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Chapter 18

Climate change causes, impacts, action plan, and human health in India

Causas, impactos, plan de acción y salud humana del cambio climático en la India

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ABSTRACT

Climate change has become a big problem for India and the whole world today. Climate change is having an impact on humans as well as the environment. The reason for this is anthropogenic and natural. Human beings are suffering from diseases due to increases in temperature due to climate change, an increase in harmful gases, the greenhouse effect, etc. The problem of climate change has arisen. Due to climate change, problems with water, food, drought, economy, health, etc. have arisen. Globally, conferences are being held every year to tackle climate change. Countries from all over the world are present at this conference and are working to deal with climate change. India is moving ahead with many plans to deal with climate change. The world is working to reduce CO_2, CH_4, N_2O, and temperatures. Research is being made to tackle climate change. Climate change has been discussed in detail in this review.

Keywords: climate change, impact, international, national action plan, human health, and India.

RESUMEN

El cambio climático se ha convertido en un gran problema para la India y el mundo entero en la actualidad. El cambio climático está teniendo un impacto tanto en los seres humanos como en el medio ambiente. La razón de esto es antropogénica y natural. Los seres humanos sufren enfermedades debido al aumento de la temperatura debido al cambio climático, aumento de gases nocivos, efecto invernadero, etc. Ha surgido el problema del cambio climático. Los problemas de agua, alimentación, sequía, economía, salud, etc. han surgido debido al cambio climático. A nivel mundial, se organizan conferencias cada año para abordar el cambio climático. Países de todo el mundo están presentes en esta conferencia y trabajan para hacer frente al cambio climático. India está avanzando con varios planes para abordar el cambio climático. El mundo está trabajando para reducir el CO_2, CH_4, N_2O, y la temperatura. Se están realizando investigaciones para abordar el cambio climático. El cambio climático se analiza en detalle en esta revisión.

Palabras clave: cambio climático, impacto, internacional, plan de acción nacional, salud humana e India.

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INTRODUCTION

Accumulation of trace gases such as carbon dioxide (CO_2) and methane (CH_4) in the atmosphere, caused mainly due to anthropogenic activities such as the burning of fossil fuels, is believed to be altering the earth's climate system. The Intergovernmental Panel on Climate Change (IPCC) in its fourth assessment report observed that "warming of the climate system is now unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global sea level" (Soloman et al., 2007). The atmospheric concentrations of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) have increased by 47%, 156%, and 23%since the beginning of the Industrial Revolution (Masson-Delmotte, V., et al. 2021). The last 30 years, paralleling the unprecedented emission of greenhouse gases, were recorded as the hottest period since 1850 (Allen, M., et al. 2019). The warming atmosphere and ocean over time have affected Earth's climate system and disrupted the balance of nature through complicated pathways, resulting in climate perturbation and natural disasters, e.g., more frequent extreme temperature events (ETFs), droughts and floods, over the past decades (Romanello, M., et al. 2021, and Pörtner, H. O., et al. 2022). Global average temperatures are projected to increase between 1.4 and 5.88C by the end of this century1; an associated rise in sea level is also expected. The number of people at risk from flooding by coastal storm surges is projected to increase from the current 75 million to 200 million in a scenario of mid-range climate changes, in which a rise in the sea level of 40cm is envisagedbythe2080s (McCarthy, J. J., et al. 2001). Developing countries like India are responsible only for a small percentage of greenhouse gases and global warming but this accounts for a significant impact on health. An increase in global temperature affects water, food, air quality, infectious diseases, physical comforts, and human health. Research has estimated that climate change has caused 150,000 deaths and 5 million illnesses each year (WHO 2002). The vulnerable population includes the elderly, children, pregnant ladies, urban populations, and slums (Ebi, K. L., & Paulson, J. A. 2010). The relationship between climate and health is evidenced by the increase in the visit of patients to clinics after severe heat, rain, and cold. Variation in climate temperature for 100 years in India has been reported as 0.50C (India's initial national communication to the United Nations framework convention on climate change. 2004). Climate change has been regarded as the single largest global health challenge in the 21st century by affecting the physical environment and ecosystem and their interactions with human beings (Romanello, M., et al. 2021, Vicedo-Cabrera, et al. 2021, and Perera, A. T. D., et al. 2020).

WHAT CAUSES GLOBAL WARMING?

A: Global warming occurs when carbon dioxide (CO_2) and other air pollutants collect in the atmosphere and absorb sunlight and solar radiation that have bounced off the earth's surface. Normally this radiation would escape into space, but these pollutants, which can last for years to centuries in the atmosphere, trap the heat and cause the planet to get hotter. These heat-trapping pollutants—specifically carbon dioxide, methane, nitrous oxide, water vapor, and synthetic fluorinated gases—are known as greenhouse gases, and their impact is called the greenhouse effect (Global Warming 101).

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CAUSES OF CLIMATE CHANGE

The causes of climate change can be divided into two categories natural causes and anthropogenic (man) causes are described by climate change.

A. Natural Causes

Following are the natural factors responsible for climate change

Variations in the Sun's output

Variation in the emitted energy amount by Sun is reported by Kelly and Wigley (1992) on the longest timescales of Earth's geological history. 'Sunspots'- the dark patches on the Sun face are known for many centuries with the regular cyclic variation in some sunspots within a specific period of certain years. These processes within the sun might affect the solar output and, hence, Earth's climate and climatic change. In the early 1600s, the sunspot cycle almost disappeared and this phenomenon was supposed to link with a considerable decrease in global temperature at that time. It has also been claimed that the warming of the 20thcentury was largely due to trends in a relative increase in sunspot activity (Climate change and associated issues, InsightsIAS, 2022).

Volcanic Activity

Volcanoes have played a noticeable role in climate, and volcanic eruptions released large quantities of carbon dioxide in the distant past. Some explosive volcano eruptions can throw particles (e.g., SO2) into the upper atmosphere, where they can reflect enough sunlight to space to cool the surface of the planet for several years (Fahey, David; et al., 2017). Volcanic particles from a single eruption do not produce long-term climate change because they remain in the atmosphere for a much shorter time than greenhouse gases. In addition, human activities emit more than 100 times as much carbon dioxide as volcanoes each year (Fahey, D.W., et al., 2017).

Ocean Currents

Ocean current is one of the major components of the climate system. It is driven by horizontal winds causing the movement of the water against the sea surface. The temperature differences in the water influence the climate of the region (Climate change and associated issues, InsightsIAS, 2022).

Changes in Naturally Occurring Carbon Dioxide Concentrations

Over the last several hundred thousand years, carbon dioxide levels varied in tandem with the glacial cycles. During warm interglacial periods, carbon dioxide levels were higher. During cool glacial periods, carbon dioxide levels were lower (National Academy of Sciences. 2020). The heating or cooling of the earth's surface and oceans can cause changes in the natural sources and sinks of these gases, and thus change greenhouse gas concentrations in the atmosphere (Stocker, T. F., et al., 2013). These changing concentrations have acted as positive Climate feedback, amplifying the temperature changes caused by long-term shifts in the earth's orbit (National Academy of Sciences. 2020).

PLATE TECTONICS

Due to the change in the temperature in the core of the Earth, the mantle plumes and convection currents forced the Earth's Plates to adjust leading to the rearrangement of the Earth Plate. This can influence the global and local patterns of climate and atmosphere. The oceans' geometry is determined by the continents' position. Therefore, the position of the continents influences the pattern of the ocean. The location of the sea also plays a crucial role in controlling the transfer of heat and moisture across the globe and determines the global climate. A recent example of the tectonic control on ocean circulation is the formation of the Isthmus of Panama about 5 million years ago, leading to the prevention of direct mixing of the Atlantic and Pacific oceans (In-depth, 2022).

Milankovitch cycles

Over time scales of thousand years and longer, changes are predicted in the Earth's orbit around the Sun and in its rotation. This can significantly affect the amount of radiant energy from the Sun and its distribution by season and by latitude; which might be responsible for the cyclic increase and decrease in global temperature over a longer time. This phenomenon is known as the 'Milankovitch Effect' and it generates cyclic changes (Jouzel et al., 2007 and Tarling, 2010).

B. Anthropogenic Causes

Following are the anthropogenic factors responsible for climate change

Greenhouse Gases

Concentrations of the key greenhouse gases have all increased since the Industrial Revolution due to human activities. Carbon dioxide, methane, and nitrous oxide concentrations are now more abundant in the earth's atmosphere than at any time in the last 800,000 years (National Academy of Sciences 2020). These greenhouse gas emissions have increased the greenhouse effect and caused the earth's surface temperature to rise. Burning fossil fuels changes the climate more than any other human activity (Causes of Climate Change, 2022).

Carbon dioxide: Human activities currently release over 30 billion tons of carbon dioxide into the atmosphere every year (Hayhoe, K., et al., 2018). Atmospheric carbon dioxide concentrations have increased by more than 40 percent since pre-industrial times, from approximately 280 parts per million (ppm) in the 18th century to 414 ppm in 2020 (Stocker, T.F., et al., 2013, p. 166, and NOAA. 2021).

Methane: Human activities increased methane concentrations during most of the 20th century to more than 2.5 times the pre-industrial level, from approximately 722 parts per billion (ppb) in the 18th century to 1,867 ppb in 2019 (Stocker, T.F., et al., 2013, p. 167, and NOAA. 2021).

Nitrous oxide: Nitrous oxide concentrations have risen approximately 20 percent since the start of the Industrial Revolution, with a relatively rapid increase toward the end of the 20th century. Nitrous

oxide concentrations have increased from a pre-industrial level of 270 ppb to 332 ppb in 2019 (Stocker, T.F., et al., 2013, p. 168, and NOAA. 2021).

CFC in global warming: Halogenated carbons such as CFCs were used as refrigerants, insulating foams, and aerosol sprays. Its GWP is 12,000 its radiative forcing is 24% (IPCC, 2001as cited in Kemp, 2004). However, the use and production of CFC are completely banned by the Montreal protocol thus current levels of global CFC in the atmosphere are declining (Sivaramanan, S. (2015).

Water Vapor: Water vapor is another greenhouse gas and plays a key role in climate feedback because of its heat-trapping ability. Warmer air holds more moisture than cooler air. Therefore, as greenhouse gas concentrations increase and global temperatures rise, the total amount of water vapor in the atmosphere also increases, further amplifying the warming effect (Wuebbles, D. J., et al., 2017).

Ground-Level Ozone: Ground-level ozone is created by a chemical reaction between emissions of nitrogen oxides and volatile organic compounds from automobiles, power plants, and other industrial and commercial sources in the presence of sunlight. In addition to trapping heat, ground-level ozone is a pollutant that can cause respiratory health problems and damage crops and ecosystems (Basics of Climate Change, 2022).

Reflectivity or Absorption of the Sun's Energy: Activities such as agriculture, road construction, and deforestation can change the reflectivity of the earth's surface, leading to local warming or cooling. This effect is observed in heat islands, which are urban centers that are warmer than the surrounding, less populated areas. One reason that these areas are warmer is that buildings, pavement, and roofs tend to reflect less sunlight than natural surfaces. While deforestation can increase the earth's reflectivity globally by replacing dark trees with lighter surfaces such as crops, the net effect of all land-use changes appears to be a small cooling (Fahey, D.W., Set al., p 78 - 86. 2017, and Causes of Climate Change, 2022).

Emissions of small particles, known as aerosols, into the air can also lead to reflection or absorption of the sun's energy. Many types of air pollutants undergo chemical reactions in the atmosphere to create aerosols. Overall, human-generated aerosols have a net cooling effect on the earth (Causes of Climate Change, 2022).

Impacts of climate change

Global warming

The term "global warming" was first used by Broecker (1975) to describe the phenomenon of an increase in average global surface temperature. The IPCC has reported to 0.4ºC to 0.7ºC increase in global mean annual temperature at the end of the 20thcentury, above that recorded at the end of the 19th century (Pachauri, R. K., & Reisinger, A. 2008). During the last 50 years, the global mean temperature is increased at the rate of 0.13ºC per decade, with a steep rise during the past one and half decades. IPCC has projected the temperature increase to be between 1.1ºC and 6.4ºC by the end of the 21st Century. IPCC, 2014 has also given future predictions of global warming. Which suggested

that the manipulations in greenhouse gases emission will decide the future global temperature trends (Kalhapure, A. H., et al., 2019).

Impacts of climate change on different sectors of agriculture

Global climate change can affect directly and indirectly various attributes of agriculture viz., crops, soils, livestock, pests, etc. The increase in temperature, can reduce crop duration, alter photosynthate partitioning to economic products, increase crop respiration rates, affect pest populations and distribution, hasten nutrient mineralization in soils, and increase evapotranspiration rate and decrease fertilizer use efficiencies. Indirectly, there may be considerable effects on land use due to snow melt, availability of irrigation water, frequency and intensity of inter- and intra-seasonal droughts and floods, soil organic matter transformations, soil erosion, changes in pest profiles, a decline in arable areas due to submergence of coastal lands, and availability of energy. Equally important determinants of food supply are socio-economic environment, including government policies, capital availability, prices, and returns, infrastructure, land reforms, and inter and intra-national trade that might be affected by the climatic change. The detailed impacts of climate change on agriculture are discussed below- (Kalhapure, A. H., et al., 2019).

Availability of water

The increased temperature leads to an increase in potential evapotranspiration which will

Result in more water demand for irrigation and ultimately lower groundwater tables in some places. A decrease in rice yield by 20% due to water shortage under climate change conditions is predicted in India. Indian agriculture is highly dependent on monsoon precipitation; irregularities in its onset, erratic nature, drought, frequent dry spells, floods, and cyclones cause the elevated water crisis. There will be short-term increased availability of water in the Ganges, Brahmaputra, and their tributaries due to the melting of glaciers in the Himalayas; but in the long run, water availability will decrease considerably. Increased erratic nature of precipitation may increase runoff losses and floods in the wet season. The water balance in different parts of India will be disturbed and the quality of groundwater along the coastal track will be affected more due to the intrusion of sea waters (Pathak, H., et al., 2012).

Rise in sea level

About 10% of the rice cultivation area which is enough to feed 200 million people in South, South East, and East Asia is susceptible to a 1 m rise in the sea level. This Direct loss of land combined with less favorable hydraulic conditions may reduce rice yields by 4%, endangering the food security of at least 75 million people. Saltwater envision in freshwater bodies will the other issue promoting water scarcity conditions (Mimura, N. 2013).

Biodiversity losses

As a result of human activities and resulting in climate change situation animals and plant species are disappearing at a 100times faster rate than the historical record. It is reported from the assessment of the 394 species of primates from South America to Indonesia that 29% of species are in danger of disappearing due to habitat loss and climate change (Sintayehu, D. W., 2018).

Increased intensity of pests, weeds, and diseases

The intensity of pests, weeds, and diseases will increase through many inter-related processes, including range extensions and phonological changes, as well as increased rates of population development, growth, and migration due to the increase in global temperature. As the crops and animals will face different types of stresses under climate change situations; they are more susceptible to disease and pests because of declining resistance among them. The temperature rise will favor insect development and winter survival. Rising atmospheric carbon dioxide concentrations may lead to a decline in food quality for plant-feeding insects, as a result of reduced foliar nitrogen levels. The epidemiology of plant diseases will be altered. The prediction of disease outbreaks will be more difficult in periods of rapidly changing climate and unstable weather. Environmental instability and increased incidence of extreme weather may reduce the effectiveness of pesticides on targeted pests or result in more injury to non-target organisms (Fand, B. B., et al., 2012, and Kalhapure, A. H., et al., 2019).

Effect on livestock

The increased temperature would reduce the fodder digestibility due to enhanced lignification of plant tissues; which affects fodder production and nutritional security of livestock. A decrease in the production of feed and fodder due to increased water scarcity may also observe. An increase in vector-borne diseases will be observed due to the increased vector population and decreased resistance in livestock. Scarcity of water, shelter, and energy will also be observed in the global warming situation (Grossi, G., et al., 2019, and Lacetera, N. 2019).

Change in landscapes

Increasing temperature and changing climate and weather patterns across the globe led to the shift of trees and plants towards Polar Regions and mountains. As the vegetation tries to adapt to climate change by moving towards colder regions, the animals that are dependent on them will be forced to follow them for survival. While some survive, many perish in the attempt. Other species like polar bears dependent on cold terrains will not have any habitat due to the melting of ice, causing a risk to their survival. Thus, the current hasty change in the landscape causes a considerable risk to the survival of many species, including the human population (Climate change and associated issues, InsightsIAS, 2022).

Ocean Acidification

The increase in the CO_2 concentration in the atmosphere has increased the CO_2 absorption in the ocean. This makes the ocean acidic. The increase in the acidification of the ocean can be harmful to many marine species like plankton, mollusks, etc. The corals are especially susceptible to this as they find it difficult to create and maintain the skeletal structures needed for their survival (Ocean acidification, 2020).

Health issues:

The high temperature across the globe can pose health risks and deaths. The increased heat

Waves caused by climate change have led to the deaths of many globally. For instance, in 2003, the extreme heat waves led to the death of more than 20,000 people in Europe and caused more than 1,500 deaths in India. Climate change increases the spreading of contagious diseases as the long-term warm weather allows disease-carrying insects, animals, and microbes to survive longer. Disease and pests that were once confined to the tropics may find it habitable in the colder regions that were previously inhospitable. Currently, there is an increase in death due to extreme heat, natural disasters, and diseases due to climate change. The World Health Organisation estimates that between 2030 and 2050, climate change may cause approximately 250,000 additional deaths per year due to malnutrition, malaria, diarrhea, and extreme heat (Climate change and associated issues, InsightsIAS, 2022).

Economic impacts

It is estimated that if action is not taken to address the carbon emissions, climate change could cost about 5 to 20% of the annual global GDP. In contrast, the cost to lessen the most damaging effects of climate change is just 1% of the GDP. Climate change can alter shoreline habitats. This may lead to the need for relocation of ports and near-shore infrastructures and habitats, costing millions of dollars. The increased hurricanes and other related natural disasters can bring forth extreme economic losses caused by damaged properties and infrastructures. Declining crop yields due to lengthy droughts and high temperatures can lead to the risk of starvation for thousands of people. Coral reefs generate approximately $375 billion each year in goods and services. Their very survival is currently under threat (Climate change and associated issues, InsightsIAS, 2022).

INDIA IN THE INTERNATIONAL FORUMS ON CLIMATE CHANGE

India is currently setting up voluntary targets in the international forums to commit itself to the mission to combat climate change. It is also playing a major role in climate change mitigation. India’s proactive role in mitigating climate change is due to the domestic compulsion of tackling issues like the need for poverty eradication, food, and nutritional security, universalization of health and education, water security, sustainable energy, and employment. India believes that the developing countries' need for inclusive growth, sustainable development, poverty eradication, and universal access to energy must be made the fundamental differentiation between them and the developed nations. Currently, the Conventions recognize the historical

emissions of the developed nations as the basis for differentiation between the developed and developing nations (Climate change and associated issues, InsightsIAS, 2022).

Efforts are taken at the international level to combat climate change

International Community and Climate Change: UNFCCC-

The United Nations Framework Convention on Climate Change (UNFCCC) is an international treaty adopted in 1992 by 197 countries (United Nations Framework Convention on Climate Change, 21 November 2016). The treaty was set up to look into global warming and to prepare for its effects (e.g. temperature change and other climatic events). The UNFCCC sets out an agreement, which calls for the international community to come together in the interest of human safety to tackle the challenges posed by climate change. Parties to the Convention recognize that the climate is a shared resource whose stability is of utmost importance and that it can be affected by emissions of carbon dioxide and other greenhouse gases (Lolaksha Nagaveni, P., & Anand, A. 2017). One of the achievements of the UNFCCC has been to "establish a reporting framework which provides information on greenhouse gas emissions and removals using common categorization and definitions. This framework encourages reporting of data from most of the countries that are party to the Convention. This data provides essential input to:

1. Climate scientists (looking at the relationship between greenhouse gas emissions, temperature change, and other environmental factors) in predicting whether climate change and the speed of climate change pose a significant risk to humans or the environment.
2. Track progress in historical emissions and removal trends.
3. Prioritize actions for emission reduction." (United Nations Framework Convention on Climate Change, 22 November 2016, and Lolaksha Nagaveni, P., & Anand, A. 2017).

Kyoto Protocol-

Kyoto Protocols was adopted in Kyoto, Japan on 11th December 1997 and came to force on 16th February 2005. Its signatories are committed to the achievement of emission reduction targets. COP 7 held in Morocco in 2001 saw the adoption of the detailed rules for the implementation of the protocol. These are referred to as the "Marrakesh Accords". his protocol holds the developed countries accountable for the current high levels of GHG emissions into the atmosphere due to their role in the industrial revolution. Kyoto Mechanism, also known as Flexible Mechanism, is defined under the Kyoto Protocol to lower the overall cost of achieving the emission targets. It includes Emission Trading, the Clean Development Mechanism, and Joint Implementation. In December 2012, the Doha Amendment to the Kyoto Protocol was adopted. The changes made include: New commitments were made by Annex I Parties (developed nations and Economies in Transition) to be implemented between the period of 1st January 2013 and 31st December 2020. A revised list of GHG is to be reported by the Parties during the second commitment period. Amendments were made to update several articles of the Kyoto Protocol to be on par with the second commitment period. The

Kyoto Protocol is a significant step towards the reduction of the global emission regime that will allow the stabilization of GHG emissions (Climate change and associated issues, InsightsIAS, 2022).

Copenhagen Accord-

A political accord was struck by world leaders at the U.N. Climate Change Conference in Copenhagen in 2009 which provided for explicit emission pledges by all major economies including, China and other major developing countries but laid down no clear path toward a treaty with binding commitments, which is one of its major criticisms. The accord was merely 'recognized' by the 193 countries at the Copenhagen summit, rather than approved in the backdrop of tense negotiations (Lolaksha Nagaveni, P., & Anand, A. 2017).

Paris Agreement 2015-

"The Paris agreement which is formally known as the Conference of Parties protocol on fighting climate change is the world's first comprehensive regime on tackling the phenomenon within the UNFCCC."('India and the Paris climate deal, 2016). 197 countries in Paris adopted the agreement; the agreement will come into force after it has been ratified by at least 55 countries responsible for 55% of global emissions. The Paris Agreement entered into force on 4 November 2016 (Lolaksha Nagaveni, P., & Anand, A. 2017). "The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. Additionally, the agreement aims to strengthen the ability of countries to deal with the impacts of climate change. To reach these ambitious goals, appropriate financial flows, a new technology framework, and an enhanced capacity-building framework will be put in place, thus supporting action by developing countries and the most vulnerable countries, in line with their national objectives. The Agreement also provides for enhanced transparency of action and support through a more robust transparency framework"('The Paris Agreement ,2016). Concerning India, the Paris agreement is significant in the sense that, India accounts for over 4% of global emissions and that it will have to reduce its carbon footprint by 33-35% from its 2005 levels, which has to be achieved by 2030 ('India and the Paris climate deal',n 66).

Intergovernmental Panel on Climate Change (IPCC) -

The World Meteorological Organisation (WMO) and the UN Environment Programme (UNEP) founded the IPCC to provide a mechanism to study the effects of global warming at a governmental level. IPCC is a UN body that assesses the science related to climate change. It provides the policymakers with regular scientific assessments on climate change, its implications, and potential future risks while also providing adaptation and mitigation options. It complements UNFCCC and vice versa (Climate change and associated issues, InsightsIAS, 2022).

REDD+

Reducing Emissions from Deforestation and Forest Degradation (REDD+) is a mechanism developed by Parties of the UNFCCC. It creates financial value for the carbon stored in forests to offer incentives for the developing nations to reduce emissions from forested lands and invest in low-carbon paths. The developing nations will receive results-based payments for results-based actions. The REDD+ goes beyond simply deforestation and forest degradation by including the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks. It is estimated that the financial flows for the GHG emission reduction from REDD+ could reach up to $30 billion per year. This improved North-South flow of funds can ensure a significant reduction of carbon emissions and the promotion of inclusive development. It could also improve biodiversity conservation and secure vital ecosystem services. Forests are a vital carbon sink and thus, it is vital to increase their resilience to climate change (Climate change and associated issues, InsightsIAS, 2022).

Responses: mitigation and adaptation

Climate change impacts can be mitigated by reducing greenhouse gas emissions and by enhancing sinks that absorb greenhouse gases from the atmosphere. To limit global warming to less than 1.5 °C with a high likelihood of success, global greenhouse gas emissions need to be net-zero by 2050, or by 2070 with a 2 °C target. This requires far-reaching, systemic changes on an unprecedented scale in energy, land, cities, transport, buildings, and industry. Scenarios that limit global warming to 1.5 °C often describe reaching net negative emissions at some point. To make progress toward a goal of limiting warming to 2 °C, the United Nations Environment Programme estimates that, within the next decade, countries need to triple the number of reductions they have committed to in their current Paris Agreements; an even greater level of reduction is required to meet the 1.5 °C goals. Although there is no single pathway to limit global warming to 1.5 or 2.0 °C (2.7 or 3.6 °F), most scenarios and strategies see a major increase in the use of renewable energy in combination with increased energy efficiency measures to generate the needed greenhouse gas reductions. To reduce pressures on ecosystems and enhance their carbon sequestration capabilities, changes would also be necessary for agriculture and forestry, such as restoring natural ecosystems by reforestation. Other approaches to mitigating climate change entail a higher level of risk. Scenarios that limit global warming to 1.5 °C typically project the large-scale use of carbon dioxide removal methods over the 21st century (Climate change and associated issues, InsightsIAS, 2022).

The Way Forward

Wealthy nations like the U.S. and those of the EU argued that emissions from developing countries are consistently rising and they need to commit to more serious emission cuts. A consensus needs to be developed at the earliest. The immediate up-scaling of ambition in the second Commitment period of the Kyoto Protocol and its early ratification by all Kyoto Protocol parties would be a step in the right direction. Concerning mitigation, the distinction enshrined in the Convention between Annex I

(Developed) and nonAnnex I (developing) Parties must be maintained following the principles of Equity, CBDR, and other provisions of the UN Conventions. The 'developing versus developed country' schism needs to be diluted at the earliest and Developed Countries should avoid watering down the CBDR principle envisaged in earlier agreements (Climate change and associated issues, InsightsIAS, 2022).

India's Efforts to Counter Climate Change

India is the world's third-largest economy and fifth largest greenhouse gas (GHG) emitter, accounting for about 5% of global emissions. India's emissions increased 65% between 1990 and 2005 and are projected to grow another 70% by 2020 (Data from IEA, 2007). By other measures, India's emissions are low compared to those of other major economies. India accounts for only 2% of cumulative energy-related emissions since 1850. On a per capita basis, India's emissions are 70% below the world average and 93% below those of the United States (climate change mitigation measures in India, 2008). India is also at the frontline of facing the impacts of climate change. Shifting rainfall patterns, recurring floods, stronger cyclones, and droughts or soil erosion are exacerbating the challenge of poverty eradication and necessitate the allocation of scarce national resources for preventing loss of human life (Govt. of India MOEFCC, 2014). Despite resource constraints, India is undertaking ambitious actions to undertake adaptation and mitigation actions, including a thorough lowering of the energy intensity of our economic growth, increasing energy efficiency across sectors, and making greater use of renewable (India committed to fighting against climate change, 2014). India has doubled the Clean Energy Cess on coal, which very few countries have, and the Clean Energy Fund already has over 3 billion US dollars to be used for promoting clean technologies India's National Solar Mission is being scaled up five-fold from 20,000 megawatts to 100,000 megawatts (Statement of Shri Prakash Javadekar, 2014). This will mean additional investment of 100 billion dollars and savings of about 165 million tonnes of CO2 emissions per year. India is releasing 6 billion US dollars in one go for intensive afforestation which will result in more carbon sinks. India has allocated about 200 million US dollars for the 'National Adaptation Fund', setting up of Ultra Mega Solar Projects, Ultra-Modern Super Critical Coal Based Thermal Power Technology and the development of Solar Parks on canals. Another initiative is "100 Smart Cities' with integrated policies for adaptation and mitigation to reduce the vulnerability and exposure of urban areas to climate change and also to improve their energy efficiency for which 1.2 billion US dollars have been allocated. India has put in place stringent norms for the cement industry. Our Action Plan for cleaning one of the longest rivers in the world, River Ganga will bring multiple benefits of pollution reduction and climate adaptation. We have also taken initiatives for protecting coastal, Himalayan, and forest areas. India has initiated preparations to develop a National Air Quality Index and has launched a National Air Quality Scheme. Setting up of Ultra Mega Solar Projects in Tamil Nadu, Rajasthan, Gujarat, Andhra Pradesh, and Ladakh to promote renewable energy (Climate change and associated issues, InsightsIAS, 2022).

NATIONAL ACTION PLAN ON CLIMATE CHANGE (NAPCC) -

The Government of India launched National Action Plan on Climate Change (NAPCC) on 30th June 2008 outlining eight National Missions on climate change.

As a part of the NAPCC, the Indian government had launched 8 missions in focused areas. They are:

1. National Mission for a "Green India" Goals
2. National Mission for Enhanced Energy Efficiency
3. National Mission for Sustainable Agriculture
4. National Mission for Sustaining the Himalayan Ecosystem
5. National Mission on Strategic Knowledge for Climate Change
6. National Mission on Sustainable Habitat
7. National Solar Mission
8. National Water Mission

The Department of Science & Technology, Ministry of Science & Technology was entrusted with the responsibility of coordinating two out of these eight national missions on climate change. These are:

1. National Mission for Sustaining Himalayan Ecosystem (NMSHE) and
2. National Mission on Strategic Knowledge for Climate Change (NMSKCC)

(Ministry of science and technology Govt. Of India).

International Solar Alliance (ISA)

State Action Plan on Climate Change (SAPCC): State governments have drafted climate strategies aligned with the eight National Missions under the NAPCC. The strategies focus on issues ranging from climate mitigation, energy efficiency, and resource conservation to climate adaptation.

Atal Mission for Rejuvenation & Urban Transformation (AMRUT) for Smart Cities.

Pradhan Mantri Ujjwala Yojana: The scheme provides LPG connections to five crore below-poverty-line beneficiaries. The connections are given in the name of women beneficiaries to reduce their dependence on fossil fuels and conventional fuels like cow dung for cooking food, thus reducing air pollution.

UJALA scheme: The scheme was launched by Prime Minister Narendra Modi in January 2015 with a target of replacing 77 crore incandescent lamps with LED bulbs. The usage of LED bulbs will not only result in reducing electricity bills but also help in environmental protection.

FAME Scheme for E-mobility: Union Government April 2015 launched the Faster Adoption and Manufacturing of Hybrid and Electric vehicles (FAME) – India Scheme intending to boost sales of eco-friendly vehicles in the country. It is a part of the National Mission for Electric Mobility (Combating climate change, 2022).

India in the international forums on climate change

India is currently setting up voluntary targets in the international forums to commit itself to the mission to combat climate change. It is also playing a major role in climate change mitigation. India's

proactive role in mitigating climate change is due to the domestic compulsion of tackling issues like the need for poverty eradication, food, and nutritional security, universalization of health and education, water security, sustainable energy, and employment. India thinks that the developing countries' need for inclusive growth, sustainable development, poverty eradication, and universal access to energy must be made the fundamental differentiation between them and the developed nations. Currently, the Conventions recognize the historical emissions of the developed nations as the basis for differentiation between the developed and developing nations (Climate change and associated issues, InsightsIAS, 2022).

Renewable energy

Renewable energy often referred to as clean energy, comes from natural sources or processes that are constantly replenished. For example, sunlight or wind keep shining and blowing, even if their availability depends on time and weather.

The most common renewable power technologies include Wind, Solar, Hydropower, Biomass, Ocean, and Geothermal (Climate change and associated issues, InsightsIAS, 2022).

Health effects

Direct physiological effects by heat and cold, high heat affect several in Indian states during early 2015, sunstroke killed several, continuous exposure can cause skin damage, eye disease, adverse effect on the immune system and skin cancer, temperature increases blood pressure, viscosity and pulse thus increase the death related to cardiovascular disease and increased stress and malnutrition also adversely affect the health. Epidemics of water-borne and vector-borne diseases occur as flooding increases breeding places of mosquito vectors and also breakage in water pipes, septic tanks, sewers, drainage, and stormwater gets leak and contamination in potable water sources (McMichael, A. J., et al., 2003).

CONCLUSION

India is facing climate change. The speed at which CO2 is increasing is a matter of concern. There has been a steady rise in temperature for about 25 years. It is affecting human health. There are anthropogenic and natural causes due to which climate change has arisen. Many welfare schemes have been made by the Government of India regarding climate change, which needs to be implemented well. There is a need to work on these plans to control climate change. All the states of India should take a new step in this field today and provide funds to the researcher.

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