



IMPACT OF CLIMATE CHANGE ON BIO DIVERSITY WITH A REFERENCE TO JAIPUR

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ABSTRACT

Climate change affects agriculture, water resources, forestry, biodiversity, human health, energy, and infrastructure at subnational, regional, and national levels. Due to the vast spectrum of effects, a variety of measures will be needed to mitigate climate change. Since many of the actions being addressed are state-related and must be done within the states, national priorities and state-specific initiatives must be synergized. While mitigation actions at the state level may take advantage of opportunities or adopt a co-benefits strategy while supporting national mitigation efforts, adaptation is always done locally. In this circumstance, state-level climate change action plans are essential to manage current and future climate risks and capitalise on potential possibilities. State climate action plans can do this. Researching the state's climate change risks, impacts, and opportunities is the first stage in creating a SAPCC. Prioritising research and policy themes based on current and future vulnerabilities and climate change impacts is the next step.

Keywords: *Climate Change, environment, human health*

INTRODUCTION

One of the biggest issues of our day is climate change. Burning fossil fuels and deforestation have become the main human-caused contributors to the increase in atmospheric carbon dioxide (CO₂), other greenhouse gases, and subsequent global warming. Collateral proof of global climate change is provided by proxy records of fluctuation in temperature, precipitation, sea level, and extreme weather occurrences. Numerous biological, economic, and social systems appear to be impacted by climate change, according to observational evidence from the land and oceans and model findings. The largest state in terms of territory in India, Jaipur, is located in a region with a highly sensitive climate. The physical and socioeconomic makeup of the state is likely to be significantly impacted by the fluctuations of the climate. More than any other location in India, Jaipur has recently seen severe and frequent droughts.

The most significant worldwide environmental challenge now is climate change. Scientists, planners, governments, and politicians from all over the world have been interested in it. It poses both a risk and a difficulty. The main economic sectors and sustainable development



are likely to be negatively impacted by the anticipated climatic changes. In developing nations, the effects of climate change would be more severe. There is clear evidence that human activities have an impact on the climate system, according to the many scientific assessments and special reports published by the Intergovernmental Panel on Climate Change (IPCC). There is proof that the physical and biological systems on many continents and in different locations have changed as a result of climate change over the past century and the current decade. Climate change would also have an effect on biodiversity, which is essential to human existence.

In accordance with the Convention on Biological Diversity, biodiversity refers to the variety of living things from all sources, including, for purposes of the convention, terrestrial, marine, and other aquatic ecosystems, as well as the ecological complexes to which they belong. This includes diversity within species, diversity between species, and diversity of ecosystems.

Through natural ecosystems, biodiversity offers the human race a variety of critical indirect services as well as substantial direct economic benefits. It also significantly influences the stability and function of ecosystems. All life forms, ecosystems, and ecological processes are included in biodiversity, which is the foundation for human existence and economic prosperity. There are an estimated 13 million species on earth, yet only around 1.76 million of them have been described, showing that our knowledge of and documentation of biodiversity is astonishingly lacking.

Climate Change

- **Global climate change**

The Intergovernmental Panel on Climate Change (IPCC) is a global organisation that evaluates climate change science. The most recent IPCC 5th Assessment Report (AR5) claims that the 30 years between 1983 and 2012 were likely the warmest in the previous 1400 years (IPCC, 2014a). Over the past century, sea levels have increased by around 20 cm and global temperatures have risen by about 0.8°C. This observed temperature increase since the middle of the 20th century is 'very likely' to be caused by human activity. The paper claims that numerous places have experienced changes in their snow and rain patterns. At the poles and all over the rest of the earth, snow, ice, permafrost, and glaciers are melting. Over the period of 1971 to 2009, the global average rate of glacier ice loss, excluding glaciers on the edges of ice sheets, was very likely 226Gt yr⁻¹. Ocean acidity is rising as a result of increased carbon dioxide absorption. Extreme weather occurrences are growing more frequent, according to observational data. For instance, heat waves are enduring longer and are getting stronger.



• **Climate Change Projections**

In the 21st century, the global climate system will likely experience several changes that would be much more significant than those seen during the 20th century if greenhouse gas (GHG) emissions continued at their current rates or increased. Using four alternative Representative Concentration Pathways (RCPs) scenarios, the IPCC AR5 provided future projections. The IPCC used these RCPs for its Fifth Assessment Report (AR5), which deals with GHG concentrations rather than emissions trajectories. RCP8.5, RCP6, RCP4.5, and RCP2.6 are the four RCPs. The figures represent radiative forcing (global energy imbalances) by the year 2100, expressed in watts per square metre.

OBJECTIVE

1. To study on the effects of climate change on biological diversity with a focus on Jaipur.
2. To research how climate change is affecting the environment

REVIEW LITERATURE

According to Reed (2012), a key indicator of the health of the planet is the variety of life forms that inhabit it. At least 40% of the world's economy is derived from biological resources, which means that biodiversity offers enormous direct advantages to humans. Greater food security, prospects for economic growth, and a solid foundation for new drugs and other medical advancements are all benefits of maintaining biodiversity. Ironically, maintaining ecosystem function and biodiversity levels is important for reducing climate change, despite the fact that climate change is predicted to seriously disrupt Earth's ecological systems, leading to a general loss of biodiversity and a reduction in the goods and services that humans can access.

Melese Muluneh. 2021. Human activity as much as natural elements are to blame for climate change. Biodiversity, agricultural output, and food security are all expressively altered. The majority of endemic and narrowly adapted species are in danger of extinction. Because it provides nourishment for all life forms and primary healthcare for more than 60–80 percent of humans worldwide, concerns over species extinction are justified. Despite the fact that the effects of climate change on biodiversity and food security have been acknowledged, nothing has been done to address the issue given its global scope. Determining, evaluating, and synthesising the relationship between climate change, biodiversity, and food security are the goals of this review.



GoR. (2022) The effects of climate change on different sectors, including agriculture, water resources, forestry, biodiversity, human health, energy, and infrastructure, have diverse ramifications at the national and subnational levels. Such a wide range of repercussions necessitate the use of a variety of techniques in order to respond effectively and improve climate change preparation. Given that many of the activities being considered are State matters and must be implemented in the States, there is a need to develop synergy between national priorities and state-specific initiatives. While mitigation measures at the state level can take use of possibilities that the State can benefit from or adopt a co-benefits approach while concurrently supporting national mitigation efforts, adaption is by its very nature localised in action. Preparing State level action plans on climate change is essential in this situation in order to manage present and future climate threats and take advantage of potential opportunities through a variety of response tactics.

T. Amend and S. Eilng (2019), Human existence is threatened by climate change and the ensuing loss of biodiversity. The anthropological system is seriously endangered by the loss of biodiversity, which has been occurring on a global scale. This loss is probably going to continue in the near future, according to an analysis of the current trend and potential outcomes. India has a rich range of biodiversity, which has recently come under threat from climate change, which has been hastened by human activity from many sources of pollution. The analysis demonstrates that climate change is a significant environmental issue that jeopardises the drive for sustainable development. The most pressing environmental issue of our decade is climate change. It is important to reduce carbon emissions and greenhouse gases from the industrial, energy, and transportation sectors by using less fossil fuel and more renewable/green energy. However, the preservation of natural ecosystems is a crucial component of governments' climate change plans as they search for mitigation and adaptation.

METHOD

Another significant impact is the conversion of previously forested and grassland areas into residential areas and the use of those areas for other types of development that reduce biodiversity. Deforestation significantly reduces forest cover and contributes to global climate change, which affects ecosystems all over the world. It also has a significant influence on biodiversity.

Ecological effects of biodiversity loss are caused mostly by environmental changes. Together with other variables, the environment significantly influences how organisms' function and are distributed. Environmental changes continue to be one of the main forces influencing biodiversity patterns today and will continue to do so in the future. Environmental changes

are examined in relation to climate change, as well as changes brought on by excessive population growth, overuse of natural resources, and deforestation.

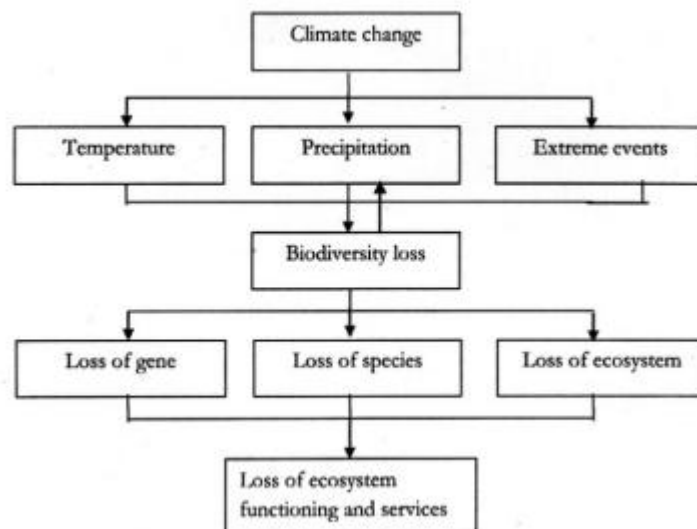


Figure 1: Link between climate change and its impacts on loss of biodiversity and ecosystem

DISCUSSION

Environmental Change and Its Effect

The term "climate" describes how the weather changes in a certain place throughout time. Climate comprises the typical temperature, precipitation totals, number of daylight hours per day, and other factors that could be measured at any location. However, alterations to the Earth's ecology can also have an impact on the climate. Any change in the environment brought on by human activity or by natural processes is referred to as climate change. Significant and ongoing alterations to a region's climate are referred to as climate change. These modifications may take a few decades or millions of years to take place. All of the plants and animals that reside there are affected by climate change, along with entire ecosystems.

Animals and plants are sensitive to changes in climate and temperature. Rapid temperature changes have been linked to a widespread extirpation of plants and animals, according to evidence of organic evolution. Rapid climatic changes could result in a rise in diseases, land slides, and forest fires, all of which would be bad for both plants and animals. Every living thing has a specific range of climate adaptations. Several plant and animal species are at danger of going extinct due to climatic change. Despite the fact that not all species are



directly impacted by changes in the environment, they do so indirectly through interactions with other species. The way plants react to climate change will depend in part on indirect effects. For instance, a species whose range expands due to climate change may "invade" the territory of another species, creating a new competitive interaction. Therefore, climate change is anticipated to have an impact on the minimum and maximum temperatures as well as cause more extreme storms and rainfall occurrences. Less winter precipitation and more summer monsoon precipitation are anticipated for the Indian subcontinent; decreases in winter precipitation of 10% to 20% and increases in summer precipitation of 30% have been forecasted by 2050. The causes of climate change are both manmade and natural.

Natural factors include variations in solar radiation, the Milankovitch cycle, volcanic eruptions, plate tectonics, ocean circulation, earthquakes, and other phenomena that affect the earth's climate. According to Rathore and Jasrai (2013), anthropogenic drivers refer to human activities that contribute to an alarming rate of increase in the emission of greenhouse gases like carbon dioxide, methane, and nitrous oxide into the atmosphere from a variety of sectors, including energy supply (25.9%), industry (19.4%), deforestation (17.4%), agriculture (13.5%), transportation (13.1%), urbanisation (7.9%), and waste (2.8%).

Impact Of Climate Change on Environment

Climate change Through the greenhouse effect, the effect of greenhouse gases is the warming of the earth's near-surface temperature. Since the middle of the 1800s, the average global temperature has risen by 0.6°C, and by the year 2100, it is expected to have increased by 1.4-5.8°C. Plants, animals, and microorganisms are all impacted by global warming, which alters their habitats and has a direct impact on their physiological functions. The means that sea level has increased by 10 to 20 cm and could rise by another 88 cm. Climate change has caused temperatures to rise by around 5°C above average, melting ice sheets, and rising sea levels, all of which are endangering endemic species including ringed seals, emperor penguins, walruses, and polar bears.

coral whitening Coral bleaching is a significant phenomenon linked to temperature rise. Rising temperatures and other climatic concerns cause corals to lose their vibrant colours and turn white. The disappearance of the reefs, which are thought to be one of the most biodiverse ecosystems, is caused by the rising water temperatures, which have an adverse effect on the corals.

Resources for water: Water resources are impacted by climate change due to rising evaporation rates. In many locations, lower water supplies are anticipated as evaporation rates rise. The summer is predicted to have the worst deficits, which will result in lower soil moisture levels and more frequent and severe agricultural droughts. Climate change will



result in more frequent and severe droughts, which will have significant management implications for those who use water resources. These droughts also have an impact on the expense of controlling wildfires as well as the loss of resources like timber.

Climate Change's Effect on Biodiversity

The biodiversity is severely impacted by even slight changes in climate patterns, which affect the habitats of the species and put their survival in jeopardy, rendering them susceptible to extinction. According to the Millennium Ecosystem Assessment (MEA), the main danger to biological variety will be climate change.

Many plant species, including *Berberis sciatica*, *Taraxacum officinale*, *Jasminum officinale*, and others, have moved to higher elevations in Nainital as a result of the warming climate. In central India, it is projected that teak-dominated forests would displace Sal trees, and that deciduous trees may displace conifers. According to Gates (1990), a 3°C increase in temperature may cause a forest to travel 2.50 km per year, which is ten times faster than the rate at which a forest naturally moves.

that climatic variations have an impact on a plant's typical life cycle. He added that native species, which are more resilient to climatic changes, are in danger from invasive plants including Lantana, Parthenium, and *Ageratum conyzoides*. Indigenous plants may be more susceptible to pests and diseases due to more frequent droughts and floods caused by changes in temperature and precipitation patterns.

Animal species become extinct when the climate slightly changes. For instance, due to climate change, species like the golden toad and the Monteverde harlequin frog are now extinct. Polar bears are at danger as a result of the shrinking Arctic ice cap, and the North Atlantic whale may go extinct as a result of the decline in plankton populations brought on by climate change. Though further research on the effects of climate change on India's natural resources is still needed, groundbreaking studies have revealed that endemic species like the Nilgiri that are at higher risk of going extinct. Additionally, there are signs that some species, like the Black-and-rufous Flycatcher, are expanding their range to higher altitudes and that portions of the Shola woods are periodically dying due to the rise in ambient surface temperatures.



Table 1 Threats to global biodiversity and their impacts

Habitat loss and fragmentation	Decrease in natural habitat, homogenization of species composition, fragmentation of landscapes, and soil degradation
Invasive alien species	Competition with and predation on native species Changes in ecosystem function Extinctions and Homogenization
Overexploitation	Genetic contamination Extinctions and decreased populations Alien species introduced after resource depletion
Climate change	Homogenization and changes in ecosystem functioning Extinctions Expansion or contraction of species ranges
Pollution	Changes in species compositions and interactions Higher mortality rates Nutrient loading and acidification
Anthropogenic threats	species extinction Habitat loss and conversion Degradation and fragmentation Over Harvesting

Impact of climate Change On Ecosystem

According to the Millennium Ecosystem Assessment (MEA), even a little change in the climate will have a significant effect on the ecosystems.

Coastal and marine ecosystem: Oceans, which include distinct ecosystems including mangroves, coral reefs, and sea grass beds, cover 70% of the earth's surface. Sea level rise, increased coastal erosion, flooding, stronger storm surges, sea salt incursion, higher sea surface temperatures, ocean acidification, and coral bleaching are all effects of climate change. The tremendous threat posed by rising sea levels to marine ecosystems can disrupt the habitats and patterns of survival of marine animals. Sea level rise puts wetland and coastal habitats in grave danger. To avoid the increasing water level, several populations have already become climate refugees. Gujarat, Maharashtra, Goa, and the Sundarbans are among



the Indian coastal regions most at risk from climate change. Species distribution and composition will undoubtedly be impacted by these changes. With a land area of 10,000 square kilometers, the Sundarbans is the world's largest low-lying mangrove environment. The loss of 28% of the mangrove environment is a result of the sea level rise that has been observed over the last 40 years. According to modelling, the Sundarbans might lose up to 96% of its viable tiger habitat in the next 50 to 90 years.

Ecosystem of the Himalayas The Himalayan environment is seeing annual temperature increases of 0.9°C, which is significantly faster than the global average of 0.7°C each decade. The cities of Lhasa and Tibet, which are approximately 3490 metres above sea level, have reported mosquitoes for the first time as a result of these changes. Similar reports of flies have been made from Nepal's Mount Everest base camp. The presence of these insects raises the possibility that vector-borne illnesses like malaria and dengue fever will now be present in places where they were previously unavoidable due to lower temperatures.

The inland water environment, which makes up 0.8% of the planet's surface yet is home to 6% of all species, includes the lotic and lentic fresh water ecosystems. They are a plentiful source of food, money, jobs, and biodiversity. Some animals, like migratory fish and birds, experience variations in their phenology, physiology, and migration patterns as a result of changing climatic circumstances like rainfall and temperature.

Ecosystem of the forest: Two-thirds of all terrestrial species are found in forests, which cover one third of the planet's surface. They are also hotspots for abundant biodiversity. But up till now, half of the original forest has been removed. Due to the greenhouse effect, some forests are growing more quickly, some tree species are migrating to higher elevations, there are more pests and invasive species attacking, and there are more wildfires. As a result of these changes, many animals, including primates, and 9% of all known plant species are in danger of going extinct.

Agriculture: Climate change affects plant development and productivity by causing heat stress, heat-related rainfall pattern unpredictability, the spread of pests and diseases, and a shorter crop cycle. Both sustainable and non-sustainable agriculture are impacted. Unsustainable agriculture disrupts the ecological balance and biodiversity structure, among other things. Indigenous people's hunting and fishing methods have been damaged by biodiversity loss, potentially affecting their only source of sustenance. Crop yields may decline by 30% in Central and South Asia and 20% in East and Southeast Asia by the middle of the century.



Human effects of climate change

Climate change causes the temperature to rise, the ice to melt, and more frequent natural disasters like floods, droughts, and cyclones that force people to leave their homes. Insect pests, vectors, and infections in particular spread more widely and have higher survival rates in hot climates. According to estimates, an increase in surface temperature of 1°C will result in a 10% increase in the prevalence of pest insects and diseases like cholera, typhoid, and others, as well as the spread of tropical and vector-borne illnesses like malaria, dengue fever, and other illnesses, as well as rodent-borne illnesses like plague. Over the past 50 years, many diseases have steadily increased in prevalence.

Thus, there are significant effects of global climate change on human health. It is clear that changes to the ecosystem will affect how prevalent and distributed vector-borne infectious diseases, especially bacterial infections, are. Epidemiological changes may already be under way, and complicated biological changes are linked to environmental change. When hygienic standards are compromised and conditions are favourable for the spread of infections, water- and food-borne diseases wreak havoc in underdeveloped nations. Greenhouse gases contribute to the acceleration of the illness curve by raising carbon emissions. Animal life are becoming more and more susceptible to viruses and diseases when carbon emission rises to alarming levels. Numerous islands have already been flooded as a result of the rising sea levels, and soon the world will be forced to accommodate millions of displaced people. The influx of sea salt into fresh water sources has rendered the land uninhabitable and will soon pose a threat to the security of our food supply.

Impact Of Habitat Loss, Overpopulation And Overexploitation

Other human actions, in addition to climatic change, are substantially to blame for biodiversity loss. An estimated 27000 species go extinct each year, according to estimates. By 2050, 30% of the world's species may be gone if this trend continues. The current pace of extinction is between 100 and 1000 times higher than the natural rate. Other human activities include the overuse and destruction of natural resources, invading species, pollution, and habitat degradation. Invasive species will be able to invade new areas in new ways as a result of climate change. As the globe heats, more and more severe natural disasters like storm surges and strong winds spread invasive plants and insects to new areas. The major taxonomic groups, including India, have invaded nearly all habitats on earth. Lantana camara, Eupatorium odoratum, Eupatorium adenophorum, Parthenium hysterophorus, Ageratum conyzoides, Mikania micrantha, Prosopis juliflora, and Cytisus scoparius are some of the most problematic invasive alien plant species.



Due to the rapidly expanding population, men were forced to clear the forests in order to meet their needs for food and shelter. Deforestation has resulted in the degradation of plant and animal habitats. The biggest factor in species extinction is habitat loss. The loss of their natural habitat forces the species to shift to areas where it is more difficult for them to adapt, which may ultimately result in their extinction. Physically larger species, those inhabiting lower latitudes, woodlands, or oceans, and those living in those environments are more sensitive to habitat loss. In the end, habitat damage is caused by human actions such as deforestation, pollution, and overpopulation. The decrease of biological variety is also a result of the introduction of exotic species. It's possible that native species like endemics and others won't be able to compete with foreign species and won't be able to survive. One of the main factors contributing to the loss of biodiversity is overexploitation, which takes the form of hunting animals and plants for their commercial worth. The biggest threat to biodiversity loss is illegal wildlife commerce. The primary causes of all biodiversity loss are excessive human population growth and resource exploitation.

CONCLUSION

The priorities that were identified under the Jaipur Action Plan on Climate Change (RAPCC) are consistent with the overall development perspective of the state. This plan was developed by adopting a process that was inclusive and collaborative, and it included extensive consultations with a number of departments of the Jaipur government and other stakeholders. The Jaipur Environment Policy, 2010; the Jaipur Environment Mission, 2010; and the Climate Change Agenda for Jaipur served as inspirations for the development of the Jaipur Regional Adaptation and Pollution Control Committee (Jaipur RAPCC). RAPCC's goal for Jaipur is "to achieve sustainable development by reducing vulnerability to climate change impacts and enhancing resilience of ecological, economic, and social systems in Jaipur." This is the organization's mission statement.

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