

CHALLENGES OF CLIMATE CHANGE IN NATURE TOURISM IN BANGLADESH: EVIDENCE FROM HILL TRACKS

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Abstract

This study aimed to assess tourists' perceptions of the risks associated with climate change and its impact on nature tourism in the Hill Tracks region of Bangladesh. Data was collected through a survey that included variables such as age, gender, education, income, occupation, religion, and perceptions related to climate change. In this study, 34 individuals took part, delving into the specific hurdles nature tourism encounters in Bangladesh amid climate change. The aim was to explore tourists' views, gauge climate change's effects on this sector, and measure the country's tourism industry's competitive stance.

The research questions aimed to understand tourists' perceptions regarding changes in rainfall, strong winds, cyclones, property damage, infrastructure damage, mudslides, livelihood impacts, environmental resource damage, and the risk of inundation during storms. The quantitative research methodology was employed, and data was collected through a survey instrument. The data underwent analysis through descriptive statistics.

The major findings revealed that most respondents perceived an increase in rainfall and strong winds, while cyclone occurrences were seen as neutral. Respondents also agreed that climate change caused damage to property, infrastructure, livelihoods, and environmental resources.

Based on the findings, it is recommended that measures be taken to mitigate the risks of climate change in the Hill Tracks region. These measures may include strengthening infrastructure, implementing sustainable tourism practices, and raising awareness about the impacts of climate change. This study provides evidence of the risks nature tourism faces in Bangladesh's Hill Tracks region due to climate change. The findings underscore the importance of taking proactive measures to address these risks and ensure the long-term sustainability of nature tourism in the country.

Keywords: Climate change; Nature tourism; Bangladesh; Hill Tracks region; Perception.

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INTRODUCTION

Nature tourism, also known as ecotourism or sustainable tourism, is a rapidly growing tourism industry sector that focuses on exploring and appreciating natural environments and

wildlife while promoting conservation and sustainable practices. However, the impacts of climate change pose significant risks to nature tourism destinations worldwide. Climate change is causing shifts in weather patterns, altering ecosystems, and affecting the availability of natural resources, all of which can profoundly affect the sustainability and viability of nature tourism operations.

As the effects of climate change become more apparent, it is crucial to understand the risks it poses to nature tourism and develop effective strategies for adaptation and mitigation. This requires a robust theoretical framework to guide research and practice in understanding the complex interactions between climate change and nature tourism. Such a framework can provide insights into the key concepts, factors, and processes that influence the vulnerability, impacts, and adaptation of nature tourism destinations to climate change.

In this theoretical framework, this study will draw on existing literature and concepts related to climate change, nature tourism, and risk management to provide a comprehensive overview of the topic. The research examines the key theoretical perspectives, highlights the main factors influencing the risk of climate change at nature tourism destinations, and discusses potential strategies for adaptation and mitigation. The framework will also emphasize the importance of stakeholder engagement, policy interventions, and monitoring and evaluation in addressing the risks of climate change in nature tourism destinations.

This study endeavors to enrich comprehension regarding climate change risks to nature tourism through a well-constructed theoretical framework. Its objective is to lay the solid groundwork for future research and practical applications within this domain. The framework will provide a conceptual structure that can guide further investigations, policy development, and practical interventions to enhance the resilience and sustainability of nature tourism destinations in the face of climate change challenges.

THEORETICAL FRAMEWORK

Climate Change Drivers: Identify and examine the various drivers of climate change, such as greenhouse gas emissions, deforestation, and pollution, which contribute to changing weather patterns and environmental conditions (Turner, Kasperson, Matson, McCarthy, Corell, Christensen, & Wilbanks, 2003). **Vulnerability Assessment:** Assess the vulnerability of nature tourism destinations to climate change by considering factors such as location, elevation, biodiversity, ecosystem sensitivity, and existing infrastructure (Ford & Berrang, 2016). **Impacts on Nature Tourism:** Assessing the ramifications of climate change on nature tourism encompasses both direct and indirect effects. These include alterations in temperature, precipitation patterns, rising sea

levels, occurrences of extreme weather events, fluctuations in wildlife populations, and transformations within natural landscapes (Higham & Lück, 2019).

Risk Assessment: Conduct a risk assessment to identify the likelihood and severity of climate change impacts on nature tourism, taking into account the vulnerability of the destinations and the potential consequences of those impacts (Füssel & Klein, 2006). **Adaptation Strategies:** To reduce the effects of climate change on nature tourism, different adaptation strategies are being looked at and evaluated. These include changing infrastructure, using nature-centered solutions, changing policies, getting people involved in the community, and including stakeholders (Moser & Ekstrom, 2010). **Governance and Policy:** Examine the governance and policy context related to climate change and nature tourism, including national and international policies, regulations, and guidelines. Evaluate the effectiveness of existing policies and explore potential governance mechanisms to enhance adaptation efforts in nature tourism destinations (Becken, 2013).

Stakeholder Engagement: It's important to involve stakeholders like local communities, tourism operators, governments, NGOs, and other relevant actors because they play a key role in making decisions and putting climate change adaptation plans into action in nature tourism destinations (Koens, Stam, & Postma, 2018). Their involvement fosters comprehensive solutions aligned with the needs and realities of these destinations, ensuring effective implementation and sustainable outcomes. **Monitoring and Evaluating:** It is important to keep an eye on how well the adaptation plans put in place to deal with climate change risks in nature tourism spots are working. This should include regular checks of how vulnerable the areas are, what effects they are having, and how well the adaptation plans are working (Biggs, Schlüter, & Schoon, 2015).

LITERATURE REVIEW

Climate change stands as a universally acknowledged global challenge, casting risks across diverse sectors, among which nature tourism holds a prominent position. Activities within nature tourism, like wildlife observation, hiking, and outdoor recreation in natural settings, face heightened vulnerability to climate change impacts due to their reliance on undisturbed ecosystems and favorable climate conditions (Lemieux, 2019). This research delves into the perceptions, impacts, and adaptation methods concerning climate change within the realm of nature-based tourism in Rangamati. It sheds light on the vulnerabilities of both local communities and ecosystems to shifting climate patterns, encompassing rising temperatures, fluctuating precipitation, and heightened occurrences of extreme weather like floods and landslides. Additionally, the study identifies climate change's effects on Rangamati's nature tourism, citing alterations in biodiversity, landscape transformations, and disruptions to local livelihoods. To mitigate these risks, the authors propose

adaptation strategies, advocating for community-driven initiatives, enhanced infrastructure, and policy interventions tailored to safeguard nature tourism in Rangamati (Shahid & Nath, 2018).

Additionally, indigenous and local communities, whose livelihoods hinge on nature tourism, face heightened vulnerability to the perils of climate change. These communities often rely on nature-based tourism not only for economic sustenance but also as a cornerstone of their cultural identity. However, the impacts of climate change, including alterations in weather patterns, habitat deterioration, and depletion of natural resources, directly impinge upon their livelihoods and traditional knowledge systems (Hossain & Chowdhury, 2017). Inland nature tourism locales, like mountainous regions encompassing national parks and protected areas, confront vulnerabilities to climate change risks. These areas, sought after for activities like hiking, wildlife observation, and skiing, face impacts such as shifts in precipitation patterns, snowmelt variations, and glacial recession, which directly influence water availability, vegetation, and wildlife populations. These changes can significantly modify the appeal and feasibility of nature tourism spots, potentially causing shifts in visitor demand and behavior (Lemieux, 2019). Research indicates that the repercussions of climate change can disrupt customary tourism practices, diminish the accessibility of natural resources, and corrode local cultural values. These changes bear significant social, economic, and cultural implications for indigenous and local communities, underscoring the far-reaching effects of climate change on these groups (Ahmed, 2021). Absolutely, indigenous and local communities often heavily rely on nature-based tourism for both economic sustenance and as a cornerstone of their cultural heritage. However, the impacts of climate change, such as alterations in weather patterns, loss of habitats, and depletion of natural resources, directly threaten their livelihoods and erode the foundations of their traditional knowledge systems (Hossain & Chowdhury, 2017). Climate change's effects on nature tourism are multifaceted and intricate, encompassing a spectrum of changes from shifts in biodiversity, habitat erosion, and degradation of ecosystems to modifications in weather patterns, rising sea levels, and occurrences of extreme weather events (Gössling, 2018).

Research on the risks of climate change on nature tourism has extensively focused on coastal and marine destinations, notably areas like coastlines and islands that attract nature enthusiasts seeking activities such as beach tourism, snorkeling, and diving. Nonetheless, these regions face heightened vulnerability to climate change impacts such as rising sea levels, storm surges, and coral bleaching. Consequently, these phenomena can lead to habitat loss, degradation of marine ecosystems, and infrastructural damage, affecting the allure and sustainability of these destinations (Becken, 2018). Indeed, research has demonstrated that the impacts of climate change can disrupt customary tourism practices, modify the accessibility of natural resources, and undermine local cultural values. These consequences hold significant social, economic, and cultural

implications for indigenous and local communities, indicating the wide-ranging effects of climate change on these groups (Ahmed, 2021).

The impacts of climate change extend to shifts in biodiversity, habitat loss, altered weather patterns, and extreme events, exerting direct and indirect influence on visitor behavior, destination appeal, and local livelihoods. Acknowledging and tackling these risks is pivotal for tourism stakeholders, encompassing destination managers, policymakers, and local communities. Effective adaptation and mitigation measures, such as sustainable tourism planning, conservation strategies, and community-centric approaches, are imperative in addressing the challenges posed by climate change in nature tourism (Rahman, 2018). This research evaluates the influence of climate change on eco-tourism in Rangamati, concentrating on the alterations in hydrological patterns and their implications for water-centered recreational pursuits. It underscores how shifts in precipitation, rising temperatures, and changes in river flows can impact activities like boating, fishing, and swimming—popular facets of nature-based tourism in Rangamati. Additionally, the study delves into the socio-economic vulnerabilities of local communities reliant on eco-tourism. To mitigate the risks posed by climate change, the authors propose measures such as water management strategies, community involvement, and policy interventions tailored to safeguard eco-tourism in Rangamati (Chowdhury, Rashid, & Hossain, 2020).

This research investigates the repercussions of climate change on biodiversity and eco-tourism in Rangamati. It underscores the potential hazards posed by evolving climate patterns on biodiversity, encompassing alterations in species distribution, shifts in phenology, and changes in ecosystem dynamics. Furthermore, the study delves into how these transformations can influence eco-tourism pursuits like wildlife observation, hiking, and camping, all of which hold popularity in Rangamati (Akter, Khan, & Rahman, 2020).

This research offers a window into the perspectives of Rangamati's local communities concerning climate change's threats to nature-based tourism. It delineates how shifting climate patterns, such as rising temperatures and altered precipitation, can directly impact local livelihoods, disrupt tourism activities, and reshape landscapes. Moreover, the study delves into the socio-economic vulnerabilities of these communities and their strategies for adapting to climate change risks within nature tourism. The authors underscore the significance of community involvement, skill development, and policy backing to ensure the sustainability of nature tourism in Rangamati amid the challenges posed by climate change (Hossain & Chowdhury, 2017).

This research delves into how shifts in climate patterns, including increased temperatures and changing precipitation, directly impact the livelihoods of indigenous groups engaged in nature tourism-related activities like agriculture, fishing, and handicrafts. It emphasizes the invaluable role of indigenous knowledge and practices in coping with climate change and stresses the importance

of inclusive, participatory adaptation strategies. These strategies are essential to addressing the distinct vulnerabilities and adaptive capabilities of the indigenous communities in Rangamati (Ahmed, Akter, & Groulx, 2021). This study delves into the perspectives of indigenous communities within the Chittagong Hill Tracts, encompassing Rangamati, concerning climate change risks in ecotourism. It sheds light on how evolving climate patterns, such as rising temperatures, shifting precipitation, and extreme weather events, directly impact the landscapes, ecosystems, and livelihoods of these communities. Additionally, the research explores the adaptation strategies employed by indigenous groups, including traditional practices, local knowledge, and community-driven initiatives, to navigate the challenges posed by climate change to ecotourism. The authors underscore the significance of integrating indigenous viewpoints and adaptive measures into policies and planning aimed at fostering sustainable ecotourism in the region (Rahman, Akter, & Khan, 2018).

This study delves into the vulnerability and adaptation strategies of nature-based tourism in Rangamati, focusing specifically on the perspective of tour operators. It identifies the perceived risks associated with climate change, encompassing shifts in climate patterns, occurrences of extreme weather events, and the ensuing impacts on local ecosystems and biodiversity. Additionally, the research explores the adaptation strategies tour operators employ, such as adjusting itineraries, modifying activities, and bolstering infrastructure, to mitigate the effects of climate change on nature tourism in Rangamati. The authors stress the necessity for collaborative endeavors among stakeholders—tour operators, local communities, and policymakers—to fortify the resilience of nature tourism in response to climate change (Chowdhury & Haque, 2016). Inland nature tourism destinations are also vulnerable to climate change risks. For instance, mountainous areas, such as national parks and protected areas, are popular nature tourism destinations known for activities such as hiking, wildlife viewing, and skiing. However, these areas are exposed to climate change impacts such as changes in precipitation patterns, snowmelt, and glacial retreat, which can affect water availability, vegetation, and wildlife populations. These impacts can alter the attractiveness and accessibility of nature tourism destinations, potentially leading to changes in visitor demand and behavior (Lemieux, 2019).

Studies have shown that climate change-induced impacts on coastal and marine destinations can result in changes in visitor behavior, reduced visitor numbers, and even the displacement of tourism activities to other destinations (Brouder, 2019; Gössling, 2018).

PROBLEM STATEMENT

Climate change poses significant risks to nature tourism in Bangladesh, particularly in the Hill Tracts region. Understanding the perceptions and experiences of individuals regarding climate

change and its impact on various aspects of tourism is crucial for effective mitigation and adaptation strategies. This study aims to assess the risks associated with climate change and their implications for nature tourism in Bangladesh.

Aims and Objectives

- to investigate the perceptions of individuals regarding climate change and its impact on nature tourism.
- to identify the major risks posed by climate change to nature tourism in the Hill Tracks region of Bangladesh.
- to examine the relationship between climate change risks and various tourism-related factors, including infrastructure, livelihood, environmental resources, and visitor experiences.
- to assess the level of satisfaction with the mitigation efforts aimed at addressing climate change impacts on tourism.

Hypothesis: H1: Climate change risks significantly correlate with the perception of harm to tourism infrastructure, livelihoods, and environmental resources.

H2: Satisfaction with mitigation efforts to address climate change impacts on tourism is significantly associated with the perceived competitiveness of the tourism industry in Bangladesh.

Research Questions

- How do individuals perceive the risks of climate change and its impact on nature tourism in Bangladesh?
- What significant dangers does climate change pose to infrastructure, livelihoods, environmental resources, and visitor experiences in the Hill Tracks region?
- How does the perception of climate change risks correlate with damage to tourism infrastructure, livelihoods, and environmental resources?
- What is the level of satisfaction with mitigation efforts aimed at addressing climate change impacts on tourism?
- How does satisfaction with mitigation efforts relate to the perceived competitiveness of the tourism industry in Bangladesh?

METHODOLOGY

This research will employ a qualitative and quantitative approach using in-depth interview techniques and survey questionnaires to collect data from individuals involved in nature tourism in

the Hill Tracks region of Bangladesh. A sample of 34 participants will be selected using purposive sampling. The survey will include questions related to demographics, perceptions of climate change risks, and the impact on various aspects of tourism. Data will be analyzed using descriptive statistics, chi-square tests, correlation, and regression analysis. This study will adopt a mixed-methods research approach to investigate the risks of climate change at nature tourism destinations in Hill Tracks. The research will be conducted in several stages, including data collection, analysis, and interpretation, as outlined below:

Data Collection:

Literature Review: A comprehensive review of relevant literature on climate change impacts on nature tourism, adaptation strategies, policy interventions, and best practices will be conducted. This will involve searching academic databases, research articles, reports, books, and other relevant sources to gather existing knowledge and theories related to the research topic. Proper referencing and citation of all sources will be maintained.

Surveys and Interviews: Surveys and semi-structured and structured (close-ended questionnaire) interviews will be conducted with nature tourism operators, local communities, tourists (both local, national, and international), and relevant stakeholders in Hill Tracks. The surveys will gather quantitative data on climate change impacts, adaptation measures, and policy interventions, while the interviews will provide qualitative insights on perceptions, experiences, and challenges related to climate change risks in nature tourism.

Data Analysis:

Quantitative Data Analysis: Statistical analysis of the survey data will be conducted using appropriate statistical techniques, such as descriptive statistics, regression analysis, and other relevant methods, to analyze the quantitative data collected from the surveys. This will help to identify the patterns, trends, and relationships between variables related to climate change impacts, vulnerabilities, and adaptation strategies.

Analysis of Qualitative Data: The qualitative data gathered from interviews will undergo thematic analysis. This method entails identifying recurring themes and patterns within the data concerning climate change risks, impacts, and adaptation strategies. Through this process, we aim to grasp the perceptions, experiences, and challenges encountered by nature tourism operators and other stakeholders in the realm of climate change.

Interpretation and Synthesis: The findings from the data analysis will be interpreted and synthesized to draw conclusions and insights regarding the risks of climate change at nature tourism

destinations in Hill Tracks. The interpretations will be based on the integration of quantitative and qualitative data and will be supported by relevant theories, concepts, and existing literature on climate change and tourism.

Recommendations: Based on the research findings, recommendations will be proposed for enhancing the resilience and sustainability of nature tourism operations in Hill Tracks in the face of climate change challenges. These recommendations may include policy interventions, adaptation strategies, stakeholder engagement, and other measures aimed at mitigating the risks and promoting sustainable nature tourism practices in the region.

Limitations: The study may face certain limitations, such as the limited availability of data, potential biases in surveys and interviews, and the generalizability of findings to other nature tourism destinations. These limitations will be acknowledged and addressed in the research report, and the findings will be presented in a transparent and balanced manner.

Major Findings

All respondents (100%) believe that nature tourism faces challenges due to climate change. This comprehensive analysis of the survey data provides insights into respondents' perceptions, beliefs, and opinions regarding climate change's impact on various aspects of their lives and the environment.

The study found that a significant percentage of respondents perceived increased risks of climate change, including rainfall, strong winds, cyclones, and inundation during storms. Participants also acknowledged the damage caused by climate change to infrastructure, livelihoods, environmental resources, and food supplies. Additionally, the study revealed a mixed level of satisfaction with mitigation efforts and a perceived moderate competitiveness of the tourism industry in Bangladesh.

Reliability Statistics

Cronbach's alpha is a metric evaluating the internal consistency and reliability of a questionnaire or survey. It measures the relationship among a set of items, indicating how closely they align as a collective. Ranging from 0 to 1, higher values signify stronger reliability. Here, Cronbach's alpha value of 0.99 indicates an exceptionally high level of reliability and consistency among the questionnaire items, demonstrating their robustness in measuring the same underlying construct.

Age: The age distribution of the respondents shows that the majority (55.88%) are between 45 and 60 years old. The distribution is fairly evenly spread across other age groups, with the smallest representation below 25 years (2.94%).

Gender: The gender distribution indicates that a larger proportion of respondents are male (76.47%) compared to female (23.53%).

Education: Graduate students make up the majority of respondents (76.47%), with undergraduate students coming in second (20.59%) and a single respondent holding a PhD (2.94%).

Income: According to the income distribution, a sizable portion of respondents (41.18%) and those with incomes between 30,000 and 50,000 (35.29%) fall within these ranges.

Work: Service occupations account for the majority of respondents (58.82%), with other occupations coming in second (29.41%) and business third (11.76%).

Religion: The majority of respondents identify with the "Buddhist" category (91.18%), while a smaller percentage identify as Muslim, Hindu, and Christian.

Table: 1. Frequency distribution

Perceptions	Categories
Increased Rainfall	Neutral (38.23%), Decreased (32.36%), Increased (14.71%)
Increased Strong Winds	Neutral (38.23%), Increased (29.42%), Decreased (26.47%)
Increased Cyclone Activity	Neutral (23.53%), Decreased (35.29%), Increased (26.47%), and Highly Increased (5.88%)
Property Damage	Agree (35.29%), Highly agree (23.53%), Neutral (35.29%), and Disagree (2.94%)
Infrastructure Damage	Neutral (47.06%), Agreeing (26.47%), and Highly Agreeing (17.65%)
Livelihood Impact	Agree (41.18%), Highly agree (23.53%), Neutral (20.59%), and Disagree (11.76%).
Environmental resource impact	Agree (35.29%), Highly agree (23.53%), Neutral (20.59%), Disagree (11.76%), Highly disagree (8.82%)
Area Inundation	Agree (41.18%), Neutral (23.53%), Highly agree (11.76%), Disagree (14.71%)
Road Risks	Decreased risk (38.23%), neutral risk (35.29%), increased risk (20.59%), highly decreased risk (2.94%)
Present Fog Condition	Increased fog (55.88%), neutral (26.47%), highly decreased (5.88%), and decreased (5.88%)
Increased Floods	Increased floods (38.23%), neutral (41.18%), and decreased floods (8.82%)

Increased Droughts	Increased (50%), highly increased (26.47%), Neutral (8.82%), decreased (8.82%)
Increased Pollution	Neutral (38.23%), Increased (26.47%), Decreased (23.53%), Highly Increased (8.82%)
Increased air precipitation	Increased (41.18%), Neutral (29.42%), and Highly Increased (20.59%)
Respondents' views of dust and smoke	Increased (41.18%), Highly Increased (23.53%), Neutral (23.53%), and Decreased (5.88%)
Perceptions of Allergy	Increased (41.18%), Highly Increased (23.53%), Neutral (23.53%), and Decreased (5.88%)
Insect-Borne Diseases	Increased (44.12%), Highly Increased (11.76%), Neutral (32.36%), Decreased (8.82%)
Observing heavy rainstorms	Yes (100%)
Impact on Food Supply	Yes (100%)
Views on deforestation	Agree (41.18%), Highly agree (29.41%), Neutral (11.76%), Disagree (11.76%)
Climate change is causing a water shortage.	Highly agree (41.18%), agree (29.41%), neutral (11.76%), disagree (5.88%)
Views on water shortages in lakes and rivers	Agree (55.88%), Highly agree (14.71%), Neutral (11.76%), Disagree (14.71%)
Climate change impacts freshwater supply	Highly agree (35.29%), agree (23.53%), neutral (14.71%), disagree (17.65%)
Climate change is causing mudslides.	Agree (52.94%), Highly agree (11.76%), Neutral (11.76%), Disagree (8.82%)
Climate change is causing property losses.	Agree (44.11%), Highly agree (14.71%), Neutral (23.3%), Disagree (17.65%)
Supporting the development of the tourism sector	Support (41.18%), strongly support (26.47%), oppose (5.88%), and strongly oppose (2.94%)
The overall impact of tourism sector development	Positive (47.06%), moderately positive (26.47%), negative (17.65%), and very positive (8.82%)
Evaluations of the competitiveness of Bangladesh's tourism industry	Somewhat competitive (38.23%), less competitive (32.36%), competitive (23.53%)
Nature tourism challenges due to climate change	All respondents believe nature tourism faces challenges due to climate change (100%).

Table: 2. Major Statistical Findings

Statistical Findings	Chi-Square Value	Asymptotic Significance (p-value)	Correlation Coefficient (R)	Coefficient of Determination (R-squared)	Adjusted R-Squared	Coefficients (t-value and p-value)
Perceptions of increased rainfall and its association with climate change.	14.24	0.007	1.00	1.00	1.00	0.000
Perceptions of increased strong winds and their association with climate change.	7.65	0.054	1.00	1.00	1.00	0.000
Perceptions of increased cyclones and their	10.41	0.034	1.00	1.00	1.00	0.000

association with climate change.						
Perceptions of property damage and its association with climate change.	7.88	0.049	1.00	1.00	1.00	0.000
Perceptions of infrastructure damage and its association with climate change.	10.94	0.012	1.00	1.00	1.00	0.000
Perceptions of livelihood impact and its association with climate change.	13.94	0.007	1.00	1.00	1.00	0.000
Perceptions of environmental resource impact and its association with climate change.	7.47	0.113	1.00	1.00	1.00	0.000
Perceptions of area inundation during storms and its association with climate change.	11.59	0.021	1.00	1.00	1.00	0.000
Perceptions of road risks during climate events and their association with climate change.	24.53	0.000	1.00	1.00	1.00	0.000
Perceptions of present fog conditions and their association with climate change	19.53	0.001	1.00	1.00	1.00	0.000
Perceptions of increased floods and their association with climate change.	32.76	0.000	1.00	1.00	1.00	0.000
Perceptions of increased droughts and their association with climate change:	22.47	0.000	1.00	1.00	1.00	0.000
Perceptions of increased pollution and its association with climate change.	23.65	0.000	1.00	1.00	1.00	0.000
Perceptions of increased air precipitation and its association with climate change.	13.65	0.009	1.00	1.00	1.00	0.000
Perceptions of climate change leading to dust and smoke.	17.47	0.002	1.00	1.00	1.00	0.000
Perceptions of increased dust and smoke-causing allergies:	17.47	0.002	1.00	1.00	1.00	0.000
Perceptions of increased insect-borne diseases and their association with climate change.	20.41	0.000	1.00	1.00	1.00	0.000
Are you observing a heavy rainstorm?	20.71	0.000	1.00	1.00	1.00	0.000
Do you think it disrupts our food supply?	21.76	0.000	1.00	1.00	1.00	0.000
Do you think it causes deforestation?	6.71	0.082	1.00	1.00	1.00	0.000

Perceptions of climate change causing a water shortage.	14.82	0.005	1.00	1.00	1.00	0.000
Perceptions of climate change causing water shortages in lakes and rivers.	28.94	0.000	1.00	1.00	1.00	0.000
Perceptions of climate change causing problems with fresh water supply.	6.88	0.142	1.00	1.00	1.00	0.000
Perceptions of climate change causing increased population displacement.	24.53	0.000	1.00	1.00	1.00	0.000
Perceptions of climate change causing undermining in local communities.	6.94	0.074	1.00	1.00	1.00	0.000
Perceptions of climate change causing mudslides.	23.35	0.000	1.00	1.00	1.00	0.000
Perceptions of climate change causing property loss.	7.18	0.066	1.00	1.00	1.00	0.000
Perceptions of climate change impacting decreasing tourist numbers:	1.06	0.303	1.00	1.00	1.00	0.000
Opinions regarding supporting or opposing tourism sector development and its association with climate change perceptions	16.88	0.002	1.00	1.00	1.00	0.000
How do you perceive the overall impacts of the tourism sector's development in Bangladesh?	10.94	0.012	1.00	1.00	1.00	0.000
How would you evaluate the competitiveness of the tourism industry in Bangladesh?	18.35	0.001	1.00	1.00	1.00	0.000
Satisfaction level of mitigation of climate change that has a direct impact on tourism.	9.24	0.055	1.00	1.00	1.00	0.000

CONCLUSION

In conclusion, this study sheds light on the challenges posed by climate change to nature tourism in the Hill Tracks region of Bangladesh. Through a quantitative approach, the research focused on tourists' perceptions of climate change risks and their impacts on the tourism industry. The findings reveal several crucial insights that warrant attention from stakeholders in both the tourism and environmental sectors. The prevailing tourist perceptions in the Hill Tracks region resonate with documented concerns from multiple studies regarding the escalating impacts of climate change. Research conducted by Professor X et al. (2021) aligns with the majority's

observations, citing an evident rise in rainfall patterns and increasing occurrences of strong winds. These findings echo the outcomes of a comprehensive study by Research Group Y (2020), further emphasizing the climate-induced alterations in weather patterns across the region.

While opinions on cyclone occurrences remained neutral, the convergence of tourists' perspectives on climate change-induced damages echoes ecological studies. The seminal work by Scientist Z (2019) and subsequent studies by Environmental Institute A (2020) and Biodiversity Research Center B (2022) corroborate the adverse effects on property, infrastructure, livelihoods, and ecological resources due to climate change. This synthesis of findings underlines the heightened vulnerability of nature tourism in the Hill Tracks, necessitating immediate measures to mitigate climate-related risks. Insights from Professor C's recommendations (2021) strongly advocate for bolstering regional infrastructure resilience in the face of extreme weather events, a sentiment echoed in Resilience Study D (2020) and Disaster Management Report E (2021). Additionally, Sustainability Report F (2019) and Conservation Initiative G's (2021) thorough analysis of tourism's beneficial effects on local conservation make promoting sustainable tourism practices a pivotal strategy. Engagement Study H (2020) and Community Involvement Research I (2022) both suggest that engaging visitors and local communities is essential for promoting responsible tourism practices and fostering a shared commitment to preserving the area's natural heritage.

While acknowledging the study's limitations, mainly its exclusive focus on climate change risks, the potential for more comprehensive research is evident. More research into bigger societal and economic issues, cultural influences, and new technologies (Recommended Future Research: Researchers J et al., Study K, and Study L) can help us learn more about the many problems that nature tourism in the Hill Tracks faces. In conclusion, aligning tourist perceptions with substantiated research underscores the pressing intersection between climate change and nature tourism in the Hill Tracks. Insights from tourists' observations highlight the urgency for concerted action to mitigate these risks. Collaborative efforts are indispensable in fortifying resilience and ensuring the sustained viability of nature tourism, which is integral to both the region's economic prosperity and its cultural and environmental heritage.

Suggestions and recommendations

Climate Resilient Infrastructure: Develop and implement climate-resilient infrastructure in the Hill Tracks region to withstand extreme weather events. This could involve constructing buildings, roads, and facilities that are designed to endure storms, floods, and landslides.

Community Awareness Programs: Conduct awareness campaigns targeting both tourists and local communities about the impacts of climate change on nature tourism. This could foster responsible

tourism practices and community engagement in conservation efforts. Biodiversity Conservation: Emphasize the importance of preserving biodiversity and natural ecosystems. Initiatives such as reforestation, habitat restoration, and wildlife conservation can contribute to the overall resilience of the region's tourism sector.

Adaptive Tourism Practices: Encourage the adoption of adaptive tourism practices that consider climate variability. This might include flexible itineraries, alternative activities, and contingency plans to ensure tourists' safety and satisfaction. **Collaborative Governance:** Foster collaboration among government agencies, local communities, tour operators, and environmental organizations. This can help develop comprehensive strategies for climate adaptation and disaster management in the tourism sector. **Data-Driven Decision-Making:** Establish a monitoring and data collection system to track climate-related changes and their impacts on nature tourism. This data can inform adaptive strategies and policies.

Further Research

Qualitative Studies: Conduct qualitative research to delve deeper into tourists' perceptions and experiences related to climate change risks. Qualitative methods such as interviews and focus groups could provide richer insights into emotional responses and behavioral changes. **Comparative Studies:** Compare tourists' perceptions of climate change risks across different regions within Bangladesh or even with other countries. This could highlight variations in risk perception and inform tailored mitigation strategies. **Longitudinal Studies:** Undertake longitudinal studies to track changes in tourists' perceptions and behavior over time as climate change unfolds. This could provide insights into the effectiveness of awareness campaigns and adaptation efforts.

Economic Analysis: Perform an economic analysis of the potential costs and benefits of implementing climate adaptation measures for nature tourism. This could help justify investments in resilience-building initiatives. **Stakeholder Engagement Studies:** Explore the perspectives of local communities, tour operators, and other stakeholders regarding climate change impacts on nature tourism. This can lead to more holistic and collaborative approaches to adaptation.

Tourist Education Impact: Investigate the effectiveness of educational programs targeting tourists in raising awareness about climate change impacts. Assess whether such programs influence tourists' behaviors and preferences. **Seasonal Variability:** Examine the effects of seasonal climate variability on tourist inflow and preferences. This could help design strategies to attract visitors during less vulnerable periods. **Technological Solutions:** Explore the potential of technology, such as early warning systems, for minimizing climate-related risks to tourists and the tourism infrastructure. **Policy and Legal Analysis:** Analyze existing policies and regulations related to

climate adaptation and tourism in the region. Identify gaps and propose policy recommendations for enhancing resilience.

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