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A Review on Climate Change and Mitigation: Balancing the Scales

Himanshi Pandey

University School of Environment Management, Guru Gobind Singh Indraprastha University,Dwarka, New Delhi -11078
himanshi.pandey720@gmail.com

ABSTRACT

Climate change is described as a change in weather patterns caused mostly by greenhouse gas emissions from natural systems and human activities. Anthropogenic activities have so far resulted in around 1.0 °C of global warming above pre-industrial levels, with 1.5 °C projected between 2030 and 2052 if current emission rates continue. In 2018, the world had 315 natural disasters, the majority of which were caused by climate change. Storms, floods, wildfires, and droughts affected around 68.5 million people, resulting in $131.7 billion in economic losses, with storms, floods, wildfires, and droughts accounting for roughly 93 percent of the total. The economic losses attributable to wildfires in 2018 are nearly comparable to the total losses experienced by wildfires over the previous decade, which is frightening. Furthermore, the most susceptible sectors under climate change have been recognised as food, water, health, ecology, human habitat, and infrastructure.

Climate change is one of the most difficult problems we face today. It has many facets - science, economics, society, politics, and moral and ethical issues – and is a global issue that will be felt on local scales for decades and centuries. Carbon dioxide, the heat-trapping greenhouse gas that has fueled recent global warming, can stay in the atmosphere for hundreds of years, and the Earth (particularly the seas) takes a long time to adjust to warming. As a result, even if we completely ceased generating greenhouse gases today, global warming and climate change would continue to effect future generations. As a result, humanity has "committed" to a certain degree of climate change. This Article will highlight the current trends and the measures taken and the future steps which have been decided to take up.

Introduction

What is the extent of climate change? That will be determined by how long we continue to emit greenhouse gases and how our climate system reacts to them. Despite growing awareness of climate change, our greenhouse gas emissions continue to climb at an alarming rate. For the first time in human history, the daily level of carbon dioxide in the atmosphere topped 400 parts per million in 2013. The last time levels were that high was during the Pliocene Epoch, about three to five million years ago. The Paris Agreement was signed in 2015 with the primary goal of reducing global temperature rise to 2 degrees Celsius by 2100 and pursuing attempts to restrict it to 1.5 degrees Celsius. This article examines the primary climate change mitigation options, including traditional mitigation, negative emissions, and radiative forcing geoengineering. Mitigation technologies that have been used in the past have primarily focused on reducing CO2 emissions from fossil fuels. Negative emissions technologies aim to absorb and sequester carbon dioxide from the atmosphere in order to reduce CO2 levels. Finally, geoengineeringradiative forcing techniques change the earth's radiative energy budget in order to stabilise or lower global temperatures. It is clear that traditional mitigation efforts alone will not be sufficient to reach the Paris Agreement's targets; consequently, the use of other methods looks to be unavoidable. While some of the technologies discussed are still in research, biogenic-based sequestration approaches are quite mature and may be applied right away.

Status of Climate Change

Climate change is described as a change in weather patterns caused primarily by greenhouse gas emissions. Heat is trapped by the earth's atmosphere as a result of greenhouse gas emissions, which has been the primary driver of global warming. Natural systems and human activities are the primary sources of such emissions. Natural systems include forest fires, earthquakes, oceans, permafrost, wetlands, mud volcanoes and volcanoes (Yue and Gao 2018), while human activities are predominantly related to energy production, industrial activities and those related to forestry, land use and land-use change (Edenhofer et al. 2014). Yue and Gao used statistical analysis to determine that global greenhouse gas emissions from natural systems and anthropogenic activities are self-balancing, and that manmade emissions put extra pressure to the earth system (Yue and Gao 2018).

Strategies of Climate Change and Mitigation

There are three main climate change mitigation strategies that have been discussed in the literature. First, traditional CO2 reduction strategies include renewable energy, fuel switching, efficiency increases, nuclear power, and carbon capture, storage, and use. The majority of these technologies are well-established and come with a manageable amount of risk (Ricke et al. 2017; Victor et al. 2018; Bataille et al. 2018; Mathy et al. 2018; Shinnar and Citro 2008; Bustreo et al. 2019). A second path is made up of a fresh collection of technologies and methodologies that have lately been offered. Negative emissions technologies, often known as carbon dioxide removal methods, are techniques that could be used to capture and sequester CO2 from the atmosphere (Ricke et al. 2017) Bioenergy carbon capture and storage, biochar, enhanced weathering, direct air carbon capture and storage, ocean fertilisation, ocean alkalinity enhancement, soil carbon sequestration, afforestation and reforestation, wetland construction and restoration, and alternative negative emissions utilisation and storage methods such as mineral carbonation and using biomass in construction are among the most widely discussed negative emissions techniques in the literature. (Lawrence et al. 2018; Palmer 2019; McLaren 2012; Yan et al. 2019; McGlashan et al. 2012; Goglio et al. 2020; Lin 2019; Pires 2019; RoyalSociety 2018; Lenzi 2018).

Finally, a third path is based on the notion of modifying the earth's radiation balance through solar and terrestrial radiation control. The fundamental goal of such techniques is temperature stabilisation or reduction, and they are known as radiative forcing geoengineering technologies. This is accomplished without affecting greenhouse gas concentrations in the atmosphere, unlike negative emissions methods. Stratospheric aerosol injection, marine sky brightening, cirrus cloud thinning, space-based mirrors, surface-based brightness, and various radiation management strategies are among the principal radiative forcing geoengineering techniques explored in the literature. All of these strategies are currently theoretical or in the early phases of testing, and they come with a lot of uncertainty and danger when it comes to large-scale deployment. At the moment, policy frameworks do not cover radiative forcing geoengineering techniques (Lawrence et al. 2018; Lockley et al. 2019).

Because we are already committed to some degree of climate change, we must take a two-pronged approach to combating it: Mitigation is lowering emissions and stabilising levels of heat-trapping and greenhouse gases in the atmosphere; adaptation entails adapting to climate change that is already underway.

Mitigation is limiting the flow of heat-trapping greenhouse gases into the atmosphere, either by reducing sources of these gases (such as the burning of fossil fuels for electricity, heat, or transportation) or by improving the "sinks" that gather and store these gases (such as the oceans, forests and soil). The goal of mitigation is to avoid significant human interference with the climate system and to “stabilise greenhouse gas levels in a timeframe sufficient to allow ecosystems to adapt naturally to climate change, ensure that food production is not jeopardised, and enable economic development to proceed in a sustainable manner.” (from the 2014 report on Mitigation of Climate Change from the United Nations Intergovernmental Panel on Climate Change, page 4).

Adapting to living in a changing environment entails making adjustments to the current or predicted future climate. The goal is to lessen our vulnerability to climate change's negative consequences (like sea-level encroachment, more intense extreme weather events or food insecurity). It also includes making the most of any potentially good climate change opportunities (for example, longer growing seasons or increased yields in some regions). People and communities have adjusted to and adapted with changes in climate and extremes to varied degrees of success throughout history. Climate change (and particularly drought) has had a role in the development and fall of civilizations. For the past 12,000 years, Earth's climate has been largely stable, which has been critical for the development of our modern civilization and life as we know it. The constant climate to which we have become used has shaped modern life. We will have to learn to adapt as our climate changes. The more rapidly the climate changes, the more difficult it may become.

While climate change is a global problem, it has a local impact. As a result, cities and municipalities are at the forefront of adaptation. Cities and local communities around the world have been working on tackling their own climate concerns in the absence of national or international climate policy direction. They're striving to reinforce flood defences, prepare for heat waves and greater temperatures, and install water-permeable pavements to better handle floods and runoff. There will be substantial climatic repercussions even if world average temperature increases are kept below 2℃. We've seen a 1.1℃ increase in world average temperature since pre-industrial times, as well as a 26% increase in ocean acidity. There are rising number of damaging weather-related extreme events. Climate change was blamed for the severity and magnitude of wildfires that ravaged Australia and California in 2019-20, for example. Until date, efforts to reduce and adapt to climate change have been led by multiple policy communities, each of which has built on specialised expertise and information and mobilised various stakeholders to confront different technological and distributional difficulties. The concerns of mitigation and adaptation, on the other hand, are intertwined, and when handled together, their impact and effectiveness can be amplified.

Prime Minister NarendraModi startled the globe earlier this week by announcing climate promises on a global scale. Months after appearing to defy high-income countries' temptation to "do more" to rescue the planet, India changed its mind and provided the world more than it had anticipated. The international stage in question is the 26th Conference of Parties (COP26), which is currently taking place in Glasgow. Countries have gathered to discuss how to slow global warming, and despite the fact that these discussions take place every year, the conference has gained new vigour since the Intergovernmental Panel on Climate Change (IPCC) warned that humanity will have already missed the bus, sending the planet down a path of irreversible man-made destruction unless significant action is taken now.

A quick scan of the headlines from COP26 reveals everything from leaders signing urgent pledges to reduce coal use and deforestation to publications criticising high-income countries for making empty promises. World leaders appear to be at least talking the talk when it comes to halting climate change.

India's participation in the COP

Prime Minister Modi made five new pledges at the podium, all of which analysts believe are ambitious, but which might go either way in practise. India stated that by 2030, it would grow installed renewable capacity to 500 gigawatts, install 50% of its power capacity from non-fossil fuel resources, reduce carbon emissions by 1 billion tonnes, and reduce the economy's carbon emissions intensity by 45 percent.

It also stated that by 2070, it would have achieved net-zero emissions, meaning it would have removed as much carbon dioxide from the environment as it produced. This is a lot for the world's third-largest emitter (we emitted 2.88 billion tonnes of CO2 last year). In practise, this entails phasing out coal, which accounts for 70% of our electricity, moving to electric vehicles, decarbonizing polluting industries such as cement and steel, building carbon-absorbing forests, and expanding solar power plants over the next few decades.

Despite being the world's top carbon emitter today — accounting for 11% of all emissions — our next-door neighbour, China, made no new pledges. Critics argue that the US should have committed to net-zero emissions far before 2050 to compensate for its historical emissions that are driving global warming today. India's position, on the other hand, hasn't always been so obvious. It respectfully declined to pledge net-zero emissions just a few months ago on several occasions, stressing that countries should instead deliver on their previous obligations. According to reports, India is one of the few countries on track to meet its Paris Agreement targets, which were set during the 21st COP. When the IPCC warned that countries must cut emissions and achieve net-zero emissions by 2050, India claimed its position had been "confirmed" and that it was now up to rich countries to make significant reductions. All efforts to secure India's elusive net-zero pledge, including Joe Biden's World Leaders Summit, US climate envoy John Kerry's visit, and COP President Alok Sharma's visit, were in vain.

Negotiations on climate change in the past

The COP has been in existence since 1995, but this gathering in particular has a lot riding on it. The COP26 is the first time since the Paris Agreement that climate change targets have been reviewed and revised, with the goal of keeping global warming "well below" 2 degrees Celsius. It's also the first COP to decide on the regulations governing the Paris Agreement, such as those governing climate financing. Climate funding is a touchy subject. High-income countries have been chastised by low- and middle-income countries for failing to provide the $100 billion promised in 2009. This money will be used to assist developing nations in mitigating and adapting to climate change, without which they will suffer not just devastation but also the risk of failing to reach their goals. According to a research by the UN's finance committee, developing nations would need trillions of dollars to meet just a portion of their climate change commitments set in 2015. Temperatures will rise to 2.7 degrees by the end of the century, according to the IPCC study, unless countries do more to curb climate change.

Developed countries have confessed sheepishly that they will not be able to deliver the $100 billion by 2023. Climate activists have dubbed their efforts to secure private-sector support "greenwashing," implying that they are falsely professing to protect the environment while businesses continue to destroy it.

Conclusion

Extreme weather patterns are altering around the globe as a result of human-caused climate change, from longer and hotter heat waves to heavier rains. All weather events are now linked to climate change on a broad scale. While natural variability continues to play a part in extreme weather, climate change has moved the odds and changed the natural limitations, increasing the frequency and intensity of certain types of extreme weather.

Although our understanding of how climate change affects extreme weather is still evolving, research suggests that extreme weather may be impacted even more than previously thought. Extreme weather is on the rise, and all signs point to it continuing to climb in predictable and unpredictable ways. Even the most strict mitigation initiatives will not be able to prevent some of the effects of climate change in the coming decades. These ramifications are already being felt. This necessitates flexibility, especially when dealing with immediate consequences. Unabated climate change, on the other hand, is likely to outstrip human ability to adapt in the long run.

Thus, developing a portfolio or mix of policies that includes mitigation, adaptation, technological development (to improve both adaptation and mitigation), and research is critical (on climate science, impacts, adaptation and mitigation). However, assessing the benefits of various strategy combinations is currently hampered by a lack of data on potential impact costs, a lack of comparable data on the damage that could be avoided through adaptation, and, most importantly, a lack of understanding of how these impacts will vary across different socioeconomic development pathways. It's critical that these knowledge gaps are swiftly filled.

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