International Research Journal of Multidisciplinary Scope (IRJMS), 2025; 6(2): 1269-1281

Original Article | ISSN (O): 2582-631X DOI: 10.47857/irjms.2025.v06i02.03944

Climate Change and Tourism: A Comprehensive Analysis

Pooja Deshmukh[1]*

[1]Department of Management Science, Maharashtra Institute of Technology, Chhatrapati Sambhajinagar, Maharashtra-431010, India.
*Corresponding Author's Email: deshmukh1111@gmail.com

Abstract

Tourism in every nation is a key contributor of foreign currency, enhancing the economy and leaving a lasting impression on visitors. Tourism plays a pivotal role in generating employment opportunities for youth and fostering cross-cultural understanding. However; in recent decades the start of the twenty-first century was marked by numerous climate challenges such as heightened temperatures, flooding, wildfires, drought, higher sea levels, and landslides due to heavy rainfall, to name a few. These challenges serve as an obstacle for the tourism and hospitality sectors. This paper aims to understand the various environmental challenges caused by climate change. It emphasizes how vulnerable certain regions are to climate-induced changes and highlights the urgency for adaptation and mitigation strategies. Some strategies for management have been proposed to support the tourism industry. The study employs primary data collected from stakeholders in the tourism industry and secondary data sourced from reputable government publications, academic journals, and internationally recognized websites. A statistical method has been used for data interpretation. The paper recommended a few strategic management solutions to promote sustainable tourism and minimize environmental degradation. These include infrastructure resilience, eco-friendly tourism practices, community engagement, and integrated policy frameworks. By adopting such strategies, the tourism industry can better navigate the evolving.

Keywords: Climate Change, Management, Sustainability, Tourism.

Introduction

India is renowned for its stunning natural beauty, including the Himalayas, valleys, ancient caves, rivers, and monuments. It provides a vital opportunity to free up the tourism industry. India attracts millions of tourists annually as it is a renowned vacation spot, thus contributing to a thriving tourism industry that boosts the Indian economy (1). The tourism sector in India is easily controlled since, as in numerous other countries, travel and tourism are significant contributors to foreign currency earnings. Between 2016 and 2019, there was a 7% compound annual growth rate in profits earned from international trade, but in 2020, they declined due to the impact of the Coronavirus Disease 2019 (COVID-19) pandemic (2). The tourism and hospitality industry, providing cabins and restaurants, is a major contributor to economic growth and an important source of foreign trade income in various nations. Tourism in India has boosted the nation's economy by showcasing its rich history, culture, and diversity (3). The continuous support from both federal and national governments has helped the tourism sector recover from the impact of the COVID-19 pandemic and return to its pre-pandemic functioning. Additional factors have also harmed the travel and tourism industry. The tour and tourism sectors are some of the most affected by changes in climate (4). Every aspect of the business benefits and is more valuable with a stable and predictable climate, allowing uninterrupted travel from sunny beach resorts to snowy mountains and smooth flying conditions (5). Climate change poses many obstacles for the tourism sector, impacting destination appeal, seasonal trends, and the occurrence of climate-related catastrophes (6). The importance of sustainable tourism practices that integrate climate change factors, points out that existing frameworks have not adequately covered the travel aspect of tourism, which plays a significant role in emissions (7). This discrepancy highlights the necessity for comprehensive approaches that include evaluating climate risks in tourism activities.

There is an increasing awareness in the tourism industry of the crucial importance of dealing with the effects of climate change. Nevertheless, it also

This is an Open Access article distributed under the terms of the Creative Commons Attribution CC BY license (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted reuse, distribution, and reproduction in any medium, provided the original work is properly cited.

(Received 28th January 2025; Accepted 17th April 2025; Published 30th April 2025)

underscored the persistent difficulties in successfully executing these methods, as numerous locations are still unaware of their susceptibility to climate change. Studies show that adaptation strategies are crucial for the resilience of tourism (8). It has been criticized that the current interaction between tourism and climate change emphasizes adaptation in a way that risks replacing sustainability. This viewpoint is considered important because it highlights the need for both short-term adaptive responses and long-term sustainability goals to be taken into account in a balanced manner (9). The current situation has become more complex due to the COVID-19 pandemic (10). The pandemic highlighted the significance of resilience and sustainability, offering a chance for the sector to reconsider its tactics in response to continued climate challenges. The pandemic can provide valuable insights for future responses and promote the implementation of carbon-neutral practices in tourism.

The under-exploration of vulnerabilities in the tourism industry, particularly in developing countries, continues to be regarded as a concern. Focused research has been recommended to address the vulnerabilities of tourism in regions such as Africa, which are especially impacted by climate change due to limited adaptive capacities. The creation of effective adaptation plans for these vulnerable areas is hindered by this lack of information, indicating an urgent need for comprehensive research that spans diverse geographical and socio-economic contexts (11). Additionally, the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report and highlighted that although tourism's impact on climate change is acknowledged, there are still uncertainties about the efficacy of adaptation strategies. Continuous research is needed to improve the understanding of the socio-economic effects of climate change on tourism and to create adaptation strategies based on empirical evidence. Governance structures play a crucial role in improving the resilience of tourism supply chains (12). The significance of collaboration at local and regional levels to effectively address the impacts of climate change has been emphasized (13). Effective governance is crucial for enacting comprehensive plans that encourage the sustainable development of tourism (14). The importance of tourism destinations shifting to low-carbon practices in alignment with the Paris Agreement when addressing the decarbonization challenge has been highlighted (15). It has been pointed out that belief systems and uncertainties can impede progress in the industry, presenting challenges during the transition. The importance of focusing on climate action to promote sustainable tourism in a warming world is highlighted by these findings (16).

The objectives of this study are to assess the impact of climate change on tourism destinations and activities, examine the strategies adopted by tourism operators and destinations, and evaluate the role of stakeholders in promoting sustainable tourism practices. The study is based on the hypothesis that climate change will lead to a shift in the popularity of tourist destinations (H1) and that growing awareness of climate change will increase the demand for sustainable tourism practices (H2).

Methodology

Research requires a structured examination of current literature and empirical research in various fields such as environmental science, economics, and social studies. The study will use various sources like academic articles, official reports, case studies, and policy papers to evaluate how climate change is affecting global tourism. Data will be gathered through a survey, interviews, and field observations to get input from key players in the industry. Tourists will be given organized surveys to explore their views on how climate change affects their travel behavior, destination preferences, and interest in sustainability. Chi-Square Test was used to analyze categorical data and determine if there is a significant association between two categorical variables (e.g., tourist satisfaction and climate change perception (17).

Climate Change

Climate change impacts people's health and lives through extreme weather events like heat-waves, floods, and droughts. This can undo decades of global health progress by limiting access to clean air, water, food, and a safe environment. It is estimated that climate-related factors will lead to 250,000 deaths annually between 2030 and 2050, with projected health costs reaching up to 400 cores annually by 2030. Developing countries may

struggle the most due to weak health infrastructure and lack of support for planning and response efforts. Controlling temperature and pollution is crucial to combat the diverse impact of climate change. A report from The University of California Berkeley suggests reducing heat to 1.5^{o}C by 2100. Failure to take action could lead to a warming of more than 2^{o}C, potentially reaching 4^{o}C or higher, causing devastating consequences (18).

Every tourist destination must maintain its appeal, with activities like golf or skiing, beautiful scenery, and easy accessibility to keep the tourism industry growing. Climate change threatens the beauty of destinations and may exacerbate accessibility issues during severe weather events. The COVID-19 pandemic severely impacted the tourism business, and climate change further strains it with increasing global temperatures. Various climate-related effects are currently being observed. Rising temperatures lead to fewer arrivals, increased cooling costs, changes in plant and wildlife populations, and spread of viral illnesses. Ganganagar city in Rajasthan has India's highest recorded temperature of 50°C (19). Himalayan glaciers have shrunk by 40% since the Little Ice Age, affecting winter destinations, snowmaking costs, winter sports, and landscape deterioration. Ice loss has accelerated in recent decades (20).

Frequent extreme storms lead to higher insurance prices and business interruption costs. India has faced multiple cyclones historically, mainly in the Bay of Bengal, Arabian Sea, and Indian Ocean, affecting tourism infrastructure. East India is more vulnerable than the West (21), Decreased rainfall and increased evaporation lead to severe water scarcity, impacting various sectors and causing desertification and wildfires. Jharkhand experienced a 26% rainfall deficit, with a 55% decrease in paddy plantations compared to last year (22). Flooding in India caused by heavy monsoon rains has resulted in damage to tourist infrastructure, historic sites, and cultural assets. The National Emergency Response Centre reported 13 deaths, nearly 1,400 people affected, and 1,200 evacuated on September 9-10. Since the rainy season began, 1,800 deaths, 89 missing, 1,100 injured, and 1.3 million evacuated. World Meteorological Organization's 2021 report shows sea levels rising rapidly along the Indian coast, causing loss of beach space and higher costs for protection. Global sea level rise was 4.5 mm per year during 2013-2021, double the rate from 1993-2002. The sea surface temperatures rising in the western tropical Indian Ocean, leading to more invasive species, coral bleaching, and degradation in dive sites. Warm pool Sea Surface Temperature (SST) values reaching 28. 0°C.National Oceanic and Atmospheric Administration (NOAA), Forest fires have varied impacts on nature, including increased flooding risk and damaged infrastructure Forest Survey of India (FSI). Diseases thrive in warmer climates, spreading easily due to people's mobility. Mosquitoes carrying diseases do not thrive in winter or rainy climates, but as the world warms, they may find suitable environments in other countries. The pandemic has had significant negative effects and is now facing additional pressure from climate change. This could have a year-round impact on the tourism sector. Solutions are needed to help the industry adapt to climate-induced consequences (19-31).

Government Initiatives

The Indian government has been constantly taking several initiatives to enhance tourism in India, trying to make the country one of the prominent international tourism hubs after realizing the potential of the nation. Let us have a look at some of the noteworthy efforts of the Indian government:

The Ministry of Tourism in the recent budget allocated Rs. 2,400 crores, an 18.42% increase from the previous fiscal year. Additionally, Rs. 1,181.30 crores were assigned for the Swadesh Darshan Scheme in the 2023 union budget, with an extra Rs. 235 crores for the Pilgrimage Rejuvenation and Spiritual, Heritage Augmentation Drive (PRASHAD) Program. 76 projects under the Swadesh Darshan program were approved in August 2022, totaling Rs. 5,399.15 corers. The Ministry of Tourism, along with the Association of Indian Universities, initiated a webinar series in June 2022 called "Azadi Ka Amrut Mahotsav" to educate the youth on India's heritage. Various initiatives were launched, including the National Strategy for Sustainable Tourism and the Responsible Traveler Campaign, to promote responsible tourism. The government also aims to boost film tourism by utilizing domestic locations and lighthouses as tourist destinations. An All-India Tourist Vehicles Authorization and Permit Rules scheme was

implemented to facilitate easy application processes for tourist vehicle operators. The State of Unity, or the Sardar Vallabhbhai Patel Monument, generated Rs. 82.51 crores since its opening in October 2018.

Both governments and businesses need to make significant changes, but scientists say we can reduce our impact on the climate by making some little lifestyle adjustments vis- Air travel uses a lot of energy and emits pollutants. Consumers don't realize the environmental costs due to affordable fares. UK study shows a single passenger on a domestic flight produces 254g of CO_2 per kilometer traveled. Department for Business, Energy and Industrial Strategy (BEIS) Long-haul flights emit 102g CO_2 per km due to takeoff emissions.

Adopting eco-friendly vehicles, like electric cars, benefits the environment by creating cleaner cities with reduced pollutants and CO_2 emissions. This leads to healthier air, fewer illnesses, and reduced operating and maintenance expenses. Electric vehicles, powered by renewable energy sources like solar panels, provide 100% clean energy. Over time, the emissions of electric vehicles are significantly lower than those of traditional fuel vehicles, with the gap likely to increase as the decarbonization of energy generation continues.

The study recommends reducing dairy and meat consumption to combat climate change. IPCC recognizes lowering meat intake as crucial for limiting global warming. Sustainable land management is needed to reduce carbon emissions. Agricultural communities should focus on land use, access to services, and land tenure security. World Resources Institute predicts a 90% increase in meat consumption by 2050. Switching to plant-based diets can help close the sustainability gap and reduce greenhouse gas emissions. Using less energy through energy efficiency helps reduce energy prices and unnecessary emissions. Many people use more energy than necessary in homes and businesses. By switching to Department for Business, Energy and Industrial Strategy (UK) (LED) bulbs, washing clothes in cold water, using ceiling fans, and turning off lights when not in use, energy consumption can be significantly reduced. This not only lowers costs and pollution but also helps protect the environment. Energy efficiency is essential for reducing contamination and safeguarding the environment, as residential and commercial sectors account for half of energy use in buildings.

The sharing economy and digitization present an opportunity to decrease the number of cars on the road, reducing noise and pollution while freeing up space for people. This shift towards sustainable transport also encourages a change in behavior towards multi-modal options like cycling and walking. Adding shared cars to a company can replace 5-15 individual vehicles, improving car occupancy, reducing emissions, and competing with trains. In addition, sustainable tourism focuses on environmentally friendly initiatives to reduce the carbon footprint. New tourist destinations are being added in India, including eco-tourism and cultural tourism. Research and development efforts aim to understand the impact of climate change on the tourism sector. Innovative strategies are being promoted to address climate change effects. Stakeholders are involved in decision-making and infrastructure is enhanced for future climate changes. Public health systems are also being improved to handle potential climate-related challenges (32-47).

Results and Discussion

The information gathered via the structured questionnaire offers insightful information about attitudes, difficulties, and solutions pertaining to tourism and climate change. The main conclusions of the data analysis are interpreted in this section and are in line with the hypothesis and objectives of the research. Supporting graphics have been included for better visualization and clarity.

Concern Levels about Climate Change and Tourism

According to the research, a sizable percentage of respondents expressed "Extremely Concerned" or "Moderately Concerned" feelings over how climate change may affect popular tourist spots. This suggests a greater understanding of the problem and the alleged risks associated with climate-related issues.

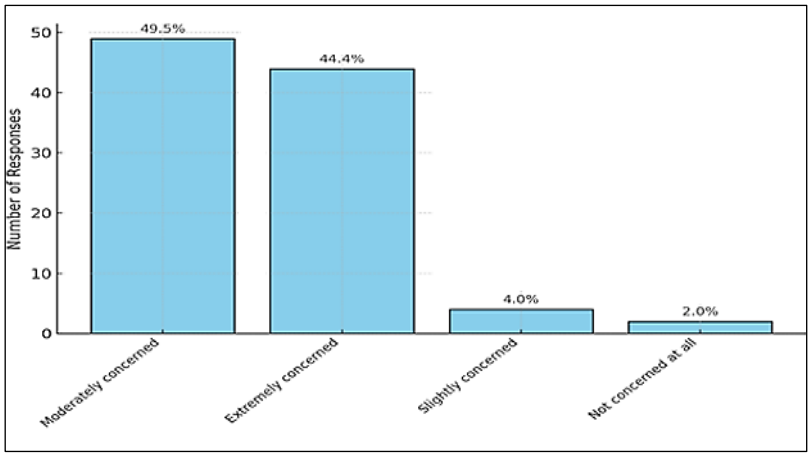

Figure 1: Concern Levels of Respondents Regarding Climate Change and Tourism

The bar chart (Figure 1) shows that a majority of respondents are concerned about the issue, with 49.5% moderately concerned and 44.4% extremely concerned**.** Only a small portion is slightly concerned (4%) or not concerned at all (2%)**.** This indicates a high overall level of concern among participants.

Most Noticeable Climate Change Impacts

Sea level rise, harsh weather, and rising temperatures are the most obvious effects mentioned by respondents. These results demonstrate how vulnerable tourist destinations, especially coastal and mountainous areas are becoming to climate-related changes.

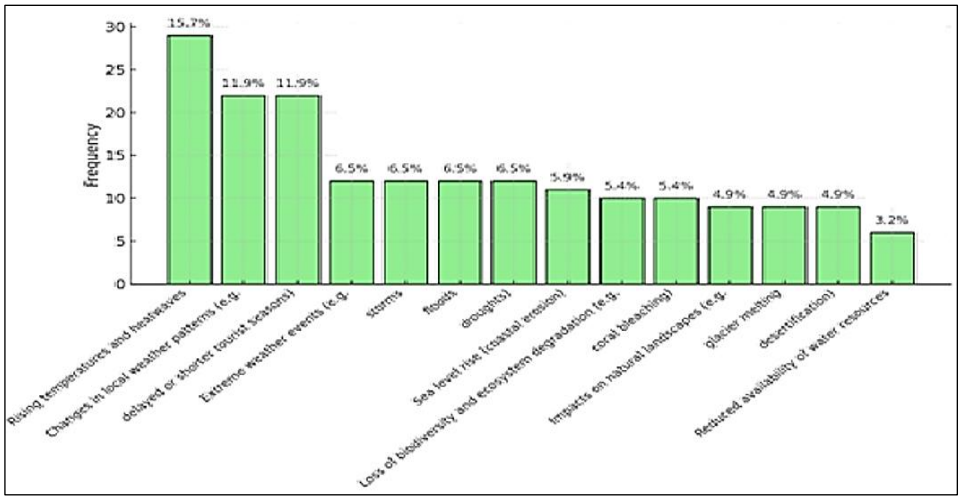

Figure 2: Most Noticeable Climate Change Impacts on Tourist Destinations

The chart (Figure 2) shows that rising temperatures and heat waves (15.7%) are perceived as the most significant climate change impact. This is followed by changes in local weather patterns and extreme weather events (both at 11.9%). Other impacts like sea level rise, biodiversity loss, and glacier melting are also noted but with lower concern levels.

Types of Tourism Activities Affected

The activities said to be most affected were beach tourism, adventure tourism, and ecotourism. This implies that tourism's natural and recreational components are impacted by climate change, which might have an impact on traveler choices and the local economy.

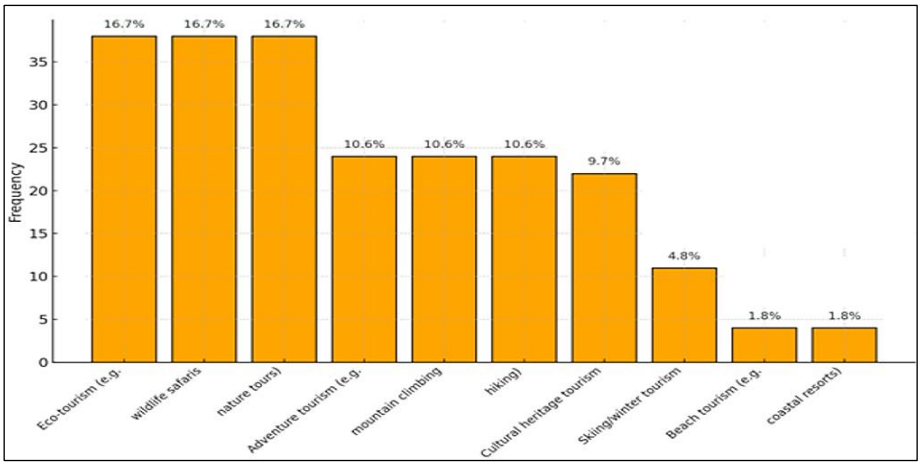

Figure 3: Types of Tourism Activities Most Affected by Climate Change

The chart (Figure 3) reveals that eco-tourism, wildlife safaris, and nature tours are the most popular tourism types, each with 16.7% frequency**.** Adventure tourism activities like mountain climbing and hiking follow closely at 10.6%**.** Beach and coastal tourism are the least preferred, each receiving only 1.8%**.**

Adaptation Strategies Implemented

The respondents reported implementing various climate adaptation strategies, including renewable energy adoption, water and energy conservation, and promoting eco-tourism. However, the analysis indicates a need for broader adoption of these measures, as not all stakeholders are equally proactive in sustainability efforts.

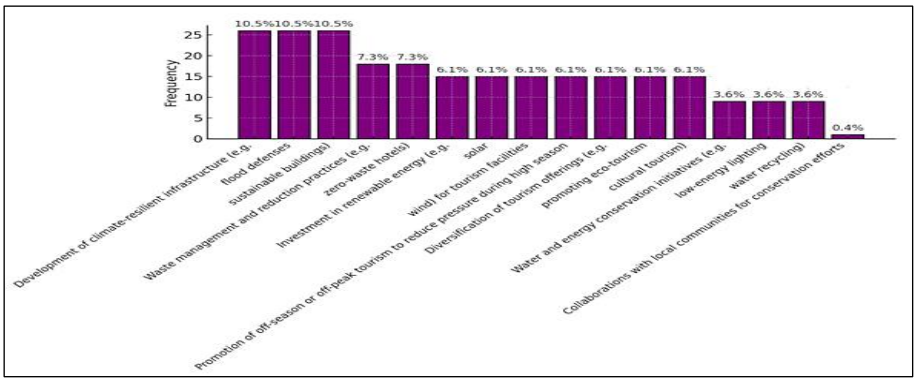

Figure 4: Adaptation Strategies Implemented by Tourism Stakeholders

The above chart (Figure 4) shows that the most frequently suggested adaptation strategies are the climate-resilient development infrastructure**,** flood defenses**,** and sustainable practices, each with 10.5%**.** Strategies like investment in renewable energy**,** waste management, and promotion of eco-tourism follow at 6.1%**.** Collaboration with local communities for conservation is the least mentioned, at only 0.4%.

Barriers to Climate Adaptation

Lack of understanding, inadequate government assistance, and budgetary limitations are the biggest obstacles to putting adaptation plans into action. These difficulties highlight how crucial it is to give stakeholders financial support, policy recommendations, and training in order to improve their capacity for adaptation.

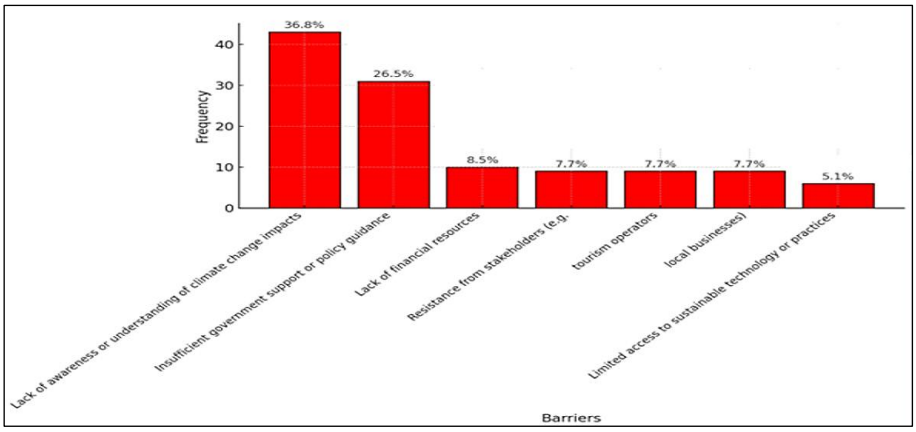

Figure 5: Barriers to Climate Adaptation in the Tourism Sector

The chart (Figure 5) indicates that the huge barrier to climate action in tourism is the lack of awareness or understanding of climate change impacts (36.8%), followed by insufficient government support or policy guidance (26.5%). Other barriers like lack of financial resources, stakeholder resistance, and limited access to sustainable technology are noted but with lower frequencies.

Stakeholder Roles in Promoting Sustainable Tourism

Non-governmental organizations (NGOs), travel agencies, and local governments have become important players in advancing eco-friendly travel. Their active participation is essential to putting into practice efficient climate adaptation strategies and guaranteeing the tourist industry's long-term resilience.

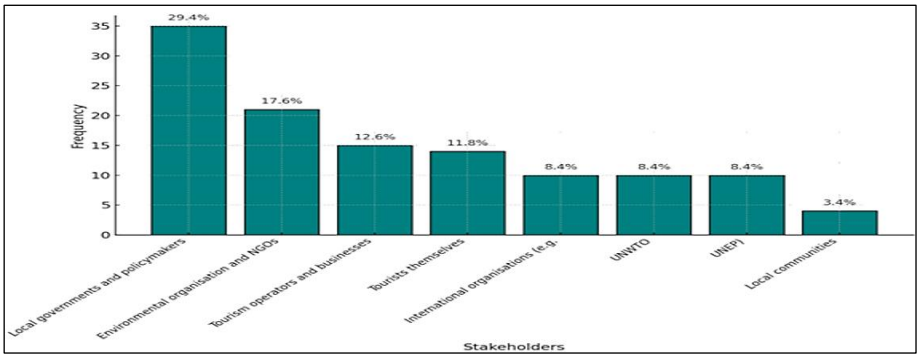

Figure 6: Key Stakeholders in Promoting Sustainable Tourism Practices

The chart (Figure 6) highlights that local governments and policymakers (29.4%) are seen as the most crucial stakeholders in addressing climate change in tourism. They are followed by environmental organizations and NGOs (17.6%) and tourism operators and businesses (12.6%). Local communities are perceived as the least involved stakeholders, with only 3.4%.

H1- Climate change will lead to a shift in popularity among tourist destinations

To test the hypothesis that climate change leads to a shift in the popularity of tourist destinations, survey data from questions Q.2, Q.3, and Q.4 were analyzed. The analysis focused on the association between various climate change impacts—such as rising temperatures, changes in weather patterns, extreme weather events, sea level rise, biodiversity loss, landscape changes, and water availability—and different types of tourism activities, including eco-tourism, adventure tourism, cultural heritage tourism, winter tourism, and beach tourism (Table 1). The observed and expected frequencies of tourism activities across climate change impacts were examined (Figure 7). The chi-square test was conducted to determine whether a significant relationship exists between climate change and shifts in tourism activities. The statistical results revealed a chi-square statistic (X^2) of 126.182, with 24 degrees of freedom and a p-value of 7.58466×10^{-16}. Since the p-value is significantly lower than

0.05, the null hypothesis (H_0) is rejected, confirming that climate change has a statistically significant effect on the popularity of different tourist destinations.

These findings suggest that climate change is actively reshaping tourism preferences, influencing travelers' choices based on environmental changes and associated risks.

Table 1: Observed and Expected Frequencies of Tourism Activities across Climate Change Impacts

Tourism Activity	Rising Temp	Changes in Weather	Extreme Weather	SeaLevel Rise	Biodiversity Loss	Landscape Impacts	Water Availability	Total
Eco-tourism	9	14	3	0	3	9	0	38
Adventure Tourism	6	1	6	6	5	0	0	24
Cultural Heritage	10	7	3	0	2	0	0	22
Winter Tourism	4	0	0	5	0	0	2	11
Beach Tourism	0	0	0	0	0	0	4	4

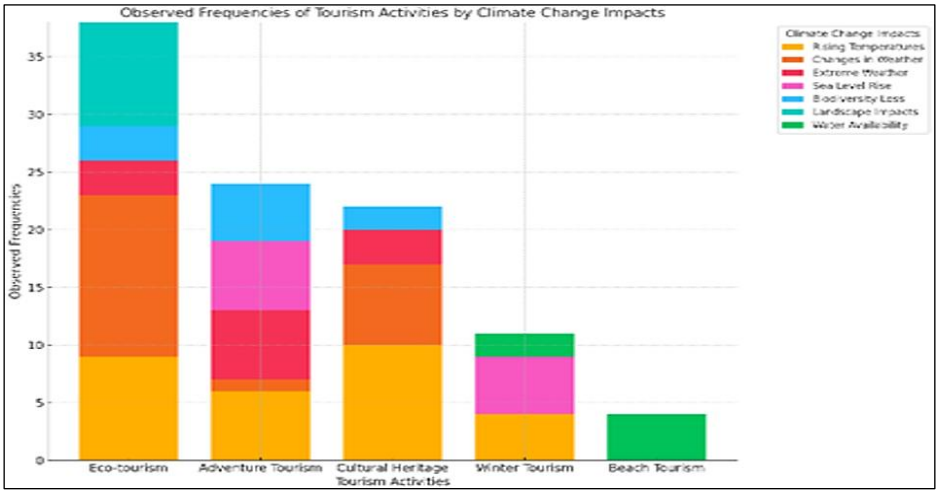

Figure 7: Observed Frequencies of Tourism Activities across Climate Change Impacts

H2- Growing awareness of climate change will lead to increased demand for sustainable tourism practices

To test the hypothesis that growing awareness of climate change leads to increased demand for sustainable tourism practices, survey data from questions Q.6, Q.7, Q.8, and Q.9 were analyzed. The relationship between various sustainability strategies, their effectiveness, associated barriers, and government involvement was examined using cross-tabulations (Table 2).

Table 2: Results of Strategies vs. Effectiveness

Strategy	Moderately Effective	Not Effective	Slightly Effective	Very Effective
Collaborations with local communities	0	0	0	1
Development of climate-resilient infrastructure	7	4	4	11
Diversification of tourism offerings	11	0	0	4
Investment in renewable energy	7	0	0	8
Promotion of off-season tourism	9	0	0	6

Waste management and reduction	3	0	4	11
Water and energy conservation	0	0	2	7

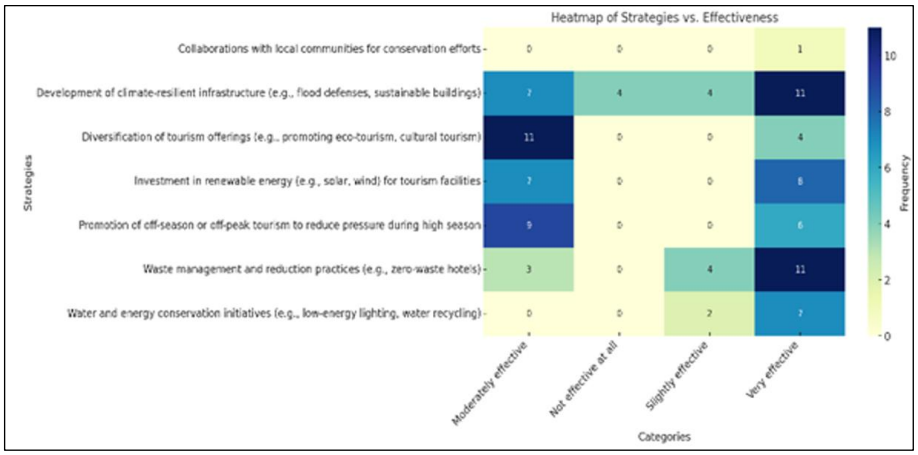

Figure 8: Heat Map of Strategies vs. Effectiveness

Table 3: Results of Strategies vs. Barriers

Strategy	Lack of Awareness	Insufficient Support	Financial Resources	Limited Technology	Stakeholder Resistance
Collaborations with local communities	1	0	0	0	0
Development of climate-resilient infrastructure	1	13	7	0	5
Diversification of tourism offerings	5	3	3	0	4
Investment in renewable energy	9	0	0	6	0
Promotion of off-season tourism	9	6	0	0	0
Waste management and reduction	9	9	0	0	0
Water and energy conservation	9	0	0	0	0

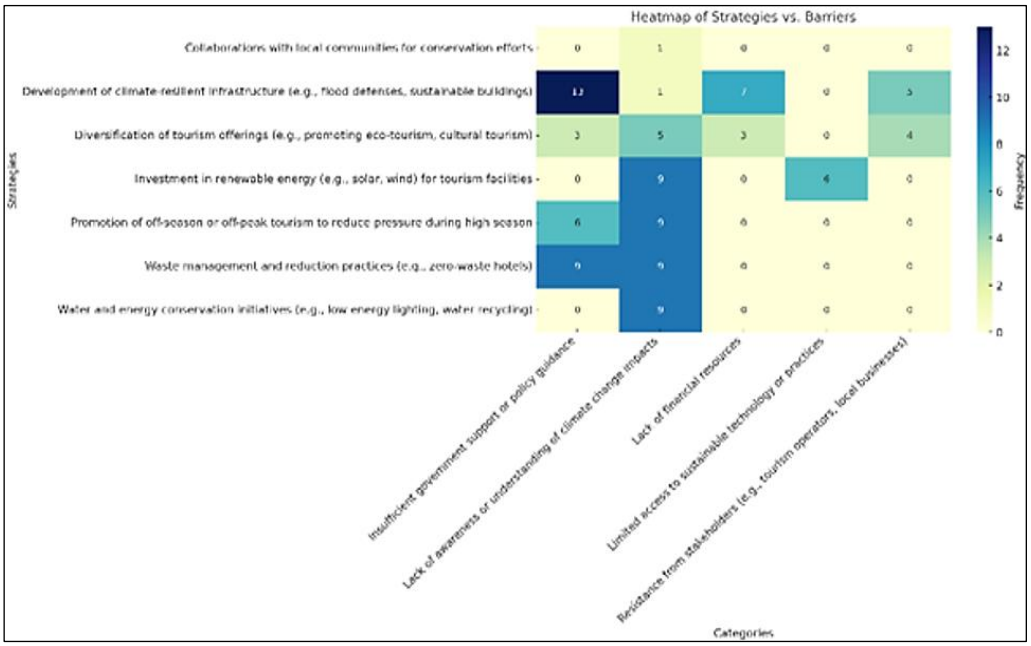

Figure 9: Heat map of Strategies vs. Barriers

Table 4: Results of Strategies vs. Government Involvement

Strategy	Moderately Involved	Slightly Involved	Very Involved
Collaborations with local communities	1	0	0
Development of climate-resilient infrastructure	12	4	10
Diversification of tourism offerings	7	3	5
Investment in renewable energy	14	1	0
Promotion of off-season tourism	6	3	6
Waste management and reduction	3	11	4
Water and energy conservation	5	0	4

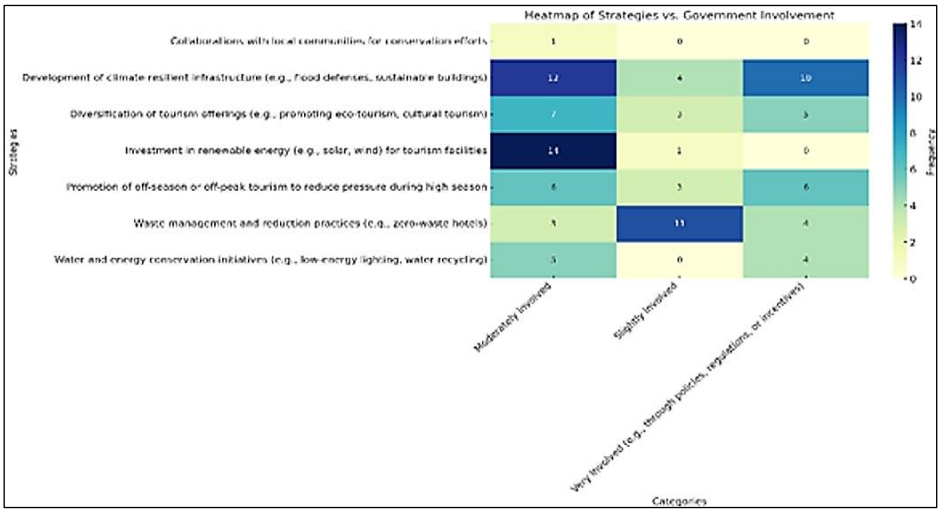

Figure 10: Heat map of Strategies vs. Government Involvement

The analysis of strategies versus effectiveness indicated that different approaches (Table 3 and Table 4), such as developing climate-resilient infrastructure, diversification of tourism offerings, investment in renewable energy, and waste management, showed varying levels of effectiveness (Figure 8). A chi-square test revealed a statistically significant relationship ($\chi^2 = 39.38$, $p = 0.0025$, $df = 18$), indicating that the effectiveness of sustainability strategies varies significantly. Similarly, the examination of barriers associated with these strategies highlighted key challenges, including financial constraints, lack of awareness, limited technology, and stakeholder resistance. The chi-square test results ($\chi^2 = 94.39$, $p < 0.0001$, $df = 24$) confirmed that these barriers significantly differ across strategies, influencing the adoption of sustainable tourism practices (Figure 9). Additionally, the relationship between strategies and government involvement was analyzed, showing that different levels of government participation impact the implementation of sustainability initiatives (Figure 10). The chi-square test results ($\chi^2 = 34.72$, $p = 0.0005$, $df = 12$) demonstrated a statistically significant variation in government involvement across different strategies. Since all p-values were significantly lower than 0.05, the null hypothesis (H_0) was rejected in all analyses. These findings support the alternative hypothesis (H_2), confirming that growing awareness of climate change leads to increased demand for sustainable tourism practices. The results highlight the importance of strategic planning, overcoming barriers, and enhancing government participation to promote sustainability in the tourism industry

Conclusion

The findings of this research underscore the profound impact of climate change on the tourism industry, particularly in terms of destination appeal and the demand for adaptive strategies. Climate-related factors such as rising temperatures, extreme weather events, biodiversity loss, and water scarcity are causing significant shifts in the popularity of tourist destinations. This shift highlights the vulnerability of natural and recreational tourism activities, such as eco-tourism, adventure tourism, and beach tourism, which are particularly sensitive to

environmental changes. These impacts emphasize the urgent need for the tourism sector to adapt to evolving climate realities. One of the main forces behind the implementation of sustainable tourism practices is growing awareness of climate change. According to the report, stakeholders have been more inclined to adopt policies including using renewable energy, conserving water, reducing trash, and promoting off-season travel as a result of growing knowledge. However, obstacles including limited funding, insufficient government assistance, and a lack of knowledge or technological know-how continue to cause the adoption rate to remain unequal. Strong legislative backing, stakeholder education, and focused financial aid are needed to overcome these obstacles and empower local communities and tourist companies. The study also emphasizes how important stakeholders are to advancing environmentally friendly travel. Key actors in promoting eco-friendly activities have been highlighted as local governments, non-governmental organizations, and travel agencies. Their active participation is necessary to ensure long-term resilience in the tourist sector and to put appropriate climate adaptation policies into action. To fully address climate concerns, collaborative governance at the local, national, and international levels is essential. These results are well supported by the study's validated assumptions. Statistical data confirmed the dynamic association between climatic impacts and tourism activities, supporting the first premise that climate change causes a considerable shift in the attractiveness of tourist locations. The second premise was similarly confirmed: as people become more conscious of climate change, there is a greater need for eco-friendly travel strategies. Strong correlations between stakeholder participation, obstacles, and methods show that knowledge is a potent motivator for environmentally friendly travel practices. This study demonstrates how tourism and climate change are intertwined, highlighting both benefits and concerns. Adopting climate-resilient strategies must be a top priority for stakeholders and policymakers to protect tourism's future. The tourist industry can move toward sustainability and ensure its resilience in the face of climatic problems by promoting awareness, cooperation, and innovation. This study highlights the significance of teamwork in tackling the effects of climate change on international tourism and offers insightful information to direct future research and policy development.

Abbreviations

BEIS: Department for Business, Energy and Industrial Strategy (UK), COVID-19: Coronavirus Disease 2019, FSI: Forest Survey of India, IPCC: Intergovernmental Panel on Climate Change, LED: Light Emitting Diode, NGOs: Non-Governmental Organizations, NOAA: National Oceanic and Atmospheric Administration, PRASHAD: Pilgrimage Rejuvenation and Spiritual, Heritage Augmentation Drive, SST: Sea Surface Temperature.

Acknowledgment

I extend our sincere gratitude to the Maharashtra Institute of Technology, Chhatrapati Sambhajinagar, Maharashtra, India for unwavering support and encouragement throughout this research. Institute sources and guidance were instrumental in the successful completion of this study.

Author Contributions

Pooja Deshmukh: Conceptualization, literature review, Data collection, manuscript drafting and correspondence, Study supervision, analysis, Manuscript editing.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

Ethics Approval

Not applicable.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

1. Arabadzhyan A, Figini P, García C, González MM, Lam-González Y, León C. Climate change, coastal tourism, and impact chains – a literature review. Curr Issues Tour. 2020;24(16):2233-68.
2. Scott D, Hall CM, Gössling S. A review of the IPCC Fifth Assessment and implications for tourism sector climate resilience and decarbonization. J Sustain Tour. 2015;24(1):8-30.
3. Luthe T, Wyss R. Resilience to climate change in a cross-scale tourism governance context: a combined

quantitative-qualitative network analysis. Ecol Soc. 2016; 21(1):27.
4. Morrison C, Pickering CM. Perceptions of climate change impacts, adaptation and limits to adaption in the Australian Alps: the ski-tourism industry and key stakeholders. J Sustain Tour. 2013; 21(2):173-91.
5. Weaver DB. Can sustainable tourism survive climate change? J Sustain Tour. 2011;19(1):15-5.
6. Brand C, Dons E, Anaya-Boig E, Avila-Palencia I, Clark A, de Nazelle A, Gascon M, Gaupp-Berghausen M, Gerike R, Götschi T, Iacorossi F. The climate change mitigation effects of daily active travel in cities. Transportation Research Part D: Transport and Environment. 2021 Apr 1;93:102764.
7. Sheller M. Reconstructing tourism in the Caribbean: connecting pandemic recovery, climate resilience and sustainable tourism through mobility justice. J Sustain Tour. 2020;29(9):1436-49.
8. Fang Y, Yin J, Wu B. Climate change and tourism: a scientometric analysis using CiteSpace. J Sustain Tour. 2017;26(1):108-26.
9. Hall CM, Scott D, Gössling S. The primacy of climate change for sustainable international tourism. Sustain Dev. 2013;21(2):112-21.
10. Scott D. Sustainable tourism and the grand challenge of climate change. Sustainability. 2021;13(4):1966.
11. Hoogendoorn G, Fitchett JM. Tourism and climate change: a review of threats and adaptation strategies for Africa. Curr Issues Tour. 2018;21(7):742-59.
12. Gössling S, Higham J. The low-carbon imperative: destination management under urgent climate change. J Travel Res. 2020;60(6):1167-79.
13. IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2391 pp. doi:10.1017/9781009157896
14. Luthe T, Wyss R, Schuckert M. Network governance and regional resilience to climate change: empirical evidence from mountain tourism communities in the Swiss Gotthard region. Reg Environ Change. 2012;12(4):839-54.
15. Fischer D, Thomas SM, Suk JE, Sudre B, Hess A, Tjaden NB, Beierkuhnlein C, Semenza JC. Climate change effects on Chikungunya transmission in Europe: geospatial analysis of vector's climatic suitability and virus' temperature requirements. International journal of health geographics. 2013;12(1):51.
16. Dogru T, Marchio EA, Bulut U, Suess C. Climate change: Vulnerability and resilience of tourism and the entire economy. Tourism Management. 2019 Jun 1;72:292-305.
17. Scott D. Why sustainable tourism must address climate change. J Sustain Tour. 2011;19 (1):17-34.
18. Prideaux B, Thompson M, Pabel A. Lessons from COVID-19 can prepare global tourism for the economic transformation needed to combat climate change. Tourism Geographies. 2020 May 26;22(3):667-78.
19. BASF and research partners collaborate to optimize mechanical recycling of plastics, Business & Financial News December 19, 2024 (Newsletter). https://www.basf.com/global/en/investors/calendar-and-publications/service-for-shareholders/ir-magazine/2024/fy2024
20. Pardikar R. Himalayas are experiencing an "exceptional" loss of glacial mass. Eos. 2022 Feb 10. https://eos.org/articles/himalayas-are-experiencing-an-exceptional-loss-of-glacial-mass
21. United States Environmental Protection Agency. Climate change indicators. 2024. www.epa.gov/climate-indicators
22. Down To Earth. Latest news, opinion, and analysis on environment and science issues. India, South Asia. http://downtoearth.org.in
23. World Meteorological Organization (WMO). State of the global climate 2021. 2024. https://wmo.int/publication-series/state-of-global-climate-2024
24. World Tourism Organization. Tourism and climate change. 2024. https://www.unwto.org/world-tourism-day-2024
25. The David Suzuki Foundation. Climate change and tourism. 2024. https://davidsuzuki.org/
26. Timperley J. Who is really to blame for climate change? BBC.com. 2020 Jun 19. https://www.bbc.com/future/article/20200618-climate-change-who-is-to-blame-and-why-does-it-matter
27. Richter F. Electric cars are found to cut emissions drastically. Statista. 2021 Jul 27. https://www.statista.com/chart/25412/life-cycle-emissions-savings-of-electric-cars/
28. World Resources Institute. Climate change and tourism. 2024. https://www.wri.org/climate
29. Forest Survey of India. State of Forest Report 2024. Dehradun, India: Ministry of Environment, Forest and Climate Change, Government of India. 2024. https://www.fsi.nic.in/
30. India - Monsoon Rain, Update (IMD, NDMI) (ECHO Daily Flash of 12 September 2022) India. Relief Web. 2022.https://reliefweb.int/report/india/india-monsoon-rain-update-imd-ndmi-echo-daily-flash-12-september-2022
31. World Health Organization. Climate change and health. https://www.who.int/health-topics/climate-change#tab=tab_1
32. Open Text BC. Tourism and climate change. https://opentextbc.ca/introtourism2e/chapter/tourism-and-climate-change/
33. Reef Resilience. Models to manage tourism. https://reefresilience.org/models-to-manage-tourism/
34. Ministry of Tourism, India. National strategy for ecotourism 2022. https://tourism.gov.in/sites/default/files/2022-09/National%20Strategy%20for%20Ecotourism%202022.pdf
35. Marras C. 10 solutions to climate change + 5 actions for your green travel. Ecobnb. 2016 May 31. https://ecobnb.com/blog/2016/05/climate-change-actions-green-travel/

36. Will climate change disrupt the tourism sector? Walter L F. Emerald Insight. 2022. https://www.emerald.com/insight/content/doi/10.1108/IJCCSM-08-2021-0088/full/html
37. Drishti IAS. Tourism and climate change. https://www.drishtiias.com/mains-practice-question/question-1529/pnt
38. United Nations. Climate change and tourism. https://news.un.org/en/story/2022/10/1129247
39. United Nations. Act Now: Ten actions for climate change. https://www.un.org/en/actnow/ten-actions
40. Adiran R. 6 things you can do to prevent climate change. https://www.activesustainability.com/climate-change/6-things-you-can-do-to-prevent-climate-change/?_adin=02021864894
41. National Ocean Service. Earth Day and climate change. https://oceanservice.noaa.gov/ocean/earthday.html
42. Jocelyn T. Should we give up flying for the sake of the climate? BBC Future. 2020 Feb 19. https://www.bbc.com/future/article/20200218-climate-change-how-to-cut-your-carbon-emissions-when-flying
43. World Economic Forum. Less meat and dairy to save the rainforests. 2019 Aug 8. https://www.weforum.org/agenda/2019/08/less-meat-and-dairy-save-the-rainforests
44. Save on energy and protect the environment. 2019 May. https://nhsaves.com/learn/2019/05/save-on-energy-and-protect-the-environment/
45. Transport & Environment. Does sharing cars reduce car use? 2017 Jun. https://www.transportenvironment.org/articles/does-car-sharing-really-reduce-car-use
46. Gourav P. How climate change poses challenges to sustainable tourism. Times of India. 2022. https://timesofindia.indiatimes.com/blogs/voices/how-climate-change-poses-challenges-to-sustainable-tourism/
47. Richter F. Electric Cars Found to Cut Emissions Drastically. Statista. 2021 July 27. https://www.statista.com/chart/25412/life-cycle-emissions-savings-of-electric-cars/