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REVIEW OF CLIMATE CHANGE – MITIGATION AND ADAPTATION STRATEGIES

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INTRODUCTION

CLIMATE CHANGE

Climate change is an inconsistent variation of Earth's climate carried around due to changes in the atmosphere as well as the interactions between the atmosphere and various other geological, chemical, biological and geographical factors within the Earth's system. Climate change is making the weather patterns less foreseeable. These unpredictable weather patterns will make it tough to sustain and grow crops, thus making agriculture bound countries like India greatly susceptible. The climate change is causing destructive weather events like more recurrent and powerful hurricanes and tornadoes, deluges, typhoons, flooding etc. Due to consistent increase in temperature caused by climate change, the ice in the polar areas is melting at a much faster rate, causing upsurge in sea levels. This rise in sea level is damaging the coastlines, due to the increased flooding and erosion. The unmindful human activities are causing rapid climate change and threatening the very survival of humankind on the planet.

Effects Of Climate Change

Global warming has caused prominent changes in the weather conditions. The rainfall pattern is disturbed, there is increased flooding, drought, heatwaves, etc. The planet's ocean and glaciers are affected. Oceans are presently warming up and becoming acidic. The mountain ice caps are melting, causing the sea levels to rise. These climatic changes are expected to be more happening in the coming decades thus threatening our environment and its very existence.

Impacts Of Climate Change

I. Rise in atmospheric temperature

The emission of greenhouse gases due to human doings are responsible for the rise in temperature of the Earth. The last decade has seen the maximum rise in temperature. These years have been recorded as the hottest years in history. The rise in temperature has been the major cause of heat-related deaths and illnesses, rise in sea levels and surge in the intensity of natural disasters. The 20th century saw increase in the Earth's average temperature by 1°F. This is thought to be the fastest increase in a thousand years. The researches have estimated that by the end of this century, if the greenhouse gases are not restricted, the average temperature of our planet can rise by 3-5°F.

Variation in landscapes: The rise in temperature and fluctuating weather patterns across the world has led to shift of trees and plants towards mountains and Polar areas. As the plants try to acclimatize to climate change by shifting towards colder areas, the wildlife that are reliant on them will be forced to trail them for their existence. Though few of them may survive, several of them will perish in the go. Other types of animals like polar bears who survive only on cold territories will be devoid of any habitat due to the melting of ice and their mere existence will be at stake. Thus, the existing speedy variation in the landscape will cause a significant risk to the survival of many species, including the human population on this planet.

Risk in the ecosystem: With the rise in temperature across the planet the weather and vegetation patterns are considerably changing thus making the flora and fauna species to migrate to cooler areas for survival. The increase in temperature is a great threat to the survival of numerous species. It is predicted that by 2050, one-fourth of the species around the globe may become extinct if the existing drift continues.

Rising sea levels: A rise in temperature of the Earth is leading to increase in sea level due to thermal expansion (a state wherein the warm water takes up additional extent than cool water). Further the melting of glaciers is adding to this problem. The population residing in low-lying areas, islands and coasts are at risk by the rising of sea levels. The effect of climate change can be observed by the erosion of the coastlines, damage of properties and destruction of ecosystems like mangroves and wetlands that shield the shores from squalls and hurricanes. It has been observed that in the last hundred years, the sea level has risen to almost 4-8 inches and will still continue to rise between 4 to 36 inches in the next hundred years.

Ocean Acidification: The steady rise in the CO₂ concentration in the atmosphere has increased the absorption of CO₂ in the ocean thus making the ocean more acidic. The acidification of ocean will be damaging for many marine species like plankton, molluscs, etc. The corals are particularly vulnerable to this as they find it hard to produce and sustain the skeletal structures required for their existence.

Increased risk of natural and manmade disasters: Due to high atmospheric temperature the humidity from land is rapidly evaporating thus causing drought. These areas affected by drought are highly prone to the adverse effects of flooding. If the present climatic scenario persists the droughts may become more frequent and more severe. This will lead to difficult consequences for agriculture, water safety, and wellbeing. Many countries in Asia and Africa have already started to face this phenomenon, with droughts becoming longer and intense. The



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steady rise in temperature is not only causing droughts but also increasing the cases of forest fires across the Earth. There has been increase in hurricanes and tropical storms, causing a devastation to human societies and the environment. The main reason for the intensified hurricanes and storms is the rise in the ocean temperature. The warm waters influence the hurricanes and tropical storms energies. The other aspects that cause intensified hurricane and tropical storms are rising sea levels, vanishing wetlands and enhanced coastal development.

Health issues: The increase in temperature around the world are posing grave health risks and deaths. The intensified heat waves caused by climate change has led to several deaths globally e.g., in 2003, the dangerous heatwaves led to the death of more than 20,000 people in Europe and triggered more than one thousand and five hundred deaths in India. Climate change has resulted in the spreading of infectious diseases around the globe as the long-term warm weather conditions lets disease-carrying insects, animals and microbes to live for a longer period. Virus and pests that were once restricted to the tropics will now find it liveable in the colder regions that were earlier not congenial. Presently climate change has seen an increase in death due to extreme heat, natural calamities and illnesses. The World Health Organisation has projected that between 2030 and 2050, climate change may cause roughly 250,000 added deaths per year owing to malnourishment, malaria, diarrhoea and life-threatening heat.

Economic impacts: It has been projected that if timely action is not taken to address carbon emissions, the climate change might cost approximately 5 to 20% of the annual global GDP. In contrast, the price to reduce the damaging effects of climate change is almost 1% of the GDP. Climate change is altering the coastline habitats. This will need relocation of ports and near-coast infrastructures and surroundings, pricing about millions of dollars. The regular storms and tornadoes and other associated natural adversities will bring forth large scale economic losses caused by damaged properties and infrastructures. The decline in crop produces due to long droughts and high temperatures will imminently lead to high risk of starvation of thousands of people. Coral reefs make around \$375 billion each year in goods and services. Their mere existence is presently under threat.

Agriculture productivity and food security: Agriculture has always been dependent on climate patterns chiefly on solar radiation, favourable temperature and precipitation. The existing climate change is affecting agricultural production, food supply and food security. These effects are mainly biophysical, ecological and economic. The change in agricultural production pattern, unpredictable precipitation patterns due to increased atmospheric temperature has increased the vulnerability of the landless and the poor farmers.

Efforts Taken at The International Level to Combat Climate Change Intergovernmental Panel on Climate Change (IPCC)

The World Meteorological Organisation (WMO) and the UN Environment Programme (UNEP) instituted the IPCC to make available mechanisms to study the effects and results of global warming at the governmental level.

IPCC is a United Nation body that measures the science related to climate change. It makes available the policymakers with regular scientific assessments on climate change, its consequences and possible forthcoming risks while also providing adaptation and mitigation choices. It complements United Nations Framework Convention on Climate Change (UNFCCC) and vice versa.

United Nations Framework Convention on Climate Change (UNFCCC): UNFCCC came to force on 21st March 1994. The 195 nations that have approved it are named Parties to the Convention. The UNFCCC is a Rio Convention, one of the three adopted at the Rio Earth Summit in 1992. The others comprise of the UN Convention on Biological Diversity and UN Convention to Combat Desertification. The Joint Liaison Group was recognized to guarantee collaboration among the three Conventions. Presently, it also comprises of Ramsar Convention on Wetlands. The eventual aim of the Convention is to alleviate the greenhouse gas concentration at a level that would avert hazardous anthropogenic interfering with the climatic system of the earth.

It also aims to realize the supposed level within a precise period, so that the ecosystem is able to naturally adapt to climate change, while also guaranteeing food security and sustainable financial growth. Subsequent to its founding, the COP1 (first Conference of Parties) was organized in Berlin, COP2 was held in Geneva and COP3 was held in Kyoto to adopt the “Kyoto Protocol” that guarantees the implementation of the UNFCCC’s goals and objective.

Kyoto Protocol: The Kyoto Protocol was adopted in Kyoto, Japan on 11th December 1997 and came to force on 16th February 2005. The signatories are bound towards the accomplishment of the target of emission reduction.

The COP 7 held in Morocco in 2001 saw the adoption of the comprehensive guidelines for the implementation of the protocol. These are mentioned as “Marrakesh Accords”. The said protocol holds the developed nations accountable for the existing high levels of Green House Gas emissions into the atmosphere due to their involvement in the industrial revolution. Kyoto Mechanism, also recognized as Flexible Mechanism, is stated under the Kyoto Protocol to lessen the global cost of realizing the emission targets. This comprises Emission Trading, the Clean Development Mechanism and Joint Implementation.

The Doha Amendment to the Kyoto Protocol was adopted on December 2012. The changes made include:

- New pledges made by Annex I Parties (developed nations and Economics in Transition) to be realized between the period of 1st January 2013 and 31st December 2020.



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- Revised list of Green House Gases is to be informed by the Parties during the second commitment period.
- Amendments done to update numerous articles of the Kyoto Protocol to be at par with the second commitment period.
- The Kyoto Protocol is noteworthy step towards the lessening of global emission management that will permit the stabilisation of Green House Gas emissions.

Paris Agreement

The Paris Agreement is considered to be the world’s first all-inclusive climate agreement signed in 2016. It aims to:

- Retain the global temperature well below 2°C that is overhead pre - industrial period and endeavours to restrict them to 1.5°C.
- Reinforce the countries’ capacity to combat the antagonistic bearings of climate change.
- The Paris Accord demands for decrease in Green House Gas emission due to human actions equivalent to that of the plants, soil and oceans such that they can be absorbed naturally.
- According to the Agreement, contribution of each country towards reducing the emission must be reviewed every five years.
- It further states that economically strong nations must assist the poorer countries by arranging for them “Climate finances” to make them move towards renewable energy practice.
- The agreement is obligatory in elements like reporting necessities. Other essentials of the agreement are not compulsory like the emission goals of the different countries.
- The Paris Agreement demands all Parties to put out their best energies through Nationally Determined Contributions (NDCs) and to fortify these energies in the forthcoming years.
- This also embraces the necessity for systematic reporting of emissions and execution by the parties.
- India’s Intended Nationally Determined Contribution (INDC) consist of the drop in the intensity of its GDP by 33 to 35% by 2030 from 2005 level. In addition, it has promised to increase the portion of non-fossil fuel-based electricity upto 40% by 2030. It has also agreed to increase its forest cover, which will absorb 2.5 to 3 billion tonnes of Carbon dioxide by 2030.

REDD+

- Reducing Emissions from Deforestation and Forest Degradation (REDD+) is a system developed by Parties of the UNFCCC.
- It generates monetary cost for the carbon deposited in jungles to propose enticements for the developing countries to decrease emissions from woodland and invest in low-carbon tracks.
- The developing countries will have results-based payments for results-based activities.
- The REDD+ goes way past deforestation and forest degradation by counting the role of conservation, sustainable management of forests and improvement of forest carbon stocks.
- It is projected that the monetary flow for the Green House Gas emission decrease from REDD+ could reach up to \$30 billion per year.
- The enhanced North-South flow of capitals can guarantee a substantial lessening of carbon emissions and elevation of inclusive growth. It can also improvise biodiversity conservation and protect dynamic ecosystem facilities.
- Forests are important carbon sink and consequently, it is vital to intensify its flexibility to climate change.

Mitigation and Adaptation

Mitigation

Mitigation is reducing climate change, encompasses lessening the flow of heat trapping greenhouse gases into the atmosphere. Primarily, by decreasing the sources of these gases e.g., burning of fossil fuels for electricity, warmth or transportation or increasing the “sinks” that amass and stockpile these gases, such as the oceans, forests and soil. The goal of mitigation is to evade substantial human meddling with the climate system, and alleviate greenhouse gas levels in a time-frame adequate to permit ecologies to familiarize naturally to climate change, guarantee that food produce is not endangered and to allow monetary development to ensue in a sustainable way (as given in the 2014 report on Mitigation of Climate Change from the United Nations Intergovernmental Panel on Climate Change, page 4).

Adaptation

Adaptation is regulating to life in a varying climate. It includes regulating to real or anticipated future climate. The goal is to lessen our susceptibility to the damaging effects of climate change, like sea-level encroachment, intense weather events or food insecurity. It also incorporates making the most of any probable advantageous prospects associated with climate change for example, longer growing seasons or increased yields in some regions.



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All through history, individuals and civilizations have adjusted to and survived with the changes in climate extremes with variable degree of accomplishment. Climate change, particularly drought has been partly responsible for the rise and fall of civilizations. Earth's climate has been comparatively steady for the past 12,000 years and this constancy has been vital for the advancement of our modern civilization and life as we see it. Modern life is custom-made to the constant climate we have become habituated to. Now as our climate fluctuates, we will have to learn to adapt. The faster there will be climate changes, the tougher it could get.

Although climate change is an international issue but it is experienced at the local scale. Therefore, the cities and municipalities are at the frontline of adaptation. The cities and local communities around the world have been focusing on solving their own climate problems in the absence of national / international climate policy direction. They are working to build flood defence mechanisms, strategize for heatwaves and higher temperatures, fix water-permeable pavements to deal with floods and stormwater and advance water storing and usage.

According to the 2014 report on Climate Change Impacts, Adaptation and Vulnerability (page 8) from the United Nations Intergovernmental Panel on Climate Change, governments at different levels are getting better at reworking and adaptation. Now climate change has started to be incorporated into diverse development plans like, how to deal with more and more extreme disasters being faced and their accompanying risks, how to shield shorelines and manage with sea-level intrusion, how to bring about best management of land and forests, how to arrange for and plan for water scarcity, how to grow resilient crop yield varieties and how to safeguard energy and public substructure.

Strategies to Achieve Climate Mitigation and Adaptation Simultaneously

Climate actions are often categorized into one of these two strategies:

- mitigation efforts to lessen or eliminate greenhouse gas emissions from the atmosphere, and
- adaptation efforts to regulate schemes and societies to endure the effects of climate change.

This difference has led to the misled understanding that addressing climate change means either pursuing mitigation or adaptation.

This division is counterproductive and risky, particularly for seaside townships, farmers, small island countries and other societies at the fronts of climate bearings. The truth is that adaptation and mitigation are two flanks of the same coin. In fact, both procedures and technical knowhows that both restrict climate change and deal with its impact already exist.

Though it is not always likely or hands-on to work exclusively on activities that are both adaptive and mitigating. Nor these actions are silver bullet to solve climate crisis. Simply keeping, where it makes sense, the government and communities ought to pursue such activities.

Following solutions can curb both climate change and help to cope with its impacts simultaneously:

➤ Protect Coastal Wetlands

Salt marshlands, mangroves and seagrasses are exclusive seaside bionetworks that aid as natural water filtration arrangements and sea environments. They protect coastlines against rise in sea level shielding hurricane, outpourings and floodwaters, and hoard tons of carbon in their roots and soils. Presently the Mangrove jungles hold almost equivalent of more than two years of global emissions, which will be released into the atmosphere and deteriorate the effects of climate change if these woodlands are destroyed.

Increasing endangered seaside marshes and improving about 40% of the ecosystem's global coverage by 2050 could mitigate one gigaton of CO₂ per year, i.e., over three years of emissions. All the efforts to preserve seaside swamps essentially take in local societies that depend on these ecosystems for their homes and livings. Countries like Fiji and Papua New Guinea have effective experiences around society-based conservation and education to bring about these marshlands and sustain the growth of immediate communities.

Benefits of Sustainable Agroforestry

The land use changes from forestry and agriculture account to approximately 25% of anthropogenic greenhouse gas emissions, therefore it is sure that existing land managing arrangements need to change drastically. Agroforestry observes integration



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of assorted plants or vegetation with crops and cattle. To be precise, grasslands with trees can requisition five to ten times more carbon than areas of the same size without trees. Farmers can be more productive by simultaneously growing crops and raising livestock using considerably less land. Diversification of crops together with livestock on these lands can give farmers supplementary sources of income and lessen the risks to livelihoods caused by climate change and erratic weather. Planting trees in farmsteads and pastures lets farmers to expand their income whereas their land absorbs more carbon.

3. Decentralize Energy Distribution

The unpredictability of the climate will harmfully effect countries' power transmission programmes and delivery infrastructure. Along with this, the development and population growth are growing energy demand and use. The centralized energy systems with large power plants and infrastructure which are connected over long distances are more susceptible to climate change, since interruptions at one point in the arrangement can disturb the complete system.

The decentralized systems are ever so often powered by renewable energy, with shorter transmission lines and smaller distribution zones. They are more climate-resilient. In the event of a disaster, a society having its own decentralized energy supply is not affected by major power outages in other zones. Smaller power sources are more manageable and can recover from disasters more swiftly. Low-carbon technical knowhows e.g., solar panels and batteries can provide dependable, clean energy to critical services, like hospitals in isolated regions that are not already connected to the grid or experience frequent power cuts.

Secure Land Rights of Indigenous People

The native and local societies manage nearly 50% of land on the planet, where up to 2.5 billion people are reliant for their livelihoods. Over generations these communities have skilfully adapted on their lands, evolving a deep form of traditional knowledge that can benefit others to understand how to adjust to varying environment.

It has been found that areas where native persons have lawful rights to their land have at least two times lesser deforestation rates than parallel areas without secure tenure. This has been found in Bolivia, Brazil and Colombia. The indigenous individuals and local groups have protected forests that hold almost 25% of all above-ground carbon in tropical forests. So far, these societies legitimately hold less than 1/5th of this land. Safeguarding rights of indigenous people will ensure that they can have their land, shield natural properties and better withstand their livelihoods in the aspect of climate change.

5. Improve Mass Transit

Approximately 72% of global transport-related emissions are from road transport that accounts for a percentage which will continue to grow unless more low-carbon transportation options become available and accessible. Transportation infrastructure is also tremendously susceptible to impacts of climate change like storms and extreme heat. Disruption in network owing to extreme weather conditions will excessively affect low-income people and other vulnerable city populations who have lesser mobility options.

Expansion of urban public transport by 40% till the year 2050 can reduce the expected number of cars on the road and evade 6.6 gigatons of carbon emissions. Retrofitting and designing of mass transportation that can survive climate hazards like natural disasters, rise in sea level or dangerously high heat, guarantees these transport choices are safe and dependable in the long-term. These advances will impact usage and better adjust for future growth.

Conclusion

These are some instances of climate actions that can be helpful to address both adaptation and mitigation at the same time. There are many others options that exist and can accommodated by different societies, the ecosystems, nations and varied communities. The climate crisis is massive and urgent. Given restricted funding, resources and attention that can be allocated to solving it, policymakers need to prioritize such integrated efforts.

References

- <https://www.man-es.com/discover/carbon-capture-utilization-storage?gclid=>
- <https://www.sciencedaily.com/releases/2022/02/220228131507.htm>
- [3.https://www.wri.org/insights/ipcc-report-2022-climate-impacts-adaptation-vulnerability?utm_medium=cpc&utm_source=google&utm_campaign=ipcc2022&gclid=CjwKCAjwzeqVBhAoEiwAOrEmzRb16n6CJtIvJv3fRbOsdmBzVXGieNtJHD6yQU_OErFCybECUumZ6BoC48cQAvD_Bwe](https://www.wri.org/insights/ipcc-report-2022-climate-impacts-adaptation-vulnerability?utm_medium=cpc&utm_source=google&utm_campaign=ipcc2022&gclid=CjwKCAjwzeqVBhAoEiwAOrEmzRb16n6CJtIvJv3fRbOsdmBzVXGieNtJHD6yQU_OErFCybECUumZ6BoC48cQAvD_Bwe)
- <https://www.iasexpress.net/climate-change/>
- <https://onlyias.com/climate-change-mitigation-strategies>



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DOI: <http://ijmer.in.doi./2022/11.07.03>

- https://www.activesustainability.com/climate-change/mitigation-adaptation-climate-change/?_adin=02021864894
- <https://www.insightsonindia.com/2018/02/21/insights-editorial-adapting-better-climate-change>
- <https://www.wri.org/insights/5-strategies-achieve-climate-mitigation-and-adaptation-simultaneously>
- https://ar5-syr.ipcc.ch/topic_adaptation.php
- [9.https://www2.cifor.org/cobam/background/adaptation-and-mitigation](https://www2.cifor.org/cobam/background/adaptation-and-mitigation)
- [10. https://www.cifor.org/fileadmin/fileupload/cobam/ENGLISH-Definition-and-ConceptualFramework](https://www.cifor.org/fileadmin/fileupload/cobam/ENGLISH-Definition-and-ConceptualFramework)
- [11. https://www.bbc.com/future/article/20181102-what-can-i-do-about-climate-change](https://www.bbc.com/future/article/20181102-what-can-i-do-about-climate-change)
- [12https://climate.nasa.gov/solutions/adaptation-mitigation/](https://climate.nasa.gov/solutions/adaptation-mitigation/)
- [13. https://www.nrdc.org/stories/how-you-can-stop-global-warming](https://www.nrdc.org/stories/how-you-can-stop-global-warming)
- [14. https://www.unep.org/news-and-stories/story/10-ways-you-can-help-fight-climate-crisis](https://www.unep.org/news-and-stories/story/10-ways-you-can-help-fight-climate-crisis)