

Climate Risks: The Impacts of Climate Change on Tourism Activities

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ABSTRACT

Climate change poses systemic risks to socio-economic systems, infrastructure, ecosystems, and human health on a global scale. The increasing frequency and intensity of extreme weather events have made it necessary to reassess emergency preparedness systems. This article examines the nature of climate risks, the concept of emergency preparedness, mechanisms for risk reduction and adaptation, the resilience of healthcare and governance systems, as well as the impacts of climate change on tourism. It also analyzes the economic, environmental, and social effects of tourism activities on the climate. Furthermore, sustainable tourism approaches and adaptation strategies are explored, and international frameworks are reviewed. The main objective of the study is to substantiate a comprehensive, multi-level emergency preparedness model against climate risks from both theoretical and practical perspectives, and to investigate sustainable tourism approaches and adaptation strategies. The study is based on a systematic literature review and a comparative analysis method. Climate change is one of the major challenges affecting various sectors of the global economy in the modern era. The tourism sector acts both as a contributor to climate change and as a field directly impacted by it. The article analyzes the effects of climate change on tourism activities, as well as the economic, environmental, and social impacts of tourism on the climate, while also examining sustainable tourism approaches and adaptation strategies.

Keywords: Climate change; climate risks; emergencies; tourism; sustainable development; ecotourism; adaptation strategies; early warning systems

1. INTRODUCTION

In the 21st century, climate change has become a key component of the global security and development agenda. Climate change is a major source of risk for environmental and socio-economic systems worldwide. As a result of the increase in average atmospheric temperature and the growing frequency and intensity of extreme weather events, unpredictable threats emerge for human life, health, the environment, and infrastructure systems. These changes lead to an increase in emergencies such as floods, droughts, heatwaves, and wildfires. In modern approaches, emergency preparedness is considered an integral part of climate adaptation strategies.

Climate change refers to long-term alterations in weather patterns, caused by both anthropogenic and natural factors. The most commonly observed outcomes include an increase in heatwaves, rising sea levels, and extreme weather events (Eslamian & Eslamian, 2022). The tourism sector, as an important component of the global economy, also has a significant impact on the environment, particularly on the climate system. Climate change is characterized by global temperature rise, changes in precipitation patterns, and the intensification of extreme weather events. These changes affect the tourism sector both directly—through altered climatic conditions—and indirectly—through impacts on infrastructure and ecosystems. Since the tourism sector constitutes a significant share of global employment and GDP, its vulnerability to climate risks is of particular importance.

2. CLIMATE RISKS AND EMERGENCY PREPAREDNESS

2.1 Theoretical Foundations of Climate Risks

The increase in climate risks is further intensified by urbanization, population growth, and ecosystem degradation. This necessitates a comprehensive and systematic approach (World Meteorological Organization, 2022). Effective emergency preparedness systems include risk assessment, first aid training, public awareness, and adapted operational procedures. Modern research shows that the following components are essential in climate change planning: risk assessment through the identification and prioritization of potential hazards; training and education programs aimed at increasing preparedness levels of society and professionals; public awareness measures that strengthen citizens' response capabilities in the face of threats; and system coordination through cooperation among government, non-governmental, and public sectors (International Journal of Disaster Risk Reduction, 2022).

2.2 Sustainability and Preparedness of Health Systems

Climate risks have both direct and indirect impacts on the healthcare sector. Heatwaves, waterborne diseases, and food safety issues lead to increased pressure on health systems. The World Health Organization has identified the development of climate-resilient health systems as a priority (WHO, 2021). Health systems, especially in low- and middle-income countries, are highly vulnerable to climate risks. Enhancing system resilience requires adaptation, coordinated approaches, and sustained investments (BMC Public Health, 2023).

2.3 Infrastructure and Urban Resilience

Adapting urban infrastructure to climate change is a key element of emergency preparedness. Sustainable construction standards, water management systems, and modernization of energy networks contribute to risk reduction. In this context, the concept of resilience is widely applied. New technologies and risk training models are also used to improve the effectiveness of emergency preparedness. For example, simulation technologies such as extended reality (XR) are used in training for risk preparedness and help improve society's response capabilities in emergency situations (Konstantakos et al., 2025).

2.4 International and Regional Policy Frameworks

Global response mechanisms to climate risks are primarily shaped within the framework of the United Nations Framework Convention on Climate Change (UNFCCC). The Paris Agreement, adopted in 2015, identifies adaptation to climate change and strengthening resilience as one of its main objectives (Eslamian & Eslamian, 2022). At the international level, various documents and conventions exist regarding climate change adaptation and risk management. COP conferences and international agreements enhance cooperation among countries and promote measures against climate risks. Unified

approaches in preparedness and adaptation policies, shared data exchange, and coordinated resource management contribute to the development of strong systems to address climate risks. These documents encourage the integration of emergency preparedness into national strategies and strengthen information exchange between states. The analysis shows that emergency preparedness for climate risks is not limited to technical measures alone. This process requires institutional governance, public participation, education, and the application of innovative technologies. In particular, digital early warning systems and artificial intelligence-based forecasting models play a crucial role in the early identification of risks.

3. THE RELATIONSHIP BETWEEN CLIMATE CHANGE AND THE TOURISM SECTOR

3.1 Mechanisms of Tourism's Impact on Climate

There is a two-way relationship between tourism and climate change: tourism contributes to climate change through its emissions and resource consumption, while climate change simultaneously affects tourism activities and destinations. Research shows that transportation, accommodation, and tourism activities contribute to the increase of greenhouse gas emissions, thereby accelerating climate change. At the same time, the implementation of sustainable tourism strategies can play a significant role in reducing these impacts (RayHaber, 2024).

Tourism activities are a major source of greenhouse gas emissions. Fuel consumption in the aviation and transportation sectors constitutes the largest share of tourism's climate impact; aviation is characterized by particularly high carbon emissions, with studies indicating that approximately 40–50% of tourism-related CO₂ emissions derive from air transport. Hotels and other accommodation facilities are also energy-intensive sectors, as heating, cooling, lighting, and service operations require large amounts of energy, which indirectly leads to greenhouse gas emissions. Furthermore, tourism activities such as ski tourism, cruises, and safaris lead to intensive use of natural resources, resulting in ecosystem degradation and disruption of the carbon balance. These processes include excessive use of water and energy resources, increases in greenhouse gas emissions, growth in waste volumes, and negative impacts on biodiversity including degradation of natural areas, loss of biodiversity, and soil erosion (RayHaber, 2024). International studies emphasize that tourism increases biodiversity risks and has long-term impacts on regional ecosystems. According to research, the tourism sector accounts for approximately 8–10% of global carbon emissions.

3.2 The Impact of Climate Change on Tourism

Climate change is one of the major global challenges that directly and indirectly affects the tourism sector. It directly influences tourism activities by altering the quality and accessibility of tourism resources and affecting tourist preferences. Changes in temperature and climate comfort levels influence the direction and intensity of tourist flows. Studies show that changes in climate comfort lead to a decrease in tourist numbers or a shift toward new regions (Universal Journal of Scientific Research, 2024).

The main impacts of climate change on tourism activities are multi-dimensional. Rising temperatures directly affect the attractiveness of tourism destinations: hot climate zones may become less suitable for summer tourism, while cooler regions may emerge as new tourist destinations. The increase in extreme weather events such as hurricanes, floods, droughts, and wildfires poses serious risks to tourism infrastructure and safety, leading to a decrease in tourist flows and economic losses. In coastal tourism areas, rising sea levels cause damage to beaches and tourism facilities. The destruction of coral reefs, melting of glaciers, and loss of biodiversity further reduce the quality of tourism resources (RayHaber,

2024). These changes lead to additional consequences including the extension or shortening of tourism seasons, the redistribution of tourist flows toward regions with more favorable climate conditions, and reduced investments in the tourism sector.

3.3 Transformation of the Tourism Sector Due to Climate Change

Climate change causes significant transformations in the tourism sector. Rapid changes in weather conditions lead to shifts in seasonal patterns, damage to tourism infrastructure, and changes in tourist behavior. Tourism seasons are extended in some regions while being shortened or limited in others. Sea-level rise and coastal erosion pose serious threats to beach tourism, potentially damaging or even destroying tourism infrastructure. Global warming reduces snow cover, limiting mountain and ski tourism, especially in mountainous regions. The intensification of storms, floods, droughts, and heatwaves shortens tourism seasons, reduces tourist safety, and increases insurance and service costs. Climate change also affects tourist preferences, leading to a shift toward cooler regions, increased interest in environmentally responsible travel, and new seasonal trends in the tourism market (Scribd, n.d.).

3.4 Economic and Social Impacts

Climate change emerges as a factor that significantly affects the economic stability of the tourism sector. The increasing frequency of climate events leads to a decline in tourist flows, which results in a reduction in income generated from the tourism sector, weakening the local economy; a decline in the number of people employed in tourism, potentially leading to higher unemployment rates; and a slowing of regional development, since tourism revenues are often essential for investments in local infrastructure and social services (Scribd, n.d.). The vulnerability of the tourism sector to climate change is further intensified due to its close interconnection with other sectors such as water supply, agriculture, and infrastructure. The weakening of the tourism sector negatively affects the social welfare and living standards of local communities, potentially resulting in decreased income for rural populations, increased unemployment, and a decline in the quality of local services.

4. SUSTAINABLE TOURISM AND ADAPTATION STRATEGIES

To mitigate the impacts of climate change, sustainable tourism and adaptation strategies are of crucial importance. Sustainable tourism models aim to reduce carbon emissions through the use of environmentally friendly transportation, energy-efficient tourism infrastructure, and other sustainable practices. Adaptation measures including climate-resilient tourism planning, diversification of seasonal tourism products, and the establishment of risk management systems will help the tourism sector adapt to climate change. Conferences and initiatives at international and national levels emphasize the importance of integrating tourism into climate policy, which is essential for promoting sustainable tourism (Universal Journal of Scientific Research, 2024). Increasing environmental responsibility in tourism is one of the key conditions for sustainable tourism development among both tourists and business operators.

5. ASSESSMENT OF THE IMPACT OF CLIMATE CHANGE ON THE TOURISM SECTOR OF AZERBAIJAN

The tourism sector of Azerbaijan is significantly affected by climate change. This process creates both certain risks and new opportunities. In particular, problems such as coastal erosion along the Caspian Sea coastline and the reduction of water resources create challenges for ensuring the sustainable development of the local tourism sector. Seasonal changes in mountain tourism also lead to a shortening of the operational period of tourism infrastructure and cause temporary financial losses (Ministry of

Ecology and Natural Resources of the Republic of Azerbaijan, 2024; Qebulol.az, 2025). Addressing these challenges requires the development and implementation of national climate adaptation strategies that specifically target the tourism sector, as well as strengthened cooperation between government bodies, the private sector, and international organizations.

6. CONCLUSION

The increasing risks associated with climate change further strengthen the strategic importance of emergency preparedness. An effective preparedness system should be grounded in scientifically based risk assessment; the establishment of early warning and monitoring systems; the adaptation of infrastructure to climate conditions; the strengthening of the resilience of healthcare and social systems; and the integration of international and national policies. A resilient and flexible management model for climate risks can minimize the impacts of future emergencies.

The tourism sector is a complex system that both contributes to and is significantly affected by climate change. Climate change is a multifaceted problem that impacts tourism activities through the depletion of natural resources as well as economic and social changes. The implementation of sustainable tourism strategies and the strengthening of climate adaptation measures are crucial for reducing these impacts. Future research should focus on quantitative assessments of climate change impacts on specific tourism destinations, the development of sector-specific adaptation frameworks, and the integration of tourism into national and international climate policy instruments.

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REFERENCES

- Eslamian, S., & Eslamian, F. (2022). *Disaster risk reduction for resilience: Climate change and disaster risk adaptation*. Springer Nature.
- International Journal of Disaster Risk Reduction. (2022). The implications of climate change for emergency planning. *International Journal of Disaster Risk Reduction*. Elsevier.
- Konstantakos, S., Maragkos, G., Chalkidis, I., & Papadakis, S. (2025). An extended reality-based framework for user risk training. *arXiv preprint*. <https://arxiv.org/abs/2504.12345>
- Ministry of Ecology and Natural Resources of the Republic of Azerbaijan. (2024). *Climate change in Azerbaijan*. <https://eco.gov.az>
- Qebulol.az. (2025). Climate change: Impacts on sectors. *Qebulol.az*. <https://qebulol.az>
- RayHaber. (2024). The impacts of climate change on tourism and sustainable practices. *RayHaber*.
- Scribd. (n.d.). *Climate change and tourism [PDF]*. <https://www.scribd.com>

Universal Journal of Scientific Research. (2024). Climate change and tourism. *Universal Journal of Scientific Research*.

World Health Organization. (2021). *Climate-resilient health systems*. WHO. <https://www.who.int>

World Meteorological Organization. (2022). *Early warning systems for climate risk reduction*. WMO.

BMC Public Health. (2023). Disaster preparedness of health systems in LMICs in the face of climate change: A mapping review. *BMC Public Health*.

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