio and thereby enable customers to reduce their emissions. They can invest in carbon capture storage technology to capture emissions produced from the use of fossil fuels in electricity generation and industrial processes, preventing carbon dioxide from entering the atmosphere. And they can also reduce emissions from transport operations.

6. Conclusion:

All the world and human civilization unequivocally know that human activities such as burning fossil fuels and cutting down forest leads to excess emission of greenhouse gases and currently global temperature have risen by 1.1 degrees Celsius. In wealthier countries, income groups within the country are emitting much more carbon. Historically they have emitted much more than in 2019 35% of the world's population

countries emitting more than 9 tonnes of CO₂ per capita. While 41% population of the world is emitting, 3 tonnes of CO₂ per capita, this shows that there is widespread carbon inequality not all emitters are the same. The IPCC estimated the beginning of 2020 we had around 500Gt CO₂ that we could emit. If we wanted 50% chance of controlling the global average temperature rise to 1.5 degrees Celsius. This carbon budget based on the current rate of emissions is likely to be depleted very soon, and we could blow past the 1.5-degree Celsius temperature target. The IPCC has certain prescriptions or findings on how we can manage the situation if we blow past 1.5 degrees Celsius known as an overshoot scenario, there are technologies known as carbon removal technology (CDR) i.e., direct air capture or bioenergy capture storage; however, these technologies are still quite speculative and they come with a number of feasibility concern, sustainability concern and we are untested at scale. So, while theoretically surpassing 1.5 degrees Celsius means that we could deploy this technology these two bring temperature down feasibility that is still like a big unknown. Especially on a global scale, but the good news is feasible low-cost methods are also available for both adaptation and mitigation. This is the key message that scholars believe must have been picked up by the IPCC synthesis report 2023. The report layout a whole menu of options from widespread electrification to great deployment of solar power and wind power, small-scale hydropower to transitioning to greater adaptation to battery-powered electric vehicles. IPCC states “several options to cut off the climate change effect are: solar energy, wind energy, electrification., which are technically viable, are becoming increasingly cost-effective and are generally supported by the public which are great a policy perspective. There is a dearth of global capital for the investment that is needed it’s just a question of diverting and redirecting the capital towards climate change action through the barrier which are particularly in developing nations. Attention needs to focus on providing affordable finance that should be available in developing countries to enable the green transition and shift away from fossil fuel systems which are today providing some better cheap energy to the world. So, this support is going to be crucial and has to come from the developed world. We know the problem and we know the solution and it’s really a question of political will to implement all of the solutions, we need to make emission cuts and lot more has to be done to save the future of the “Mother Earth”.

Declaration by Authors

Author's contribution: Mr. Abhijeet wrote the manuscript. Dr. E. A. Singh conceptualized the topic and edited the manuscript and M.R. Shindikar help in editing of the manuscript.

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