



# The Vulnerability of Tourism to Climate Change in Portuguese and Brazilian Cities—A Review <sup>†</sup>

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**Abstract:** Tourism and climate change exhibit a binomial relationship, in which the former contributes to and is affected by the latter. In this context, the vulnerabilities of the tourism sector to climate change are assessed, focusing on cities in Portugal and Brazil, based on a literature review. A literature review was conducted using the keywords “tourism”, “climate change”, “Brazil”, “Portugal”, and their derivatives in Portuguese on Web of Science, Scopus, and Google Scholar databases. In both countries, extreme rainfall events cause delays or interrupt travel, and affect infrastructure, equipment, and services for tourists. In addition, heat waves and droughts have caused thermal discomfort and water shortages for residents and tourists. Adaptation and mitigation strategies are therefore urgently needed in both territories.

**Keywords:** tourism; global change; climate resilience; review



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## 1. Introduction

Tourism and climate change have a binomial relationship, with tourism being both sensitive to and responsible for climate change [1,2]. Rising temperatures, rising sea levels, and the occurrence of extreme weather events have a negative impact on the tourism sector, reducing visitor numbers, altering visitor flows, fragmenting the length of stays, and increasing operating costs, especially for air conditioning in accommodation [2,3]. Nevertheless, tourism is responsible for about 5% of global greenhouse gas (GHG) emissions, with air transport being one of the main sources of emissions [4,5]. In this context, climate change is the greatest challenge for sustainable tourism in the 21st century [6].

Despite growing recognition of the need for sustainable tourism practices, significant vulnerabilities and knowledge gaps remain [7,8].

Therefore, this literature review assesses the vulnerability of the tourism sector to climate change, focusing on cities in Portugal and Brazil. The study is derived from an ongoing research project that aims to contribute to climate change resilience by proposing a local governance agenda for several cities in Brazil, Mozambique, Portugal, and Spain, funded by the Brazilian National Council for Scientific and Technological Development (CNPq).

Research on the impacts of climate change on tourism, particularly in urban areas, still has significant gaps that hinder effective adaptation and mitigation strategies. These gaps

include a lack of comprehensive analyses across different regions, a limited understanding of the impacts of extreme weather events, and a lack of integrated assessments at the destination level [9]. In addition, there is an urgent need for decision-relevant information and tailored climate services [10].

## 2. Materials and Methods

To carry out the study, papers and other scientific works were consulted on the Web of Science, Scopus, and Google Scholar portals, using the keywords “tourism”, “climate change”, “Brazil”, “Portugal”, and their derivations in Portuguese, with the Boolean operator AND, and without restriction on the type of work or period of publication.

## 3. Results and Discussion

The Intergovernmental Panel on Climate Change’s (IPCC) Sixth Assessment Report (AR6) paints a clear and alarming picture, at the 99% confidence level, that human activities have undeniably caused the planet’s temperature to rise, leading to rapid and widespread changes in the atmosphere, oceans, ice sheets, and living systems [11].

Portugal is expected to experience a decline in tourism due to rising temperatures, making it one of the European countries with the greatest decline in tourism over the coming decades (third place), with a 5% decline in coastal regions [12].

The implementation of structural measures and effective collaborative planning for urban tourism adaptation to climate change by 2050 is essential, with the need for government and community guidance in defining adaptation proposals, especially in key areas for sustainable practices: energy-focused hotel solutions, green infrastructure development, and stakeholder network participation [13]. In addition, another important action is the ability to map risk areas, with an example of a methodology capable of assessing outdoor thermal comfort in the tourist city of Porto—Portugal [14]. Other major cities in Portugal are suffering from the worsening of extreme phenomena, such as heatwaves, which are becoming more frequent and intense (Figure 1A), or with flooding and waterlogging, affecting the city of Lisbon (Figure 1B).

Despite the studies presented for urban areas with higher temperatures exacerbated by Urban Heat Island (UHI), the literature reviewed indicates that sun and beach tourism in Portugal is particularly vulnerable to climate change [2,6–16], and this is also a major concern in the case of Brazil, where 69% of national and international tourist flows are directed to coastal regions [17–19].

The Brazilian cities with the highest tourist demand (e.g., Rio de Janeiro, Salvador, Recife, Natal, Florianópolis, and Balneário Camboriú) face aggravated challenges due to the greater frequency and intensity of extreme precipitation events that cause sudden sea inundations, floods, and landslides [17–20], as illustrated in Figure 1C.



Figure 1. Cont.



**Figure 1.** Some evidence of climate change in tourism sector in Portugal and Brazil. (A) Heat waves during the summer in Lisbon—Tower of Belém. Source: CNN Portugal (2024) [21]. (B) Flooding in a central area illustrates the risks of climate change. Source: A Mensagem (2022) [22]. (C) Waves invade the shore of Rio de Janeiro (RJ)/Brazil) during a sea rebound on 6 November 2023. Source: O Globo (2023) [23]. (D) Porto Alegre Airport (RS/Brazil) closed after the flooding of Lake Guaíba in May 2024. Source: CNN [24].

In general, in both the Portuguese and Brazilian cases, adverse climatic events can cause disruptions and closures of roads and airports, delaying or interrupting travel [2,3] and affecting infrastructure, facilities, destinations, and services for tourists [5,20,25–29]. In addition, heat waves and droughts are becoming more frequent and intense, causing thermal discomfort and water shortages for residents and tourists [3,5,18,28].

#### 4. Conclusions

Since climate change is no longer a future scenario, but a daily reality on a global scale, adaptation and mitigation strategies are urgently needed to protect local populations and the tourism sector. Some measures have been implemented in European cities, such as the strategy of adaptive architecture and climate refuges for tourists, already implemented in Porto [21], and with the prospect of being adopted in Lisbon. However, mitigation and adaptation actions and measures are still in the early stages of development in Brazil, especially those that consider the tourism sector, activities, and destinations.

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