REVIEW ARTICLE

Impact of changing climate on Global Biodiversity

Pramod Kumar Singh, Shreyashi Srivastava*, Surabhi Srivastava

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Abstract

Climate change has accelerated biodiversity loss by gradually altering ecosystem structures, endangering the survival and integrity of numerous species due to changes in optimal temperature ranges. Among the effects of climate change are severe droughts, water scarcity, fires, flooding, rising sea levels, melting polar ice, devastating storms, and decline in biodiversity. Biodiversity and ecosystems are at serious risk due to the long-term effects of climate change which are mostly caused by human activities. Sea level rise is endangering coastal communities, and biodiversity is under tremendous strain as ecosystems find it difficult to adjust to the quickly changing environment, leading to habitat loss and the extinction of species. As the average global temperature rises, extreme weather events such as hurricanes, floods, cloudbursts and droughts are becoming more severe and frequent; climate models are based on records of the kinds of weather that have occurred under comparable patterns, as well as on global patterns in the ocean and atmosphere. Recently, Dharali in Uttarakhand, Kistwar in Himachal Pradesh and Kathua in Jammu and Kashmir have been severely affected through cloudburst in Himalayan range. Agriculture faces serious challenges due to temperature and precipitation variations brought on by climate change like heat stress is increased by rising temperatures, which interferes with pollination and reduces staple crop yields. Extreme heat and unpredictable rainfall deteriorate soil health by reducing organic matter and vital nutrients, while irregular monsoon patterns and decreased rainfall cause severe droughts and flash floods.

Furthermore, the prevalence of heat-related illnesses and the spread of vector-borne diseases are increasing worldwide. Extreme weather events, air quality, water resources, infrastructure, energy demands, socio economic inequality, and the urban heat island effect are some of the main effects of climate change on urban climates.

Keywords: Climate change, Biodiversity, Climate model, Sustainability and Earth emergencies.

Highlights:

- Extreme Weather: Heatwaves, wildfires, floods, and tropical storms are occurring more frequently and with greater intensity.
- Sea-Level Rise: Sea levels are rising due to melting glaciers and ice sheets, endangering marine life and coastal communities.
- Particulate matter: Higher temperatures and a more severe drought make wildfires more common, which releases enormous amounts of smoke and particulate matter into the atmosphere.
- Food Security: Droughts, floods, and changing seasons are causing crop yields to decline, leading to food insecurity and unstable economic conditions.
- Health Hazards: As temperatures rise, the main causes of death are heat stress and malnutrition.

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Introduction

The term "climate change" refers to the gradual modification of the atmosphere brought about by either natural or human-caused factors (IPCC, 2007, 2013). The primary findings of the IPCC's Sixth Assessment Report (AR6), released in March 2023, are compiled in the Climate Change 2023: Synthesis Report, IPCC,2023); explain thorough analysis that human activity is the primary driver of global warming, which has far-reaching effects such as increased frequency of heat waves, heavy rains, droughts, and floods. According to the climate research, further warming will exacerbate all effects, and drastic changes in living biodiversity (Rathore A. *et al.,*2018). The most prevalent signs of climate change are an increase in the average global temperature and more extreme and unpredictable weather. Climate change has impacted marine, terrestrial, and freshwater ecosystems all over the world. It has resulted in the extinction of local species, increased disease rates, and mass mortality of plants and animals, marking the first climate-driven extinctions. Changes in phenology, species abundance and distribution, community composition, habitat structure, and ecosystem processes are examples of direct impacts on biodiversity. Indirect impacts include habitat loss and fragmentation, overexploitation, pollution of the air, water, and soil, and the spread of invasive species. The term "urban heat island effect" describes how urban areas tend to have significantly higher temperatures than adjacent rural areas. This phenomenon is caused by the widespread use of heat-absorbing materials such as buildings, concrete, and asphalt. Climate change has the potential to intensify the urban heat island effect, leading to higher temperatures and increased health hazards for city

Department of Botany, Udai Pratap Autonomous College, Varanasi

***Corresponding author:** Shreyashi Srivastava, Department of Botany, Udai Pratap Autonomous College, Varanasi, Email: Shreyashi99sri@gmail.com

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dwellers, such as respiratory issues, heat stress, and heatstroke. Climate change can also have a negative impact on urban air quality because it prolongs periods of high pollution and encourages the formation of ground-level ozone (O_3).

Reductions in greenhouse gas emissions are necessary to prevent further climate change because it is directly exacerbating humanitarian emergencies through heat waves, wildfires, floods, tropical storms, and hurricanes, which are escalating in scale, frequency, and intensity. In recent centuries, human activity has emerged as the primary driver of climate change, resulting in enduring global alterations in meteorological and thermal patterns. As the climate catastrophe escalates, it harms to the ecosystems in several ways like. elevated sea levels, glacial melt, increased ocean temperatures, intensified and more frequent storms, heat waves, and droughts exemplify the worldwide environmental consequences of climate change (Murugan, 2010). Over time, the number of gases emitted into the atmosphere has significantly increased due to growing industry, false technology, and population growth. It is impossible to compare the greenhouse gas effect to previous levels due to unequal rise in temperature. As carbon emissions increase, the consequences of global warming brought on by greenhouse gas emission have grown unacceptable. The main cause of climate change has been continuous rise in greenhouse gas emissions brought on by human activities Cardinale (2012). Reducing greenhouse gas emissions, restoring habitats, and increasing public awareness are all crucial steps that shall develop an eco-friendly, sustainable environment. Two important ways that agricultural practices impact climate change are deforestation and changes in land use. In addition to directly raising the atmospheric concentration of CO_2 by decreasing the amount of forest cover, deforestation also indirectly causes land degradation by changing land use, which in turn degrades soil. Climate change has a significant impact on the health of the population and impairs the functioning of healthcare systems.

Environmental change presents operational challenges for health systems. Resilience is required to respond quickly to changing environmental conditions and reduce carbon emissions.

Climate change may exacerbate erosion, organic matter depletion, salinization, soil biodiversity loss, landslides, desertification and floods. Climate change can have an impact on soil carbon storage due to changes in atmospheric CO_2 concentrations, rising temperatures, and shifting precipitation patterns. Climate-related events that influence soil degradation include extreme precipitation events, rapid melting of snow or ice, huge river discharges, and increased droughts. It is anticipated that rising water temperatures and more frequent and severe droughts will result in worsening water quality. These circumstances promote the growth of harmful bacteria and algae, exacerbating the issue of water scarcity, which has been primarily brought on by human activity. Since storm water can introduce untreated sewage into surface water, the rise in cloudburst events is also expected to have an impact on the amount and quality of fresh water available. According to research, 3.6 billion people currently reside in regions that are particularly vulnerable to climate change. Climate change is predicted to result in an additional 250,000 deaths annually from malnutrition, malaria, diarrhea, and heat stress alone between 2030 and 2050 (WHO,2023).

In order to comprehend and lessen the effects of climate change on biodiversity, it is also essential to fill research gaps and promote international cooperation (COP29): an agreement on financial strategies to lessen the effects of climate change and assist developing countries switch to more sustainable energy sources. Global collaboration for the integration of policies, and sustainable behaviors are necessary for biodiversity protection. Climate models describe the interactions of matter and energy in various regions of the ocean, atmosphere, and land using mathematical formulas. Global patterns in the ocean and atmosphere, as well as historical records of the kinds of weather that have occurred under comparable patterns, serve as the foundation for climate models.

Global climate model

Climate models are crucial tools used to improve our knowledge of the past and present climate. The physical, chemical and biological processes influencing the climate system are depicted in a climate model. When taking into consideration the strength of climate feedbacks, models are used to estimate the amount of warming that future emissions will cause. The annual cycle of the seasons, the movement of carbon between the atmosphere and the land surface, and the movement of the oceans are all predicted by models.

The resilience and adaptation of society and ecosystems are seriously threatened by these changes which are linked to drier soil and greater variability in soil moisture and pressure. The response of the climate to current and future human activities is simulated and measured using climate models. The first step is to model the current climate for long periods of time, usually decades, without altering any external climate forcing. The IPCC believes that General circulation models accurately predict future climate and attribute observed changes to human-caused greenhouse gas emissions. It is originated from Atmospheric General Circulation Models, which were commonly employed to predict daily weather. GCMs are used for various purposes, such as analyzing climate system interactions, simulating evolution, and projecting future climatic states based on different scenarios (Li *et al.*,1995) The most commonly acknowledged use is the projection of future climate states under various scenarios of rising atmospheric CO2. Its projection helps with planning, preparing for the likely extreme weather events, and mitigating the effects of climate change. GCMs are capable of calculating a wide range of parameters, such as humidity, wind speed, atmospheric temperature, and pressure.

Fig 1. Input of global climate model includes: The burning of fossil fuels, such as coal, oil, and gas, is the main cause of excessive greenhouse gas emissions. The capacity to sequester carbon is diminished by massive deforestation and degradation of land ecosystems. The melting of polar ice lowers the Earth's reflectivity, allowing more solar heat to be absorbed by the ocean and accelerating further warming.

Output of global climate model includes: The melting of the Antarctic ice sheets contributes significantly to sea-level rise, threatening the displacement of hundreds of millions of people living in coastal areas, a combination of extreme droughts and

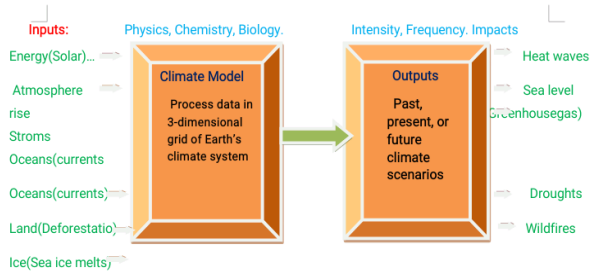

Fig.1: Diagram showing input and output of catastrophic Global Climate Model (Source-NOAA: Climate models)

quick glacial melt, which drastically reduced the amount of freshwater available.

Fig. 2. As seen by the Uttarkashi incident disasters are becoming more likely to occur in ecologically vulnerable areas and their occurrence is becoming less assured. The August 5 flash flood in Uttarakhand's Uttarkashi district destroyed Dharali village, bringing attention to the dangers of severe weather across the Indian subcontinent. Flash floods are typically caused by periods of intense rainfall that result in landslides and a significant volume of debris entering rivers or streams. With its immense force, the debris sweeps away roads, buildings, and plants as it tumbles down steep hillsides with the rushing water. Flash floods are frequently caused by cloudburst, which are intense, abrupt downpours of rain that cover a limited region quickly (Newbold, T. *et al*., 2015). The cause that triggered the flash flood in the Kheer Ganga that hit Dharali remains unclear. Another cloudburst hit a remote village in Kathua district of Jammu and Kashmir and the flooding took place in the remote village of Chositi in Kishtwar district of Himachal Pradesh due to cloudburst in the atmospheric conditions (Mishra, 2015).

The main source of global greenhouse gas emissions is industries that burn coal, oil, and natural gas for fuel, with power plants being the largest contributors to CO_2 emissions that exacerbate the greenhouse effect. Agricultural activities produce two major greenhouse gases: methane and nitrous oxide. The complex interactions among humans, microbes, and the broader biosphere have led to an increase in greenhouse gas concentrations, specifically CO_2, CH_4, and N_2O. This rise in greenhouse gases is causing global warming and a range of cascading effects, including shifts in rainfall patterns, melting ice, rising sea levels, and instances of cloudbursts. One of the evident changes noted in recent years is the intense and erratic weather, alongside a rise in the frequency and severity of natural disasters such as floods, droughts, cyclones, and wildfires (Mori, 2020). The World Meteorological Organization's extensive report, released in August 2021, claims that during the past 50 years, the number of disasters linked to climate change has increased by a factor of five. The most lethal effect of global warming is the rise in sea levels, which is brought on by the ice and glaciers melting more quickly. Consequently, water levels in lakes, rivers, and oceans will increases adversely affecting the environment since encroaching seawater can devastate coastal ecosystems and contaminate inland freshwater aquifers, which are vital for agriculture and potable water. The rate of global warming is accelerating; temperatures rose twice as rapidly in the last 50 years compared to the previous 100 years.

Fig. 2: Cloudburst in the Himalaya region at Uttarakhand Human induced Climate impacts on the environment

The Earth's surface temperature has increased every ten years since 1970s. In at least the last 2000 years, this increase occurred more quickly than in any other 50-year period. The temperature in the 21st century has warmed by 1.09°C when compared to the second half of the 19th century (IPCC, 2021). It is brought on by anthropogenic activities, which significantly alter the atmosphere, as well as external factors like variations in solar radiation. Carbon dioxide from fossil fuels accounted for 73.7% of all greenhouse gas emissions in 2023, followed by CH_4 (18.9%), N_2O (4.7%), and Fluorine gases (2.7%). The accumulation of these gases changes the radiative balance in the atmosphere. The second major factor contributing to global warming is the deterioration of the ozone layer, primarily caused by chlorine-containing gases. This process also makes organic matter in forests more susceptible to dry which raises the danger of wildfires (Walther *et al.*,2002).

Fig. 3 A recent report from the World Meteorological Organization (WMO,2024) explores the intricate relationship between climate and air quality, emphasizing the part that small particles known as aerosols play in urban pollution, shipping emissions, winter fog, and wildfires. In order to protect human and environmental health and minimize financial and agricultural losses, it emphasizes the necessity of better atmospheric monitoring and more integrated policies. Changes in vegetation growth and distribution due to climate change may affect emissions of biogenic volatile organic compounds (BVOCs), including terpenes and isoprene. Secondary pollutants like O_3 and PM can be produced when these substances react with other pollutants. Urban air pollution levels may be impacted by BVOC emissions, which are influenced by warming temperatures and changing precipitation patterns. The Air Quality Life Index (AQLI) 2025 annual update states that every Indian resides in an area where the WHO annual average limit of 5 µg/m^3 is exceeded by the annual average particulate pollution level (PM2.5). India's air quality is also poor according to its own standards, which are more lenient than those of the WHO. According to the report, 46% of India's population lives in areas where the national annual PM2.5 standard of 40 µg/m^3 has been exceeded.

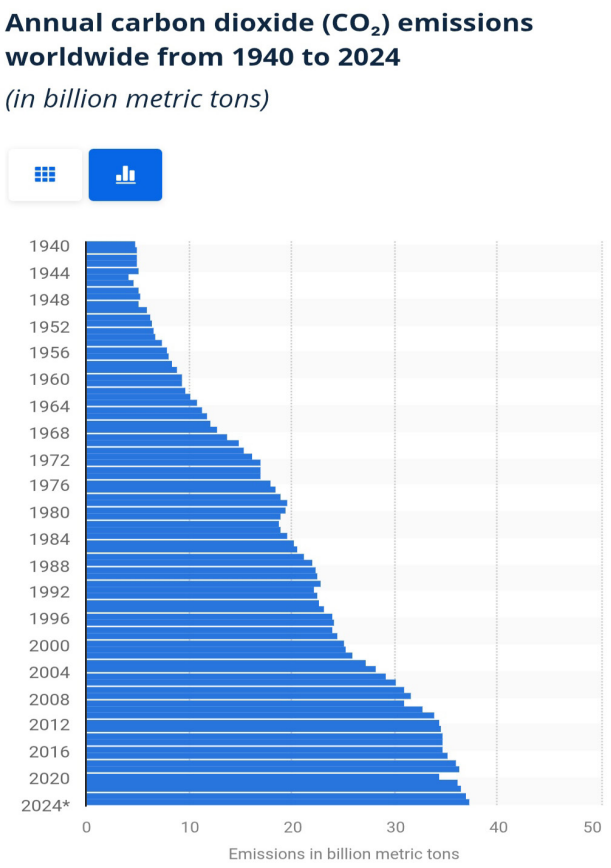

Fig. 3: Presentation of Statistical data showing the rate of CO_2 emissions worldwide

Warming is occurring rapidly in the Arctic. These fluctuations in temperature ranges, changes in ice cover, and snow patterns are changing the distribution of Arctic vegetation. It has been observed that changes in climate may affect the chemical constituents, ensuring the survival of aromatic and medicinal plants in the Arctic. Ocean ecosystems are essential to life on Earth because they sustain biodiversity, control the climate, and supply food. However, marine environments are being drastically changed by the ongoing effects of climate change, including rising sea levels, ocean acidification and rising ocean temperatures. Since biomass is the primary carbon reserve, its loss mitigates climate-related problems**.**

Table 1: Climate Change Performance Index:2025 (CCPI .org)

Rank	*Country*	*Score*
4	Denmark	78.37
5	Netherlands	69.60
6	United state	69.29
7	Philippines	68.41
8	Morocco	68.32
9	Norway	68.21
10	India	67.99

Table 1. The term "climate change performance model" can refer to either Global Climate Models (GCMs), which are computer programs that simulate and project future climate changes, or the Climate Change Performance Index (CCPI), an annual report that ranks nations on their climate protection efforts. The CCPI assesses nations according to their energy consumption, climate policy, greenhouse gas emissions, and renewable energy.

Impacts of climate change on agriculture

Climate change has a severe impact on agriculture, causing increased heat stress, irregular rainfall patterns and an increase in pests and diseases, all of which can lead to lower crop yields and nutritional quality. Extreme weather events such as droughts, floods, and heat waves cause immediate damage to crops and infrastructure while also affecting soil quality and water availability. These combined effects undermine global food security, raise food costs and disproportionately impact vulnerable regions. It will have a major detrimental influence on crop productivity as the level of warmth increases; crop yield is impacted by the complex and wide-ranging effects of global climate change. Crop yield is negatively impacted by elevated temperatures because they increase evapotranspiration rates, which exacerbate water evaporation and cause soil dryness and water scarcity. Crop quality is also affected both in terms of flavor and nutritional value as the protein content and quality of staple crops may decrease as a result of rising temperatures and CO_2 concentrations, extreme weather events could cause significant crop damage or even crop failure.

A significant amount of agricultural methane emissions originates from rice fields, it has a moderate potential for global warming over longer timescales and a high potential for global warming over short timescales (Qian *et. al.,* 2023). Methane is thus, the second most significant cause of global warming because of its effect on climate change, lowering methane emissions from rice farming is becoming an important research objective. Agriculture contributes roughly 16% of global greenhouse gas emissions, with agricultural soils serving as a major source of these emissions, which either directly or indirectly contributes to climate change. The recent FAO report emphasizes how climate calamities like floods and heat stress cause disproportionately large financial losses for rural women in the nation (FAO, 2012).

Climate change can affect crop yields by hastening development and generating less grain over a certain temperature range and the rising temperatures make it more difficult for plants to absorb and utilize moisture (Singh *et al.,* 2011). The consequences of climate change on agriculture take into consideration rising CO_2 levels, which are a substantial contributor to this (Rotter R *et al.,*1999). While total crop yields have increased over the last 50 years due to agricultural improvements, changing climate has already slowed yield growth. The biggest issue is observed with mango cultivation. It can withstand temperatures ranging from 0-48°C without suffering any adverse effects. However, the plant will die if it is kept at a low temperature, pollen granules swell and become less viable at temperature lower than 17°C. Young mango trees may die if the temperature drop below 0.5°C because mangoes are sensitive to cold and have a negative impact on its flowering. The amount of precipitation received and its distribution over

an average year in different places will be altered by changing climate, which will also affect precipitation patterns globally (Harshad *et al.,* 2024). The stability of the soil organic carbon reserve has been upset by climate change-induced temperature increases and altered precipitation patterns. These changes have also threatened soil fertility, which has exacerbated soil-salinization problems. Floods and droughts are examples of extreme weather events that can reduce soil fertility and high temperatures can hasten the breakdown of soil organic matter which causes the soil to lose nutrients. Together, these factors lower the soil quality which has an impact on crop growth. Another effect of a changing climate that is seen in various regions of the world is the soil erosion that increases with climate change and is the key concern to lower the useful storage capacity of the river dam reservoirs. Cover crops, crop rotation, conservation tillage, and better irrigation techniques are examples of soil conservation techniques that have been shown to have beneficial effects on soil health, carbon sequestration, and water retention, making them essential tools for sustainable agriculture.

Changes in climate could endanger the stability of entire food systems. The need has been estimated that agricultural products will rise as the world's population grows, which might require a change in the intensification of sustainable food systems. The most popular soil erosion is predicted to occur due to changes in the erosive power of precipitation and variations in plant biomass. An increasingly serious threat to human health and the environment is pesticide contamination. Pesticides undergo extensive long-range atmospheric transport in the gas phase in aerosols and clouds as they are widely used in agriculture to control pests and disease carriers. India's agriculture, which employs 65% of the workforce, contributes nearly 25% of the country's GDP, is highly climate-sensitive, and accounts for 13.3% of all exports when combined with related activities (GOI, 2002).

Table 2. Agroforestry and organic amendment can be employed to stop degradation and biodiversity loss. It is essential to enhance soil biodiversity monitoring, incorporate soil biological indicators into climate models and give soil life more policy attention for ecology and climate resilience. Through the mediation of nutrient cycling, soil structure, organic matter decomposition and plant health, soil biodiversity is crucial for supporting ecosystem services and agricultural productivity. It alters the structure of the food web and reduces functional diversity by stressing soil microorganisms and fauna. Changes in climate could endanger the stability of entire food systems. In the absence of implementation of adaptive measures, rainfed rice yields in India are projected to reduce by 20% in 2050 and 47% in 2080 scenarios, while irrigated rice yields are projected to reduce by 3.5% in 2050 and 5% in 2080 scenarios (Press information bureau, 2023). Climate change is projected to reduce wheat yield by 19.3% in 2050 and 40% in 2080 scenarios towards the end of the century, with significant spatial and temporal variations. It is expected to diminish kharif maize yields by 18 and 23% in the 2050 and 2080 scenarios, respectively. Climate change diminishes crop production and lowers the nutritional content of produce. Droughts and other extreme weather events have an impact on food and nutrient intake, as well as on farmers. The Indian government has developed policies and plans to strengthen agriculture's resilience to climate change. The National Mission for Sustainable Agriculture (NMSA) is one of the missions under the National Action Plan on Climate Change (NAPCC). The mission aims to develop and execute a solution for this. Researchers predict that worldwide yields of calories from staple crops in a high-emissions future will be 24% lower in 2100 than they would be in the absence of climate change after accounting for how actual farmers adapt. First, systematically assess how much farmers adapt to changing situations for example; change crop varieties, planting and harvesting time or fertilizer applications. By 2050, climate change is expected to reduce world grain yields by 8%, regardless of how much emissions rise or fall in the next decades (*Hultgren et al., 2025*). This is because carbon dioxide emissions persist in the atmosphere for hundreds of years trapping heat and inflicting harm. According to him if we ignore those long-run damages, we assign an economic value of zero to them, and that is clearly wrong.

Impact of climate change on humans-

Human health and food security are impacted by climate change. In the US, almost 38 million individuals reside in families where there is food insecurity. Food insecurity impacts dietary quality, quantity and consistency is linked to poor income. Certain groups, such as women, children, older persons and low-income communities would be disproportionately affected by food system disruptions during increasingly frequent and severe extreme events brought on by climate change in terms of food accessibility, nutrition, and health. If climate change affects the availability of healthy foods, households may choose for high-calorie but low-nutrient diets, leading to increased health risks and healthcare expenses (S. Ohrel *et al.,* 2018).

If the balance between Earth's ecology and other biophysical life support systems declines, the health of the human population will be jeopardized. By the end of 2023, the World Health Organization (WHO) determined that the biggest threat to human health was climate change negativity impacts the health due to lack of access to clean drinking water. Increased frequency of extreme weather events, such as heat waves, storms, zoonoses, food-, water- and vector-borne diseases as well as psychological disorders, floods and droughts have

Table 2: Multidimensional impacts of climate change on agricultural productivity

To investigate how climate change affects crop yields and agricultural productivity in various contexts.
Examine methods for managing soil and water resources that improve crop yields, maximize water efficiency and improve soil health to increase agricultural productivity.
Investigate how innovations in technology and policy can improve agricultural resilience and encourage sustainable farming methods.
Analyse how well climate-smart agriculture and conservation techniques work as adaptation strategies to reduce agricultural losses.

a substantial impact on human health through a number of mechanisms. These factors increase the risk of mortality and non-communicable diseases, as well as the onset and spread of infectious diseases and health emergencies (Frumkin H *et al.,* 2019). One of the most significant indirect consequences of global climate change on human health could be effects on cereal crop production. Cereal grains make up approximately 66% of all foods consumed by humans. These effects would be felt through temperature and moisture variations affecting germination, growth, and photosynthesis, as well as indirect impacts on plant diseases, predator-pest relationships, and irrigation water supplies. Another significant indirect effect on human health may be a shift in the transmission of vector-borne diseases. Changes in temperature and precipitation may influence vector behavior and geographical distribution, altering the incidence of vector-borne diseases. Increased production of aeroallergens (spores, pollens) brought on by climate change is the other main health risk, aggravating asthma and other allergic diseases (Bunyavanich *et al.,* 2003). Health-determining industries including cloud bursting, water and sanitation, and agriculture are predicted to have extremely high annual rates by 2030. Many diseases are mostly limited to the monsoon season, like dengue, chikungunya and zika fever. By facilitating their temporal and spatial spread, global warming exposes additional populations and areas to these illnesses over an extended period of time. According to recent studies, 37% of heat-related mortalities are caused by climate change (Keck *et al.,*2025). Another concern to human health brought on by the rise in resistant pathogenic illnesses is antibiotic resistance, which is accelerated by climate change.

(Fig. 4). Numerous chronic conditions, including cardiovascular and respiratory diseases, have become more prevalent as a result of urbanization-induced air pollution, climate change, and decreased biodiversity. Environmental factors like foods, dust mites, pollens, and fungi, as well as genetic susceptibility, have been linked to allergic diseases.

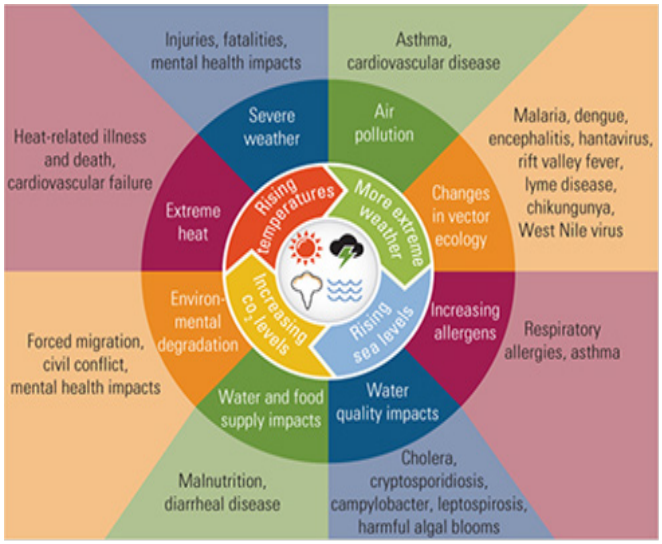

Fig. 4: Impact of climate change on human health (Source- CDC.gov.)

Climate change affects the concentrations and locations of these aeroallergens because these allergenic precursors play a significant role in determining the factors that contribute to the incidence and prevalence of allergic diseases. There are various ways in which climate change affects human health. Natural ecosystems, agricultural productivity, species migration, and the distribution patterns of vector, water-borne, and food-borne diseases are all impacted by extreme weather events, which include heat to drought, heavy rainfall, flooding, and cyclones. Climate change may also have indirect health effects, such as undernourishment, mental illness, unemployment due to illness and conflict. There has been a consistent rise in diseases over the last 50 years. Temperature increases brought on by climate change cause melting of the ice, a rise in natural disasters like droughts and floods, and people are uprooted from their homes by cyclones. Warm weather creates insect pests in general, as well as pathogens and vectors in specifically to increase their survival rate and spread over a larger area. A 1°C rise in surface temperature is estimated to be equivalent to a 10% rise in insect occurrence as pests and the spread of numerous illnesses including typhoid and cholera the proliferation of tropical and vector-borne diseases such as malaria, plague, dengue and other rodent-borne illnesses. Over the next decades to centuries, earth will continue to warm significantly more according to all model forecasts. Further global-averaged warming of 2.6 to 4.8 °C (4.7 to 8.6 °F) would be anticipated during the 21st century if there were no technological or policy improvements to slow emission trends from their current course.

Methodology for Literature search

This review was conducted using a systematic literature search method to ensure accuracy and reliability. Major scientific databases such as Scopus, PubMed, Research-gate and Google scholar were utilized to gather peer-reviewed publications. The literature from 1999 to 2025 were included in the search with the keywords like Climate change, biodiversity, climate model, sustainability and earth emergencies to cover both the early and recent situation in climate change impact.

Conclusion

The human activities are the primary cause of environmental changes that harm biodiversity and its loss. Increased greenhouse gas emissions accelerate global warming and negatively harm biodiversity, ecological balance, and human health. Climate change profoundly impacts species biodiversity and poses a substantial future challenge for conservation initiatives. Furthermore, biodiversity protection adapted to changing climate circumstances not only at the species level but also habitat adaptation. The example of Dharali indicates that a destructive flash flood can be caused by even modest or typical rainfall. However, there are undoubtedly ways to mitigate the situation. Among these would be relocating villages and people a considerable distance from the catchment area of rivers and refraining from building activities close to their banks. In the imminent future, agriculture broadly and mango

production specifically will encounter significant challenges due to climate change. Crop-level adaptation to climate change, which may include adjusting crop cultivars, sowing times, cultivation methods, and irrigation practices, is anticipated to be crucial in reducing future yield losses. Global net reductions in methane near future can be achieved by lowering emissions from rice fields. At the end, protecting biodiversity is essential to preserve the natural ecosystem services that sustain human life and ensuring a robust future for all living beings on the planet.

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Author Contributions

Conceptualization- Dr. P.K. Singh, literature search, editing- Surabhi Srivastava, manuscript writing and editing - Shreyashi Srivastava

Conflict of Interest

All authors have read and agreed to the manuscript and there is no conflict of interest.

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