

Advances in Spatial Science

Paula Remoaldo · Hélder Lopes ·
Vítor Ribeiro · Juliana Alves *Editors*

Tourism and Climate Change in the 21st Century

Challenges and Solutions

 Springer

Advances in Spatial Science

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Preface

Knowledge of the effects of climate change on tourism and the effectiveness of the sector's adaptation to climate change continues to be inadequate and lags behind other economic sectors that have a long tradition of academic development, government involvement and business participation. This is a concern considering the tourist industry's continuous rapid growth on a global scale and its importance in many national economies. In the context of rapid changes, many issues are still on the real agenda, even in the light of the social, economic and environmental research interests in the field that underpins tourism and climate change. This book emphasises the need for more in-depth knowledge, the lack of contact among stakeholders and the resource constraints, particularly with regard to the implementation of the new stage of tourism (new segments and interests).

Among the eight chapters, the authors' contributions try to update research on the identified lack of research. It focuses on the tourism adaptation, mitigation and resilience to climate change. Managing water resources in tourist areas, the circular economy, mobility and transportation, the psychological effects of weather and climate on leisure activities and theoretical aspects of adaptation, mitigation and resilience in tourism are the authors' main concerns.

The goal of the book is to highlight the research between tourism and climate change across various dimensions to:

- (i) discuss some of the basic ideas and concepts;
- (ii) find solutions and good practices to the main present and future challenges;
- (iii) use new geo-technological approaches to measure and simplify planning strategies;
- (iv) provide insights for better communication;
- (v) contribute to a more effective role of citizen science and stakeholders' engagement.

Within this framework, the book is a collection of scholarly articles that explore the complex relationships between climate change and tourism, examining the major obstacles and their effects. Nowadays, researchers highlight that the tourism industry

is acutely sensitive to climatic alterations. Additionally, they clarify how these inter-related dynamics can have a significant impact on the industry, affecting travel destinations, seasonal trends and traveller experiences in general. The studies emphasise how urgent it is to take more drastic action right now to address the many threats that climate change poses to both human health and the travel and tourism sector.

The first three chapters of the book focus on the theoretical background. Chapter 1 explores the complex relationship between tourism and climate change, highlighting the significant impact of anthropogenic climate change on tourism activities worldwide. It highlights the vulnerability of different geographical regions to climate change, exploring how coastal areas, mountainous regions, urban centres, tropical islands, desert destinations and historic cities are affected differently. The chapter also emphasises the critical role of geo technologies in tourism studies, highlighting their contribution to understanding spatial patterns, assessing climate change impacts, facilitating adaptive spatial planning and promoting sustainable tourism development. It also addresses the psychological impacts of climate change, highlighting the importance of addressing mental health concerns in the face of climate-related challenges.

Alexandra Esteves and Isabel Amaral describe in Chap. 2 a qualitative study entitled “Challenges and Crossroads Towards Sustainability-Oriented Tourism Facing Humanity and Its Relationship with Nature Throughout Contemporary History”. It introduces the reader to the main effects of pandemics and climate change on human mobility, tourism and leisure activities, underlining the lack of global understanding of mankind’s responsibility to protect Nature. It is an issue that has only rarely been addressed in analysis of tourism activity. Tourism is very sensible to the spread of contagious diseases, affecting economic development. The authors analyse Bubonic Plague, Cholera, Yellow Fever, Malaria, Ebola, SARS, MERS and COVID-19, as well as the impact of tourism on zoonoses and climate change, due to tourists’ lifestyles and consumption patterns. It is assumed that sustainable tourism practices can help reduce the spread of several diseases, by fostering responsible tourist behaviour, reducing the carbon footprint and promoting a more sustainable future. Given the complexity of this relationship (zoonoses, climate change and tourism), the authors suggest that a holistic approach is needed, and in the wake of the COVID-19 pandemic, we must rethink the future.

Chapter 3 is grounded on empirical studies and begins with a more diversified analysis. It is entitled as “A Scientific-Metric Analysis of Urban Tourism and Climate Change—An Investigation Based on Web of Science and Scopus”. It explores the intersections between urban tourism and climate change, highlighting the relevance of the literature review to foster new approaches. The COVID-19 pandemic disrupted the tourism sector’s growth, which emphasises the need for climate adaptation strategies. Despite the sector’s importance, research on the effects of climate change on tourism behind that of other industries. The chapter analyses the limited focus on urban areas within this context and emphasises the absence of a literature review specific to urban tourism. It cites previous studies that have identified challenges, such as under-studied cities, measuring climate effects and raising awareness within

tourism communities. The increasing importance of climate and weather conditions in tourism decision-making is discussed, with studies showing that extreme weather events can significantly impact travel choices given that the findings of the Intergovernmental Panel on Climate Change (IPCC) indicate that stakeholders must prepare for drastic climate changes. The chapter mentions the usual approaches to, and relevance of, using citizen science and collaborative methods.

Taking into consideration Chap. 4, it was produced by Carmen Minguez and Sandra Ricart and is entitled “Is the Tourism Perspective Envisaged in Climate Change Adaptation Planning? Evaluating the Road Map of Political, Social, and Environmental Dimension in Spanish Destinations”. It provides a thought-provoking exploration of the crucial intersection between tourism and climate change in Spain. Their insightful analysis scrutinises the Spanish National Plan for Adaptation to Climate Change 2021–2030 (PNACC) and local climate adaptation strategies, focusing on measures designed to bolster the adaptive capacity of the tourism industry. The authors pose pertinent research questions, guiding us through this intricate landscape: What actions are advocated within the PNACC, as well as local strategies, to address the challenges posed by climate change? Does the nature of a tourist destination influence the design and prioritisation of these actions? How do public and private entities work together in reducing the tourism industry’s vulnerability to the impacts of climate change? The chapter takes us on a journey, evaluating Spain’s top-ten tourist cities, employing a triple-loop approach that traverses the political, social and environmental dimensions of climate change adaptation. It also scrutinises policy coherence standards, in order to reveal critical insights.

Chapter 5 “Climate Change Acknowledgement and Adaptation and Mitigation Responses in Rural Tourism Destinations”, by M. Belén Gómez-Martín, Xosé A. Armesto-López, Martí Cors-Iglesias and Emilio Martínez-Ibarra, offers a captivating exploration of the intricate relationship between rural tourism and climate change. Their research analyses the perceptions, responses and challenges faced by key stakeholders in Catalonia (Spain), shedding light on the profound impacts of climate change on this vital sector. The authors employ a meticulous mixed methodology, blending quantitative and qualitative approaches, to unearth the perceptions of climate change risk among these stakeholders. Their study offers a comprehensive understanding of how climate change is affecting rural tourism businesses and the strategies being employed for adaptation and mitigation. We discover the awareness and concern among stakeholders about climate change, its origins and consequences. This heightened awareness is not purely academic; it has practical implications for the preservation of local landscapes and the productive activities that they sustain. Intriguingly, the research unveils disparities in perceptions and responses between the stakeholders who are directly involved in the primary sector of the economy and those who are not. This divergence reflects the intricate interplay between risk perception and the sociocultural and economic contexts within which individuals operate.

In Chap. 6, “Regional Resilience and Dependence on Tourism in a Changing Climate”, André Samora-Arvela, Patrícia Pinto, Thomas Panagopoulos, Eric Vaz, Jorge Ferreira, Helena Pina and Diogo Pinto focus on the loss of beach area in the

Algarve region due to rising sea levels. They indicate that the main expected impacts of climate change are increased temperatures, thermal comfort for outdoor activities, wildfires, floods, flash floods and reduction in water availability. To compensate these ongoing problems and to avoid significant economic losses, the authors defend a diversification strategy based on sustainable tourism, supported by nature-based, cultural and creative tourism. The strategic guidelines presented are supported by a methodology based on a survey of residents and tourists and a Delphi survey. The authors recognise that the purposed tourist diversification will contribute to the regional resilience of the Algarve region and fulfil the 17 Sustainable Development Goals.

Chapter 7 is also concerned with territories in the Iberian Peninsula, particularly with the Alicante region, that borders the Mediterranean. This chapter “Climate Change and Tourism in Spain. The Case of the Canary Islands and the Costa Blanca (Alicante): Comparative Analysis” is produced by Pedro Dorta Antequera, Esther Sánchez-Almodóvar, Abel López-Díez, Jaime Díez-Pacheco and Jorge Olcina-Cantos. The authors analyse two leading tourism destinations: the Canary Islands and the Costa Blanca (Alicante) adopt a scalar approach to understand the importance of tourism activity in Spain. It analyses the relationship between climate change and tourism in Spain based on a review of the most recent specialised literature on tourism, climate change and climate risks and statistical data from secondary sources, particularly from the European Commission, European Parliament and, at a national level, from the Spanish State Meteorological Agency (AEMET). They highlight the need to increase adaptation policies, based on a clear acceleration of the effects of climate change over the coming decades.

Concerning Chap. 8, “Coastal Tourism Adaptation to Climate Change in Brazil: Practices and Alternative Solutions”, deals with the impacts of climate change on coastal tourism. Isabel Jurema Grimm introduces adaptation practices and solutions addressing the primary current and future challenges related to the impacts of extreme weather events on coastal tourism in Brazil. The Brazilian coast’s vulnerability to climate change-induced impacts necessitates proactive and adaptive solutions to safeguard its economic and environmental assets and which will foster practices to mitigate the adverse effects of climate change on these coastal areas. Coastal tourism, among the sectors susceptible to climate change, faces the increased occurrence of intense heatwaves, coupled with decreased beach accessibility, due to rising sea levels. This will alter the recreational experience at destinations, impacting tourist demand and spending. The author used qualitative research methods, including bibliographical and documental research, with data collected from CAPES Portal and Google Scholar. Complementary documents from Balneário Camboriú were consulted. Institutional websites and news reports were also reviewed.

Chapter 9, “A Debate on Turkey Tourism’s Adaptation to Climate Change”, presents a debate on the Turkish tourism sector’s adaptation to climate change. It provides some key information about each of the seven official geographical regions while providing recommendations (with 4 of these regions being coastal and the remaining 3 exhibiting varying degrees of continental climate characteristics). The authors, Gamze Coban Yildiz and Onur Sevket Yildiz, propose both local

and general strategies for adaptation and mitigation. The chapter relies on secondary data, encompassing relevant literature, tourism development data and meteorological measurements and projections, to analyse the relationship between climate change and tourism. The authors provide a comprehensive analysis that considers the diversity of Turkey's geographical regions, with in-depth examination of each region, encompassing an overview of their climate characteristics and tourism activities. The analysis then delves into the implications and offers recommendations for adapting to, or mitigating the risks of, climate change. These recommendations are developed considering climate projections and their specific relevance to the tourism industry. The authors believe that the results and recommendations developed in this study may provide a starting point both for practitioners and researchers.

Finally, Chap. 10, "Conservation-Based Tourism Development, Climate Change, Inclusion of Locals, and Post-human-Wildlife Co-existence Conflicts: A Case Study of Gonarezhou National Park", Zimbabwe, by Tawanda Makuyana, Regina Makoni and Serena Lucrezi, analyses a crucial, yet rarely studied, relationship. It is necessary to develop more in-depth analysis of conservation-based tourism development, climate change, local inclusion and post-human-wildlife co-existence conflicts in African Trans-frontier Conservation Areas. Using a qualitative approach, the chapter describes the symbiotic relationship between the effects of climate change and the communities impacted by such effects. The increase of population in territories located near national parks has led to humans encroaching on wildlife habitats, increasing conflicts of human-wildlife co-existence. On the other hand, it is assumed that ongoing conservation-based tourism development initiatives tend to primarily involve elite communities. This chapter identifies gaps and can make a relevant contribution to induce policymakers and managers of organisations concerned with wildlife, tourism and communities around protected areas incorporating new policies in their planning.

This book must be viewed as a forum of discussion of a scientific perspective, but also of crucial social and environmental issues. Its contribution can have an impact on several scientific fields, such as tourism studies, tourism geography, environmental studies, entrepreneurship, sociology, economic growth and regional and local development. It uses different research approaches and techniques to analyse several challenges and scenarios induced by climate change in several countries.

Guimarães, Portugal

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Chapter 1

An Introduction to Spatial and Territorial Dimensions of Tourism and Climate Change



Hélder Lopes, Paula Remoaldo, Vítor Ribeiro, and Juliana A. Alves

Abstract This introductory chapter assesses the complex relationship between tourism and climate change, focusing on the spatial and territorial dimensions. It discusses the vulnerability of tourism destinations to climate impacts in different geographical areas, highlighting the role of geotechnologies in tourism studies. It also explores sustainable tourism development to address spatial inequalities and mitigate climate-related risks, while highlighting the psychological impacts of climate change on individuals' mental health. Key findings underscore the importance of interdisciplinary approaches to trying to understand and address the complex challenges posed by climate change in the tourism sector.

Keywords Tourism · Climate change · Geotechnologies · Sustainable development · Mental health

The findings of the Intergovernmental Panel on Climate Change (IPCC) reveal that anthropogenic climate change stands out as the predominant catalyst for alarming and far-reaching disturbances within the natural world (IPCC, 2023). This phenomenon is markedly affecting the lives of billions of persons across the globe, despite ongoing

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efforts to mitigate these risks. Moreover, the repercussions of climate change are casting detrimental effects on tourism activity, presenting a growing threat to our general capacity of fruition of destinations (Silva Lopes et al., 2021).

At present, the world is grappling with substantial climate-induced perils forecasted for the forthcoming decades, as global warming teeters on the brink of surpassing the critical 1.5 °C threshold (McKay et al., 2022). Even transiently exceeding this limit is poised to unleash further serious ramifications, some of which might prove to be irreversible. Given this scenario, there exists a recognized need for literature that can enhance the understanding of the intricate interplay between climate change and tourism, while also spotlighting the pivotal role played by hazards within this complex framework (e.g., Loehr & Becken, 2021; Scott et al., 2012; Silva Lopes et al., 2021; Silva Lopes et al., 2021).

Considering the relationship between environment and climate, tourism is considered a very vulnerable economic sector. It is also highly sensitive to the climate, similar to agriculture, the insurance industry, energy, and transport sectors. Tourism contributes significantly to greenhouse gas (GHG) emissions growth, particularly produced by transport, accommodation, and activities. Indeed, several subjects can be associated to tourism studies. One can highlight the climate change vulnerability and spatial footprint, the contribution of geotechnologies, the sustainability, and the psychological effects associated to Tourism.

The main objectives of this brief chapter are to undertake a critical analysis on the global climate vulnerability (highlighting different geographies worldwide) and the psychological effects of the climate crisis and also to confirm the contribution of geotechnologies to a more holistic approach in tourism research.

The chapter is structured as follows: after the introduction, we deal with the global tourism and vulnerability to climate impacts. In the second section, we present the contribution of geotechnologies in tourism studies and some examples of how geotechnologies can enhance tourism product development in a more sustainable way. Some aspects of sustainable tourism's role, especially the relevance of the local community in decision-making, are present in the third section. Finally, we present a recent discussion and still little treated within the tourism studies: the impacts of climate change on mental health, ending up asking ourselves: can climate change also affect tourist behavior?

The Spatial Footprint of Tourism: Climate Change Vulnerability in Different Geographies

The global distribution of tourist destinations and the spatial extent of the tourism industry have evolved significantly in recent years, with tourism spreading across the globe (Seyfi et al., 2022). The significance of tourism is underscored by recent data from the UNWTO, revealing that international arrivals reached 80% of pre-pandemic levels in the first quarter of 2023. An estimated 235 million tourists embarked on international journeys during the initial three months, surpassing the figures from the same period in 2022 by more than double (UNWTO, 2023). This remarkable recovery in international tourism highlights its resilience and its critical role in global economies as a driver of growth and employment. Popular tourist regions such as Europe, Asia,

and North America continue to attract millions of visitors, while emerging destinations in Africa, Latin America, and the Middle East are gaining prominence (Scott & Gössling, 2022; Scott et al., 2019).

Different regions experience varying levels of tourist influx and environmental impact due to their unique spatial characteristics. Accessibility, cultural attractions, and natural beauty significantly influence a region's popularity among tourists (Kim & Brown, 2012). Coastal areas are vulnerable to climate change, facing threats like rising sea levels, storm surges, and hurricanes (IPCC, 2023). Mountain regions are impacted by changes in snowfall and glacial melt, affecting winter sports tourism and freshwater resources (Scott et al., 2019). Urban centers, including major cities, deal with climate vulnerabilities such as heatwaves, air pollution, and extreme weather events (Romero-Lankao & Dodman, 2011). Tropical islands like the Maldives and the Caribbean depend heavily on tourism but face threats from rising sea levels and extreme weather events (Scott et al., 2019). Desert destinations like Dubai confront water scarcity and heat-related challenges, necessitating innovative solutions (Kelbaugh, 2019). Historic cities like Venice must balance cultural preservation with tourism industry needs (Sesana et al., 2019). The carbon footprint of tourism, driven by travel patterns and accommodations, plays a pivotal role in environmental impact (McKercher et al., 2010; Pereira et al., 2019). Efforts to reduce emissions include advancements in aircraft technology and sustainable aviation fuels (Pereira et al., 2019).

The future aligns climate change vulnerability with expected tourism growth, particularly in Sub-Saharan Africa and South Asia, two highly vulnerable sub-regions (Scott et al., 2019). Limitations exist in current indices assessing vulnerability, with variations across different assessments (Scott et al., 2019; Silva Lopes et al., 2021) (Fig. 1.1).

Contribution of Geotechnologies in Tourism Studies

Tourism is very dependent of spatial characteristics due to highly mobility-driven and pattern identification. Consequently, spatial analysis is very important to measure, monitor, model, predict, and map it toward a more realistic spatial planning to achieve more competitive tourist destinations. Geotechnologies have become the main geospatial tools, extensively used in tourism, to produce spatial analysis (Bahaire and Elliott-White, 1999; Ribeiro, 2022). Also the geotechnologies can contribute to implement the 4-Ws approach answer the 4 categories: What, Where, Who, and Why (Yang et al., 2023). Geotechnologies is a set of tools, data, and methods that include Geographic Information Systems (GIS), remote sensing, web mapping, and GPS/GNNS (Ribeiro, 2022; Ribeiro et al., 2018, 2020; Kerski, 2015).

The collaboration between academics and organizations like the Global Sustainable Tourism Dashboard can enhance tracking of climate change vulnerability (<https://www.tourismdashboard.org/explore-the-data/>). Research should expand to include underrepresented areas, particularly those affected by climate change, health issues, or wildfires (Silva Lopes et al., 2021, 2022). Embracing geospatial technologies in tourism studies, such as GIS, remote sensing, and web mapping can be particularly relevant for tourism planning and impact assessment. One can use



Fig. 1.1 Global tourism and vulnerability to climate impacts. *Source* Own elaboration, based on IPCC (1990, 1995, 2001, 2007, 2013) and Scott et al. (2016a, b)

geotechnologies to enhance tourism product development in a more sustainable way, such as;

1. *Tourism Accessibility and Tourist Spatial Patterns*

- Overview spatial distribution of tourist origin-destinations and the spatial extent of the tourism industry.
- Analyze territory degree of tourist influx and environmental impact due to their spatial characteristics.
- Explore how diverse geographical contexts, such as coastal areas, mountain regions, and urban centers, contribute to spatial vulnerability to climate change impacts.
- Examine case studies highlighting the unique challenges faced by different types of tourist destinations.
- Explore the carbon footprint associated to tourists' travel patterns.
- Analyze how transportation modes and accommodation choices impact the environmental.

2. *Spatial Analysis of Climate Change Effects on Tourism*

- Introduction to spatial analysis techniques used to assess the impacts of climate change on tourist destinations.
- Discussion on how geotechnologies, particularly Geographic Information System (GIS) and remote sensing, aid in understanding shifts in climate patterns and their implications for tourism.

3. *Adaptive Spatial Planning for Climate-Resilient Tourism—Strategies, Zoning, and Policies*

- Examination of the role of spatial planning in building resilient tourist destinations against climate change effects.
- Presentation of strategies such as zoning, land use planning, and disaster risk reduction to enhance destination sustainability.
- Identify new sustainable tourist products.
- Model and create scenarios.

4. *Sustainable Tourism Development*

- Analysis of how sustainable tourism development can address spatial inequalities and contribute to more equitable distribution of economic benefits.
- Consideration of ways to involve local communities in decision-making processes to ensure spatially inclusive development.
- Identify spatial inequalities.
- Promote a tourism more accessible for all.
- Tourism marketing and traveler's experience enhancement using emergent geospatial technologies.

Effectively, the use of geotechnologies in tourism creates numerous potentials for both enterprises and their customers. It enables, for example, the use of up-to-date information for tourist and planners, reduces costs, contributes to create more sustainable communities and territories, and also enhances deliverable services. It can contribute to improve both demand and supply sides.

The Sustainable Tourism's Role

As the global community grapples with the far-reaching impacts of climate change, it becomes increasingly imperative to address not only environmental concerns but also the socioeconomic disparities that often accompany these changes. Sustainable tourism development emerges as a potent instrument for mitigating spatial inequalities and fostering a more equitable distribution of economic benefits in the context of climate change.

In regions prone to the adverse effects of climate change, such as extreme weather events or rising sea levels, tourism that is prepared for these challenges can offer economic stability. By actively engaging in climate adaptation measures, local communities can reduce vulnerabilities, ensuring that tourism remains a viable economic option for years to come. The solution to mitigate the impacts of climate change and tourism-related emissions lies in collaborations between visitors and local communities and between them and other relevant private and public stakeholders, to create strategies for moving away from the still prevailing mass tourism and embracing sustainable tourism models. The countries need to develop measures in order to build a more resilient tourism economy post COVID-19 and that can answer positively to present and future climate changes challenges (OECD, 2020).

Sustainable tourism encourages the exploration of new and less-visited areas. As climate-related factors impact the attractiveness and accessibility of certain destinations, sustainable practices can promote diversification and dispersion. This approach prevents the concentration of tourists in a few locations, thereby distributing economic benefits across a broader geographical spectrum. The sector urgently needs a tourism policy that allows for a more balanced cooperation between countries and high and low-density territories (intraregional scale), exchange of good practices and that is prepared to mitigate the massified tourism and extreme events related to climate change.

Sustainable tourism's emphasis on community involvement and empowerment plays a pivotal role in addressing spatial inequalities. Local communities often bear the brunt of climate change impacts. By involving them in decision-making, profit-sharing, and adaptation planning, sustainable tourism ensures that these communities participate in and benefit from the industry's growth. This inclusivity can be a potent driver of equity, especially in regions disproportionately affected by climate change.

As climate change poses threats to ecosystems and biodiversity, sustainable tourism highlights the importance of environmental conservation. Tourists seeking nature-based experiences often show greater interest in regions committed to preserving their natural beauty. This creates an incentive for local communities to engage in sustainable practices and ecosystem protection, leading to both environmental and economic benefits that are equitably distributed.

Psychological Effects

The latest document from the World Health Organization (WHO), presented at the Stockholm + 50 Conference, states that the climate crisis amplifies numerous social and environmental risk factors, resulting in psychosocial impacts that can lead individuals to emotional distress, the development of new mental health conditions, and exacerbation of existing conditions (World Health Organization, 2022).

It is not surprising that rising ambient temperatures are associated with increased rates of aggression and violent suicides, while prolonged droughts can elevate suicide rates among farmers and negatively affect mental health, leading to higher levels of stress. Experiencing climate disasters can also intensify post-traumatic stress disorder, adaptive disorders, and depression (Padhy et al., 2015). Furthermore, climate change and global warming can lead to population migrations, potentially causing acculturation stress and contributing to the rise of physical health issues related to psychological stress (Padhy et al., 2015). Among the lesser-known and often marginalized effects of climate change are feelings of helplessness, fear, and sadness; suicidal behavior; the use of alcohol and illicit substances; mental health conditions (e.g., anxiety and depression); and emerging concepts (e.g., eco-anxiety and solastalgia—Cianconi et al., 2020; World Health Organization, 2022).

Therefore, climate change has significant implications for mental health and impacts on social, economic, and environmental aspects, with more severe consequences for disadvantaged populations. Similarly, a full understanding of the social and environmental challenges posed by climate change can lead to emotional stress and anxiety (Fritze et al., 2008).

Recognizing the importance of global intervention, in policies with both immediate and long-term impacts, the science community cannot abstain from developing strategies and programs to address issues related to individuals' psychological health.

A study conducted in China, analyzing 400 million posts on the Weibo social network, yielded important insights into the impacts of climate change on mental health. The authors concluded that extreme weather conditions worsened emotional expressions and that global warming could have highly detrimental effects on individuals' well-being in the future (Wang et al., 2020).

As a result, in order to develop strategies to mitigate the aforementioned issues and the subsequent necessary adaptations, it is essential to understand how the impacts of climate change alter individual well-being from a multidisciplinary perspective. Nevertheless, these day-to-day impacts are still relatively poorly understood, particularly in the field of Social Sciences.

Conclusions

Climate change still be an up-to-date and policy concern subject. Among other things, the tourism industry has been identified as a key contributor to climate change. This is due since tourist movement and territory consumption heart of the tourist activity. It is affected both from the supply and demand sides. It will affect the global tourism footprint and the sustainable communities and territories. Here geotechnologies can contribute to obtain a more realistic picture of the patterns and create scenarios to get more sustainable policies and decisions. Take into account all potential of geotechnologies one can reach a more sustainable touristic activity. Also, with the relevance of global intervention in adaptation and mitigation policies, the scientific community cannot avoid adopting strategies and initiatives to address concerns concerning individuals' psychological health to mitigate emotional stress and anxiety.

References

- Armstrong McKay, D. I., Staal, A., Abrams, J. F., Winkelmann, R., Sakschewski, B., Loriani, S., ... & Lenton, T. M. (2022). Exceeding 1.5 C global warming could trigger multiple climate tipping points. *Science*, 377(6611), eabn7950.
- Bahaire, T., & Elliott-White, M. (1999). The application of geographical information systems (GIS) in sustainable tourism planning: A review. *Journal of Sustainable Tourism*, 7(2), 159–174.

- Cianconi, P., Betrò, S., & Janiri, L. (2020). The impact of climate change on mental health: A systematic descriptive review. *Frontiers in Psychiatry*, 11(74), 1–15. <https://doi.org/10.3389/fpsyt.2020.00074>
- Fritze, J. G., Blashki, G. A., Burke, S., & Wiseman, J. (2008). Hope, despair and transformation: Climate change and the promotion of mental health and wellbeing. *International Journal of Mental Health Systems*, 2, 1–10. <https://doi.org/10.1186/1752-4458-2-13>
- IPCC. (1990). *Climate Change—the IPCC [Intergovernmental Panel on Climate Change] Scientific Assessment*. Cambridge University Press.
- IPCC. (1995). Climate Change 1995: The science of climate change. In: Houghton, J.T., Meira Filho, L.G., Callander, B.A., Harris, N., Kattenberg, A., Maskell, K. (Eds.), *Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.
- IPCC. (2011). *IPCC special report on renewable energy sources and climate change mitigation*. In O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P. Eickemeier, G. Hansen, S. Schlömer, & C. von Stechow (Eds.). Cambridge University Press.
- IPCC. (2023). Summary for Policymakers. In *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, H. Lee, & J. Romero (Eds.)] (pp. 1–34). IPCC. <https://doi.org/10.59327/IPCC/AR6-9789291691647.00>
- Kelbaugh, D. (2019). *The urban fix: Resilient cities in the war against climate change, heat islands and overpopulation*. Routledge.
- Kerski, J. J. (2015). Geo-awareness, geo-enablement, geotechnologies, citizen science, and storytelling: Geography on the world stage. *Geography Compass*, 9(1), 14–26.
- Kim, A. K., & Brown, G. (2012). Understanding the relationships between perceived travel experiences, overall satisfaction, and destination loyalty. *Anatolia*, 23(3), 328–347.
- Loehr, J., & Becken, S. (2021). The tourism climate change knowledge system. *Annals of Tourism Research*, 86, 103073.
- McKercher, B., Prideaux, B., Cheung, C., & Law, R. (2010). Achieving voluntary reductions in the carbon footprint of tourism and climate change. *Journal of Sustainable Tourism*, 18(3), 297–317.
- OECD. (2020). *OECD policy responses to Coronavirus (COVID-19). Rebuilding tourism for the future: COVID-19 policy responses and recovery*. Available at <http://www.oecd.org/coronavirus/policy-responses/rebuilding-tourism-for-the-future-covid-19-policy-responses-and-recovery-bced9859/>.
- Padhy, S. K., Sarkar, S., Panigrahi, M., & Paul, S. (2015). Mental health effects of climate change. *Indian Journal of Occupational & Environmental Medicine*, 19(1), 3–7. <https://doi.org/10.4103/0019-5278.156997>
- Pereira, R. P. T., Filimonau, V., & Ribeiro, G. M. (2019). Score a goal for climate: Assessing the carbon footprint of travel patterns of the English Premier League clubs. *Journal of Cleaner Production*, 227, 167–177.
- Romero-Lankao, P., & Dodman, D. (2011). Cities in transition: Transforming urban centers from hotbeds of GHG emissions and vulnerability to seedbeds of sustainability and resilience: Introduction and Editorial overview. *Current Opinion in Environmental Sustainability*, 3(3), 113–120.
- Ribeiro, V. (2022). Methods and techniques in creative tourism: Why technologies are so relevant to achieve creativity?. In Remoaldo, P., Alves, J., & Ribeiro, V. (Ed.) *Creative tourism and sustainable territories*. Emerald Publishing Limited, Leeds, pp. 179–222. <https://doi.org/10.1108/978-1-80262-681-020221011>
- Ribeiro, V., Remoaldo, P., Matos, O., Freitas, I., Gôja, R., & Pereira, M. (2018). New approaches in Tourism: Web mapping technologies to enhance visitors' participation. In *Participatory culture and new challenges for tourism: Responses to the challenges of mass cultural tourism*, Barcelona, Spain.

- Ribeiro, V., Remoaldo, P., Pereira, M., Gôja, R., Matos, O., Freitas, I., & Alves, J. (2020). Geo-crowdsourcing contributions for cultural mapping. *Journal of Information Science Theory and Practice*, 8(1), 56–67.
- Scott, D., & Gössling, S. (2022). A review of research into tourism and climate change—Launching the annals of tourism research curated collection on tourism and climate change. *Annals of Tourism Research*, 95, 103409.
- Scott, D., Gössling, S., & Hall, C. M. (2012). International tourism and climate change. *Wiley Interdisciplinary Reviews: Climate Change*, 3(3), 213–232.
- Scott, D., Hall, C. M., & Gössling, S. (2019). Global tourism vulnerability to climate change. *Annals of Tourism Research*, 77, 49–61.
- Scott, D., Hall, C. M., & Gössling, S. (2016a). A review of the IPCC fifth assessment and implications for tourism sector climate resilience and decarbonization. *Journal of Sustainable Tourism*, 24(1), 8–30.
- Scott, D., Hall, C. M., & Gössling, S. (2016b). A report on the Paris climate change agreement and its implications for tourism: Why we will always have Paris. *Journal of Sustainable Tourism*, 24(7), 933–948.
- Sesana, E., Gagnon, A. S., Bertolin, C., & Hughes, J. (2018). Adapting cultural heritage to climate change risks: Perspectives of cultural heritage experts in Europe. *Geosciences*, 8(8), 305.
- Sesana, E., Bertolin, C., Gagnon, A. S., & Hughes, J. J. (2019). Mitigating climate change in the cultural built heritage sector. *Climate*, 7(7), 90.
- Seyfi, S., Hall, C. M., & Saarinen, J. (2022). Rethinking sustainable substitution between domestic and international tourism: A policy thought experiment. *Journal of Policy Research in Tourism, Leisure and Events*, 1–15.
- Silva Lopes, H., Remoaldo, P. C. A., Silva, M., Ribeiro, V., & Vide, J. M. (2021). Climate in tourism's research agenda: Future directions based on literature review. *Boletín de la Asociación de Geógrafos Españoles*, (90), 8. <https://doi.org/10.21138/bage.3116>
- Silva Lopes, H., Remoaldo, P. C., Ribeiro, V., & Martin-Vide, J. (2022). Pathways for adapting tourism to climate change in an urban destination—Evidences based on thermal conditions for the Porto Metropolitan Area (Portugal). *Journal of Environmental Management*, 315, 115161.
- UNWTO. (2023). Tourism on track for full recovery as new data shows strong start to 2023. <https://www.unwto.org/news/tourism-on-track-for-full-recovery-as-new-data-shows-strong-start-to-2023>. Available in September 10, 2023.
- Wang, J., Obradovich, N., & Zheng, S. (2020). A 43-million-person investigation into weather and expressed sentiment in a changing climate. *One Earth*, 2(6), 568–577. <https://doi.org/10.1016/j.oneear.2020.05.016>
- World Health Organization. (2022). Mental health and climate change: Policy brief. World Health Organization. <https://www.who.int/publications/i/item/9789240045125>
- Yang, T. T., Ruan, W. Q., Li, Y. Q., & Zhang, S. N. (2023). Virtual tourist motivation: the differences between virtual tourism and on-site tourism. *Tourism Review*, 78(5), 1280–1297.

Chapter 2

Challenges and Crossroads Towards Sustainability-Oriented Tourism Facing Humanity and Its Relationship with Nature Throughout Contemporary History



Alexandra Esteves and Isabel Amaral

Abstract The relationship between human beings and Nature has been marked, especially since the Industrial Revolution, by a growing imbalance, which translates, amongst other manifestations, into the destruction and unbridled consumption of resources, which have led to the disappearance of large patches of forest and habitats essential for the survival of many animal and plant species, and, at the same time, for the development of other biomes harmful to the survival of human societies. The successive intervention of human beings on ecosystems has potentiated the emergence of zoonoses of epidemic and pandemic dimensions, and History shows how the occurrence of these impacts has been increasingly frequent and how urgent it is to reflect on the unruly attitude of society towards Nature, especially in the context of climate change and Anthropocene discussion. The bubonic plague, cholera, and yellow fever, which were present in the nineteenth century, are clear examples of the effects of globalization on the spread of diseases, thus demonstrating the need for international cooperation to control and struggle against them. In the twentieth century, other examples such as malaria, the Spanish flu, SARS, MERS, and COVID-19, whose consequences we intend to analyse in more depth, translate into a double effect of global lack of responsibility for the protection of Nature. After all, history proves that human action can lead to the emergence and spread of diseases of epidemic proportions that end up affecting the lives of people and societies, at an economic, social and cultural level. Tourism was one of the activities most affected by the COVID-19 pandemic. Born at the end of the seventeenth century, with the

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Grand Tour, tourism has known, throughout its own history, fluctuations dictated by events of a different nature, namely political (e.g. the French Revolution), social, and health. Thus, with this work, having as theoretical basis elements collected in the history of health/disease and in the environmental history, it is intended to reflect on the effects of pandemics and climate change verified with greater incidence in recent years on human mobility, tourism and leisure activities, as well as underlining the importance of the thickness of history in a debate that we consider crucial and urgent to increase public awareness on a global scale.

Keywords Nature · Climate change · Pandemics · Tourism · Environmental history

Introduction

The relationship between human beings and Nature has been marked, especially since the Industrial Revolution, by a growing imbalance, which translates, among other manifestations, into the destruction and unbridled consumption of resources. This has, in turn, led to the disappearance of large patches of forest, and habitats that were essential to the survival of many animal and plant species, and, at the same time, for the development of other biomes that could be harmful to the survival of human societies.

The successive intervention of human beings on ecosystems has potentiated the emergence of zoonoses of epidemic and pandemic dimensions, and History shows how the occurrence of these impacts has been increasingly frequent. Also, how urgent it has become to reflect on the unruly attitude of society towards Nature. The bubonic plague, cholera, and yellow fever, which were present in the nineteenth century, are clear examples of the effects of globalization on the spread of diseases, thus demonstrating the need for international cooperation to control and fight against them. In the last two centuries other examples of diseases such as malaria, the Spanish flu, SARS, MERS and COVID-19, whose consequences we intend to analyse in more depth, have translated into a double effect of the global lack of responsibility in the protection of Nature (Hon, 2013). After all, History proves that human action can lead to the emergence and spread of diseases of epidemic proportions that end up affecting the lives of people and societies, at economic, social, and cultural levels.

Tourism was one of the activities mostly affected by the spread of contagious diseases. Born at the end of the seventeenth century with the Grand Tour, tourism has known, throughout its own history, fluctuations dictated by events of a different nature, namely political (e.g. the French Revolution), social and medical.

In this chapter, we will seek to establish the relationship between Tourism, Human-Nature interaction, and the spread of certain diseases throughout Contemporary History, examining different periods marked by significant epidemics with far-reaching consequences (such as bubonic plague, cholera, yellow fever, malaria, Ebola, SARS, MERS, and COVID-19). We will reflect on the intrusive actions of

humans in nature (Butcher, 2020; Higgins-Desbiolles, 2020) particularly through travel and poorly regulated tourism activities, which have resulted in interference with the animal kingdom and ecosystems, compounded by climate change, and have contributed to the emergence of new pathogens. One of the consequences of this scenario has been human exposure to a range of threats, as witnessed recently, with the potential for new post-COVID epidemic outbreaks. Within this context, we propose to reflect on the role of Tourism in the global sustainability agenda, encompassing concepts such as innovation, resilience, responsibility, and forward-thinking (Butler, 1999).

Through this qualitative study, we aim to reflect on the profound effects of epidemics and climate change that have significantly influenced human mobility, tourism, and leisure activities. Drawing from elements collected from the history of health/disease and environmental history, our analysis encompasses, not only the impacts of and after the COVID-19 pandemic (Gössling et al., 2021), but also those dating back to the nineteenth century. Our goal is to identify solutions that can effectively mitigate these effects and contribute to the development of a healthy and sustainable society and planet, based on a historical perspective.

The chapter comprises four topics. Firstly, we provide a contextualization of the essential relationship between humanity and the environment, starting from the Industrial Revolution. We emphasize the impacts of this interaction between Mankind and Nature. In the second part, we examine the significance of tourism in relation to diseases and the environment. Moving on to the third part, we delve into the historical significance of epidemics and explore how they can serve as examples for envisioning a sustainable future for humanity and the planet, with tourism playing a fundamental role. Finally, we present the main conclusions that enable us to explore the future challenges of tourism within the broader global and planetary agenda. This agenda encompasses the increasing interactions between society, the natural world, and diseases, presenting unexpected challenges that are progressively more difficult to address. Ultimately, the question remains: *quo vadis?*

Mankind and Nature

The relationships and impacts of human action on the environment and the planet have long been known and subjected to reflection across different areas of knowledge (Quammen, 2020). Its interpretation in the field of History has been lesser common, although in recent years there has been a growth in the number of studies in this domain, mainly due to the development of environmental history and, to a lesser extent, the history of health. Our work is included in the latter field and aims to assess how humanity's progress over the course of last two centuries has contributed to a broader discussion in the context of the Anthropocene, in which the ecological footprint and public health challenges are evident. Simultaneously, we will analyse the impacts of these advancements on tourism, considering both positive and negative effects. Also, how tourism has played a role in the emergence of new public

health issues and examine the potential constraints it has imposed on specific development paths due to challenges that may impede the growth of adventure tourism, leisure activities, and overall well-being. In this research, we have employed a qualitative methodology, utilizing document analysis, essays, and reports in the three key domains: history, tourism, and epidemiology/history of public health.

The end of the eighteenth century and the beginning of the following were marked by a set of undeniable progresses that had a significant impact on the quality of life of individuals, especially in the Western world. The Industrial Revolution, led by the development of the steam engine (in England) and the use of hydroelectric energy (in France), had a series of impacts not only on technical and economic aspects, but also on cultural and even civilizational advances. The revolution in both transportation and energy allowed the distances in the world to be shortened, thus triggering a network of interconnected flows of information and services on a global scale. Distances decreased, and human beings came closer together.

The development of the railway, steamship, automobile, airplane, and even the bicycle resulted in significant benefits for human mobility, a fundamental condition for the development of tourism. Tourism has its roots in the late seventeenth century with the Grand Tour, a type of travelling that mainly had pedagogical outcomes and that saw young English people make their way to Southern Europe, especially to Italy, motivated by a fascination with the old ruins of classical civilizations (Black, 2010; Chaney, 2014). However, with the political instability lived in Europe between the end of the eighteenth century and the beginning of the nineteenth century, this type of travel declined. Still in this century, travels to the hubs of “civilization” emerged and included the cities of Paris, London, and Berlin (Crouch, 2005). Along with these journeys, visits to the countryside started to take place, in search of contact with nature. These were highly encouraged by the Romantic Movement, but also by improvements in hygiene and the consequences of industrialization. The mountains gained relevance in the summer and winter times, giving rise to ski resorts in the Pyrenees and the Rhone Valley (Corbin, 2001). Initially, these leisure expeditions had an elitist sense and were only accessible to a minority. However, with the progress of technical solutions, mobility ceased to be a luxury and became a necessity. This way, the evolution of transportation became a reality, and the democratization of mobility started attracting increasingly more people to both thermal and seaside resorts, which filled up in the summer period already in the second half of the nineteenth century (Corbin, 2001). These spaces were sought for their treatment or prevention potential for certain diseases. This paradigm changed in the twentieth century with the rise of new aesthetic standards and the affirmation of the beach as a leisure space, which, in turn, led to the search for specific places with high temperatures and exotic environments. Along with these trips, there were also cultural journeys, where people searched for other civilizations, knowledge of new cultures, and alternative life experiences.

At the end of the nineteenth century and the beginning of the previous century, these practices were still associated with the elites, and the affirmation of the Social State after the First World War (Silva, 2013). The emergence of paid holidays,

especially after 1945, was accompanied by the development of civil aviation that contributed to the affirmation of tourism throughout the twentieth century.

At the beginning of the next millennium, the tourism sector underwent transformations dictated by political, social, cultural, and technological changes. The desire to enjoy different sensations and the assertion of individuality, not necessarily anonymous, led to the need to search for new sensations and differentiating experiences. Thus, journeys to inhospitable and dangerous locations, also known as dark tourism, became current trends (Marton et al., 2020). In this context, humans often venture into the unknown, and around habitats of visible beings that are carriers of invisible beings, and which may put their health at risk. These experiences are rooted on a will to live through dangerous situations that appeal to an individual management of emotions, and the release of adrenaline. How to explain this desire for extreme sensations and conscious exposure to danger? There are several examples from recent history that show global public health crises that originated in this type of adventure tourism, and which marked the end of the twentieth century up to the present day (Bentley & Page, 2001). In recent centuries, the pace of human impact on the environment has accelerated dramatically. Industrialization, urbanization, and globalization have catapulted a rapid depletion of natural resources and an increase in pollution, deforestation, and climate change. However, other new destinations and modes of travel also manifested concerns for outdoor recreation focussed on sustainability and environmental preservation. In this context, ecotourism and adventure tourism are gaining increasing momentum today (Buckley, 2000, 2004).

As we will explore, the widespread adoption of these practices not only poses risks to human health but also results in the destruction of habitats for various living beings and environmental imbalances (Hawkins & Roberts, 1994; Hawkins et al., 1999). These imbalances contribute to climate change, which in turn is responsible for global warming. This pattern of civilizational development has already echoed in the contextual expansion of “exotic” diseases, in what Michael Hall calls, the four transition (Hall, 2006) and in the compromise of idyllic landscapes and tourist destinations. On the other hand, the search for exotic destinations, associated with tropical landscapes, has led to the saturation and, in some cases, to the temporary closure of some locations, which endured the consequences of human invasion, namely through the compromise of the local fauna and flora (Nunes et al., 2020).

Tourism, Diseases, and the Environment

The history of humanity is a history of mobility, not only of people and goods, but also of pathogenic agents and infectious diseases, some of which are responsible for the most devastating epidemic outbreaks affecting both humanity and the environment (McNeil, 1976). It has played a leading role in the recent historiography of the COVID-19 pandemic, when contextualizing the central role of infectious diseases in the evolutionary pattern of human societies throughout history and also including the debate on the ecological impact of biomedical determinants. The author explained

how these have decided the course of some wars, selected colonization territories, and naturally influenced the nature and progress of civilization as a whole (Corbin, 2001).

Human mobility, especially through tourism, can contribute to the spread of infectious diseases due to several factors. These include the heightened exposure to animals that act as carriers of pathogens; the growth of transient populations, including international travellers visiting popular destinations for personal reasons; the potential declines in sanitation and hygiene standards in certain destinations; and the impact of climate change, which can create favourable conditions for the proliferation of disease-causing agents, posing risks to human health.

It is important to recognize and address these factors to mitigate the potential transmission of infectious diseases during travel and tourism activities (Wilson, 1995). Climate change affects human health in various ways, including in its increased exposure to air pollution, heat or cold waves and natural disasters, such as droughts, floods, and fires, as well as adding to the manifestation and/or proliferation of pathogens or their vectors (Ben Clarke et al., 2022).

Nowadays, the speed and reach of travel have come to unprecedented levels. The consequences of travel extend beyond the tourists themselves, who interact with the local population and also their ecosystem. Microbes, animals, and other forms of biological life also accompany them. The current massive movement of humans and materials sets the stage for the mixing of the genetic pool that interacts with biodiversity patterns (Wilson, 1995).

Globalization has been diluting geographical and territorial boundaries and increasing the speed of human mobility, which has led to the global spread of infections. The emergence, re-emergence, or appearance of new diseases mobilizes the economic-political agenda, in which tourism is one of the visible faces. When travelling, each human being carries his/her genetic composition, alongside his/her immunological condition, the sequels of past infections, cultural preferences, habits, and behaviours. This multifactorial condition favours the development or the emergence of infections, which only manifest themselves if they find an environment that is conducive to their expression. Pathogens that survive in the human host and are spread through contact can be easily transported to any part of the world. Diseases such as HIV infection, tuberculosis, measles, whooping cough, diphtheria, and hepatitis B are easily carried by tourists and can spread to a new geographical area (Wilson, 1995). However, populations protected by vaccines can resist their dissemination. Pathogens that have animal hosts, environmental restrictions, arthropod vectors, or complex life cycles become increasingly difficult to take to another geographical or populational area. Examples of the latter are the epidemics of dengue and yellow fever, which cannot manifest in all the regions that tourists travel to. But with climate changes all could change (Wilson, 1995). Dengue fever is one of the diseases that the World Health Organisation considers to be a threat for the upcoming summer of 2023, placing Portugal (with an only outbreak known in 2012) as one of the countries under epidemiological surveillance. On the 19th of April, 2023, Filomeno Fortes, director of the Institute of Hygiene and Tropical Medicine of Lisbon, commented: “These are real reasons for concern. They are not new. We have been warning Europe

for some time now about climate change. And not only that. Although the articles that are coming out are linking the possibility of the proliferation of these diseases to climate change, it's not just the changes. We are talking about global health" and in this context, tourism plays a crucial role. During travels, tourists may come in to contact with regions where the virus and vector exist, and may become infected and spread the disease. On the other hand, infected mosquitoes or their eggs could be transported to other regions, and under favourable conditions of temperature and humidity, they could hatch, thus triggering the transmission chain (Fortes, 2023).

Some diseases are associated with behaviours, brands, and stigmas. This connection is particularly visible in sexually transmitted diseases, as it was evident in the past and still is in the present day of diseases as syphilis, HIV infection (Cohn, 2018) and the monkeypox virus. According to the World Health Organisation WHO, several cases of the monkeypox virus have been reported since May 2022 in countries where the disease is not endemic, and the illness still continues to be reported in several other endemic locations. For the first time, many cases were simultaneously reported in non-endemic and endemic countries, representing very unequal geographical areas. The United States, Brazil, Spain, France, and the United Kingdom reported more than 3500 cases by March 2023 (WHO malaria report, 2023), which highlights the relevance of the virus travelling with passengers in transit.

Tourism has evolved beyond carefree development and is now recognized as an economic activity that carries multiple risks. Within this context, it is crucial to acknowledge the contributions of certain authors who not only emphasize the significance of the risks associated with this new pattern of disease transmission (Taylor et al., 2001). It is also important to illuminate the global trends that arise regarding security, transmissibility, and mobility of both human and non-human agents within the broader context of tourism (Jones et al., 2008).

Despite the advances in science, technology, medicine, and public health, it is worrying that the threat of epidemics has become increasingly important in the course of the twentieth century, with particular emphasis towards the last decades of the century (Burkle, 2006). Not only globalization but also the gradual change in the type of travel that attracts tourists plays a fundamental role in this complex equation concerning the rapid spread of diseases (Hall, 2005). Several processes have emerged together that increase the risk of epidemics, to the point of becoming a pandemic. On the one hand, our "global village" is highly urbanized, and over half of the world's population lives in urban centres. The greater the concentration of people, the greater the potential for disease transmission through contact and proximity (Connolly et al., 2020). On the other hand, the ease of mobility in urban centres is very diverse and allows for long distances to be travelled in a short period of time. Thus, both passengers and diseases can now travel at ever-increasing speeds (Hall et al., 2020). Furthermore, the easy access of tourists to remote and exotic locations with great biodiversity enhances the risk of disease transmission through wild reservoirs.

Amongst the infectious diseases that have garnered significant attention within the tourism agenda and amongst its main stakeholders, zoonoses occupy a prominent position (Recht et al., 2020). It is estimated that approximately two-thirds of

newly emerging infectious diseases are zoonoses (Bidaisee and Macpherson, 2014). Zoonoses are diseases that can naturally transmit from animals to humans, with animals acting as reservoirs for the pathogenic agents, thereby maintaining their life cycle. Zoonoses can be classified into three categories: endemic, epidemic and emerging, re-emerging, and neglected zoonoses. This classification reflects the evolving and increasingly interconnected relationship between humans and ecosystems.

Epidemics in History: Readings of the Present, Lessons for the Future?

Bubonic Plague and Cholera

Bubonic plague and cholera are diseases that still exist today, although not with the same prominence as two centuries ago (Esteves, 2020). They are now controllable due to advances made in the pharmaceutical industry, alongside containment measures developed within the public health system. However, these illnesses are still associated with stigma and fear, much in the same way as they were in the nineteenth century (Esteves, 2020).

The bubonic plague still exists endemically in some locations, particularly in Latin America, Madagascar, and some areas of China (Kohn, 1995). Cholera is noticeable in disaster contexts, mainly when the health structures are affected. Both these diseases became more globalized in the nineteenth century, with the Industrial Revolution, improvements in transportation and the “Europeanization” of the world. In this century, cholera left its Indian niche and reached Europe, where it manifested in different waves, and affected areas distinctly. The bubonic plague, on the other hand, experienced its third major contemporary outbreak in the late nineteenth century. The disease was endemic in the Chinese region of Yunnan (Snowden, 2020). With the increasing human contact, the disease reached Hong Kong and from there went to India, where its effects were catastrophic at a time when the territory was a British colony. This is how it spread towards Europe, particularly affecting the harbour cities of Lisbon and Porto (Amaral, 2022; Jorge, 1899). In most cases, regions were able to stem the advance of the disease by resorting to old quarantine mechanisms, such as sanitary cordons, and lazarettos. In 1899 and in the Portuguese context, Porto was highly affected by the disease. As a result of the action of the hygienist doctor Ricardo Jorge, the bubonic plague was able to be confined to the city, but not without an uprising against the measures adopted (Almeida, 2021, 2012a, 2012b; Pontes, 2012). However, the disease did not disappear from the Portuguese context with this outbreak, much less from the globe (Esteves, 2021). Fear of the disease still persists today, despite its treatability, and is still associated with some exotic destinations, as Madagascar.

Despite the progresses made by human beings, cholera continues to be connected to the risk of natural disasters, and its impacts are not exogenous to human action. Sites located in areas of tectonic instability are densely populated; forests continue to be destroyed, thus opening the door to natural disasters; coastal territories have densely inhabited coastal areas, which are all factors that contribute to what Niall Ferguson has recently considered to be the human involvement in high mortality rates caused by certain cataclysms (Ferguson, 2012). Under these circumstances, we cannot consider these phenomena to be external to human intervention. It is in these scenarios of catastrophe that diseases, such as cholera, currently manifest, and therefore undermine some tourist destinations (Ferguson, 2012).

If at present it is war and natural disasters scenarios that are associated with the proliferation of cholera, in the past the disease was connected to European imperialism. The illness was known to Europeans since the sixteenth century, with the Portuguese being the first to describe it when they encountered it in India, where it was endemic (Cunha, 2002; Ferreira, 1990; Lemos, 1991). However, globalization was not unrelated to the economic exploitation that the English made of the region, as well as other parts of Asia and the African continent. It is widely known that English imperialism had as its main resource India, which helps to explain its departure from the Indian context during a time of intense economic exploitation of the colony. Upon its arrival to Europe, the disease manifested itself throughout the nineteenth and twentieth centuries in several outbreaks (Rosenberg, 1987). Ignorance about the nature of the disease and its transmission exacerbated the fear for something new.

This disease exhibited symptoms that triggered panic and created a terrifying image of death, which rapidly spread within the collective imagination. The press during that time also played a significant role in fuelling fears and raising concerns about the disease by prominently featuring it in their headlines (Almeida, 2012a, 2012b; Svobodný, 2004). Despite the progress made since Koch's discovery of the pathogenic agent responsible for cholera in 1883, as well as the implementation of sanitary measures, such as improvements in water supply and sanitation systems, the medical advancements and the development of vaccines, cholera continues to instil fear in people nowadays. As a result, it continues to impact tourism by deterring travellers and influencing their travel choices.

The bubonic plague is no longer a public health threat as it can be effectively controlled through the administration of antibiotics. However, it remains a concern for tourism. On May 7, 2019, Euronews reported that tourists and residents in the city of Ulgii were placed under quarantine due to the suspicion of two deaths caused by the disease (Kennedy, 2019). This demonstrates that the history of diseases is not limited to the past, and in response to any suspicion, the tourism industry promptly reacts with the available tools of the time, including quarantine, to prevent the spread of diseases.

Yellow Fever and Malaria

Yellow fever is another disease that remains highly significant in modern times, affecting thousands of individuals in temperate regions. It is believed to have been introduced to the American continent during the slave trade in the fifteenth and sixteenth centuries, originating in Africa. In the new environment, the virus encountered favourable ecological conditions that facilitated the establishment of a sustainable sylvatic cycle (Carter, 1931). Yellow fever outbreaks occurred in New York (1668), Boston (1691), and Charleston (1699), resulting in numerous casualties in major cities across the eastern and southern regions (Woodalla & YuilWhy, 2016). This is the reason why yellow fever is known as the American plague (Crosby, 2007). The disease, originating in Gambia, Sierra Leone, and Senegal, was brought to the Western Hemisphere and the first epidemic outburst was reported in Yucatan in 1648 (Carter, 1931). In the following three centuries, outbreaks occurred on a large scale in tropical regions of America, in northern American coastal towns, but also in Europe (Strode, 1951), coming in on board of ships of British merchants and the Royal Navy (Boyce, 1911). Recurrent yellow fever epidemics dissuaded Napoleon Bonaparte from advancing from the French Louisiana to the United States (Marr & Cathey, 2013), and contributed to the repeated postponement of the construction of the Panama Canal. The record of the first cases of yellow fever in Brazil may have resulted from the transportation of slaves coming from the Portuguese colonies in Africa. The epidemic that hit Rio de Janeiro in 1850 likely affected a third of the city's population and registered a high mortality rate (Rego, 1872). Since then, the disease has remained endemic in the country, being responsible for sporadic outbreaks in different regions (Chalhoub, 2006; Lowy, 2006). The disease targeted immigrants, travellers, and ship crews, endangering both the country's health security and then tourism success in a time when there was no scientific theory to explain the aetiology of the disease, and its transmission to humans by a mosquito. This hypothesis was first put forward in 1881 by Carlos Finley in Cuba, and was confirmed 20 years later by a commission headed by Walter Reed (1851–1902), and led by William Gorgas (1854–1920), two North American military doctors located in Havana (Benchimol, 2001; Benchimol and Sa, 2005).

In Europe, Spanish ports recorded 60,000 fatal cases in 1800, and Barcelona registered 20,000 deaths (1/6 of the population) in 1821 (Hempel, 2020). Other outbreaks occurred in France (1802 and 1861), Italy (1804 Livorno), Portugal (1851, 1856, 1857 Porto, and Lisbon), the United Kingdom (1852 and 1865 Swansea), and Gibraltar (1828). The last outbreak in Europe took place in this latter location in 1905 (Hempel, 2020).

Portugal experienced the effects of the disease during the eighteenth century, as already mentioned. From the 1850s onwards, there were occasional outbreaks in the cities of Lisbon and Porto (Carvalho, 1898). In the latter city five cases were identified in customs guards in 1850, who were aboard the ship *Duarte IV* coming from Brazil. In August 1851, the ship *Tentadora* arrived in Porto from Rio de Janeiro (Packard, 2011). During the journey, five people died of yellow fever. Meanwhile,

the disease spread to several areas of the city, including Miragaia and Massarelos. In total, 40 people lost their lives. The epidemic was considered under control by mid-September 1851 (Meirelles, 1866).

Other occurrences of yellow fever were recorded in Porto. They were believed to have originated from two ships coming from Brazil in July 1856. The outbreak in that year caused 63 deaths, and once again, customs guards were the first to be infected. In response to the rapid spread of the epidemic, the Health Council implemented measures destined to contain it, but these were met with protests from the merchants. The epidemic was eradicated by October of the same year, but at that time a Brazilian ship left Porto for Rio de Janeiro with several infected people on board, including people who died on the ship, and others who reportedly succumbed to the disease already at the destination (Meirelles, 1866).

In 1856, Lisbon was also hit by the “black vomit”. It was first recorded in August and ended in December of that year, causing 122 deaths. The origin of this outbreak is unknown, but it is suggested that it may have been transported by a ship from Brazil (Meirelles, 1866).

The largest yellow fever outbreak recorded in Portugal in the nineteenth century took place in 1857, precisely in the capital, causing around 18,000 infections and 5652 deaths (Meirelles, 1866). Its origin is attributed to one of several boats coming from Brazil and arriving in Lisbon, as the first person infected was a customs guard in July of that year. The disease manifested more severely during the summer months, starting to decline in the autumn season, until it was considered extinct in December, although there are still references to some cases in 1858 (Meirelles, 1866).

Porto was hit in 1858, once again after the entry of a ship from Brazil that had infected people on board and had been subjected to quarantine in Vigo. The same happened with a ship that had also been quarantined in Lisbon and docked in Ponta Delgada. Two crew members infected with yellow fever were identified (Meirelles, 1866).

In the following century, the fear of yellow fever assumed greater proportions, due to a more globalized world, and as a result of the closer communication between different continents, despite the fact that the disease could be prevented with the administration of an effective vaccine from 1938.

Malaria is one of the oldest and deadliest diseases known to Man, and its impact on human history is significant. It was described in Egyptian medical documents, and referred to as “Roman fever” during the Classical Antiquity period. It gained particular prominence in the nineteenth century, especially in tropical and subtropical regions. In the twentieth century, the physician Randall Packard, when writing the biography of the disease, highlighted three essential conditions that explained its spread and compromised its eradication in tropical regions: colonization, urbanization, and globalization (Packard, 2011). In the latest report on malaria published by the WHO, The World Malaria Report 2022, 50% of the population was at risk of contracting the disease, and in sub-Saharan Africa, the disease was one of the leading causes of death amongst children under the age of five (WHO, 2022).

Throughout history, human mobility has played a significant role in the spread and transmission of malaria. The expansion of the Roman Empire around the Mediterranean region facilitated the dissemination of the disease to new areas carried by both soldiers and merchants. Similarly, the colonization of the American continent by the Europeans took malaria to the New World, where it did not exist previously. Trans-Saharan trading routes also fostered contagion (Bruce-Chwatt & Zulueta, 1980).

“Mau a” or “mala aria”, the designation by which the disease was known in the nineteenth century in the context of the miasma theory, denotes its close connection with the environment. The disease is believed to have migrated from Africa and Asia to Europe (Bruce-Chwatt & Zulueta, 1980) becoming an epidemic in this continent throughout the nineteenth century. With the colonization to Africa, the disease was the leading cause of mortality and morbidity amongst military and civilian settlers in those territories, becoming a hindrance to European expansion due to the high number of casualties it caused. For nations that did not participate in the European imperialist agenda, like Italy, the significance of seasonal malaria epidemics and the vulnerable socio-economic conditions in which the disease impacted the country prompted the initiation of systematic studies on the disease. These studies, collectively known as malariology, brought Italian medicine into the limelight for its research program on the disease, spanning from the 1880s until World War II (Snowden, 2006). Amongst the group of actors associated with the experimental study of malaria, the tropical doctors Alphonse Laveran (1845–1922), Ronald Ross (1857–1932), and Patrick Manson (1844–1922) can be highlighted. They identified its causative agent as well as how it transmitted to human being through a vector, the mosquito. Laveran was a doctor of the French Foreign Legion stationed at the Bone military hospital, located in the province of Constantine (Algeria) since 1878. He frequently encountered acute and frequent fevers in French soldiers. He was the one who identified the malaria parasite in the blood of patients. In 1882, he saw the same parasite again in the blood of patients in a Roman Campaign in Italy. From this discovery onward, several researchers began to recognize the malaria parasite in the blood of carriers on all continents, which followed the same characteristics as he firstly described (Lobo, 2012, 2017).

In Portugal, the escalation of the disease’s severity and intensity in the late nineteenth century was closely linked to the expansion of rice production in the country. This connection between malaria and rice cultivation became inevitable (*Relatório sobre a Cultura do Arroz em Portugal e a sua influência na saúde pública*, 1860; Saavedra, 2010, 2018), resulting in a widespread apprehension throughout the nation regarding the perceived harmful effects of rice paddies (Lobo, 2017).

In the early decades of the twentieth century, malaria existed in all regions of mainland Portugal and represented a serious public health problem, leading to the implementation of a plan to control the spread of the disease, particularly amongst migratory groups that seasonally moved to different regions of the country in search for better working conditions (Saavedra, 2017). “Mosquito hunting” on the other hand, allowed the control of the reproduction of species that would be harmful to human health.

Following the reforms in the Public Health system pioneered by Ricardo Jorge in Portugal, malaria came to be understood as a social disease, for which an epidemiological characterization was required, alongside a strategy to fight it according to European standards. In the Portuguese colonies, the approach to malaria presented different challenges from those faced in the metropolis. In Angola, Mozambique, and São Tomé and Príncipe, malaria was considered a serious threat. However, in colonies with lower economic potential, such as Guinea and Timor, combating malaria received less attention. The colonial health organization lacked specialized medical staff, which created difficulties in providing assistance to the indigenous population outside of European-populated areas. The lack of both human and technical resources in these territories required the relocation of experts based in Luanda (Angola) or Lourenço Marques (Mozambique), where laboratories existed, to affected areas, so that they could confirm diagnoses and study epidemic outbreaks. These had significant consequences for the colonial economy and the health of populations in Africa (Shepard et al, 1991).

The initial ten years of studying and combatting malaria in Portugal reached its culmination with the publication of a comprehensive epidemiological analysis of the disease in 1942 by Cambournac, titled *Sobre a Epidemiologia do Sezonismo em Portugal* (On the Epidemiology of Malaria in Portugal). This work represented a decade of dedicated study and research on the disease. Following the publication, an eradication plan was implemented in Portugal and Cambournac was appointed to a position in the WHO, recognizing the positive outcomes achieved in addressing malaria in the country (Lobo and Monteiro, 2016). These efforts played a significant role in the eradication of malaria in 1958. Nonetheless, Portugal remained under the WHO's surveillance until 1973, when the country was considered free from the disease (Cambournac, 1994).

Nowadays, effective preventive measures such as prophylactic medication and long-lasting insecticide-treated bed nets have greatly reduced the risk of contracting malaria for tourists. By raising awareness amongst tourists about disease transmission and prevention methods, the tourism industry can make a significant contribution to mitigating the negative impact in destinations located in countries affected by the disease. However, it is important to acknowledge that malaria-free tourist destinations are not immune to changes. There is a potential for malaria to re-emerge in territories where the disease was previously eradicated, or in new territories, due to climatic changes that can create favourable conditions for disease-carrying mosquitoes to thrive. This evolving situation could have a significant impact on the tourism industry.

Spanish Flu, SARS, MERS, and Ebola

The “Spanish Flu” ravaged the world between 1918 and 1920. The several studies on the subject differed as to where it first appeared. Many authors locate patient zero in the state of Kansas (USA) (Spinney, 2018), while others argue that the disease emerged in France in 1916 (Spinney, 2018). As a third hypothesis, there is China.

There is also no accurate assessment of the number of victims, which is believed to have ranged from 50 to 100 million deaths, although some researchers speculate that the numbers may have been higher (Esteves, 2019). What is certain is that it reached all continents, although affecting them unevenly. Initially, populations failed to realize its global reach, with the idea circulating that it was a disease confined to certain areas, which may help to explain some of the designations attributed to it, as “Bolshevik flu,” “German flu,” or “Brazilian flu.” Consequently, and as it happened on other occasions, the disease functioned as a weapon, ready to be launched against the “enemy to be defeated”. The analysis of the Spanish influenza cannot be detached from the context in which it occurred, particularly the temporal coincidence with World War I. The first cases were recorded in March 1918 and the first outbreak lasted until June of that year. According to Laura (Spinney, 2018), there is no discontinuity between the first and second waves, as it continued to rage in Europe in July. For example, Mustafa Kemal Atatürk, the founder and the first President of the Republic of Turkey, was stranded in Vienna, Austria, due to the epidemic (Spinney, 2018). In August, the second wave appeared, manifesting itself in three places in the Atlantic: Freetown (Sierra Leone), Boston (USA), and Brest (France). In the following months, it spread throughout the American continent and the western coast of Africa. By September, it had spread to practically all of Europe, northern Asia, and India. In October, it reached China. In 1919, there was a third wave, and in some countries, a fourth may have also occurred (Spinney, 2018).

The Spanish Flu pandemic placed societies in turmoil at a global scale: it harmed young adults, whereas until then, the flu had primarily victimized the elderly, the sick, and the physically weaker patients. There was difficulty in diagnosing the disease, which evolved and spread very quickly, and the known treatments at the time were ineffective, leading to the questioning of existing health measures and systems. Regarding the physical and mental sequelae of this first main pandemic, they have not been yet fully understood, despite the existence of studies for some of the regions in the globe. Intellectuals and artists were affected by the pandemic and by the idea of death, which translated into pessimism and a disbelief in Mankind and in a certain idea of progress. Individual freedoms were restricted, and the global economy went into crisis, with famine reaching various regions around the globe. An example of this would be the gold mines exploitation in South Africa that declined, and the coffee plantations in Central America that were seriously affected. In the second half of the twentieth century, the world experienced the consequences of the flu again. In 1957, the Asian flu claimed 2 million lives worldwide (Spinney, 2018).

In the case of SARS, a 10% increase in confirmed cases led to a reduction of up to 9% in tourist arrivals in 2003 (Wilder-Smith, 2006). While infectious diseases appeared to have a smaller and statistically insignificant negative effect on tourist flows seeking advanced economies, the magnitude and statistical significance of the impact of infectious diseases were much higher in developing countries, where these diseases tended to be more prevalent and the health infrastructure more deficient (Spinney, 2018).

SARS, or severe acute respiratory syndrome, emerged in 2003 and demonstrated that the easiness with which we move around the world can have serious consequences for the global public health. The origin of the disease, caused by a coronavirus, is believed to have been in the transference of the virus from civets to humans (Wilder-Smith, 2006). Civets were being sold in markets, along with other live animals, meant to be consumed in the Guangzhou province of China in November 2002. The way in which civets were infected with coronavirus is still not fully understood today, but it is believed to have happened through their contact with bats, which are one of the largest virus reservoirs in nature (Wilder-Smith, 2006). However, SARS ended up taking on global proportions through its human-to-human transmission, which is believed to have started with an infected doctor in Guangdong who contaminated other guests staying in a hotel in Hong Kong. The guests then transported the disease back home to countries such as Vietnam, Singapore, and Canada. In total, about eight thousand people were infected in thirty-two countries, and nine hundred and nineteen individuals died, until 2003. Since 2004, there have been no known cases of infection (Yang et al., 2020). However, the disease cannot be considered to have been eradicated, as it is a zoonosis, and the responsible agent for the illness is still present in the animal kingdom.

Years later, another zoonosis would put the world on alert and once again the rapid movement of human beings was the reason behind its spread. This was the case with the Middle East respiratory syndrome (MERS), which is also an infection caused by a coronavirus. Once again, there was the emergence of a new disease coming from Asia, more precisely from Jordan and Saudi Arabia in 2012 (Hajjar et al., 2013). In addition to the 2012 outbreak, another one was observed in 2015 in Korea, which was believed to have been caused by a traveller returning from the Middle East (Yunseon et al., 2021). As for its origin, the hypothesis put forward suggests that the virus passed from bats to camels and from there to humans (Hajjar et al., 2013).

Less well-known, but more serious and often fatal, is the disease caused by the Marburg virus, known as Marburg haemorrhagic fever. Its mortality rate is about 50%, and its natural host is the fruit bat (*Rousettus aegyptiacus*, familia *Pteropodida*) (WHO newsroom, August 7, 2021). However, the disease spreads directly between human beings, and was first identified in 1967, with simultaneous outbreaks in Marburg and Frankfurt, in Germany, and Belgrade, in Serbia. This first outbreak originated in a laboratory setting that had African green monkeys from Uganda. Meanwhile, others have been recorded in Africa and Europe.

In February and March of 2023, Equatorial Guinea and Tanzania, respectively, declared the existence of Marburg outbreaks (WHO, May 8, 2023). Due to the existence of global health organizations (e.g. WHO) as well as faster and more efficient means of communication, it becomes easier to inform about the existence of these epidemic outbreaks, and to undertake measures to restrict travelling to affected territories or, at least, to raise awareness amongst tourists about the associated dangers.

After the 1967 outbreak, cases were sporadic throughout the twentieth century (Marburg Haemorrhagic Fever, WHO). However, the situation worsened with the entry into the new millennium, with more frequent outbreaks taking place, a reality

that is not unrelated to the growing interest in the African continent, particularly from a tourist point-of-view, as demonstrated by the 2008 outbreak (Marburg Haemorrhagic Fever, WHO). In July of that year, the WHO was notified by the Dutch government of a Marburg case. A Dutch tourist, on two separate occasions, ventured into caves, one of which was the “python cave” located in the Maramagambo forest (WHO Regions, July 10, 2008). These caves were known to harbour fruit bats, and the tourist unintentionally came into contact with these animals. This outbreak did not involve citizens from other states, but the “python cave” is a tourist attraction, as it is the Maramagambo forest, which is considered to be a true reservoir of wildlife. Until 2008, the forest was sought for the “bat experience” it provided. However, the episode with the Dutch tourist ended up limiting the demand for this type of experience, although this region continues to offer a number of tourist circuits associated with wildlife viewing, particularly monkeys, and still not excluding the viewing of bats (Adventure in the wild safaris, February 28, 2022).

The disease caused by the Ebola virus represents a current fear and is one of the sanitary threats of present-day modern societies. However, the threat has been able to be contained, and the main stage for the disease is still the African continent. The virus was discovered in 1976 when two consecutive episodes of a fatal haemorrhagic fever occurred in different locations of central Africa, namely in the Democratic Republic of Congo and southern Sudan (CDC, February 10, 2023). At the root of the epidemic was the Ebola virus that had long existed in nature, but whose spread was fuelled by a population increase in the region, alongside deforestation, and the consequent close contact with wildlife and its meat consumption. Already the twenty-first century, between 2014 and 2016, several cases of Ebola were recorded, which ended up reaching urban areas and taking on global proportions (CDC, February 10, 2023).

This proves the existence of a tendency for the emergence and re-emergence of diseases, with a propensity for the birth of these concerns to be the Asian continent (SARS, MERS, COVID-19) and tropical regions. The first scenario can be explained by a social and environmental context, and the second case by the presence of a high number of pathogenic agents that are highly interconnected, and whose ecosystem has been increasingly altered by the presence of humans. The period from 1995 to 2018 experienced significant growth in the tourism sector, demonstrating resilience despite various crises (Gössling et al., 2021). Many of the chosen destinations of the time were developing countries located in tropical or subtropical areas with high biodiversity, and weak infrastructure and health responses. In this context, tourists become potential disease transmitters, who are also exposed to endemic diseases in their tropical and subtropical visited regions. Collectively, they transport new genes to their places of origin, which may lead to the introduction of new pathogenic agents in other territories (Findlater & Bogoch, 2018).

History reveals that seemingly paradoxical phenomena, such as sedentariness and mobility, have played a role in the emergence and spread of diseases. Starting from the twentieth century, these phenomena have intensified due to the rapid pace of globalization and the increased frequency of tourist activities across various regions of the world.

Covid-19

The COVID-19 pandemic that emerged in China in December 2019 was declared a pandemic by the WHO on the 11th of March, 2020, and continues to be an ongoing story...

Some authors, following on Charles Rosenberg's seminal article "What is an Epidemic" (1989), (Rosenberg, 1989) draw a parallel between this pandemic and the pneumonic flu. Both pandemics are linked to human mobility and crowding: it is not the virus that makes the epidemic, but man: the virus is sedentary, it needs a host to survive.

What has changed with this global epidemic? Everything has changed, starting with the very concept of a pandemic. Even the WHO has evolved and changed its containment rules for COVID-19, based on the dichotomous relationship existing between its virulence and mortality rates, in addition to the global economy interests. In fact, COVID-19 is not just a global epidemic, but a planetary disease. It is a struggle between a virus and the human species for survival on the planet, a human strategy that relies on the global containment of the disease's evolution, one that is not based on the notion of scientific or numerical truth, but on the notion of uncertainty, insecurity and risk. In "Contagion and Chaos," Smith outlines the threat posed by emerging and re-emerging infectious diseases to international security. He emphasizes their detrimental impact on sovereign states and puts forth five hypotheses.

- (i) Epidemic diseases can compromise the prosperity, legitimacy, structural cohesion, and, in some cases, the security of sovereign states.
- (ii) Epidemics and pandemics of emerging or re-emerging infectious diseases can foster economic and political discord between countries.
- (iii) Only a select few pathogenic agents meet the criteria for threatening national security, including factors like lethality, transmissibility, fear, and significant economic losses.
- (iv) War, whether intra- or interstate, exacerbates the issues caused by diseases.
- (v) The paradigm of health security is rooted in the political tradition of republican theory (Price-Smith, 2009).

The post-war optimism that many infectious diseases have "conquered" gave rise to new concerns about the risks after the Ebola epidemic, which underlines the impossibility of the human species to control nature, no matter how well-prepared humans believe they are (Preston, 1994).

Nathan Wolfe's reflection is convincing and timely. Based on his experience as a biologist and microbiologist, and the end result of his missions to the jungles of Africa and the tropical forests of Borneo, the American virologist offers a critical reflection on how lethal viruses have evolved alongside the human species, and why humans have become vulnerable to the threat of a global pandemic. From outbreak to outbreak, where the latter always seems worse than the previous one, Wolfe points the way forward, convinced that pandemics are not entirely random events, and this can function as our advantage. To this end, he proposes investing in the study of

potential pathogenic agents and public health infrastructure capable of detecting new pathogenic agents before they affect humans (and animals) in large numbers. In this complex equation, there is an evident concern for the economic development and sustainability on a global scale, involving the protection of the society, the economy, and the environment (Wolfe, 2011).

The impact of the COVID-19 pandemic on the tourism industry worldwide has been significant. It was not the first time in history that humanity became immobilized and isolated in the face of a global-scale epidemic for which science had no answers. The same had occurred in the nineteenth century with the yellow fever epidemic, or in the last century with the pneumonic influenza, as we have seen. However, in the case of COVID-19, disease-transmitting agents could be asymptomatic. Thus, not only were there no medicines or vaccines available, but also all contagion agents were unknown, which alarmed society as a whole. Fear confined people to isolation, resulting in economic stagnation, restricted mobility, travel limitations, and a significant impact on tourism.

According to the United Nations World Tourism Organization (UNWTO, 2020), both international departures and arrivals of tourists decreased drastically between 2019 and 2020, as a result of the sanitary constraints and panic caused by contagion, at a time when the mortality rate was still very high and there was no effective control mechanism to contain the disease.

Although travelling and the tourism industry are critical in the transmission of diseases and disease vectors, the COVID-19 pandemic had a significant impact on tourism, due to the role of public health interventions, as for example, isolation, quarantines, and border controls. In terms of tourism alone, the public health response to travels during the pandemic maintained the same containment measures applied in response to other epidemics in the past, and in 2020, with no other means of containment available, humanity came to a standstill (Gössling et al., 2021). Similarly with other outbreaks of infectious diseases, the situation began to resolve itself once mass vaccination campaigns were implemented on a global scale, thus offering a new solution that allowed tourism to recover from 2021 onwards and leading to the recovery of confidence and investment levels seen in 2019 by 2022 (Fig. 2.1).

The global tourism agenda is influenced not only by political, economic, environmental, and health determinants that affect both the regions of origin and the destination of travellers, but also by the hubs that define the intricacies of these travel movements in transit. In the context of COVID-19, resilience in the sector also required that the necessary safety conditions were guaranteed during the passage and destination of travellers both in the regions of origin and arrival, while calling for the industry's responsibility in the careful selection of destinations that allow the preservation of biodiversity without its compromise (Gössling et al., 2021).

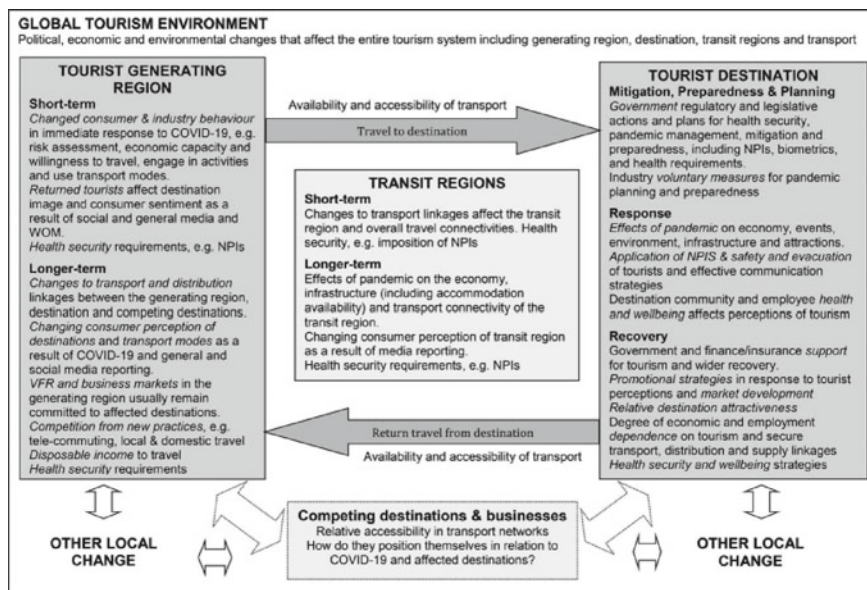


Fig. 2.1 Schematic representation of the impact of COVID-19 on the global tourism environment.
Source C. Michael Hall et al. (2020), p. 584

Some Concluding Remarks: Tourism, Society, Health and the Natural World: *Quo Vadis?*

The history of infectious diseases and their impact on global development demonstrates that they have reached epidemic proportions whenever favourable conditions for their spread have been created by humans. Some of these instances have been linked to military conquests, the necessity to relocate due to war or climate change threatening population survival, as well as religious and communal rituals, population growth, and the overcrowding of cities. Population increase, for instance, has driven human beings to encroach upon territorial niches and disrupt the ecological balance.

Currently, tourism is a major global industry, one that generates significant economic benefits but also poses environmental and social challenges. The impacts of tourism on the natural world are complex, with some destinations facing problems, such as overcrowding, pollution, and habitat destruction. At the same time, the industry suffers from mobility restrictions felt during periods of greater health stress, especially during epidemics or pandemics.

Nature has provided the necessary resources for human survival and progress, while human activities have shaped and transformed the natural world. Pandemics are an integral part of environmental history, stemming not only from human interactions with diverse ecosystems and their modification, often leading to degradation,

but also from the transformation of natural environments into built landscapes with the development of cities and large metropolises. These densely populated areas facilitate the spread of contagion, in addition to the opening of borders that enable the circulation of diseases, patients, and pathogens. In short, epidemics and pandemics are shaped by Man in his interaction with the environment, in a Darwinian survival attitude.

Zoonoses have been a human concern for centuries. Many zoonotic diseases, such as those caused by the Ebola virus, SARS, and COVID-19, have emerged or resurfaced in recent decades, and their spread is related to a variety of factors, including changes in land use, agricultural practices, and wildlife trade. Climate change is also having a significant impact on the natural world, with increasing temperatures, sea level rise, and extreme weather events affecting ecosystems and wildlife populations (Palmlund, 2012). All these events can boost the risk of zoonotic diseases, altering the balance in biodiversity and leading to the spread of disease vectors.

Tourism necessarily impacts zoonoses and climate change. Travel and tourism can contribute to disease spread by facilitating the movement of people and goods across borders. In addition, tourism can also have an impact on climate change, as a result of consumption patterns and the lifestyles sold to tourists. Alfred Crosby's proposal in *The Columbian Exchange*, when problematizing the arrival of Christopher Columbus to America in 1492, places us before an anthropogenic scenario when considering the crossbreeding of the Old with the New World to be problematic and even pessimistic. However, tourism can also play a positive role in addressing these issues. Sustainable tourism practices (ecotourism, mobility, and support for the local communities) can help reduce the spread of diseases, promote responsible behaviours amongst travellers, and reduce the carbon footprint of tourism activities.

In conclusion, zoonoses, climate change, and tourism are all part of the same equation, and one that requires a holistic approach. The history of human mobility, of tourism, and of diseases is intimately linked with the natural world, whether it be for fashion purposes, or leisure, recreation, and even cultural exchange. By promoting sustainable tourism practices, and supporting preservation efforts, while adopting measures to reduce the spread of diseases, epidemics, or pandemics, we can help mitigate their impact and promote a more sustainable future.

The history of health and disease, as well as social interactions and leisure activities, has led to studies on the implications of mobility and the growth of tourism. However, the establishment of more in-depth generalizations lacks the absence of studies on a smaller scale, which would allow for a more holistic and objective understanding of the impacts of tourism on the containment or proliferation of zoonotic diseases that may pose new threats to planetary health. On the other hand, climate change could lead to changes in global fauna and flora, causing certain agents of serious diseases to undergo distribution changes and occupy new territories, particularly in Southern Europe, affecting the tourism activity of states in this region.

The history of the recent COVID-19 pandemic has brought challenges as well as opportunities for both the tourism industry and the global community to rethink the

future in the present, based on the past. What lessons can we learn from the past in times of crisis, uncertainty, and insecurity? How can we anticipate new situations that may block tourism? It is important to continue this interdisciplinary reflection from biology and public health to social sciences, tourism, and ethics, in order to gather a denser set of data that allows us to act anticipatorily and proactively in balancing the common future of the Earth. *Quo vadis?*

References

- Almeida, M. (2012a). A epidemia de cólera de 1853–1856 na imprensa portuguesa [The cholera epidemic of 1853–1856 in the Portuguese press]. *História Ciência Saude- Manguinhos*, 18(4), 1057–1071.
- Almeida, M. (2012b). O Porto e as epidemias: Saúde e higiene na imprensa diária em períodos de crise sanitária, 1854–1856, 1899, 1918 [The Port and Epidemics: Health and Hygiene in Daily Press During Sanitary Crises, 1854–1856, 1899, 1918]. *Revista De História Da Sociedade e Da Cultura*, 12, 371–391.
- Almeida, M. (2021). As epidemias nas notícias em Portugal: Cólera, peste, tifo, gripe e varíola (1854–1918) [Epidemics in the News in Portugal: Cholera, Plague, Typhus, Influenza, and Smallpox (1854–1918)]. *Saúde Societal: Percursos De Investigação Do ISCTE*, 1(1), 13–39.
- Amaral, I. (2022). O Tejo e a defesa sanitária marítima de Lisboa nos séculos XIX e XX: epidemias, doenças tropicais, nação e império [The Tagus River and the Maritime Sanitary Defense of Lisbon in the 19th and 20th Centuries: Epidemics, Tropical Diseases, Nation, and Empire]. In A. Esteves, & H. Silva (Eds.), *Olhares cruzados sobre a história da saúde da idade média à contemporaneidade* (pp. 58–83). Landscapes Heritage and Territory Collection.
- Benchimol, J. (2001). *Febre amarela: a doença e a vacina, uma história inacabada* [Yellow Fever: The Disease and the Vaccine, an Unfinished Story]. Editora Fiocruz.
- Benchimol, J., & Sá, M. (2005). *Adolpho Lutz, Obra Completa 4 volumes* [Adolpho Lutz, Complete Works 4 Volumes]. Editora Fiocruz.
- Bentley, T. A., & Page, S. J. (2001). Scoping the extent of adventure tourism accidents. *Annals of Tourism Research*, 28, 705–726.
- Bidaisee, S., & Macpherson, S. (2014). Zoonoses and one health: A review of the literature. *Journal of Parasitology*, 8, 874345. <https://doi.org/10.1155/2014/874345>
- Black, J. (2010). *The British and the grand tour*. Routledge.
- Boyce, R. (1911). The history of yellow fever in Africa West. *British Medical Journal*, 1(2614), 249–250. <https://doi.org/10.1136/bmj.1.2614.249>
- Bruce-Chwatt, J., & Zulueta, J. (1980). *The rise and fall of malaria in Europe: A historic-epidemiological study*. Oxford University Press.
- Buckley, R. C. (2000). Neat trends: Current issues in nature, eco and adventure tourism. *International Journal of Tourism Research*, 2, 437–444.
- Buckley, R. (2004). *Environmental impacts of ecotourism* (pp. 229–244). CAB International.
- Burkle, F. M. (2006). Globalization and disasters: Issues of public health, state capacity and political action. *Journal of International Affairs*, 59(2), 231–265.
- Butcher, J. (2020). Constructing mass tourism. *International Journal of Cultural Studies*, 23(6), 898–915. <https://doi.org/10.1177/1367877920911923>.
- Butler, R. (1999). Sustainable tourism: A state-of-the-art review. *Tourism Geographies*, 1(1), 7–25. <https://doi.org/10.1080/14616689908721291>.
- Cambournac, F. (1994). Contribution to the history of Malaria epidemiology and control in Portugal and some other places. *Parassitologia*, 36(1–2), 215–222.

- Carter, H. (1931). *Yellow fever: An epidemiological and historical study of its place of origin*. Williams & Wilkins Company.
- Carvalho, A. V. (1898). *Prophylaxia da Peste, febre-amarella e cholera-morbus: medidas applicadas na Europa* [Prophylaxis of Plague, Yellow Fever, and Cholera: Measures Implemented in Europe]. Typographia França Amado.
- Chalhoub, S. (2006). *Cidade Febril: cortiços e epidemias na corte imperial* [Feverish City: Tenements and Epidemics in the Imperial Court]. Cia das Letras.
- Chaney, E. (2014). *The evolution of the Grand Tour: Anglo-Italian cultural relations since the Renaissance*. Routledge.
- Clarke, B., Otto, F., Stuart-Smith, R., Harrington, L., & Clarke, B. (2022). Extreme weather impacts of climate change: An attribution perspective environmental. *Reserach Climate*, 1, 012001. <https://doi.org/10.1088/2752-5295/ac6e7d>
- Cohn, S. (2018). *Epidemics: Hate and compassion from the plague of Athens to AIDS*. Oxford University Press.
- Connolly, C., Keil, R., & Ali, S. H. (2020). Extended urbanisation and the spatialities of infectious disease: Demographic change, infrastructure and governance. *Urban Studies*, 56, 10873. <https://doi.org/10.1177/0042098020910873>
- Corbin, A. (2001). *História dos Tempos Livres. Advento do lazer* [History of Free Time: The Advent of Leisure]. Teorema.
- Crosby, M. C. (2007). *The American plague: The untold story of yellow fever, the epidemic that shaped our history*. Berkley trade pbk.
- Crouch, D., Jackson, R., & Thompson, F. (2005). *The media and the tourist imagination: Converging cultures*. Routledge.
- Cunha, F. (2002). Historical evolution of medical science and heritage policy. *Cadernos De Cultura Medicina Na Beira Interior Da Pré-História Ao Século XX*, 16, 67–72.
- Elton, N. W. (1952). Yellow fever in Panama; historical and contemporary. *American Journal of Tropical Medicine and Hygiene*, 1(3), 436–456.
- Esteves, A. (2019). A pneumónica na imprensa do distrito de Viana do Castelo [The Pneumonic in the Press of the District of Viana do Castelo]. In H. Silva, R. M. Pereira, & F. Bandeira (Eds.), *Centenário da Gripe Pneumónica, A pandemia em retrospectiva. Portugal 1918–1919* (pp. 87–107). IGAS.
- Esteves, A. (2020). As epidemias e a memória histórica [Epidemics and Historical Memory]. In M. Martins, E. Rodrigues (Eds.), *A Universidade do Minho em tempos de pandemia: Tomo I: Reflexões*. UMinho Editora.
- Esteves, A. (2021). As epidemias em Portugal nos inícios do século XX: um olhar através da imprensa periódica [Epidemics in Portugal in the early twentieth century century: A look through periodical Press]. In A. P. Korndörfer, P. Enrique de Brum, D. Rossi, & E. Fleck (Eds.), *Em tempos de pandemia: reflexões necessárias sobre saúde e doenças no passado e no presente*. Oikos.
- Ferguson, N. (2012). *A política da catástrofe* [The Politics of Catastrophe]. Temas e Debates.
- Ferreira, F. A. (1990). *History of Health and Health Services in Portugal*. Fundação Calouste Gulbenkian.
- Findlater, A., & Bogoch, I. (2018). Human mobility and the global spread of infectious diseases: A focus on air travel. *Trends in Parasitology*, 34(9), 772–783. <https://doi.org/10.1016/j.pt.2018.07.004>
- Fortes, F. (2023). *Television interview*. Retrieved from <https://www.ihmt.unl.pt/filomeno-fortes-fala-sobre-os-virus-dengue-e-zika-num-programa-da-tvi/>. Accessed 4 May 2023.
- Gossling, S., Scott, D., & Hall, C. M. (2021). Pandemics, tourism and global change: A rapid assessment of COVID-19. *Journal of Sustainable Tourism*, 29(1), 1–20. <https://doi.org/10.1080/09669582.2020.1758708>
- Hajjar, S. A., Memish, Z. A., & McIntosh, K. (2013). Middle east respiratory syndrome coronavirus (MERS-CoV): A perpetual challenge. *Annals of Saudi Medicine*, 33(5), 427–436.
- Hall, C. M. (2005). *Tourism: Rethinking the social science of mobility*. Pearson Education Canada.

- Hall, M. (2006). Tourism, disease and global environmental change: The fourth transition? In S. Gössling, & C. Michael Hall (Eds.), *Tourism and global environmental change, ecological, social, economic and political interrelationships* (pp. 159–179). Routledge.
- Hall, C. M., Scott, D., & Gössling, S. (2020). Pandemics, transformations and tourism: Be careful what you wish for. *Tourism Geography*, 22(3), 577–598.
- Hawkins, J. P., & Roberts, C. M. (1994). The growth of coastal tourism in the Red Sea: Present and future effects on coral reefs. *Ambio*, 23, 503–507.
- Hawkins, J. P., Roberts, C. M. T., Van't Hof, K., De Meyer, T. J., & Aldam, C. (1999). Effects of recreational scuba diving on Caribbean coral and fish communities. *Conservation Biology*, 13, 888–897.
- Hempel, S. (2020). *Atlas de Epidemias. Enfermedades mortales y contagiosas desde la peste hasta el virus del Zika*. Librero.
- Higgins-Desbiolles, F. (2020). The “war over tourism”: Challenges to sustainable tourism in the tourism academy after COVID-19. *Journal of Sustainable Tourism*, 29(4), 551–569.
- Hon, K. L. (2013). Severe respiratory syndromes: Travel history matters. *Travel Medicine and Infectious Disease*, 11(5), 285–287. <https://doi.org/10.1016/j.tmaid.2013.06.005>
- International Tourism Highlights (2020). UNWTO—World Tourism Organization. Retrieved from <https://www.e-unwto.org/doi/pdf/10.18111/9789284422456>. Accessed on 30th June 2023.
- Jones, K. E., Patel, N. G., Levy, M. A., Storeygard, A., Balk, D., Gittleman, J. L., & Daszak, P. (2008). Global trends in emerging infectious diseases. *Nature*, 451(7181), 990–993. <https://doi.org/10.1038/nature06536>
- Jorge, R. (1899). *A peste bubónica no Porto 1899: Seu descobrimento: Primeiros Trabalhos*. [Bubonic Plague in Porto 1899: Its Discovery: Initial Works]. Repartição de Saúde e Hygiene da Câmara do Porto.
- Kennedy, R. (2019). European tourists quarantined in Mongolia after two die of bubonic plague. Retrieved from <https://www.euronews.com/2019/05/07/european-tourists-quarantined-in-mongolia-after-two-die-of-bubonic-plague>. Accessed 30 June 2023.
- Kohn, G. C. (1995). *The wordsworth encyclopedia of Plague and pestilence*. Facts on File.
- Lemos, M. (1991). *História da medicina em Portugal: doutrinas e instituições* [History of Medicine in Portugal: Doctrines and Institutions], 2. Ordem dos Médicos/D. Quixote.
- Lobo, R. (2012). *A História da Malária em Portugal na Transição do Século XIX para o século XX e a contribuição da Escola de Medicina Tropical de Lisboa (1902–1935)* [The History of Malaria in Portugal during the Transition from the 19th to the 20th Century and the Contribution of the Lisbon School of Tropical Medicine (1902–1935)]. Doctoral Dissertation, NOVA FCT.
- Lobo, R. (2017). *Malária: estudo, combate e erradicação (1903–1958)* [Malaria: Study, combat, and eradication (1903–1958)]. In A. Barros Veloso, L. Damas Mora, & H. Leitão (Eds.), *Médicos e sociedade: Para uma história da medicina em Portugal no século XX* (pp. 413–423). By the Book.
- Lobo, R., & Monteiro, J. (2016). A trajetória de Francisco Cambournac na Organização Mundial de Saúde (1952–1964) [The Trajectory of Francisco Cambournac in the World Health Organization (1952–1964)]. *Anais Do Instituto De Higiene e Medicina Tropical*, 15(1), 133–140.
- Lowy, I. (2006). *Vírus, mosquitos e modernidade: a febre amarela no Brasil entre ciência e política* [Viruses, Mosquitoes, and Modernity: Yellow Fever in Brazil Between Science and Politics]. Editora Fiocruz.
- Marr, J. S., & Cathey, J. T. (2013). The 1802 Saint-Domingue yellow fever epidemic and the Louisiana purchase. *Journal of Public Health Management and Practice*, 19(1), 77–82.
- Marton, Z., Ernszt, I., & Birkner, Z. (2020). Holidays to the hells of earth: Taking risk as a dark tourist? *Deturope.*, 12(1), 136–153.
- McNeil, W. (1976). *Plagues and peoples*. Anchor Books.
- Meirelles, A. (1866). *Memorias da Epidemiologia Portuguesa* [Memories of Portuguese Epidemiology]. Imprensa da Universidade.
- Multi-country outbreak of mpox. (2023). Report 19, WHO.

- Nunes, L., Raposo, M., & Pinto Gomes, C. (2020). The impact of tourism activity on coastal biodiversity: A case study at Praia da Cova Redonda (Algarve—Portugal). *Environments*, 7(10), 88. <https://doi.org/10.3390/environments7100088>
- Packard, R. (2011). *The making of a tropical disease: A short history of malaria*. Johns Hopkins University Press.
- Palmund, I. (2012). The impacts on human health and environment of global climate change: A review of international politics. In V. Berridge & M. Gorsky (Eds.), *Environment, health and history* (pp. 244–269). Palgrave Macmillan.
- Pontes, D. (2012). *O cerco da peste no Porto - Cidade, imprensa e saúde pública na crise sanitária de 1899* [The Siege of Plague in Porto - City, Press, and Public Health in the Sanitary Crisis of 1899]. Master's Dissertation, Faculdade de Letras da Universidade do Porto.
- Preston, R. (1994). *The hot zone: The terrifying true story of the origins of the Ebola virus*. Anchor.
- Price-Smith, A. (2009). *Contagion and chaos disease, ecology, and national security in the era of globalization*. The MIT Press.
- Quammen, D. (2020). *Contágio*. Objetiva.
- Recht, J., Schuenemann, V., & Sánchez-Villagra, M. (2020). *Host diversity and origin of zoonoses: The ancient and the new*. Zurich Open Repository and Archive, University of Zurich. <https://doi.org/10.5167/uzh-190634>.
- Rego, J. P. (1872). *Esboço Histórico das Epidemias que tem grassado no Rio de Janeiro desde 1839 a 1870* [Historical Sketch of Epidemics that have Raged in Rio de Janeiro from 1839 to 1870]. Typographia Nacional.
- Relatório sobre a Cultura do Arroz em Portugal e a sua influência na saúde pública* [Report on Rice Cultivation in Portugal and Its Influence on Public Health] (1860). Imprensa Nacional.
- Rosenberg, C. (1987). *The cholera years: The United States in 1832, 1849 and 1866*. The University of Chicago Press.
- Rosenberg, C. (1989). What is an epidemic? Aids in historical perspective. *Daedalus*, 118(2), 1–17.
- Saavedra, M. (2010). *Uma questão nacional: enredos da malária em Portugal, séculos XIX e XX* [A National Issue: Entanglements of Malaria in Portugal, 19th and 20th Centuries]. Instituto de Ciências Sociais.
- Saavedra, M. (2018). *A Malária em Portugal: Histórias e Memórias* [Malaria in Portugal: Histories and Memories]. Imprensa do Instituto de Ciências Sociais.
- Saavedra, M. (2017). Stories from the past and everyday experiences of malaria: Portugal, 1930–1960. *Anais Do Instituto De Higiene e Medicina Tropical*, 16, 51–59.
- Shepard, D. S., Ettling, M. B., Brinkmann, U., & Sauerborn, R. (1991). The economic cost of malaria in Africa. *Tropical Medicine Parasitology*, 42(3), 199–203.
- Silva, F. (2013). *O Futuro do Estado Social* [The Future of the Welfare State]. Fundação Francisco Manuel dos Santos.
- Snowden, F. (2006). *The conquest of Malaria, Italy 1900–1962*. Yale University Press.
- Snowden, F. M. (2020). *Epidemics and society*. Yale University Press.
- Spinney, L. (2018). *El jinete pálido. 1918: la epidemia que cambió el mundo* [The Pale Rider: 1918—The Epidemic That Changed the World]. Editorial Planeta.
- Strode, G. (Ed.) (1951). *Yellow fever*. McGraw-Hill.
- Svobodný, P. (2004). The health of the population and health policy in 19th century Bohemia: The case of Asiatic Cholera (1830s–1900s). In A. Laurinda (Ed.), *European health and social welfare policies* (pp. 200–215). Compostela Group of Universities and the PhoenixTN, European Thematic Network on Health and Social Welfare Policies.
- Taylor, L. H., Latham, S. M., & Woolhouse, M. J. (2001). Risk factors for human disease emergence. *Philosophical Transactions of the Royal Society of London, Series B*, 356, 983–989.
- WHO (2022). *World Malaria report 2022*, 8th of December.
- Wilder-Smith, A. (2006). The severe acute respiratory syndrome: Impact on travel and tourism. *Travel Medicine and Infectious Disease*, 4(2), 53–60.
- Wilson, M. (1995). Travel and the emergence of infectious diseases. *Emerging Infectious Diseases*, 1(2), 39–46. <https://doi.org/10.3201/eid0102.950201>

- Wolfe, N. (2011). *The viral storm: The dawn of a new pandemic age*. St. Martin's Griffin.
- Woodalla, J., & YuilWhy, T. (2016). Is the yellow fever outbreak in Angola a 'threat to the entire world'? *International Society for Infectious Diseases*, 4, 25. <https://doi.org/10.1016/j.ijid.2016.04.025>
- Yang, Y., Peng, F., Wang, R., Yange, M., Guan, K., Jiang, T., Xu, G., Sun, J., & Chang, C. (2020). The deadly coronaviruses: The 2003 SARS pandemic and the 2020 novel coronavirus epidemic in China. *Journal of Autoimmunity*, 109, 102434. <https://doi.org/10.1016/j.jaut.2020.102434>
- Yunseon, C., Junhui, W., & HakJun, S. (2021). The impact of the middle east respiratory syndrome coronavirus on inbound tourism in South Korea toward sustainable tourism. *Journal of Sustainable Tourism*, 29(7), 1117–1133.

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Chapter 3

A Scientific-Metric Analysis of Urban Tourism and Climate Change—An Investigation Based on Web of Science and Scopus



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and Juliana Araújo Alves

Abstract Climate change is currently one of the major challenges that tourism industry faces due to the fact that it inevitably involves the adjustment of many destinations and tourists to new scenarios. This made us consider some international studies linking urban tourism to climate. The present chapter aims to establish the evolution of the relationship between urban tourism and climate taking into consideration the last 90 years, where these issues began to be analysed. Qualitative and quantitative methods were used for measuring the coverage ratio of urban studies, tourism, weather, and climate (change) in spatial–temporal studies. This review is the first one that focuses on urban areas, seeking to discuss the issues that should concern researchers in the urban areas of recreation and leisure. To help us carry out the study, it was used a database with 80 entries created from an in-depth analysis of international bibliography on urban tourism and climate. This bibliographic study reveals the existence of a lack of articulation between theory and practice, namely in the use of terms related to climate, meteorology, and urban studies. We believe that

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this study may play an essential role in the development of research while presenting new perspectives regarding the development and application of theories and work implementations for future studies. Based on results obtained, a few implications for research design and managerial implications are discussed.

Keywords Tourism climatology · Urban areas · Tourism studies · Thermal comfort · Bibliometrics

Introduction

Tourism is one of the most relevant economic activities, that hasn't yet attained peak development in many destinations, and in several countries is the main driver of the national and local economies. However, it should be noted that COVID-19 induced a disruptive situation that led to a drop in growth of the tourism sector. The World Tourism Organization (WTO, [2023](#)) revised the forecasts for 2023 and calculated that international arrivals reached 80% of pre-pandemic levels in the first quarter of 2023.

Tourism, like agriculture, the insurance industry, energy, and transportation, is considered to be an extremely susceptible economic sector that is highly sensitive to the environment and climate. Tourism is recognised to make a significant contribution to greenhouse gas (GHG) emissions, including emissions from transport, accommodation, and other activities.

Knowledge of the effects of climate on tourism and the effectiveness of climate adaptation in this sector remains inadequate and lags behind other economic sectors that have a long tradition of academic development, government involvement, and business participation. This is problematic in view of the continued rapid growth of tourism around the world and its prominence in many national economies. This paper highlights the need for more detailed information and the limitation of resources in the context of rapid changes, in particular due to the necessary implementation of the 3rd-order stage of tourism (Lopes et al., [2021a](#)). This 3rd-order stage came about because COVID-19 exacerbated existing problems and added new responsibilities in terms of crisis management and revealed the need for intervention. To this end, it is essential to understand the evolution of studies in urban areas.

The growing interest, evidence and widespread concern about tourism and global environmental changes have led to higher production (Loehr & Becken, [2021](#)), but few studies focus on urban areas and there is no literature review for these areas. Lopes et al. ([2021b](#)) identified 889 studies published between 1940 and 2020 in this thematic area and summarised the main challenges in several areas, in particular attention to under-studied cities; new methods and use of data to measure the effects of climate and weather on tourism; scale issues and educating and raising awareness among tourism communities and agencies.

In fact, recognition of the role that climate and weather conditions currently have on the tourism sector has acquired expressive importance over recent years. In the

past decade, several international studies have assessed the influence of climate or weather conditions on travel booking decisions (Dubois et al., 2016; Gómez-Martin et al., 2017; Lopes et al., 2021a). Dubois et al. (2016) through analysis of a sample in France, demonstrated that predicted heatwaves generally have less impact on travel decision changes compared to forecasts of inclement weather or cold periods. In relation to medium- and large-scale cities (in case of urban tourism specifically), heat is the most discussed topic in connection with potential adaptation strategies for the tourism sector, although issues can multiply with intense and concentrated precipitation, storms, or other types of extreme weather events.

Scientific research produced by the Intergovernmental Panel on Climate Change (IPCC) suggests that companies, stakeholders, and decision-makers will face increasingly drastic changes in the future (Scott et al., 2012, 2019), in particular in urban areas. The sector therefore needs to learn to deal with climate change from a bottom-up perspective (Hughey & Becken, 2014; Lopes et al., 2022a; Mycoo, 2014). Stakeholders are already acquiring knowledge and experiences associated with weather patterns, extreme events and environmental changes, such as those reported by Becken et al. (2020) and Becken and Wilson (2016). In the wake of these changes, several investigations are using citizen science and collaborative-based methods, in particular Delphi rounds (Lopes et al., 2022a) or participatory workshops (Lopes et al., 2022c).

Researchers claim that significant reductions in GHG emissions are needed to remain within 'safe' thresholds, as agreed in the Paris Agreement (IPCC, 2018). The need for decarbonisation in the tourism sector should lead academics to seek to broaden knowledge on a wide range of issues related to climate change.

In this context, this chapter poses a challenge to all researchers and decision-makers, requiring them to prepare, at their own scale, a different future for the sector (Lenzen et al., 2018; Peeters et al., 2019), contrary to the trend identified by White et al. (2001) of "knowing better and losing even more".

The chapter is organised as follows: introduction, followed by the methods and data section, which presents a detailed description of the approach adopted in this paper. In section three, a quantitative analysis is provided, examining the annual, thematic, and country-based evolution of the papers published between 1990 and 2022, in the Web of Science (WoS) and Scopus databases. Subsequently, the emerging research issues and potential research areas are discussed in the conclusion.

Methods

The present research is primarily quantitative, obtained through secondary data. The analysis observed the PRISMA guidelines, is a validated reference for literature reviews, which consists of a minimum set of twenty-seven evidence-based items for reporting systematic reviews and meta-analyses, along with a four-stage flow diagram: identification, screening, eligibility, and inclusion (Page et al., 2021). The PRISMA flow diagram (Fig. 3.1) and checklist were followed to verify the results

obtained in the systematic review. Due to the exploratory nature of this review and limitations related to the keywords used to search for studies, this research was registered in PROSPERO.

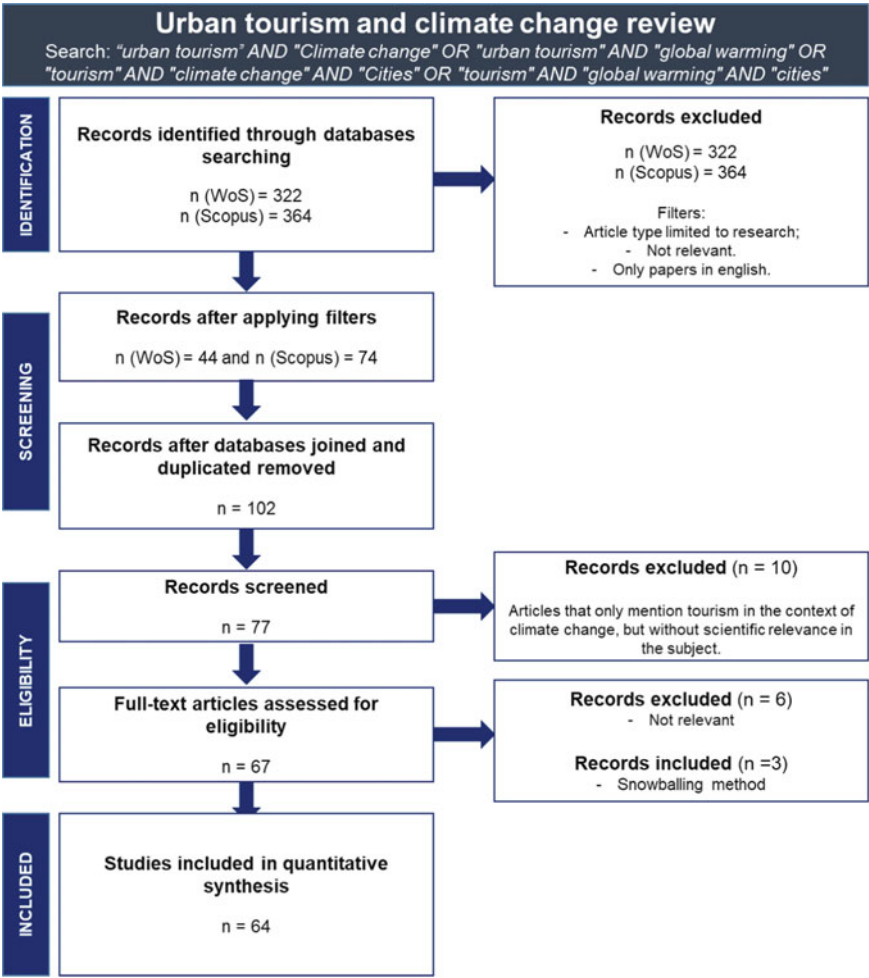


Fig. 3.1 Procedures performed for the selection of articles—identification, screening, eligibility and inclusion. *Source* Own elaboration, based on bibliometric analysis

Research Strategy and Eligibility Criteria

A literature search was conducted to collect studies in Scopus and Web of Science (WoS) focussing on urban tourism and climate change issues. The combined keywords used in all database searches included the following formulae:

“urban tourism” AND “Climate change” OR “urban tourism” AND “global warming” OR “tourism” AND “climate change” AND “Cities” OR “tourism” AND “global warming” AND “cities”.

This research builds upon previous work conducted by Lopes et al. (2021b), which made it possible to extract a significant number of records and their evaluation for relevance to this review. In cases where none of these words were present in the titles, keywords, or abstracts of the records, the article could not be included (inclusion criteria). The search was conducted in WoS (article type = research articles) and Scopus (article type = journal article, full-text availability = full text). A manual search or reference review was also performed based on previous reviews, including the 80-year study of Lopes et al. (2021b).

The literature search was conducted to collect research on climate change in the tourism sector. The inclusion criteria adopted were:

- Field studies on climate change and tourism, such as questionnaire surveys, participatory approaches, interviews, use of geographic information systems (GIS), and other methods and techniques to study assessment, perception, mitigation, adaptation, and impacts in the sector in response to the challenges of climate change.
- Availability of full texts.

The following exclusion criteria were adopted: theoretical or review articles and articles published in languages other than English were excluded.

Data Extraction of Papers

In order to obtain an overview of the selected studies, the following information was extracted: (i) city of study; (ii) country of study; (iii) research objectives; (iv) characteristics of the study sample, when available; (v) data collection method; and (vi) main results. Title, abstract, and full text were selected to assess any discrepancies. Data entry into Mendeley was cross-checked for accuracy and relevance of the extracted literature.

Evidence

After searching for data, 686 articles were found across the two databases. WoS returned 322 results and Scopus returned 364 results, between 1990 and 2022. Duplicate articles indexed in more than one database were excluded, eliminating some of the extracted records. After a thematic interest analysis for the ongoing research, 102 results remained and were analysed for relevance. Considering the aim of this review and the research questions, final screening was performed in order to identify whether the selected keywords were present in the articles' titles, abstracts, and keywords, thereby removing other articles. The full texts of the remaining 77 articles were assessed, and 13 articles were excluded because they did not meet the previously defined eligibility criteria.

A total of 64 articles were included in the literature review conducted by the authors. Based on the data extraction elements, a summary of the included studies is presented in the appendix, organised in accordance with their chronological order of publication. In the next subsection, the selected studies are analysed based on several dimensions: temporal evolution; territorial application and knowledge and links between different fields.

Results

Scientific Temporal Collaboration

Most of the papers were published in the last five years, with a peak in 2019 and 2020, with 12 papers, respectively (Fig. 3.2). This suggests that the topic of urban tourism and climate change has gained increasing attention and interest among researchers over recent years. The number of citations received in the papers is 1534 (mean $\pm$ SD = 23.97 ± 31.38 ; median (Q1–Q3) = 15(5–34), while the h-index was 56.

Prior to 2018, relatively few papers were published on this topic. However, we can confirm that there has been some interest in this area since at least 1999, with one paper published that year. There was a small increase in papers in 2004 and in 2012, with two papers published in each. It is interesting to note that the number of papers on this topic is not evenly distributed over time. Rather, there are periods of relative inactivity followed by sudden increases in research output. This may reflect the influence of external factors, such as global events or changes in research funding priorities.

Overall, the data suggest that urban tourism and climate change is an area of increasing interest among researchers, and one that is likely to continue to be the focus of future research.

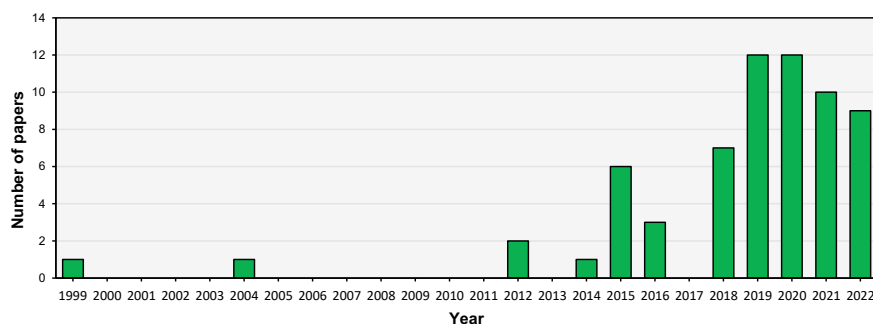


Fig. 3.2 Evolution of studies on urban tourism and climate change in the main databases (WoS and Scopus). *Source* Own elaboration, based on bibliometric analysis

Mapping Scientific Collaboration

Despite rising demand for international coordination and development of studies, there is still a lack of studies focussed on detailed analysis (urban scale), whether it be of a city or a neighbourhood. 64 studies were identified in the literature review. They focussed on urban areas and most of them were published after 2018.

This significant increase may be associated with the value placed on studies at a more detailed level, in particular the need for integration into territorial policies within a municipal or local framework. The first major study that marked the evolution of the field of knowledge was by Braun et al. (1999), which portrayed the preferences of undergraduate students at University of Koblenz and Ladau (Germany) for vacation destinations in coastal cities of the North or Baltic Sea. This study highlighted the negative effects of climate change on tourists' interest in visiting the coastal region of northern Germany in the future.

In terms of the evolution of studies on the relationship between tourism and urban climatology by geographical area, there is a concentration in three geographical areas (Figs. 3.3 and 3.4).

- **Southeast Asia**—It is mainly in China where most of the studies are concentrated on analysis of the influence of urban morphology and climate on urban tourism (e.g. McKercher et al., 2015; Zeng & Dong, 2015; Zhang & Wu, 2015). It is worth noting the analysis of the measured microclimatic conditions and subjective dimensions considered by Zeng and Dong (2015), in Chengdu, and the research conducted by McKercher et al. (2015), in Hong Kong.
- **North America**—Canada and the United States have the main publications, which are mainly related to environmental modelling and analysis of greenhouse gas effects on various sectors directly and/or indirectly related to urban tourism (e.g. transportation, coastal destinations) (Atzori & Fyall, 2018).
- **Europe**—These publications present a highly differentiated typology of destinations, with studies in the south (in the Mediterranean), including Spain

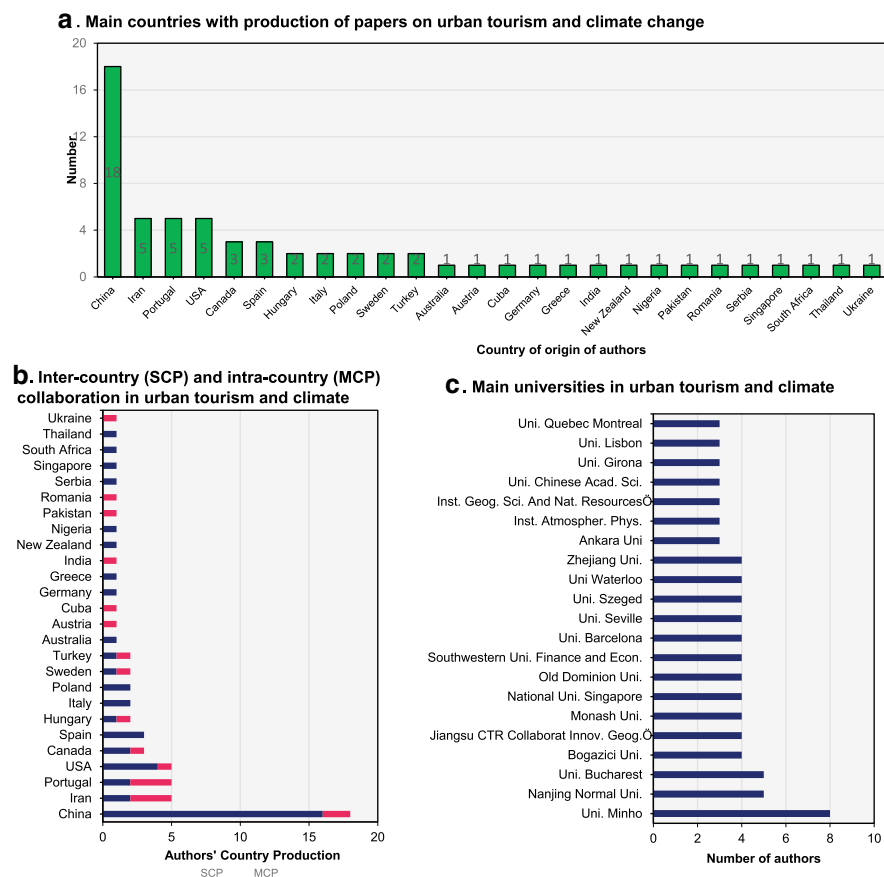


Fig. 3.3 Countries origin and collaboration between authors in urban tourism and climate change subjects. **a** Main countries; **b** inter-country (SCP) and intra-country (MCP); **c** main universities. *Source* Own elaboration, based on bibliometric analysis

(Rodríguez-Algeciras et al., 2020; Torres-Bagur et al., 2019) and Portugal (Clemente et al., 2020; Lopes et al., 2021a).

China is a major source of papers on this topic, although there is a predominance of studies conducted only with authors from the country (Single Country Publication—SCP—Fig. 3.3b). Iran and Portugal are two countries that stand out in terms of scientific production, highlighting the importance of international collaboration for published works. In particular, the University of Minho stands out, with the highest number of authors producing research on urban tourism and climate change (Fig. 3.3c).

These facts are reflected in several papers published in internationally renowned journals over the last three years (Lopes et al., 2021a, 2021b, 2022a, 2022b, 2022c). In

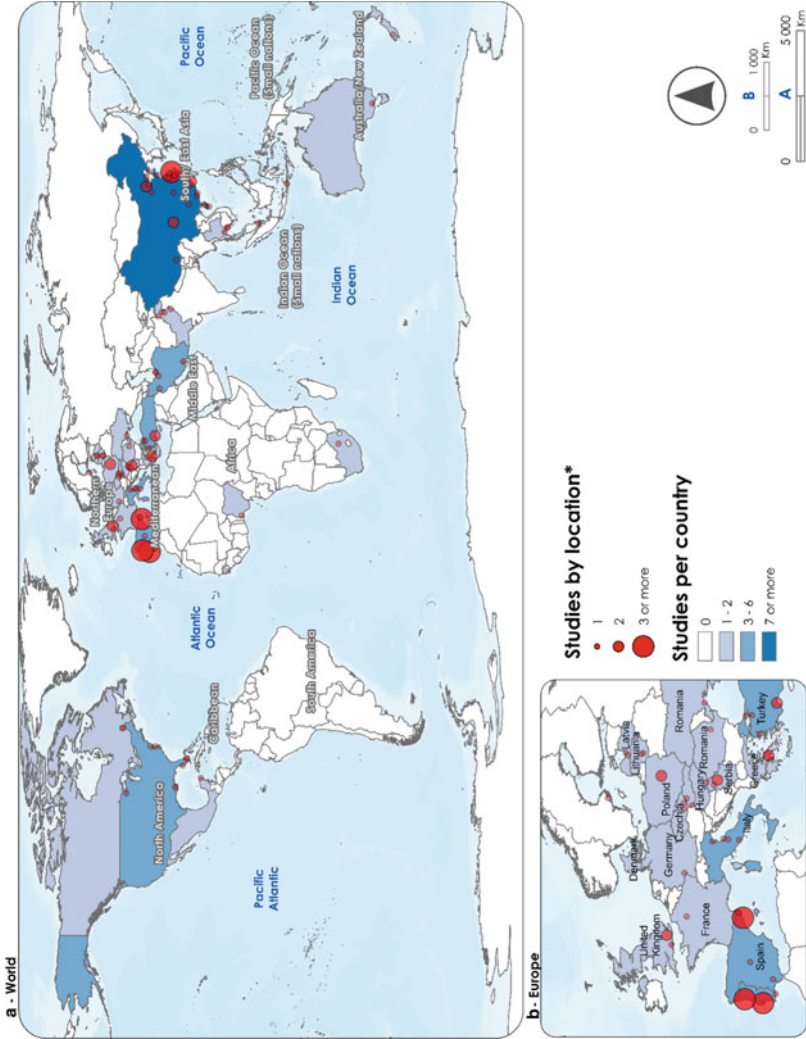


Fig. 3.4 Studies per country and location about urban tourism and climate change. *Source* Own elaboration, based on bibliometric analysis

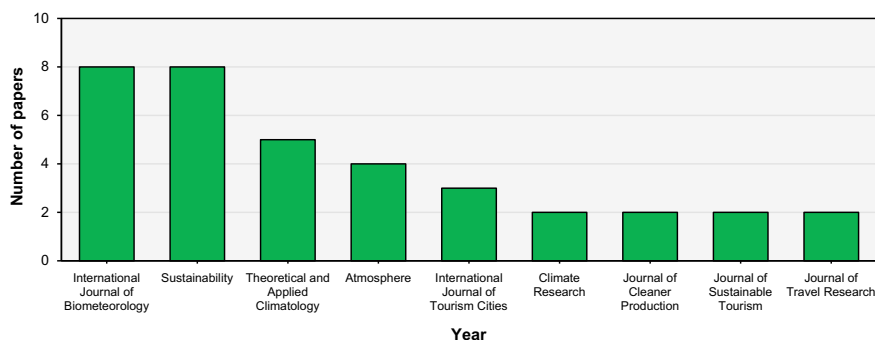


Fig. 3.5 Main journals about urban tourism and climate change. *Source* Own elaboration, based on bibliometric analysis

2021, the first Workshop on Tourism and Climate Change was held in the University of Minho by this team, with 85 participants, resulting in the development of a research agenda for practitioners and policymakers (Lopes et al., 2023).

Knowledge Links: Creation and Impacts

Production on urban tourism and climate change is still scarce. However, the evolution of studies has been conducted in climatology and tourism journals (Fig. 3.5).

The journal with the largest number of articles is the *International Journal of Biometeorology* ($n = 8$) and *Sustainability* ($n = 8$). The main reason is that the articles are based on studies on temperature and thermal comfort (Fig. 3.6— $n = 29$).

The articles published are subdivided into three types of studies: 49 quantitative, 8 qualitative, and 6 mixed-method (qual–quant) studies. By employing this diverse range of research methods, scholars and researchers in the field of urban tourism and climate change can gain a comprehensive understanding of the multifaceted nature of these phenomena. The combination of qualitative and quantitative approaches, along with the integration of various data sources, contributes to a holistic and nuanced exploration of the complex interactions between urban environments, tourism activities, and climate change impacts. Table 3.1 shows a diverse range of research methodologies employed in the study of urban tourism and climate change. The dominant use of survey questionnaires ($n = 35$) (e.g. Caldeira & Kastenholz, 2018; Clemente et al., 2020; Lindner-Cendrowska & Blazejczyk, 2018; Lopes et al., 2021a, 2021b; Nitivattananon & Srinonil, 2019; Pandey & Rogerson, 2019; Terkenli et al., 2020; Torres-Bagur et al., 2019) indicates a quantitative focus, while the inclusion of qualitative methods, such as interviews ($n = 8$) (e.g. Bethel et al., 2022; Cheng et al., 2018; Lapointe et al., 2020; Lopes et al., 2022c; Pandey & Rogerson, 2019; Torres-Bagur et al., 2019; Usher et al., 2020; Zhang & Zhang, 2020) and focus groups ($n = 1$) (e.g.

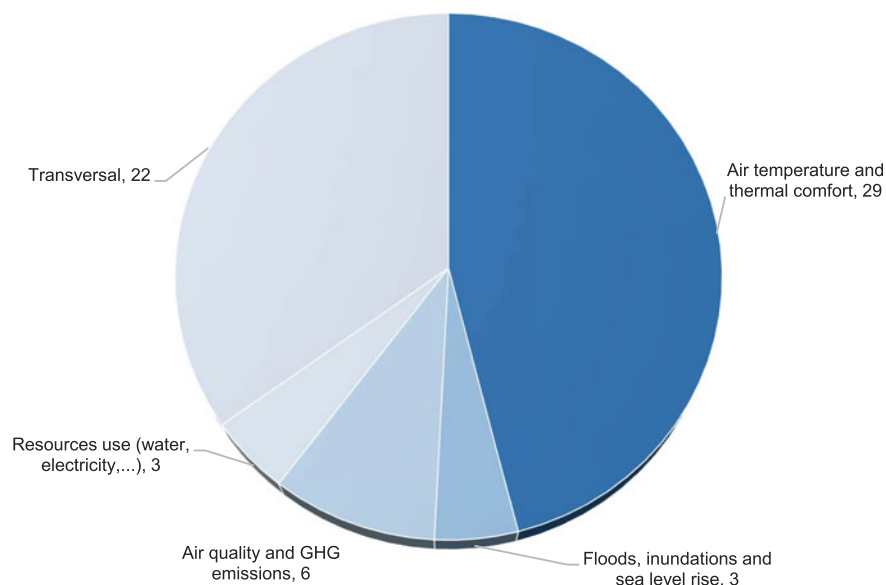


Fig. 3.6 Approaches about urban tourism and climate change. *Source* Own elaboration, based on bibliometric analysis

Nitivattananon & Srinonil, 2019), highlight the importance of capturing subjective insights. Furthermore, the integration of additional methods, such as meteorological data ($n = 18$) (e.g. Hadianpour et al., 2018; Lindner-Cendrowska & Blazejczyk, 2018; Rozbicka & Rozbicki, 2021; Valizadeh & Khorani, 2020) and documental analysis ($n = 9$) (e.g. Azcarate, 2019; Balan & Bordelon, 2021), demonstrates a comprehensive approach to studying the complex dynamics in analysis of these phenomena.

The combination of quantitative, qualitative, and complementary approaches enhances the rigour, depth, and breadth of research on urban tourism and climate change. It promotes a nuanced understanding of the subject by integrating different types of data, perspectives, and methodologies, leading to more robust and meaningful insights for policymakers, practitioners, and stakeholders. It holds significant relevance for three main reasons: (i) the holistic understanding, which enables researchers to explore both objective data-driven trends and subjective experiences, perceptions, and behaviour; (ii) the triangulation of data with the combination of multiple research methods. This strengthens the validity and reliability of the research outcomes; and (iii) the contextualisation obtained by linking environmental factors, historical perspectives, and policy implications.

Among the various themes that have gained prominence over time, the following aspects stand out (Fig. 3.7).

- In 2010, there was a strong focus on issues related to recreational activities, the creation of indices, and the evaluation of equivalent physiological temperature.

Table 3.1 Main data, authors, number of studies, and description and orientations to conduct this type of analysis

Main data used	Number of studies	Description of tasks, types, and orientations to conduct this type of analysis	Main authors
Focus group	1	The type of analysis commonly conducted involved several tasks—in particular transcriptions, coding, thematic analysis and interpretation. Focus groups are a type of qualitative research. Focus groups implies the observation of the group’s dynamic and their answers to focus group questions. It is essential to analyse the following ones • Transcription—This involves converting the audio or video recordings of the focus group session into written text. Each participant’s contribution is transcribed verbatim, capturing their responses, ideas, and discussions • Coding—This involves systematically categorising and labelling different parts of the text according to specific themes, concepts, or patterns. This process allows the researcher to identify recurring topics, issues, and ideas that emerge during the focus group discussions. It helps in organising the data and provides a basis for further analysis • Some questionnaires used in this domain made it possible to undertake the thematic, content, discourse, interpretative or comparative analysis. In this process, it is possible to identify and analyse the patterns, themes, and meanings within the coded data. Researchers search for commonalities, differences, and significant insights across the participants’ responses. Themes could revolve around urban tourism practices, impacts of climate change, adaptation strategies, challenges, opportunities or other categories. The analysis aims to uncover the key ideas, attitudes, beliefs and experiences shared by the participants • Interpretation—After identifying the themes, the researchers interpret the findings in order to understand the underlying meanings and implications. This involves going beyond the surface-level observations and exploring the connections between different themes, as well as considering the context of the focus group discussions. In the end, relevant theoretical frameworks or existing literature to provide a deeper understanding of the findings are used	Nitvattananon and Srimonil (2019)

(continued)

Table 3.1 (continued)

Main data used	Number of studies	Description of tasks, types, and orientations to conduct this type of analysis	Main authors
Survey questionnaires	35	The type of analysis typically employed is quantitative analysis. This involves analysing numerical data collected through closed-ended questions and/or Likert scale responses It can identify tendencies or patterns in participants' responses. This could involve examining the frequency and distribution of responses across different socioeconomic groups (e.g. age, gender, education, or geographic location). It is possible for the researchers to gain insights into how various factors may influence perceptions, attitudes, or behaviours Survey questionnaires can cover a wide range of topics and themes. Some common types of questionnaires used in this domain include: • Perception and Awareness: Assess participants' knowledge, attitudes, and perceptions regarding the impacts of climate change on urban tourism, sustainability practices, environmental consciousness or the influence of weather in activities related to recreation • Travel Behaviour: Explore participants' travel patterns, preferences, and decision-making processes. It may include questions about modes of transportation, accommodation choices, destination selection criteria, and willingness to engage in sustainable travel practices • Adaptation Strategies: Focussed on adaptation strategies aim to understand participants' willingness and readiness to adapt their tourism practices in response to climate change. It may inquire about perceptions of climate-related risks, awareness of adaptation measures, and willingness to support sustainable initiatives • Policy and Planning: Insights on participants' perceptions and opinions regarding urban tourism policies, regulations, and planning efforts aimed at mitigating the impacts of climate change. It can explore opinions on zoning regulations, transportation infrastructure, green spaces, and sustainability initiatives	Caldeira and Kastenholz (2018), Clemente et al., (2020), Lindner-Cendrowska and Blazejczyk (2018), Nitiwatananon and Srinonil (2019), Pandey and Rogerson (2019), Silva Lopes et al., (2021a), Terkenli et al., (2020), Torres-Bagur et al., (2019)

(continued)

Table 3.1 (continued)

Main data used	Number of studies	Description of tasks, types, and orientations to conduct this type of analysis	Main authors
Interviews	16	Some common types of interviews used in studies about tourism and climate change include: • Semi-Structured Interviews. These interviews follow a flexible format, allowing participants to express their opinions and experiences in their own words. Researchers typically have a set of open-ended questions or topics to guide the conversation while providing participants the freedom to elaborate and share insights • Expert Interviews involve engaging with individuals who have specialised knowledge, expertise, or experience in the field. These interviews aim to gather in-depth insights from professionals, researchers, policymakers, or practitioners who can provide valuable perspectives and insights based on their expertise • Stakeholder Interviews include engaging with various stakeholders involved in urban tourism and climate change, such as representatives from local governments, tourism organisations, community groups, or environmental NGOs. These interviews aim to capture diverse perspectives and understand the roles, interests, and concerns of different stakeholders Qualitative analysis of interviews in urban tourism and climate change involves approaches such as thematic analysis, interpretive analysis, discourse analysis, comparative analysis, and case study analysis	Bethel et al., (2022), Cheng et al., (2018), Lapointe et al., (2020), Pandey and Rogerson (2019), Silva Lopes et al., (2022a, 2022c), Torres-Bagur et al., (2019), Usher et al., (2020), Zhang and Zhang (2020)

(continued)

Table 3.1 (continued)

Main data used	Number of studies	Description of tasks, types, and orientations to conduct this type of analysis	Main authors
Delphi	3	Different variations of the Delphi technique can be used, depending on the research objectives and context, in particular: • Classical Delphi: Experts provide feedback through a series of questionnaires or rounds of surveys. The responses from each round are analysed and shared with the experts in subsequent rounds. This iterative process allows for the refinement of opinions, exploration of consensus, and identification of main tendencies • Policy Delphi focuses specifically on gathering expert opinions and insights on policy-related issues related to climate change and sustainability. It aims to generate consensus or expert recommendations regarding policy measures, interventions, or strategies related to urban tourism and climate change. This variation of the Delphi technique can be used to inform policy development processes • Modified Delphi Approach. With a group of experts, usually ranging from 5 to 50 participants, this variation of the Delphi technique allows for more intensive and focussed discussions among a select group of experts. It will be often used when time or resource constraints limit the feasibility of conducting a larger-scale Delphi study. Lopes et al., (2022a, 2022b, 2022c) proposed this methodology This methodology can be applied throughout the internet (Online Delphi). With advancements in technology, online platforms and tools have made the Delphi technique more accessible and efficient. Online Delphi techniques involve experts participating in the process remotely, using online platforms to provide their feedback and engage in discussions. This allows for broader geographic representation and increased convenience for experts It facilitates identification of the main tendencies and areas of agreement among experts, forecast future trends, and gain insights into the expert perspectives	Bethel et al., (2022), Lopes et al., (2022a), Zhang and Zhang (2020)

(continued)

Table 3.1 (continued)

Main data used	Number of studies	Description of tasks, types, and orientations to conduct this type of analysis	Main authors
Meteorological station data and microclimatic measurements	18	This involves examining numerical data collected from various sensors or meteorological stations to understand the microclimatic conditions and climate patterns in urban areas. It is possible to make a description of the type of analysis, main tendencies, and types used in this context: • Descriptive analysis is the basic type of microclimatic measurements and meteorological data analysis. It involves summarising and describing the data using statistical measures (e.g. averages, ranges, standard deviations, and histograms). Descriptive analysis provides a comprehensive overview of the microclimatic conditions (temperature, humidity, wind speed, precipitation, and other relevant variables in the urban environment) • Temporal analysis can explore the patterns and trends over time. This analysis facilitates identification of temporal tendencies, such as seasonal variations, diurnal cycles, or long-term trends in urban climate and weather patterns. It is useful to understand the temporal dynamics and changes in urban tourism • Spatial analysis can involve the spatial distribution of microclimatic measurements and meteorological data across different locations within the urban area. These works can analyse the spatial patterns and variations in temperature, wind speed, precipitation, or other climatic variables. It is important to identify localised microclimates, urban heat island effects, or the influence of urban form and land use on climate patterns • Correlation analysis explores the relationships and associations between different microclimatic variables and meteorological factors. Correlation analysis facilitate identification of potential connections between microclimatic conditions and urban tourism dynamics • Regression analysis is used to understand the impact of meteorological variables on urban tourism or the influence of tourism-related factors on microclimatic conditions. Regression analysis helps to identify the significance and magnitude of the relationships between different variables as temperature, precipitation, or wind speed and the tourist behaviour or the demand for specific tourism activities • Climate change analysis involves examining long-term trends and shifts in meteorological data to understand the impacts of climate change on urban tourism. Researchers analyse historical data to identify changes in temperature, precipitation patterns, extreme weather events, or other climate indicators. This analysis can be useful to assess the vulnerability of urban tourism to climate change and inform adaptation strategies	Hadianpour et al., (2018), Lindner-Cendrowska and Blazejczyk (2018), Rozbicka and Rozbicki (2021), Valizadeh and Khoorani (2020)

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Table 3.1 (continued)

Main data used	Number of studies	Description of tasks, types, and orientations to conduct this type of analysis	Main authors
Workshop	2	The analysis of a workshop in urban tourism and climate change involves a combination of qualitative and quantitative methods (Mixed-Methods), including content analysis, thematic analysis, quantitative analysis, participant feedback analysis, stakeholder mapping, and action planning/policy analysis. These approaches facilitate identification of the main tendencies, key themes, and insights emerging from the workshop discussions and outputs, facilitating a deeper understanding of the issues and informing future actions and decision-making processes Main analysis used with this type of instruments are: • Participant feedback analysis, which involves the feedback provided by workshop participants through surveys, evaluations, or open-ended responses. With this methodology, we can analyse the feedback to understand participants' perceptions, satisfaction levels, and suggestions for improvement • Workshop analysis may involve stakeholder mapping, which identifies and categorises the stakeholders present in the workshop. This type of procedure can analyse the stakeholder profiles, roles, and perspectives to understand the diverse interests, concerns, and priorities. This analysis facilitate identification of the main tendencies and types of stakeholders involved in the workshop and their influence on the discussion and outcomes • Finally, planning and policy analysis. Workshops often aim to develop recommendations or strategy proposals to policymakers. The analysis involves reviewing the outputs generated during the workshop, such as action plans, policy briefs, or strategic documents	Lopes et al., (2022a, 2022c)

(continued)

Table 3.1 (continued)

Main data used	Number of studies	Description of tasks, types, and orientations to conduct this type of analysis	Main authors
Bibliography and documental analysis	9	These approaches involve qualitative methods, such as literature review, conceptual analysis, comparative analysis, policy analysis, content analysis, and, occasionally, meta-analysis (qual-quant technique)	Azcarate (2019), Balan and Bordelon (2021)
Remote Sensing and GIS analysis	2	Remote sensing and GIS analysis in urban tourism and climate change (Safarrad et al., 2021; Shi et al., 2020) predominantly involve spatial analysis techniques, such as land cover analysis, urban heat island analysis, spatial analysis of tourism demand, coastal vulnerability assessment, and view shed analysis. These approaches facilitate identification of spatial patterns, relationships, and vulnerabilities associated, facilitating informed decision-making, planning, and management in tourism activity • Urban heat island (UHI) analysis uses remote sensing data and GIS based on air temperature measurements to assess the spatial distribution and intensity of urban heat islands in urban areas. This approach analyses satellite imagery, land surface and air temperature data to identify areas with elevated temperatures and understand the factors contributing to urban heat island formation • Spatial analysis of tourism demand can use the geospatial data, such as visitor origin and travel patterns. In this context, it is possible to integrate remote sensing with tourism data to identify spatial patterns of tourism demand, hotspots, and potential tourism corridors more or less vulnerable to the climate change conditions (e.g. heat waves, susceptible areas to UHI) • Coastal vulnerability assessment is crucial to evaluate the vulnerability of coastal areas to climate change impacts, such as sea-level rise and storm events. With the information provided by satellite imagery, elevation data, and coastal geomorphology we can assess the susceptibility of coastal zones to erosion, flooding, or saltwater intrusion. This analysis is useful to recognise vulnerable coastal areas and inform decision-making related to coastal tourism development and climate adaptation	Safarrad et al., (2021), Shi et al., (2020)

Source Own elaboration, based on bibliometric analysis

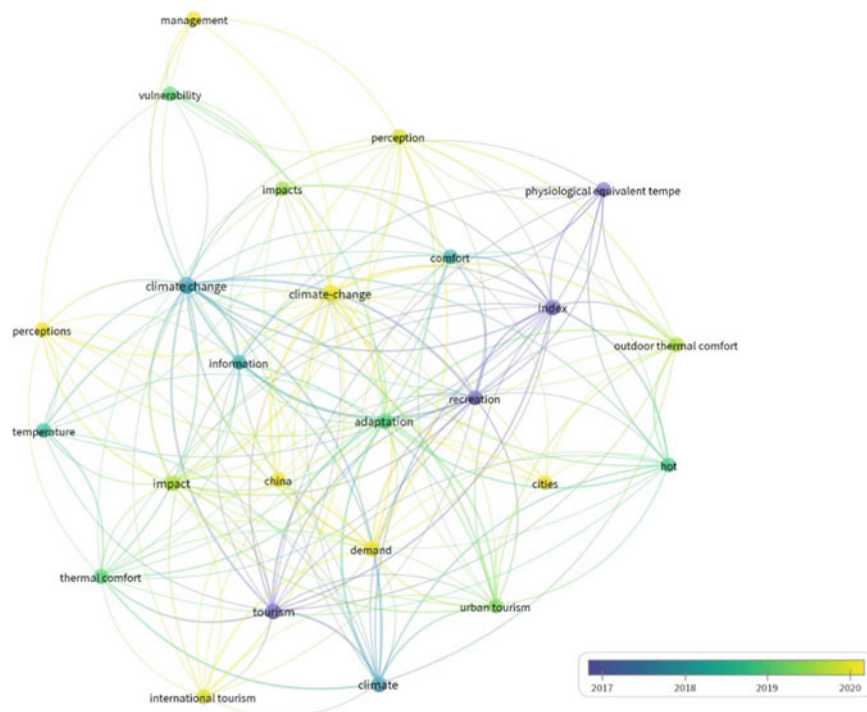


Fig. 3.7 Thematic networks and linkages about urban tourism and climate change. *Source* Own elaboration, based on bibliometric analysis

- Since 2020 articles have been more focussed on topics related to perceptions, management, and the effects of climate change on tourist demand.

In the next stage of the research, an in-depth analysis of the evolution of thematic maps was conducted, dividing the studied topics into four thematic clusters: motor, basic, niche, and emerging or declining. Figure 3.8 presents the key characteristics of the identified clusters. The results indicate that among the basic themes in the field of urban tourism and climate change, Information Systems for tourism play a significant role. Motor themes are associated with carbon emissions, uncertainty, perceptions, and adaptation indices. However, it is important to note that some themes are still considered to play a niche role in this context, such as those related to coastal cities and their associated issues (*e.g.* sea-level rise) (Balan & Bordelon, 2021) or adaptive capacity, impacts, and environmental analysis.

Among the studies related to climate change and urban tourism, 29 studies were identified that address the relationship between air temperature and thermal comfort, 22 studies with a cross-cutting approach, and 6 studies on air quality and greenhouse gases.

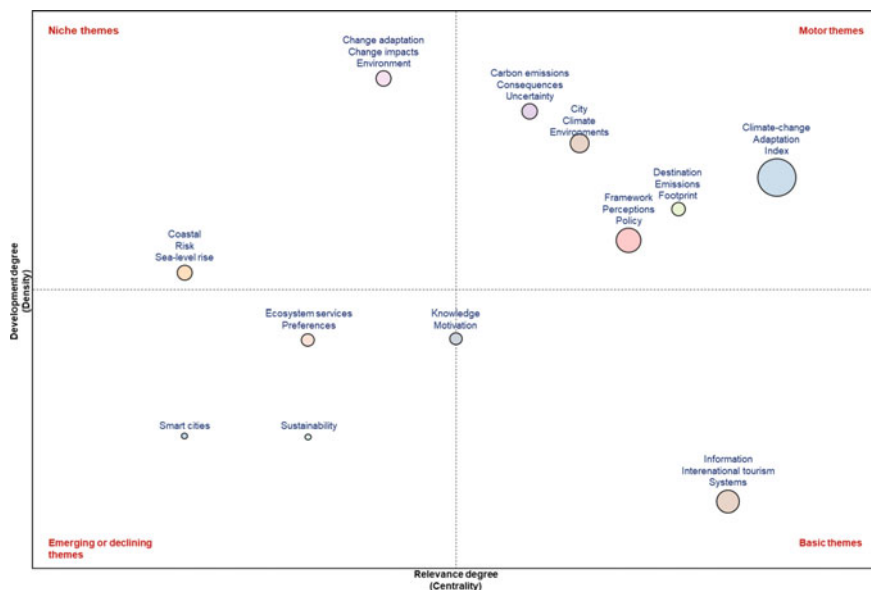


Fig. 3.8 Main themes about urban tourism and climate change (basic, motor, niche and emerging or declining themes). *Source* Own elaboration, based on bibliometric analysis

Unlike previous reviews focussed on the relationship between tourism and climate change (Fang et al., 2018; Loehr & Becken, 2021; Lopes et al., 2021b), this research, focussed on urban areas, reveals a concentration of studies in the field of environmental studies and sciences ($n = 37$).

Additionally, it is worth noting that future research in this area should explore other relevant aspects, such as the economic implications of climate change on urban tourism, the role of policy and governance in promoting sustainability, and the potential integration of innovative technologies to enhance climate resilience in urban destinations.

This study explores the scope of research, tourism sector domains, tools and indices used, as well as the purposes and paradigms employed in the literature (Fig. 3.9). The findings reveal the importance of incorporating sustainable practices into urban tourism, considering the impacts of climate change on destinations, tourists, transportation, accommodation, governance, operators, and the holistic tourism system. This review contributes to the understanding of the existing knowledge and highlights key areas for further research and policy development.

Urban tourism plays a significant role in global travel, contributing to economic growth and cultural exchange. However, the increasing challenges posed by climate change require re-evaluation of the sector's practices. This chapter helps us examine the strategies employed for mitigation, adaptation, and resilience, revealing the different strategies used by authors to create new strategies and answers.

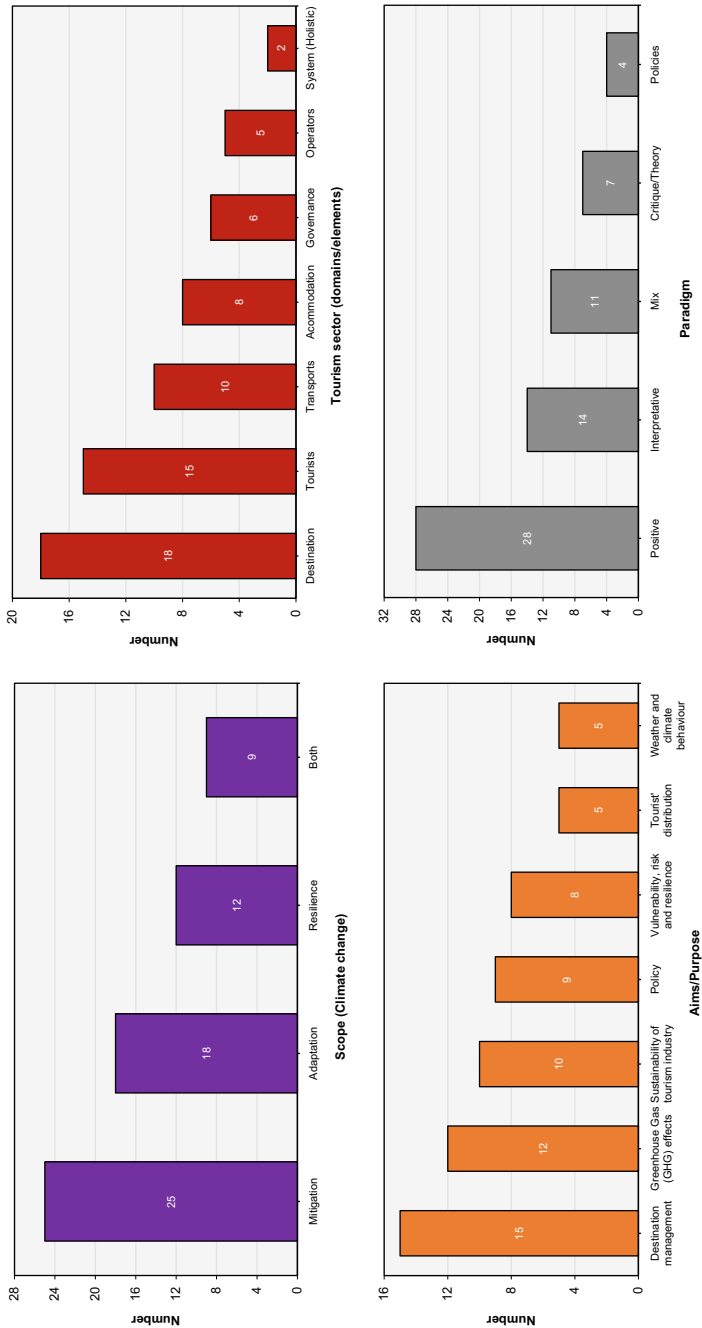


Fig. 3.9 Scope, domains/elements, aims/purposes and paradigm about urban tourism and climate change. *Source* Own elaboration, based on bibliometric analysis

The analysis reveals that mitigation efforts have received considerable attention, with 25 articles focussing on reducing greenhouse gas emissions and environmental impacts (e.g. Zhang et al., 2015).

Additionally, 18 articles emphasise the importance of adaptation measures to cope with the effects of climate change (e.g. Beery, 2019; Lapointe et al., 2020; Lopes et al., 2022b). Furthermore, 12 articles explore strategies for building resilience within the urban tourism sector (e.g. Beery, 2019; Cavallaro et al., 2021). Notably, nine articles emphasise the need for a combined approach that integrates both mitigation and adaptation efforts (e.g. Lopes et al., 2022c).

The study identifies key domains within the urban tourism sector that are impacted by climate change (Fig. 3.9). Eighteen articles highlight the significance of sustainable destination management practices, aiming to ensure the long-term viability of tourism hotspots. Furthermore, 15 articles shed light on the effects of climate change on tourists themselves. Ten articles focus on the challenges faced by transportation systems, while accommodation, governance, operators, and the holistic tourism system are also explored to a lesser extent.

A critical aspect of addressing climate change in urban tourism is the utilisation of appropriate tools and indices. Fifteen articles discuss the development and implementation of tools specifically designed for this purpose. However, it is worth noting that articles make zero or limited use of such tools ($n = 49$), indicating the need for further research and development in this area.

The analysis demonstrates the diverse aims and purposes of the research conducted in the field. Fifteen articles concentrate on destination management, aiming to enhance sustainability and resilience. Twelve articles explore the effects of greenhouse gas emissions on urban tourism, while ten articles investigate the overall sustainability of the tourism industry. Policy-related aspects are addressed in nine articles, while vulnerability, risk, and resilience receive attention in eight articles. Lastly, the distribution of tourists and weather/climate behaviour are explored in five articles each.

The literature review highlights different paradigms adopted in the analysis of urban tourism and climate change. Twenty-eight articles embrace a positive paradigm, focussing on practical strategies and solutions. Fourteen articles adopt an interpretative approach, aiming to understand the social and cultural dimensions of climate change impacts. Additionally, eleven articles take a mixed approach, combining various paradigms. Critique/theory and policy is only used in relatively few contexts in an urban context, even though it is very relevant.

Discussion and Conclusions

This analysis provides valuable results into the current research landscape of urban tourism in the context of climate change. Mitigation, adaptation, and resilience strategies play crucial roles in addressing the challenges posed by climate change in the sector. The identified gaps in the tools and indices highlight the need for further

development in this area. The findings contribute to the growing body of knowledge and emphasise the importance of sustainable practices in urban tourism, ultimately supporting the development of effective policies and strategies for a climate-resilient future. After conducting a theoretical review, this study contributes to establish guidelines for international research in the field of urban tourism and climate change.

Despite late recognition of its relevance, there has been a slow and primarily case-study-based development. The lack of theoretical foundation restricts the application of research findings. Theoretical research into tourism climatology should draw on experiences from related disciplines, such as climate, tourism, economics, geography, psychology, and behavioural sciences, establishing an analytical framework that combines climate/weather/climate change, tourism elements, and tourist behaviour.

It is imperative to build a comprehensive research content system. Research into tourism climatology should continue expanding its scope by integrating practical considerations and emphasising the relationship between tourism and climate/climate change. In this structural system, various research contents should be included, such as climate preferences for different tourist segments, the differential impacts of climate on tourists before, during, and after travel, the consideration of extreme weather events in assessing climatic comfort at tourist destinations, and the examination of stakeholders' behaviour and relationships in tourism. Additionally, specific attention should be given to areas that are sensitive to climate change. The impacts of climate on tourism are significant, particularly in climate-sensitive activities such as coastal tourism. Therefore, research in these areas needs to be strengthened, establishing a set of indicators based on environmental factors in tourism with a reasonable measurement framework and scientific evaluation methods in order to assess, longitudinally and cross-sectionally, the impacts of climate change on tourism resources and the environment. Moreover, it is necessary to explore tourists' preferences and behavioural characteristics and consequently evaluate the potential economic and environmental benefits of tourist behavioural changes within the context of climate variability.

In the face of escalating global climate change, understanding the interplay between urban tourism and its environmental impact is essential. This review has identified five thematic domains that should be the focus of further investigation, as recognised by the authors of this study. These domains are:

- *Assessing the Vulnerability of Urban Destinations.* It is important to develop research efforts that concentrate on evaluating the vulnerability of urban destinations to climate change impacts. This includes studying the potential risks and threats posed by changing weather patterns, sea-level rise, extreme events, and other climate-based factors in urban and coastal areas. This problem is stated in greater detail in the most recent IPCC report, which has begun to dedicate greater importance to urban spaces (IPCC, 2021). Assessing vulnerability will provide insights into areas that require immediate adaptation measures and aid in the development of long-term resilience strategies.

- *Understanding Tourist Behaviour and Preferences.* Research into tourist behaviour and preferences is crucial in order to shape sustainable tourism practices. Key issues include how climate change influences tourists' decision-making processes, their attitudes towards sustainable travel, and their willingness to support low-carbon initiatives. Understanding these aspects will enable policy-makers and stakeholders to develop targeted interventions and design effective communication strategies.
- *Examining Urban Infrastructure and Carrying Capacity.* In this domain, it is important to analyse the linkages between urban infrastructure, carrying capacity, and climate change impacts. By studying the capacity of urban destinations to absorb tourism-related activities, researchers can identify thresholds and develop strategies to manage visitor flows effectively. This includes evaluating the sustainability of transportation systems, accommodation facilities, and other tourism infrastructure components, in particular linked to the structure proposed by Lopes et al. (2022c).
- *Promoting Community Engagement and Stakeholder Collaboration.* To address the challenges posed by climate change in urban tourism, research should emphasise the importance of community engagement, stakeholder collaboration and co-creation practices. By involving local communities, businesses, and organisations, researchers can foster collective responsibility and knowledge exchange. This collaborative approach can lead to co-creation and creative models for sustainable tourism solutions and ensure equitable distribution of benefits.
- *Integrating Technological Innovations.* Leveraging technological innovations in urban tourism is crucial for advancing a sustainable industry. Researchers should explore the potential of emerging technologies such as artificial intelligence (AI), big data analytics, and renewable energy solutions to optimise resource management, enhance destination planning, and minimise carbon footprints. Integrating these technologies can pave the way for smarter and greener urban tourism practices.

Over the next years, research into urban tourism and climate change must prioritise vulnerability assessment, understanding tourist behaviour, evaluating urban infrastructure, promoting community engagement, and integrating technological innovations. By adhering to these guidelines, researchers can contribute to the development of sustainable urban tourism practices and ensure thriving development of cities worldwide amidst the challenges posed by climate change.

Climate change is now recognised as a significant influence on tourism segments and destinations, necessitating adaptation. This theoretical study, comprising 64 publications, plays a crucial role in advancing various scientific fields and aiding tourism companies in facing new challenges. It offers insights into the evolution of climate and tourism research, identifies future link between thematic areas and approaches, and benefits disciplines. By providing new perspectives and integrating diverse data sources and methods, it supports carbon reduction efforts, informs policymakers, and assists companies in post-pandemic readjustment. This study aims to foster holistic research and contribute to the development of comprehensive approaches.

References

- Atzori, R., & Fyall, A. (2018). Climate change denial: Vulnerability and costs for Florida's coastal destinations. *Journal of Hospitality and Tourism Insights*, 1(2), 137–149. <https://doi.org/10.1108/JHTI-10-2017-0004>
- Azcarate, M. C. (2019). Fueling ecological neglect in a manufactured tourist city: planning, disaster mapping, and environmental art in Cancun, Mexico. *Journal of Sustainable Tourism*, 27(4, SI), 503–521. <https://doi.org/10.1080/09669582.2018.1478839>
- Balan, N., & Bordelon, B. M. (2021). The role of water and tourism management in Venice and New Orleans. Shima. *The International Journal of Research into Island Cultures*, 15(1), 273–292. <https://doi.org/10.21463/shima.120>
- Becken, S., & Wilson, J. (2016). Are tourism businesses' responses to weather variability a suitable precursor to climate change adaptation? *Worldwide Hospitality and Tourism Themes*.
- Becken, S., Whittlesea, E., Loehr, J., & Scott, D. (2020). Tourism and climate change: Evaluating the extent of policy integration. *Journal of Sustainable Tourism*, 28(10), 1603–1624.
- Beery, T. (2019). Exploring the role of outdoor recreation to contribute to urban climate resilience. *Sustainability*, 11(22). <https://doi.org/10.3390/su11226268>
- Bethel, B. J., Tang, D., Wang, L., & Buravleva, Y. (2022). A fuzzy comprehensive evaluation of climate change on the Xiamen tourism industry. *International Journal of Tourism Cities*, 8(2), 444–460. <https://doi.org/10.1108/IJTC-03-2021-0044>
- Braun, O. L., Lohmann, M., Maksimovic, O., Meyer, M., Merkovic, A., Messerschmidt, E., Riedel, A., & Turner, M. (1999). Potential impact of climate change effects on preferences for tourism destinations. *A Psychological Pilot Study. Climate Research*, 11(3), 247–254. <https://doi.org/10.3354/cr011247>
- Caldeira, A. M., & Kastenholz, E. (2018). It's so hot: Predicting climate change effects on urban tourists' time-space experience. *Journal of Sustainable Tourism*, 26(9), 1516–1542. <https://doi.org/10.1080/09669582.2018.1478840>
- Cavallaro, F., Galati, O. I., & Nocera, S. (2021). Climate change impacts and tourism mobility: A destination-based approach for coastal areas. *International Journal of Sustainable Transportation*, 15(6), 456–473. <https://doi.org/10.1080/15568318.2020.1762951>
- Cheng, J. C.-H., Chiang, A.-H., Yuan, Y., & Huang, M.-Y. (2018). Exploring antecedents of green tourism behaviors: A case study in suburban areas of Taipei, Taiwan. *Sustainability*, 10(6). <https://doi.org/10.3390/su10061928>
- Clemente, F., Lopes, A., & Ambrosio, V. (2020). Tourists' perceptions on climate change in Lisbon region. *Atmosphere*, 11(3). <https://doi.org/10.3390/atmos11030297>
- Dubois, G., Ceron, J. P., Gössling, S., & Hall, C. M. (2016). Weather preferences of French tourists: Lessons for climate change impact assessment. *Climatic Change*. <https://doi.org/10.1007/s10584-016-1620-6>
- Fang, Y., Yin, J., & Wu, B. (2018). Climate change and tourism: A scientometric analysis using CiteSpace. *Journal of Sustainable Tourism*. <https://doi.org/10.1080/09669582.2017.1329310>
- Gomez Martin, M. B., Armesto Lopez, X. A., & Cors Iglesias, M. (2017). Climate change perception and local adaptation responses: Rural tourism as a case study. *Cuadernos De Turismo*, 39, 287–310. <https://doi.org/10.6018/turismo.39.290571>
- Hadianpour, M., Mahdavinnejad, M., Bemanian, M., & Nasrollahi, F. (2018). Seasonal differences of subjective thermal sensation and neutral temperature in an outdoor shaded space in Tehran, Iran. *Sustainable Cities and Society*, 39, 751–764. <https://doi.org/10.1016/j.scs.2018.03.003>
- Hughey, K. F. D., & Becken, S. (2014). Understanding climate coping as a basis for strategic climate change adaptation—the case of Queenstown-Lake Wanaka, New Zealand. *Global Environmental Change*, 27, 168–179.
- IPCC. (2018). Global warming of 1.5 C. In *An IPCC Special Report on the Impacts of Global Warming*.

- industry in Barcelona, Spain. *Theoretical and Applied Climatology*, 142(3–4). <https://doi.org/10.1007/s00704-020-03341-x>
- Rozbicka, K., & Rozbicki, T. (2021). Long-term variability of bioclimatic conditions and tourism potential for Warsaw agglomeration (Poland). *International Journal of Biometeorology*, 65(9, SI), 1485–1495. <https://doi.org/10.1007/s00484-020-01957-2>
- Safarrad, T., Ghadami, M., Dittmann, A., & Pazhuhan (Panahandeh Khah), M. (2021). Tourism effect on the spatiotemporal pattern of land surface temperature (LST): Babolsar and Fereydonkenar Cities (cases study in Iran). *Land*, 10(9). <https://doi.org/10.3390/land10090945>
- Scott, D., Gössling, S., & Hall, C. M. (2012). International tourism and climate change. In *Wiley interdisciplinary reviews: Climate change*. <https://doi.org/10.1002/wcc.165>
- Scott, D., Hall, C. M., & Gössling, S. (2019). Global tourism vulnerability to climate change. *Annals of Tourism Research*. <https://doi.org/10.1016/j.annals.2019.05.007>
- Shi, Y., Wen, J., Xi, J., Xu, H., Shan, X., & Yao, Q. (2020). A study on spatial accessibility of the urban tourism attraction emergency response under the flood disaster scenario. *Complexity*, 2020. <https://doi.org/10.1155/2020/9031751>
- Terkenli, T. S., Bell, S., Toskovic, O., Dubljevic-Tomicevic, J., Panagopoulos, T., Straupe, I., Kristianova, K., Straigyte, L., O'Brien, L., & Zivojinovic, I. (2020). Tourist perceptions and uses of urban green infrastructure: An exploratory cross-cultural investigation. *Urban Forestry & Urban Greening*, 49, 126624. <https://doi.org/10.1016/j.ufug.2020.126624>
- Torres-Bagur, M., Ribas Palom, A., & Vila-Subiros, J. (2019). Perceptions of climate change and water availability in the Mediterranean tourist sector A case study of the Muga River basin (Girona, Spain). *International Journal of Climate Change Strategies and Management*, 11(4), 552–569. <https://doi.org/10.1108/IJCCSM-10-2018-0070>
- Usher, L. E., Yusuf, J.-E. (wie), & Covi, M. (2020). Assessing tourism business resilience in Virginia Beach. *International Journal of Tourism Cities*, 6(2), 397–414. <https://doi.org/10.1108/IJTC-02-2019-0019>
- Valizadeh, M., & Khoorani, A. (2020). An evaluation of climatic conditions pertaining to outdoor tourism in Bandar Abbas. *Iran. International Journal of Biometeorology*, 64(1), 29–37. <https://doi.org/10.1007/s00484-019-01790-2>
- White, G. F., Kates, R. W., & Burton, I. (2001). Knowing better and losing even more: The use of knowledge in hazards management. *Global Environmental Change Part b: Environmental Hazards*, 3(3), 81–92.
- WTO (2023). *Tourism on track for full recovery as new data shows strong start to 2023*. Available in <https://www.unwto.org/news/tourism-on-track-for-full-recovery-as-new-data-shows-strong-start-to-2023>, August 24 2023.
- Zeng, Y., & Dong, L. (2015). Thermal human biometeorological conditions and subjective thermal sensation in pedestrian streets in Chengdu. *China. International Journal of Biometeorology*, 59(1), 99–108.
- Zhang, A., Zhong, L., Xu, Y., Wang, H., & Dang, L. (2015). Tourists' perception of haze pollution and the potential impacts on travel: Reshaping the features of tourism seasonality in Beijing. *China. Sustainability*, 7(3), 2397–2414.
- Zhang, J., & Wu, L. (2015). Modulation of the urban heat island by the tourism during the Chinese New Year holiday: A case study in Sanya City. *Hainan Province of China. Science Bulletin*, 60(17), 1543–1546.
- Zhang, J., & Zhang, Y. (2020). Assessing the low-carbon tourism in the tourism-based urban destinations. *Journal of Cleaner Production*, 276, 124303. <https://doi.org/10.1016/j.jclepro.2020.124303>

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Chapter 4

Is the Tourism Perspective Envisaged in Climate Change Adaptation Planning?



Evaluating the Road Map of Political, Social and Environmental Dimension in Spanish Destinations

Carmen Mínguez and Sandra Ricart

Abstract Climate change is one of the main challenges for today's society due to the increase of extreme event frequency and severity, demanding policy actions and coordination to mitigate their impacts. This contribution analyzes to what extent tourism activity is considered in the Spanish National Plan for Adaptation to Climate Change 2021–2030 (PNACC) and the local strategies, which measures are considered to reinforce the tourism industry adaptive capacity, and how coherent tourist cities' plans for climate change adaptation are. To this end, the following research questions are posed: (1) What actions are promoted, and how do they aim to face climate change? (2) Is the type of tourist destination a driving factor conditioning actions design? (3) What is the balance between public and private responsibilities and actions when reducing the tourism industry's vulnerability? We evaluate the top-ten Spanish tourist cities by applying the triple-loop approach to delve into the political, social, and environmental dimensions of climate change adaptation together with testing policy coherence standards. The findings reported that most plans are framed in a multi-focal adaptation strategy, in which the focus on the tourism industry can be explicit or implicit while distinguishing between actions carried out by tourist cities and cities with tourists. Interestingly, bottom-up approaches are promoted to collect citizens' perspectives regarding climate change, sometimes including tourists as end-users. Furthermore, the policy coherence test pointed out the need to strengthen

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the attention to tourism-related measures and a more pro-active engagement of the tourism industry to motivate accurate and robust actions in the medium and long terms.

Keywords Climate change · Tourism · Cities · Adaptation plan · Coherence policy · Resilience · Causal-loop diagram

Introduction

The knowledge of tourism and climate change has expanded considerably, reflecting the growing interest, evidence, and concern related to the role of tourism in global environmental change, both as a contributor and as a recipient of impacts. The climate–tourism nexus has been studied since the 1960s, and it is now firmly established that the attractiveness of a prospective destination is influenced by different variables, including people’s mental representations of the weather, that is, the psychological representation of the weather, as an important factor in tourism demand and holiday decision-making, including travel motivations, destination choice, and the timing of travel (Ngxongo, 2021; Njoroge, 2015). Tourism can be considered a high climate- and weather-sensitive economic sector because climate and weather are considered among the most valuable natural resources in tourism development (Franzoni & Pelizzari, 2019). The literature provides a comprehensive understanding of the changing climate’s direct and indirect impacts on continental and island contexts, including changes in the atmosphere, the ocean’s physical parameters, and changes in extreme event patterns.

The evidence is that climate change already affects tourism regionally through diverse impacts on natural and cultural heritage and changes in demand patterns (Scott & Gössling, 2022). Climate change also affects several ecosystem services benefiting tourism (Cheer & Lew, 2017). Depending on location and topography, heavy rainfall events, including storms and floods, can decrease tourist stays in the short run (Kostianaia & Kostianoy, 2021). Rising sea levels and other environmental issues in coastal areas can reduce beach availability and trigger environmental and social change without historical parallel (Yong, 2021). More frequent and severe heatwaves could affect tourism demand and expenditure, reducing thermal comfort, intensifying the heat island effect, and therefore, conditioning the value of the recreational experience at the destination (Huang et al., 2019). These impacts will transform tourism’s competitiveness, sustainability, and spatial distribution, increasing the tourism industry’s vulnerability and related social systems (Scott et al., 2019).

According to the last estimations by the Department of Economic and Social Affairs of the United Nations, the global share of the urban population is projected to rise further to 60% by 2030, and 40% of the global population is estimated to be living in cities with at least half of million inhabitants. As vibrant epicenters of culture and commerce, some of the world’s greatest tourist destinations are cities, which attract a growing number of visitors yearly (Bock, 2015). Cities are key elements

that contribute to global low-carbon development, promote the implementation of global sustainable development goals (SDGs), and implement New Urban Agenda actions (NUA) (Hachaichi, 2022). Globally, cities have emerged as leading climate change adaptation and mitigation actors, reflecting a shift toward a more bottom-up approach to climate action and the unique capacities of urban policymakers to implement climate policies (Jiricka-Purrer et al., 2020). To date, more than 12,000 cities on every continent (excluding Antarctica), representing about 12% of the global population, have signed the Global Covenant of Mayors for Climate and Energy to set greenhouse gas (GHG) emissions reduction targets for their local territories.

Furthermore, cities play a crucial role in global climate change governance in three ways (Castán Broto, 2017): Firstly, cities support learning and exchange processes between local governments and other subnational organizations. Secondly, they gather local resources and knowledge to implement specific schemes. Thirdly, by raising the profile of cities in international agendas, they evoke the interest of political and business actors (including the tourism industry). However, debates on cities facing climate change require, first, recognition of the role of local governments and municipalities alongside other forms of state-control; and second, a turn of attention toward the multiple actors that intervene directly or through hybrid arrangements in urban governance, including the business sector, public–private partnerships, civil society organizations and community groups, and other diverse networks of actors who routinely change urban trajectories (Lopes et al., 2022). Understanding local-level responses to change is crucial in preparing the tourism industry, the communities, and policymakers to be responsive to change (Kajan & Saarinen, 2013).

Despite the differential impacts of climate change, tourism destinations must adapt to climate change, whether to manage risks or to capitalize on new opportunities associated with impacts on regional or global competitors (Scott, 2021). The tourism industry at the urban level tends to prefer applying different mitigation strategies, using voluntary, regulatory, and economic instruments that target different stakeholder groups. Voluntary instruments, such as strategic commitments by companies and/or tourist destinations—endorsed or not by official bodies—to combat climate change have been increasingly widespread as codes of conduct, good practice guides, eco-labels, or certifications or environmental management systems (Gómez-Martín, 2017). From an institutional perspective, considering climate change in tourism policy represents a considerable shift, given that traditionally, the objective pursued by Tourism Ministries and Bureaus was to grow tourism, increase revenue, and maximize economic benefits (Joppe, 2018). As Schweinsberg and Darcy (2022) pointed out, prioritizing different areas of intervention is a central question for managing and governance of climate change in urban areas attending to public and private roles and interests. To excel in this issue, cities must design and implement local climate plans, that is, planning documents prepared at the city level that contain policies relevant to climate change adaptation and/or mitigation for different activities, including tourism (Grafakos et al., 2020).

Numerous actions have been taken to address climate change in built environments, such as cities, including adaptation plans to define actions that lead to the

abatement or reduction of vulnerability to climate change and mitigation plans to encompass actions that entail a reduction in greenhouse gas emissions. Most of them focused primarily on either adaptation or mitigation actions, but there has been limited action to integrate both adaptation and mitigation to define the political, social, and environmental dimensions of the action against climate change (Becken et al., 2020). The division between climate change adaptation and mitigation and the potential conflicts that can emerge between the two have shaped debates about what kind of action is most appropriate and hindered the development of transversal action (Boyd et al., 2022). However, although only a minority of cities' action plans considered climate policies and even fewer implement integrated adaptation and mitigation plans, some studies provided examples of cities taking measures toward a more integrated approach in climate change planning (Reckien et al., 2018). According to Lin et al. (2021), adaptation measures integrating technological, nature-based, and social solutions can provide multiple co-benefits to address complex socio-ecological issues in tourism cities while increasing resilience to potential climate change impacts.

Although an analysis of climate change policies has occurred (Iwami et al., 2020), there is limited attention to the coverage of climate change actions in urban planning adaptation plans and, more specifically, to the relevance of tourism actions in city strategies to face climate change. Therefore, it is *sine qua non* to assess and analyze the content of the adaptation strategies and plans from a tourism industry's perspective. Specifically, previous studies corroborate the paucity of tourism work that addresses mitigation and adaptation holistically and suggest that the tourism sector applies a short-term decision-making framework that relies on action strategies rather than planning. This study represents a breakthrough in the study of climate change and tourism, as it develops a comprehensive climate risk framework specific to tourism. Its novelty lies in the fact that it seeks to explore and compare the approaches set out in cities' adaptation plans to provide insights into the adoption of adaptation strategies. This employs a qualitative methodology and is based on the triple-loop approach in terms of political, social, and environmental dimensions. This approach brings originality to the work by allowing the exploration and comparison of strategies established in urban adaptation plans to check if they are strategically planned considering the exposure of tourism to the impacts of climate change. To this end, we analyze secondary data from the available information at the local scale to answer the following research questions: (1) What actions are promoted and how do they aim to address climate change? (2) Is the type of tourism destination a driving factor conditioning the design of actions? (3) What is the balance between public and private responsibilities and actions in reducing the vulnerability of the tourism industry?

This chapter is divided into five sections. After this introduction, in Sect. 2 we present The Spanish National Climate Change Adaptation Plan (PNACC), the framework for action in Spain. In Sect. 3, we define the study areas and describe the data used and the indices applied for their analysis. The results are presented in Sect. 4, differentiating each of the three dimensions addressed. Finally, Sect. 5 contains the discussion and the main conclusions.

The Spanish National Climate Change Adaptation Plan 2021–2030 (PNACC)

The Spanish National Climate Change Adaptation Plan (PNACC) is the reference framework for coordinating the Public Administrations in impact assessment, vulnerability studies, and adaptation to climate change in Spain. This document replaces an earlier version published in 2006 and spanning 2006–2020. The current strategy for 2021–2030 was approved in September 2020 and considers a series of ecological systems and socio-economic sectors for impact assessment, vulnerability studies, and adaptation to climate change, including tourism. The plan aims to facilitate and provide continuous assistance to the interested administrations and organizations—public and private, at all levels—to evaluate the impacts of climate change and the system's adaptive capacity.

The plan includes a set of strategies aimed at avoiding or reducing the impacts of climate change, as well as improving the perception of the recovery of damages. According to the National Plan, which combines adaptation and mitigation issues, the autonomous communities have developed their strategic frameworks, plans, and/or programs on adaptation to climate change. These are developed through initiatives and actions, sometimes even reinforcing the legal framework on climate change. In addition, most of the large Spanish cities have approved their plans to locally face climate change, although these do not constitute a reproduction of the National Plan at the local level.

The current edition of the PNACC 2021–2030 includes, as a novelty compared to the first edition, the definition of a series of strategic objectives by sectors and a system of indicators. In addition, the number of topics addressed and the number of involved stakeholders have increased. Specifically, the plan contemplates the impact of climate change on the tourism sector, affecting four key aspects: tourism resources, tourism infrastructure, tourism supply, and tourism demand. Due to the physical characteristics of the destinations, those located on the coast or in high mountain areas are considered especially sensitive. The plan also provides an overview of the most frequent and relevant climate risks in tourist destinations:

- Increase in temperatures and heat waves, especially during the summer, coincides with the high tourism season in Spain. This fact is especially relevant for cities along the Mediterranean coast due to the increase in seawater temperature, which may affect the climatic comfort of visitors.
- Changes in rainfall patterns, droughts, and floods. A decreased or erratic precipitation supply, especially in summer and southern areas, combined with warmer temperatures, affects the water resources supply for certain tourist and recreational activities (e.g., swimming pool, landscaping).
- Rising sea level affects the tourist resources and infrastructures on the coast, but also alters the attractive sea–sand–sun products and puts at risk the highly valued tourism hotspots with economies heavily dependent on the travel sector.

The objectives of the plan related to the tourism sector consist of (i) integrating adaptation to climate change into plans, programs, and strategies in the field of tourism, including the Sustainable Tourism Strategy of Spain 2030; (ii) protecting tourist destinations and resources and promoting the resilience of infrastructures and equipment for tourist use; (iii) define tourism models that are sustainable and take into account the environmental load capacities and climatic conditions of the destinations, and iv) stimulate supply and demand for a tourism offer that combines a good adjustment to the new climatic conditions and a low-carbon footprint.

Materials and Methods

The literature suggested a more systemic approach to inform cost-effective and socially appropriate government and private sector investment in adaptation from a tourism sector perspective (Loehr, 2020). However, there is still limited understanding of what constitutes holistic, destination-wide, climate risk reduction and how different destination elements interact and influence climate risk and resilience in tourism cities (Jopp et al., 2010). A recent review by Loehr and Becken (2021) corroborates the small number of tourism studies that address mitigation and adaptation holistically, combining and complementing methodologies and approaches to comprehensively understand trade-offs, not just between different interventions or policy goals, but also between stakeholders and system elements. Furthermore, previous studies suggest that the tourism industry applies a short-term decision-making frame that relies heavily on ‘climate coping strategies’ rather than future-oriented planning, which makes innovative and transformation analysis frameworks more urgent than ever (Weaver et al., 2022).

The present study develops a comprehensive tourism-specific climate risk framework. It adopts the policy coherence for development (PCD) approach to reinforce system analysis and provide an analytical lens to understand the motivations, measures, and implementations geared toward integrating the tourism sector in climate change adaptation policies. The PCD framework considers four aspects through which coherence can be measured: (1) motivation for policies/strategies/plans, (2) action measures, (3) implementation and resources, and (4) monitoring and evaluation, including stakeholders’ engagement (Ahmed et al., 2022). This framework will be included in an evidence-based analysis of the main driving factors considered when addressing climate change adaptation from a tourism perspective. In practice, this means scaling up experiences (identified as case studies), and learning from a triple-loop approach (political, social, and environmental dimensions), while identifying main actions and expected results and highlighting potential weaknesses and barriers to adaptation combined with new knowledge exchange from local sensitivities.

Three research questions are formulated:

- (1) What adaptation actions are promoted, and how do they aim to face climate change to reinforce tourism resilience?
- (2) Is the type of tourist destination a driving factor that differentiates or conditioning the designed actions?
- (3) What is the balance between public and private responsibilities and the actions developed to reduce the vulnerability of the tourism sector?

Data Collection

This research follows the statement by Vale (2014) and Landauer et al. (2019), according to which climate change resilience should be assessed at the local scale, being aware that actions tend to be initiated by different jurisdictions and administrations and steered by various rules, laws, and regulations to finally converge and interact (e.g., at the city level). Consequently, and in the absence of similar studies carried out in Spain, we evaluate the coverage of climate change actions in the plans and strategies developed by the ten most visited Spanish cities in 2022. Our aim is to deepen their capacity to increase resilience to impacts of climate change from a tourism perspective, filling a research gap.

Cities were selected based on official data from national and international travelers offered by the Hotel Occupancy Survey of the Spanish National Institute of Statistics. This source collects information at the municipal level for the main Spanish destinations. The number of travelers has been considered a criterion for the selection to represent the volume of tourism activity while offering a diverse dimension in terms of destination typology (i.e., other variables, such as overnight stays, tend to overestimate the coastal destinations where the stay is more prolonged). Local-level adaptation planning documents available on municipalities' websites were collected for each selected city, as key secondary sources. This documented public material is the best available information that can be used for comparative purposes, avoiding subjective self-reported information by governments.

Table 4.1 includes the locations used in the analysis, detailing the number of annual visitors, the name of the strategy or plan developed and the year of approval, and the main climate risks to be faced.

Data Analysis

The analysis aims not to compare the case studies per se but to consider the selected case studies as frontrunners in the Spanish and European contexts. Instead, we deepen the relative importance of the resilience of tourist cities based on the advantages and challenges ascribed from climate change adaptation strategies and plans to explore how they can be translated into practical effects (Madsen & Hansen, 2018). First, an evaluation matrix was used to detail a set of criteria to characterize each dimension of

Table 4.1 Characterization of selected local experiences as tourist cities

City	Visitors (in million)	Strategy/plan	Year
Madrid	8.6	<i>Hoja de Ruta hacia la neutralidad climática en 2050</i> [roadmap toward climate neutrality in 2050]	2019 (updated in 2022)
Barcelona	7.4	<i>Plan de Acción por la Emergencia climática 2030</i> [Action Plan for the Climate Emergency 2030]	2021
Sevilla	2.6	<i>Plan de acción por el clima y la energía sostenibles</i> [action plan for sustainable climate and energy]	2017
Palma (Balearic Islands)	2.4	<i>Pla d'Acció per Clima i l'Energia Sostenible de Palma</i> [Action Plan for Climate and Sustainable Energy of Palma]	2022
Benidorm	2.0	<i>Plan de adaptación ante el cambio climático de Benidorm</i> [Benidorm climate change adaptation plan]	2021
Valencia	1.9	<i>Plan de acción medioambiental del Municipio de Valencia</i> [environmental action plan of the Municipality of Valencia]	2020
San Bartolomé de Tirajana (Canary Islands)	1.6	<i>Plan de Acción por el Clima y la Energía Sostenible</i> [Action Plan for Climate and Sustainable Energy]	2021
Calvià (Balearic Islands)	1.6	<i>Plan de Acción para el Clima y la Energía Sostenible de Calvià</i> [Calvià Climate and Sustainable Energy Action Plan]	2020
Adeje (Canary Islands)	1.5	<i>Plan estratégico local contra el cambio climático</i> [local strategic plan against climate change]	2019
Málaga	1.3	<i>Alicia. Plan del clima de Málaga</i> [Alicia. Malaga climate plan]	2021

Note The scale of intervention is local for each case study and has been developed by the City Hall. Data on visitors for 2022 according to the Spanish National Institute of Statistics. 'Climate variability' was characterized according to Arabadzhyan et al. (2021). Granada is ranked 8th but has not yet defined a strategy plan for climate change adaptation

Source Authors' own elaboration

the triple-loop approach on the urban scale and evaluate their relevance in integrating mitigation and adaptation actions (Hurlimann et al., 2021). Each dimension has been conceptualized from desktop research and described by adopting similar methods (Ricart et al., 2022; Serra et al., 2022). Following similar studies (Ledda et al., 2021), we used unweighted criteria to outline each dimension (i.e., we assigned the criteria the same weight).

Therefore, each dimension has been described using components and indicators. A total of 12 components and 37 indicators have been used to delve into cities' adaptation plans (Fig. 4.1). Consequently, the political dimension was analyzed through

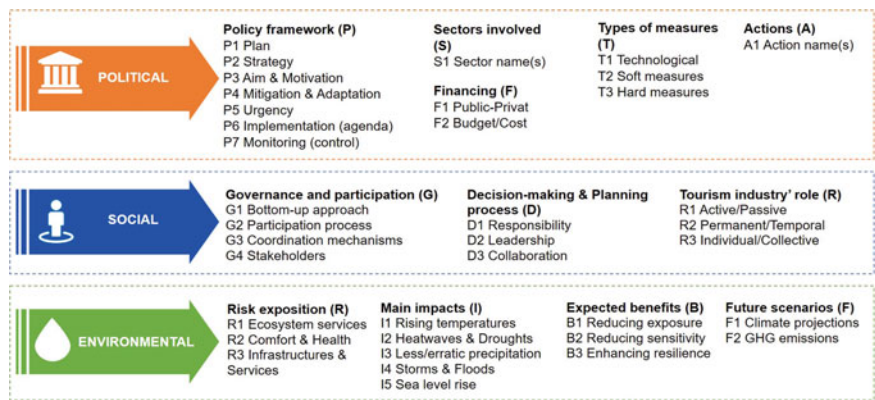


Fig. 4.1 Triple-loop approach detailing the political, social, and environmental dimensions, components, and indicators. *Source* Authors' own elaboration

14 indicators organized in five components: policy framework, sectors involved, type of measures, actions, and financing; the social dimension was analyzed through 10 indicators organized in three components: governance and participation, decision-making and planning processes, and role of the tourism industry; and finally the environmental dimension was analyzed through 13 indicators organized in four components: risk exposure, main impacts, expected benefits, and future scenarios.

Then, we examined the policy coherence between climate change adaptation requirements and focus on tourism actions according to the content of the adaptation plans. Policy coherence has emerged as a prominent concept in the debates surrounding sustainable development and adaptation, that is, the extent to which the institutional structure fosters coherent and coordinated policy-making and implementation (Glass & Newig, 2019). Different conceptual frameworks have been developed to measure policy coherence: It can be undertaken vertically and horizontally. The former refers to coherence between different levels of government, while the latter refers to coherence between policy areas and subjects (Kelleher et al., 2019). We opted to apply the second approach to explore if and how the tourism area reinforces policy actions across government departments and agencies, creating synergies toward climate change adaptation. Different coherence factors are considered: motivation, measures, implementation and resources, and monitoring and evaluation (Table 4.2). Each factor includes different variables that will be evaluated depending on whether they are explicit (E), implicit (I), or not mentioned (NM). Then, a specific score method similar to that applied by Olazabal and Ruiz de Gopegui (2021) was considered to translate qualitative into quantitative data by defining for each metric the following punctuations: explicit (1 point), implicit (0.5 points), and not mentioned (0 points).

Table 4.2 Factors for policy coherence analysis

Factor	Variable
Motivation	Observed climate change trends
	Projected climate change impacts
Measures	Tourism related
	Pro-active management
Implementation and resources	Institutional set-up
	Responsibilities
	Financial
	Supporting areas
Monitoring and evaluation	Implementation follow-ups
	Reporting

Source Adapted from Ranabhat et al. (2018)

Experiences

The selected case studies are located in six regions (Fig. 4.2), combining inland and coastal contexts and defining different typologies and motivations for tourism destinations. All of them are signatories of the Global Covenant of Mayors for Climate & Energy (GCoM), the largest global alliance for city climate leadership. Likewise, Madrid, Barcelona, Sevilla, and Valencia are members of CitiES 2030, a Spanish platform for promoting climate-neutral cities. Furthermore, Madrid and Barcelona take part of the ‘A list’ defined by the CDP not-for-profit charity to recognize the 122 cities across the globe leading environmental action, and the ‘C40 list’, a network of mayors of nearly 100 world-leading cities collaborating to deliver urgent action to confront the climate crisis.

Madrid, the capital of Spain, is considered one of the main tourist destinations in Europe since, in addition to housing the seat of government and state administration, it is home to the leading museums and the headquarters of numerous international companies, educational institutions, as well as meeting facilities. This rich and diverse offer makes it a significant cultural, leisure, shopping, meetings–incentives–conferences–exhibitions (MICE), and business destination. It also benefits from a highly centralized transportation network, which connects to all cities in the country and an international airport with direct connections to all European and American capitals.

Since the 1992 Olympic Games, Barcelona, the capital of the autonomous community of Catalonia, has become an international benchmark as a destination for a city break and MICE tourism. The consolidation of its port as the start and end of Mediterranean cruises, as well as low-cost flights and the presence of the urban beach, inferred the overtourism in the city. This process has been associated with social conflicts and the response of residents who see how their quality of life is reduced. In recent years, city council efforts have been focused on finding a balance.



Fig. 4.2 Case studies' location. *Source* INE for the map information and own elaboration and <https://procomun.intef.es> for the pictures

Sevilla is a monumental city and the capital of the autonomous community of Andalusia. The city is well recognized for its cultural attraction and leisure offers. In the years prior to COVID-19, tourist activity experienced a strong growth manifested in the expansion of the city's tourist area, affecting popular neighborhoods. The impacts of touristization are manifested in the proliferation of tourist rental housing, the replacement of traditional businesses with others oriented to tourist demand, and the rapid increase in residential rentals. These factors have led to population expulsion and even a thematization of specific areas.

Palma has been an important tourist destination since the beginning of the twentieth century, and since the 1960s, it has consolidated its position as a mass destination. Its cultural, leisure, and shopping offer is complemented by the sun and the beach, the island's main attraction. Its historic center has experienced since the 1990s an intense process of gentrification, which has driven out residents and businesses. In

recent decades, this process has increased foreign capital investment and tourist pressure, especially in the housing market with the massive proliferation of Airbnb. As in Barcelona, the social response is strong and forces the administration to regulate in search of balance.

Benidorm, in the autonomous community of Valencia, is one of the main tourist destinations of the Costa Blanca, on the Mediterranean coast. It began to receive visitors in the nineteenth century, and in 1956 the City Council approved the urban planning designed to create a city for tourist leisure. Likewise, the Benidorm music festival promoted the city internationally. Since then, Benidorm has become a film set and has received international tourists attracted by its beaches and nightlife. It remains active during the winter thanks to the IMSERSO social program to promote national tourism mobility. It is the third city with the most hotel rooms in Spain and the first to receive the Smart Tourist Destination certificate.

Valencia is a medium-sized city, the capital of the Autonomous Community of Valencia. During the twentieth century, it was consolidated as an urban destination, especially for domestic tourism. In recent decades, due to improvements in accessibility, it has experienced a significant increase in tourist activity and, consequently, the touristization of its historic center. Since the late 1990s, the city has diversified its offer, with the construction of the City of Arts and Sciences and later with the renovation of the marina to host America's Cup in 2007, as well as numerous facilities that make it an essential destination for sports tourism, internationally recognized.

San Bartolomé de Tirajana is one of the municipalities of southern Gran Canaria Island. Since the early 1960s, the city has progressively exemplified the replacement of the dominant role of agricultural activity for the nascent tourism industry, especially with the introduction of sun and beach products in coastal areas. Tourism activity transformed the territory, which has artificialized the main natural areas to regenerate beaches, promenades, breakwaters, etc., adding the construction of much of the coastal strip to offer the related accommodations.

Calvià is a municipality located next to the Sierra de la Tramontana Mountain range and on the Mediterranean coast, on the island of Mallorca. After Palma, it is the second municipality in the number of inhabitants of the Balearic archipelago. It is made up of several population centers defined after the tourist and urban development of the twentieth century. It has a wide and diverse offer of accommodations, ranging from coastal hotels to rural houses, an important second-home offer, and sports facilities (ports, golf courses, tennis academies, and hiking areas, among others).

Adeje is located in the south of Tenerife, one of the seven islands of the volcanic origin of the Canary archipelago, located in the Atlantic Ocean. The tourism development of the island has been based on the sun and beach product, particularly intense in the southern tourist area (Arona-Los Cristianos/Adeje-Las Américas), where mass tourism generates environmental and territorial impacts.

Málaga, in the autonomous community of Andalusia, is an urban destination with a cosmopolitan vocation. Visitors are attracted by the cultural, gastronomic, and leisure potential of the city, as well as by its weather conditions and proximity to beaches. These, together with improvements in accessibility and investments in culture, have led the city to experience strong growth and tourist transformation of

tourists in a short period. This process has significantly impacted the historic center, which has suffered an increase in visitors and tourist accommodations, as well as the alteration of traditional activities and functions.

Results

The Triple-Loop Approach

The Political Dimension

The selected projects have been developed as part of a strategy specific to the urban area (e.g., Madrid, Palma, San Bartolomé de Tirajana, Málaga), even framed in a more far-reaching adaptation policy framework (e.g., Barcelona, Sevilla, Adeje). Plans include both mitigation (preventing or reducing the emission of GHG) and adaptation (anticipating the adverse effects to prevent or minimize the damage) actions to be developed in a time frame from 2030 (e.g., Adeje, Calvià) to 2050 (e.g., Madrid, Palma). However, some plans do not specify the period able to accomplish the targeted goals (e.g., Valencia). Although only half of the plans explicitly recognize the urgency for action (e.g., Madrid, Barcelona, Sevilla, Palma, and Málaga), most of them provide an implementation agenda, either in a schedule form (e.g., Barcelona, Benidorm), according to different scenarios at the short, medium, and long term (e.g., Madrid, Palma, Valencia), or providing a start and end date for each action (e.g., San Bartolomé de Tirajana, Calvià, Adeje). Likewise, they all count for monitoring indicators; some fix milestones (Palma, Valencia, Málaga) or priority levels (Benidorm).

Tourism is explicitly mentioned in most of the plans as one of the priority activity sectors in which to promote mitigation and adaptation measures (Sevilla, Palma, Benidorm, San Bartolomé de Tirajana, Calvià), while in other city plans, tourism is included in a more general description of the tertiary sector or service activities (Madrid, Barcelona, Valencia). Thus, there are two approaches to climate change intervention from a tourism perspective: a 'tourist city' or a 'city with tourists'. Interestingly, plans differ in the type of measures and actions promoted to reduce the vulnerability of cities to climate change (Table 4.3). All cities are committed to a change in climate culture, although with different ideological approaches. Thus, while Madrid bets on a modal change focused on private mobility, Barcelona advocates for a change in the economic development and natural resource consumption models. For this purpose, they all combine technological measures (promoting innovation to reduce vulnerability) with hard measures (enhancing the construction of physical infrastructure and/or the improvements to the existing infrastructure) and soft measures (facilitating actions on policy, social change, management, and finance to increase awareness on climate change).

Table 4.3 Political dimension, components, and indicators in case studies

City	Main type of measures		
	Technological	Hard	Soft
Madrid	Water and energy savings and management Waste management Smart lighting Urban access regulations	Efficient energy systems at home, public spaces, and transport Renewable energy sources Green cover	Awareness campaigns Studies and plans Normative updates Coordination network
Barcelona	Water and energy savings and management Waste management Urban access regulations	Efficient energy systems at home, public spaces, and transport Green roofs in public buildings Green cover and shaded areas Renewable energy sources Charging stations	Climate finance Public energy trader Tax incentives Awareness campaigns Education and learning Studies and plans Normative updates and protocol review
Sevilla	Water and energy savings and management Waste management Smart lighting Urban access regulations	Efficient energy systems at home, public spaces, and transport Renewable energy sources Green cover and green connection Public fountains Charging stations	Tax incentives Informative website Education and learning Coordination agency
Palma	Water and energy savings and management Waste management Smart lighting Urban access regulations	Renewable energy sources Green cover	Audited financial statements Public energy trader Financial incentives Education and learning Awareness campaigns Normative updates
Benidorm	Water and energy savings and management Waste management	Green cover Desalination plant	Education and learning Studies and plans Awareness campaigns Normative updates Coordination agency
Valencia	Water and energy savings and management Waste management Smart lighting	Renewable energy sources Charging stations	Financial incentives Energy audits Awareness campaigns Education and learning Studies and plans Normative updates

(continued)

Table 4.3 (continued)

City	Main type of measures		
	Technological	Hard	Soft
San Bartolomé de Tirajana	Water and energy savings and management Smart lighting	Renewable energy sources Charging stations Cycling network Park and ride	Energy audits and certifications Financial incentives Studies and plans Awareness campaigns Education and learning Normative updates Smart mobility app
Calvià	Water and energy savings and management Waste management Smart lighting	Cycling network Renewable energy sources Charging stations	Energy audits and certifications Financial incentives Awareness campaigns Studies and plans Education and learning
Adeje	Water and energy savings and management Waste management Smart lighting	Renewable energy sources	Financial incentives Awareness campaigns Normative updates Studies and plans Coordination agency
Málaga	Water and energy savings and management Waste management	Green cover Cycling network	Normative updates Studies and plans Education and learning Financial incentives Awareness campaigns Energy audits Coordination agency Observatory

Source Authors' own elaboration

All cities promote technological measures to ensure water and energy savings and management while focusing on waste management (all except San Bartolomé de Tirajana), smart lighting (e.g., Valencia, San Bartolomé de Tirajana, Calvià, Adeje), and urban access regulations (Madrid, Barcelona, Sevilla, and Palma). Most cities support hard measures by introducing efficient energy systems at home, public spaces, and transport and expanding renewable energy sources. At the same time, complementary actions focus on reinforcing green cover (Madrid, Barcelona, Sevilla, Palma, Benidorm, and Málaga) or enhancing sustainable mobility by popularizing charging stations (e.g., Barcelona, Sevilla, Valencia) and enhancing the cycling network (San Bartolomé de Tirajana, Calvià, and Málaga). Regarding soft measures, cities highlight two common strategies: awareness-raising campaigns combined with education-learning programs and climate financing and incentives. Likewise, some cities opt for normative updates (e.g., Barcelona, Valencia, San Bartolomé de Tirajana) and coordination agencies (Sevilla, Benidorm, Adeje, and Málaga) or network (Madrid).

Most cities point out examples of actions related to the adaptive capacity of the tourism sector. For example, Sevilla aims to create shady public places that favor rest areas for tourists (and the inhabitants), while Palma and Valencia promote awareness campaigns for tourists. Benidorm encourages the implementation of environmental management systems in tourist accommodation, and San Bartolomé de Tirajana implements conservation and protection measures for the natural environment as a way of promoting sustainable tourism, similarly with the action of promoting constructive and functional recovery of the natural heritage for its enhancement and tourist use implemented in Adeje. This city also introduces support campaigns to the tourism sector to reduce GHG emissions or the creation of the Atlantic Tourism Laboratory as an innovation center to collect data on tourism development and behavior and rethink new ways of approaching the present and future dynamics of the sector. Regarding the cost of the actions, all cities except Madrid and Barcelona provide information about the cost of each action, specifying, in most cases, the public and/or private financing.

The Social Dimension

Most cities follow a bottom-up approach when planning adaptation actions, including different participation mechanisms (Table 4.4). For example, Madrid seeks a platform to stabilize collaboration frameworks taking advantage of the European initiative Climate-KIC to accelerate the transition to a zero-carbon and climate-resilient society, while Barcelona prefers the co-creation of multiple activities, workshops, and seminars. Sevilla develops thematic workshops to (1) publicize the causes and foreseeable consequences of climate change at the local level to increase citizens' awareness of the need to be prepared for possible impacts, (2) collect direct perceptions of the effects of climate change in the city from different social agents, and (3) jointly define the most appropriate adaptation measures to minimize exposure and vulnerability. Benidorm and Málaga propose a calendar of conferences to share advances in the actions and the dissemination of the annual monitoring report, and Palma emphasizes collecting citizen perception through a digital survey. Most of these actions are mainly coordinated internally through the different technical areas of the City Hall (Barcelona, Benidorm, Valencia, Calvià). However, some plans incorporate stakeholders into decisions to create public-private partnerships, including regional administrations (San Bartolomé de Tirajana), research institutions (Madrid, Sevilla, Adeje), corporations and companies (Málaga), and the public (Palma).

City Halls are leading responsibility in decision-making processes, in some cases, taking advantage of collaborations at the interdepartmental level (Madrid, Barcelona, Palma), counting with citizens (Valencia), or exchanging experiences with other municipalities and the tourism sector (Benidorm, Málaga). Regarding the role of the tourism sector in the climate change mitigation and adaptation process, we can distinguish between tourist cities, that is, cities with an active role in the definition and implementation of actions (Sevilla, Benidorm, San Bartolomé de Tirajana, Calvià, Adeje, and Málaga) and cities with tourists, that is, cities performing a secondary or

Table 4.4 Social dimension, components, and indicators in case studies

City	Governance and participation				Decision-making and planning			Tourism sector role		
	G1	G2	G3	G4	D1	D2	D3	R1	R2	R3
Madrid	✓	✓	✓	✓	CH	CH	✓	PA		CO
Barcelona	✓	✓	✓		CH	CH	✓	PA		CO
Sevilla	✓	✓	✓	✓	CH	CH		AC	PE	BO
Palma	✓	✓	✓	✓	CH	CH	✓	PA	TE	CO
Benidorm	✓	✓	✓		CH	CH	✓	AC	PE	CO
Valencia	✓	✓	✓	✓	CH	CH	✓	PA	TE	IN
San Bartolomé de Tirajana		✓	✓	✓	CH	CH		AC	PE	IN
Calvià	✓				CH	CH		AC	TE	IN
Adeje	✓	✓	✓	✓	CH	CH		AC	PE	BO
Málaga	✓	✓	✓	✓	CH	CH	✓	AC	PE	BO

Source Authors' own elaboration

Codes Legend G1 (bottom-up approach), G2 (participation process), G3 (coordination mechanisms), G4 (stakeholders); D1 (responsibility), D2 (leadership), D3 (collaboration); R1 (active or passive), R2 (permanent or temporal), R3 (individual or collective). Answers legend: CH (City Hall), PA (passive), AC (active), PE (permanent), TE (temporal), CO (collective), IN (individual), BO (both)

passive role in adaptation implementation (Madrid, Barcelona, Palma, and Valencia). Excluding Madrid and Barcelona, cities define their role in the adaptation agenda according to the level of involvement, which can be occasional (Palma, Valencia, Calvià) or permanent (Sevilla, Benidorm, San Bartolomé de Tirajana, Adeje, and Málaga), but also considering their capacity to cooperate in developing mitigation or adaptation actions. For example, by promoting changes in the urban planning and infrastructures that favor exclusively the tourist sector (e.g., Valencia, San Bartolomé de Tirajana, Calvià), the residents (e.g., Madrid, Barcelona), or both residents and tourists (e.g., Sevilla, Benidorm).

The Environmental Dimension

Cities are aware of their risk of exposure to climate change and agree to perceive the main impacts of extreme weather events. However, only some cities provide details on how exposure to risk affects ecosystem services, comfort and health, or infrastructures and services (Table 4.5). For example, cities such as Madrid, Sevilla, Benidorm, and Valencia recognize concerns about the effects on the river environment and biodiversity. At the same time, Adeje provides a more holistic plan by identifying ecosystem risks. In general, cities pinpoint health and comfort disturbances and alterations in infrastructures and services due to climate change scenarios. However,

they do not share details on managing risk exposure. There are two exceptions: San Bartolomé de Tirajana, which provides indicators related to the most vulnerable sectors, and Valencia, which promotes infrastructure adaptation to reduce the risk of proliferation of infectious vectors.

Cities notice main perceived impacts related to changes in temperature and precipitation patterns, such as rising temperatures, heatwaves and droughts, or less rainfall or erratic patterns, storms, and floods, in some cases inducing sea level rise. Plans tend not to regionalize these effects; a little background is transferred about local or particular damages. In some cases, experiences are shared through indicators of climatic threats (e.g., San Bartolomé de Tirajana). Likewise, plans contribute with observations about the expected benefits of applying the mitigation/adaptation plan in terms of reducing exposure (in some cases laying out the cost of inaction, e.g., Sevilla, Calvià) and sensitivity, for example, through communication campaigns (Madrid, Sevilla, Palma), green/climate entrepreneurship competitions and a training plan for young people (Benidorm) and together with universities (Adeje), or tax incentives and supporting programs (Málaga). Interestingly, most cities aim to enhance resilience from a social perspective, for example, by delving into transversal issues such as energy poverty (Barcelona, San Bartolomé de Tirajana, Málaga), the gender dimension, and those most vulnerable target groups (Barcelona). Regarding future scenarios, all plans except San Bartolomé de Tirajana and Calvià include climate change projections (mainly focused on temperature and precipitation patterns from

Table 4.5 Environmental dimension, components, and indicators in case studies

City	Risk exposure			Main impacts					Expected benefits			Future scenarios	
	R1	R2	R3	I1	I2	I3	I4	I5	B1	B2	B3	F1	F2
Madrid		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Barcelona		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sevilla		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Palma		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Benidorm		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Valencia		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
San Bartolomé de Tirajana		✓	✓	✓	✓	✓	✓	✓	✓	✓			
Calvià		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
Adeje		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Málaga		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source Authors' own elaboration

Codes Legend R1 (ecosystem services), R2 (comfort and health), R3 (infrastructures and services); I1 (rising temperatures), I2 (heatwaves and droughts), I3 (less rainfall or erratic patterns), I4 (storms and floods), I5 (sea level rise); B1 (reducing exposure), B2 (reducing sensitivity), B3 (enhancing resilience); F1 (climate projections), F2 (GHG emissions reduction target)

RCP 4.5 and RCP 8.5 scenarios), albeit with different time frames starting from the short- and mid-term (2030–2050) as in the case of Málaga, to the long-term as for Barcelona, Palma, Benidorm, Valencia, and Adeje). However, concerning GHG emissions, cities tend to limit their projections to the short-term (2020–2030) as for Palma, Calvià, and Adeje or to the mid-term scenarios (2050) as for Madrid or Málaga.

Policy Coherence

The policy coherence framework analysis identifies how most plans explicitly or implicitly recognize the factors building coherence between adaptation actions and associated management (Table 4.6). Motivation factors considering observed climate change trends are explicitly reported in all cities, while most cities (all except San Bartolomé de Tirajana and Calvià) also pointed out the projected patterns for the short-medium term (e.g., 2030–2050). Interestingly, cities explicitly or implicitly notice measures related to the tourism sector, in most cases combined with a proactive management role. In general, cities tend to provide an institutional set-up about the measures planned to develop while assuming different levels of responsibility. Likewise, all cities point out the budget or cost of implementing actions, sometimes subordinated to supporting areas. Regarding the monitoring and evaluation processes, all cities explicitly arrange implementation follow-ups, while all except Barcelona also explicitly report the advances of the plan.

The policy coherence test highlights an average score for the cities' level of accuracy of 83.5/100 points. Cities obtain an average of 18/20 points when planning adaptation in terms of observed and perceived climate change trends (*motivation*), 15.5/20 points regarding the role and focus on tourism activities (*measures*), 30.5/40 points on actions' responsibility and supporting management (*implementation & resources*), and 19.5/20 points on reporting and balancing actions' expected results (*monitoring & evaluation*). Interestingly, the only two issues where all city plans coincide are related to the 'motivation' and 'monitoring & evaluation' blocks: reporting observed climate change trends and implementation follow-ups (10/10 points for each). In contrast, less background is provided regarding supporting areas (5/10 points).

By cities, the average score for policy coherence is 8/10, moving from the lowest levels obtained by some of the largest cities (e.g., Madrid, Barcelona, Sevilla) (8/10 points) to the highest levels obtained by Palma and Benidorm (10/10 points). However, findings suggest that cities do not report the same level of coherency for each category and related factors. Figure 4.3 provides an overview of how cities respond to each policy coherence factor. Results indicate the highest scores in detailing the implementation processes and resources available to develop the mitigation/adaptation plan. Out of four points, Palma, Benidorm and Valencia score better in the 'implementation and resources' category, while for 'monitoring and

Table 4.6 Policy coherence analysis to each case study

Factor	Variables	Explicit	Implicit	Not mentioned
Motivation	1	ALL		
	2	Madrid, Barcelona, Sevilla, Palma, Benidorm, Valencia, Adeje, Málaga		San Bartolomé de Tirajana, Calvià
Measures	3	Sevilla, Palma, Benidorm, San Bartolomé de Tirajana, Calvià	Madrid, Barcelona, Valencia, Adeje, Málaga	
	4	Sevilla, Benidorm, San Bartolomé de Tirajana, Calvià, Adeje, Málaga	Madrid, Barcelona, Palma, Valencia	
Implementation and resources	5	Barcelona, Palma, Benidorm, Valencia, Calvià, Málaga	Madrid, Sevilla, San Bartolomé de Tirajana, Adeje	
	6	Madrid, Palma, Benidorm, Valencia, San Bartolomé de Tirajana, Calvià, Adeje	Barcelona, Sevilla, Málaga	
	7	Sevilla, Palma, Benidorm, Valencia, San Bartolomé de Tirajana, Calvià, Adeje, Málaga	Madrid, Barcelona	
	8	Madrid, Barcelona, Palma, Benidorm	Valencia, Málaga	Sevilla, San Bartolomé de Tirajana, Calvià, Adeje
Monitoring and evaluation	9	ALL		
	10	Madrid, Sevilla, Palma, Benidorm, Valencia, San Bartolomé de Tirajana, Calvià, Adeje, Málaga	Barcelona	

Source Authors' own elaboration

Legend Observed climate change trends (1), projected climate change impacts (2), tourism related (3), pro-active management (4), institutional set-up (5), responsibilities (6), financial (7), supporting areas (8), implementation follow-ups (9), reporting (10)

evaluation' factors, cities pursue a common pattern in which only Barcelona hold lower relevance.

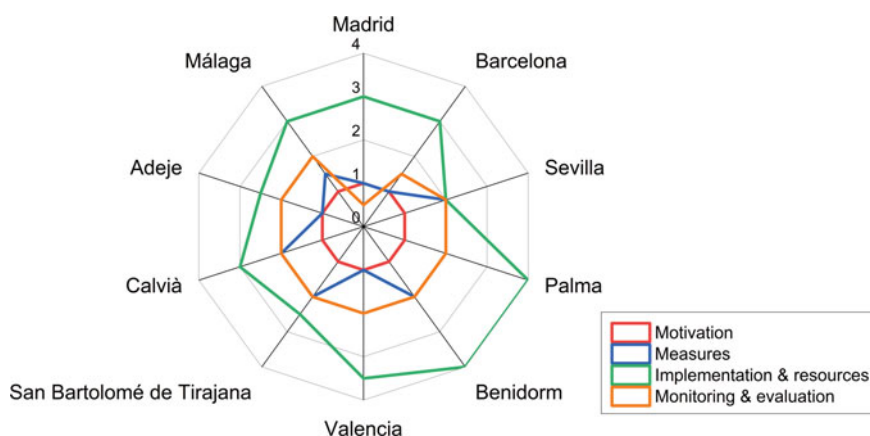


Fig. 4.3 Policy coherence scores by city and according to main factors. *Source* Authors' own elaboration

Discussion and Conclusions

Climate change is the single most important global environmental issue facing the world today and has emerged as a major topic in tourism analysis. Increasing temperatures and changes in rainfall patterns are already affecting the tourism industry and are anticipated to have profound implications for tourism in the twenty-first century, including consumer holiday choices, the geographic patterns of tourism demand, the competitiveness and sustainability of destinations, and the contribution of tourism to international and sustainable development, particularly in semi-arid regions (Grafakos et al., 2020; Scott et al., 2012). Regional studies also identified the effects of climate change, for example, on the Spanish tourist activity, including (1) loss of market share worldwide; (2) long-term reduction in the number of tourist arrivals; (3) relative loss of relevance of sun and beach tourism destinations due to the lack of climatic comfort in summer; and (4) possible changes in inland tourist destinations, with a loss of importance of the Mediterranean coast (Olcina Cantos, & Vera-Rebollo, 2016). Tourism is not a tangential activity but rather a significant agent of change, modifying policies, economies, landscapes, societies, cultures, and behaviors. It is part of the forces that affect and are affected by the geophysical changes that characterize the Anthropocene, asking for action and attitude change (Giannetti et al., 2020).

This research explored if and how the ten most visited Spanish cities adapt to climate change impacts by delving into their local mitigation and/or adaptation plans. The triple-loop approach to determine the political, social, and environmental nature of their adaptive capacity reported three main issues. First, city plans include mitigation and adaptation actions, in most cases being framed in a more ambitious adaptation strategy, which opens the door to considering climate change mitigation and adaptation as cross-sectoral tasks that are integrated into major city development

processes (e.g., urban and transport planning, green area management, education, etc.) (Kern, 2019). However, findings show that, even if it can benefit from the adaptation measure, tourism is not explicitly mentioned when promoting most of the actions, mainly focused on combining technological and hard measures to ensure water and/or energy savings and management and reinforce renewable energy sources, with the final aim of setting up strategies to become green, sustainable, circular, carbon-neutral, and resilient for both the residents and tourists (Haupt et al., 2022). Second, cities agree to promote bottom-up approaches and participation mechanisms, mainly focused on awareness campaigns, studies, and education or learning activities (e.g., conferences, workshops, surveys), to collect citizen perspectives and behaviors on climate change. Other soft measures, such as normative updates or the promotion of coordination agencies, are also considered to align adaptation and development into synergistic planning while reinforcing urban governance (Saikia et al., 2022). Finally, although plans recognize climate change risks and impacts of extreme weather events, only some cities provide details on how risk exposure affects ecosystem services, comfort and health, and infrastructures and services or how to manage risk and potential damages at the local urban scale. Conversely, plans prefer to focus on the expected benefits of developing actions, particularly when these actions entail enhancing resilience from a social perspective while delving into multi-focal issues (e.g., energy poverty, gender dimension, most vulnerable target groups and activities), which fits with the integrated assessment of climate change adaptation to increase urban resilience (Velasco et al., 2020). Interestingly, these three main issues are not conditioned by differences in cities' behavior according to their location. However, large cities (Madrid, Barcelona, and Valencia) tend to understand urban planning beyond the effect of tourism (i.e., they are considered as 'cities with tourists'). On the contrary, the smaller ones consider tourism as an active sector in planning (i.e., they are envisaged as 'tourist cities').

Furthermore, the policy coherence test pointed to the need to strengthen the attention to tourism-related measures and a more pro-active engagement of the tourism industry to motivate more accurate actions in the medium and long terms. Likewise, some studies (Olazabal & Ruiz de Gopegui, 2021) consider financial availability as one of the most important indicators of policy coherence because it determines the capacity to change and improve policies at the local scale. Our findings reported how most cities provide a detailed plan in terms of budget allocation and cost for each action, which facilitates the applicability and timing standards of the adaptation plan. However, authors such as Huttunen et al. (2014) also assert that policy coherence requires consistency between goals, instruments, and implementation procedures to promote synergies and mitigate conflicts between and within different sectors to achieve intended objectives. Our analysis tested the level of accuracy in terms of motivation, measures, implementation and resources, and monitoring and evaluation, obtaining the best results in the implementation and resources panel, with particular attention on follow-up strategies, which could be interpreted as the ambitious nature of the cities' climate adaptation targets to meet the Paris Agreement (Salvia et al., 2021). Further research should investigate the effects of climate change on tourism activity and how adaptation plans can be interpreted as benefits for their value chain.

Likewise, it is also necessary to deepen into how effective tourism incorporation is in municipal mitigation and adaptation strategies is and how different public administrations at the local, regional, and national scales interact and ensure the collaboration of public and private agents. This study focuses exclusively on analyzing the coherence of climate change adaptation and mitigation plans, which are a requirement for all selected municipalities. The existence of a plan, with actions, a budget and a timetable, does not guarantee that the municipality is acting with adequate initiatives in line with the current reality. A possible gap is thus identified between what is planned and what is actually being carried out. This gap opens a new and future line of study, aimed at verifying the robustness and accuracy of the plans according to their planned expectations.

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References

- Ahmed, A., Afik, B., Akanbang, A., Poku-Boansi, M., & Derbile, E. K. (2022). Policy coherence between climate change adaptation and urban policies in Ghana: Implications for adaptation planning in African cities. *International Journal of Urban Sustainable Development*, 14(1), 77–90. <https://doi.org/10.1080/19463138.2022.2066106>
- Arabadzhyan, A., Figini, P., García, C., González, M. M., Lam-González, Y. E., & León, C. J. (2021). Climate change, coastal tourism, and impact chains—a literature review. *Current Issues in Tourism*, 24(16), 2233–2268. <https://doi.org/10.1080/13683500.2020.1825351>
- Becken, S., Whittlesea, E., Loehr, J., & Scott, D. (2020). Tourism and climate change: Evaluating the extent of policy integration. *Journal of Sustainable Tourism*, 28(10), 1603–1624. <https://doi.org/10.1080/09669582.2020.1745217>
- Bock, K. (2015). The changing nature of city tourism and its possible implications for the future of cities. *European Journal of Futures Research*, 3, 20. <https://doi.org/10.1007/s40309-015-0078-5>
- Boyd, D., Pathak, M., van Diemen, R., & Skea, J. (2022). Mitigation co-benefits of climate change adaptation: A case-study analysis of eight cities. *Sustainable Cities and Society*, 77, 103563. <https://doi.org/10.1016/j.scs.2021.103563>
- Castán Broto, V. (2017). Urban governance and the politics of climate change. *World Development*, 93, 1–15. <https://doi.org/10.1016/j.worlddev.2016.12.031>
- Cheer, J. M., & Lew, A. A. (2017). *Tourism, resilience and sustainability: Adapting to social, political and economic change*. Routledge.
- Franzoni, S., & Pelizzari, C. (2019). Rainfall financial risk assessment in the hospitality industry. *International Journal of Contemporary Hospitality Management*, 31(3), 1104–1121. <https://doi.org/10.1108/IJCHM-10-2017-0632>
- Giannetti, B. F., Agostinho, F., Almeida, C. M. V. B., Liu, G., Contreras, L. E. V., Vandecasteele, C., Coscieme, L., Sutton, P., & Poveda, C. (2020). Insight on the United Nations sustainable development goals scope: Are they aligned with a ‘strong’ sustainable development? *Journal of Cleaner Production*, 252, 119574. <https://doi.org/10.1016/j.jclepro.2019.119574>
- Glass, L. M., & Newig, J. (2019). Governance for achieving the sustainable development goals: How important are participation, policy coherence, reflexivity, adaptation and democratic institutions? *Earth System Governance*, 2, 100031. <https://doi.org/10.1016/j.esg.2019.100031>

- Gómez-Martín, M. B. (2017). Retos del turismo español ante el cambio climático. *Investigaciones Geográficas*, 67, 31–47. <https://doi.org/10.14198/INGEO2017.67.02>
- Grafakos, S., Viero, G., Reckien, D., Trigg, K., Viguie, V., Sudmant, A., Graves, C., Foley, A., Heidrich, O., Mirailles, J. M., Carter, J., Chang, L. H., Nador, C., Liseri, M., Chelleri, L., Orru, H., Orru, K., Aelenei, R., Bilska, A., Pfeiffer, B., Lepetit, Q., Church, J. M., Landauer, M., Gouldson, A., & Dawson, R. (2020). Integration of mitigation and adaptation in urban climate change action plans in Europe: A systematic assessment. *Renewable and Sustainable Energy Reviews*, 121, 109623. <https://doi.org/10.1016/j.rser.2019.109623>
- Hachaichi, M. (2022). Cities: Allocating climate change responsibilities at planetary scale. *Urban Climate*, 46, 101329. <https://doi.org/10.1016/j.uclim.2022.101329>
- Haupt, W., Eckersley, P., Irmisch, J., & Kern, K. (2022). How do local factors shape transformation pathways towards climate-neutral and resilient cities? *European Planning Studies*. <https://doi.org/10.1080/09654313.2022.2147394>
- Huang, K., Li, X., Liu, X., & Seto, K. C. (2019). Projecting global urban land expansion and heat island intensification through 2050. *Environmental Research Letters*, 14(11), 114037. <https://doi.org/10.1088/1748-9326/ab4b71>
- Hurlimann, A., Moosavi, S., & Browne, G. R. (2021). Urban planning policy must do more to integrate climate change adaptation and mitigation actions. *Land Use Policy*, 101, 105188. <https://doi.org/10.1016/j.landusepol.2020.105188>
- Huttunen, S., Kivimaa, P., & Virkamäki, V. (2014). The need for policy coherence to trigger a transition to biogas production. *Environmental Innovation and Societal Transitions*, 12, 14–30. <https://doi.org/10.1016/j.eist.2014.04.002>
- Iwami, A., Matsui, T., Kimura, M., Baba, K., & Tanaka, M. (2020). Organizing the challenges faced by municipalities while formulating climate change adaptation plans. *Sustainability*, 12, 1203. <https://doi.org/10.3390/su12031203>
- Jiricka-Purrer, A., Brandenburg, C., & Probstl-Haider, U. (2020). City tourism pre- and post-covid-19 pandemic—Messages to take home for climate change adaptation and mitigation? *Journal of Outdoor Recreation and Tourism*, 31, 100329. <https://doi.org/10.1016/j.jort.2020.100329>
- Jopp, R., DeLacy, T., & Mair, J. (2010). Developing a framework for regional destination adaptation to climate change. *Current Issues in Tourism*, 13(6), 591–605. <https://doi.org/10.1080/13683501003653379>
- Joppe, M. (2018). Tourism policy and governance: Quo vadis? *Tourism Management Perspectives*, 25, 201–204. <https://doi.org/10.1016/j.tmp.2017.11.011>
- Kajan, E., & Saarinen, J. (2013). Tourism, climate change and adaptation: A review. *Current Issues in Tourism*, 16(2), 167–195. <https://doi.org/10.1080/13683500.2013.774323>
- Kelleher, L., Henchion, M., & O'Neill, E. (2019). Policy coherence and the transition to a bioeconomy: The case of Ireland. *Sustainability*, 11, 7247. <https://doi.org/10.3390/su11247247>
- Kern, K. (2019). Cities as leaders in EU multilevel climate governance: Embedded upscaling of local experiments in Europe. *Environmental Politics*, 28(1), 125–145. <https://doi.org/10.1080/09644016.2019.1521979>
- Kostianaiia, E. A., & Kostianoy, A. G. (2021). Regional climate change impact on coastal tourism: A case study for the Black Sea Coast of Russia. *Hydrology*, 8(3), 133. <https://doi.org/10.3390/hydrology8030133>
- Landauer, M., Juhola, S., & Klein, J. (2019). The role of scale in integrating climate change adaptation and mitigation in cities. *Journal of Environmental Planning and Management*, 62(5), 741–765. <https://doi.org/10.1080/09640568.2018.1430022>
- Ledda, A., Di Cesare, E. A., Satta, G., Cocco, G., & De Montis, A. (2021). Integrating adaptation to climate change in regional plans and programmes: The role of strategic environmental assessment. *Environmental Impact Assessment Review*, 91, 106655. <https://doi.org/10.1016/j.eiar.2021.106655>
- Lin, B. B., Ossola, A., Alberti, M., Andersson, E., Bai, X., Dobbs, C., Elmqvist, T., Evans, K. L., Frantzeskaki, N., Fuller, R. A., Gaston, K. J., Haase, D., Jim, C. Y., Konijnendijk, C., Nagendra, H., Niemelä, J., McPhearson, T., Moomaw, W. R., Parnell, S., Pataki, D., Ripple, W. J., & Tan,

- P. Y. (2021). Integrating solutions to adapt cities for climate change. *Lancet Planet Health*, 5, 479–486. [https://doi.org/10.1016/S2542-5196\(21\)00135-2](https://doi.org/10.1016/S2542-5196(21)00135-2)
- Loehr, J. (2020). The Vanuatu tourism adaptation system: A holistic approach to reducing climate risk. *Journal of Sustainable Tourism*, 28(4), 515–534. <https://doi.org/10.1080/09669582.2019.1683185>
- Loehr, J., & Becken, S. (2021). The tourism climate change knowledge system. *Annals of Tourism Research*, 86, 103073. <https://doi.org/10.1016/j.annals.2020.103073>
- Lopes, H. S., Remoaldo, P. C., Ribeiro, V., & Martín-Vide, J. (2022). Pathways for adapting tourism to climate change in an urban destination—Evidences based on thermal conditions for the Porto Metropolitan Area (Portugal). *Journal of Environmental Management*, 315, 115161. <https://doi.org/10.1016/j.jenvman.2022.115161>
- Madsen, S. H. J., & Hansen, T. (2018). Cities and climate change—Examining advantages and challenges of urban climate change experiments. *European Planning Studies*, 27, 282–299. <https://doi.org/10.1080/09654313.2017.1421907>
- Ngxongo, N. A. (2021). The impact of climate change on visitor destination selection: A case study of the Central Drakensberg Region in KwaZulu-Natal. *JAMBA Journal of Disaster Risk Studies*, 13(1), 1161. <https://doi.org/10.4102/jamba.v13i1.1161>
- Njoroge, J. M. (2015). Climate change and tourism adaptation: Literature review. *Tourism and Hospitality Management*, 21(1), 95–108. <https://doi.org/10.20867/thm.21.1.7>
- Olazabal, M., & Ruiz de Gopegui, M. (2021). Adaptation planning in large cities is unlikely to be effective. *Landscape and Urban Planning*, 206, 103974. <https://doi.org/10.1016/j.landurbplan.2020.103974>
- Olcina Cantos, J., & Vera-Rebollo, J. F. (2016). Adaptación del sector turístico al cambio climático en España. La importancia de las acciones a escala local y en empresas turísticas. *Anales de Geografía de la Universidad Complutense*, 36(2) 321–349. <https://doi.org/10.5209/AGUC.53588>
- Ranabhat, S., Ghate, R., Bhatta, L. D., Agrawal, N. K., & Tankha, S. (2018). Policy coherence and interplay between climate change adaptation policies and the forestry sector in Nepal. *Environmental Management*, 61, 968–980. <https://doi.org/10.1007/s00267-018-1027-4>
- Reckien, D., Salvia, M., Heidrich, O., Church, J.M., Pietrapertosa, F., de Gregorio-Hurtado, S., d'Alonzo, V., Foley, A., Simoes, S. G., Lorencová, E. K., Orru, H., & Dawson, R. (2018). How are cities planning to respond to climate change? Assessment of local climate plans from 885 cities in the EU-28. *Journal of Cleaner Production*, 191, 207–219. <https://doi.org/10.1016/j.jclepro.2018.03.220>
- Ricart, S., Berizzi, C., Saurí, D., & Terlicher, G. N. (2022). The social, political, and environmental dimensions in designing urban public space from a water management perspective: Testing European experiences. *Land*, 11, 1575. <https://doi.org/10.3390/land11091575>
- Saikia, P., Beane, G., Giné-Garriga, R., Avello, P., Ellis, L., Fisher, S., Leten, J., Ruiz-Apilánez, I., Shouler, M., Ward, R., & Jiménez, A. (2022). City water resilience framework: A governance based planning tool to enhance urban water resilience. *Sustainable Cities and Society*, 77, 103497. <https://doi.org/10.1016/j.scs.2021.103497>
- Salvia, M., Reckien, D., Pietrapertosa, F., Eckersley, P., Spyridaki, N.-A., Krook-Riekkola, A., Ozabal, M., Hurtado, S. D. G., Simoes, S. G., Geneletti, D., Vigiú, V., Fokaides, P. A., Ioannou, B. I., Flamos, A., Csete, M. S., Buzasi, A., Orru, H., de Boer, C., Foley, A., Rižnar, K., & Heidrich, O. (2021). Will climate mitigation ambitions lead to carbon neutrality? An analysis of the local-level plans of 327 cities in the EU. *Renewable and Sustainable Energy Reviews*, 135, 110253. <https://doi.org/10.1016/j.rser.2020.110253>
- Schweinsberg, S., & Darcy, S. (2022). Climate change, time and tourism knowledge: The relativity of simultaneity. *Sustainability*, 14, 16220. <https://doi.org/10.3390/su142316220>
- Scott, D. (2021). Sustainable tourism and the grand challenge of climate change. *Sustainability*, 13, 1966. <https://doi.org/10.3390/su13041966>

- Scott, D., & Gössling, S. (2022). A review of research into tourism and climate change—Launching the annals of tourism research curated collection on tourism and climate change. *Annals of Tourism Research*, 95, 103409. <https://doi.org/10.1016/j.annals.2022.103409>
- Scott, D., Hall, C. M., & Gössling, S. (2012). *Tourism and climate change: Impacts, adaptation and mitigation: Contemporary geographies of leisure, tourism and mobility*. Routledge.
- Scott, D., Hall, C. M., & Gössling, S. (2019). Global tourism vulnerability to climate change. *Annals of Tourism Research*, 77, 49–61. <https://doi.org/10.1016/j.annals.2019.05.007>
- Serra, V., Ledda, A., Ruii, M. G. G., Calia, G., Mereu, V., Bacciu, V., Marras, S., Spano, D., & De Montis, A. (2022). Adaptation to climate change across local policies: An investigation in six Italian cities. *Sustainability*, 14, 8318. <https://doi.org/10.3390/su14148318>
- Vale, L. J. (2014). The politics of resilient cities: Whose resilience and whose city? *Building Research & Information*, 42, 191–201. <https://doi.org/10.1080/09613218.2014.850602>
- Velasco, M., Russo, B., & Martínez-Gomariz, E. (2020). Integrated assessment of climate change impacts and urban resilience: From climate and hydrological hazards to risk analysis and measure. *Sustainability*, 12(16), 6430. <https://doi.org/10.3390/su12166430>
- Weaver, D., Moyle, B. D., Casali, L., & McLennan, C.-L. (2022). Pragmatic engagement with the wicked tourism problem of climate change through ‘soft’ transformative governance. *Tourism Management*, 93, 104573. <https://doi.org/10.1016/j.tourman.2022.104573>
- Yong, E. L. (2021). Understanding the economic impacts of sea-level rise on tourism prosperity: Conceptualization and panel data evidence. *Advances in Climate Change Research*, 12(2), 240–253. <https://doi.org/10.1016/j.accre.2021.03.009>

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Chapter 5

Climate Change Acknowledgement and Adaptation and Mitigation Responses in Rural Tourism Destinations



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Abstract From the point of view of the tourism sector, scientific research on the current changes in the climate and their impact on the sector is of key importance for the design and development of effective policies for adaptation and mitigation. However, although scientific data are essential, a complete picture cannot be gained without finding out more about the attitudes and beliefs of the people affected by these changes and their perceptions of the risk they involve. In the tourism sector, the study of risk perception associated with climate change has emerged in recent years as a subject of great interest due to its influence on the people working in the industry and, consequently, on their ability to respond to the phenomenon, either through the adoption of strategies that can modulate its effects or through the adoption of strategies for reducing greenhouse gases emissions. Determining the perception of the risk associated with climate change, the local responses to this environmental challenge, and the barriers that hinder local capacities for adaptation and mitigation is essential for the adequate planning and management of tourist destinations. The COVID-19 crisis has taught the tourism sector several surprising lessons about the effects of global change and the urgent need to respond to the ongoing climate crisis, with impacts on the sector that are potentially far worse than those caused by the pandemic. The current situation offers us an opportunity to promote the adaptation and decarbonization of tourism in rural area, an objective which, in the new post-pandemic scenario, has taken on real importance. Based on

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a mixed methodology that combines a quantitative and qualitative approach, this paper explores the perception of risk associated with climate change manifested by key stakeholders in rural tourism in Catalonia. The proposed approach sheds light on their perceptions of the impacts of climate change, its possible repercussions on rural tourism businesses and the local responses of adaptation and mitigation put into practice so far. The research also identifies certain subjective barriers to adaptation that might hinder the fight against climate change. It shows that the stakeholders studied are aware of the climate change issue, its origins and consequences, and can identify evidence of its effects in their local environment that may have considerable repercussions on the preservation of current landscapes and the productive activities that they sustain. Both these circumstances have raised stakeholders' awareness of the climate change phenomenon and are matters of interest and concern. We observed significant differences between the perceptions and responses of stakeholders who are totally or partially involved in the primary sector of the economy (i.e. owners of farms and owners of agritourism establishments) and those who are not directly involved (i.e. owners of rural tourism establishments), in that the first group were more observant of, and more sensitive to, the changes taking place around them. It seems that those who have a symbiotic relationship with nature are more predisposed to identifying the results of climate change, a finding that reflects the links between people's perception of risk and the sociocultural and economic context in which they live.

Keywords Rural tourism · Climate change · Perception · Impacts · Adaptation · Mitigation

Introduction

Climate change is a phenomenon that consists of a slow alteration in average climatic conditions, the gradual nature of which renders it difficult to detect and assess accurately based on personal observation. Nevertheless, the *perception of risk associated with climate change* is emerging as a key research topic because of its influence on actor proactivity, and consequently, on the capacity to respond to the phenomenon by adopting adaptation or mitigation strategies (Becken et al., 2015; Capstick et al., 2015; Mertz et al., 2009; Poortinga et al., 2019; Weber, 2015). To a large extent, the ways in which individuals, businesses, society, and policies respond to climate change depend on public perceptions of its causes and consequences.

Tourism is an economic activity that is vulnerable to climate change (Gómez-Martín, 2005a, 2005b, 2017). Understanding the perception of risk associated with the phenomenon, the strategies adopted to tackle this environmental challenge and the barriers to implementing adaptation and mitigation measures is essential for medium- and long-term planning in the sector (Belle & Bramwell, 2005; Eriksen & Selboe, 2012; Klint et al., 2012; Rice et al., 2022). Furthermore, it is extremely useful to confine such research on perception to tourist destinations in particular

regions, and within these, to companies and actors engaged in a specific type of tourism. Numerous studies have reported geographical, sectoral, and sub-sectoral differences in perceptions of climate change and have observed divergent responses among the various territorial and tourism stakeholders involved (Jovanović et al., 2018; Saarinen & Tervo, 2006; Tervo-Kankare, 2019; Wolfsegger et al., 2008).

Autonomous or planned responses to climate change occur in economically, socially, and institutionally diverse tourism scenarios. Autonomous adaptation or mitigation actions have frequently been identified as being private initiatives, the number and effectiveness of which often suggest the need for a planned response by public agencies (Bicknell & McManus, 2006; Brouder & Lundmark, 2011). Consequently, this need is determined, at least in part, by the strength and consistency of autonomous responses spurred by perception. Therefore, knowledge of this issue in a particular region would be useful in order to design an appropriate climate change action policy.

Many reports in the literature have examined perceptions of climate change among territorial and tourism stakeholders. Noteworthy examples include the studies by Belle and Bramwell (2005), Buckley (2008), Buzinde et al. (2010), Gössling et al. (2006), McEvoy et al. (2008), and Valls and Sardá (2009) for sun and sand tourism; and those by Hopkins and Maclean (2014), Prideaux et al. (2010), Scott et al. (2008), Steiger et al. (2019), and Trawöger (2014) for ski tourism in mountainous regions. Study subjects have primarily been tourists (Gössling et al., 2012), but have also included supply-side actors (Gómez-Martín et al., 2017), public agents, and market operators (Saarinen & Tervo, 2010; Strobl et al., 2011; Wyss et al., 2014). Such studies have used quantitative and qualitative methods, with the most commonly employed tools being questionnaires, interviews, Delphi panels, and focus groups. Although the results are complex and varied depending on the territorial scope of the study, the tourism sector analysed, and the stakeholders considered, there are several aspects of interest that merit highlighting. Broadly speaking, participants have tended to detect evidence of climate change in their surroundings, but have generally minimized the potential consequences of this phenomenon for their activity because they do not perceive the immediacy of the problem and believe that communication campaigns exaggerate the dangers (Belle & Bramwell, 2005). Moreover, the particular nature of the tourism sector, which consists of a large number of small businesses, hinders actors from thinking and working beyond the day-to-day. As Hall (2006) has observed, the year-to-year struggle for survival of small tourism businesses prevents engagement with medium- and long-term strategic planning. Nevertheless, Brouder and Lundmark (2011) found that small, local businesses are more concerned about the phenomenon because they are strongly rooted in their region and would therefore have greater difficulty in moving in the event of a severe impact. Dhoomun et al. (2022) have shown that in some tourism destinations, actors view climate change as potentially catastrophic and believe it poses significant risks to tourism. However, most of the study participants were unaware of the climate change policies being implemented at regional and local level, and thought that the few actions taken by the public sector were inadequate, insufficient, and did not interact with business

interests. In these cases, the local actors' lack of knowledge highlighted the need to improve communication channels and education on climate action.

In the field of tourism, there is still much research to be done on the *perception of risk associated with climate change*, and analyses of tourism sectors that are highly important in their territories—such as rural tourism—should be made a priority in the coming years (Scott et al., 2012). Rural tourism is less dependent on climatic resources than sun and sand or snow tourism. Instead, like nature tourism, it is highly dependent on landscape resources. Thus, the landscape is an essential resource for rural tourism (Cánoves et al., 2005; Espejo Marín, 2011; Skowronek et al., 2018), and can be understood, according to Hernández (2009: 170), as “a complex concept shaped by a combination of natural, historical, and functional elements, but which also acquires symbolic and subjective value as it is considered a reflection of the cultural heritage and identity of a people and the result of historical practices carried out by a human group in the territory”. There is limited knowledge about perceptions of the impact of climate change on the landscapes that support rural tourism or the repercussions this may have for rural tourism businesses. Exploring this question is complicated by the fact that the current multi-functionality of rural landscapes implies the need to include all the various stakeholders involved in shaping them, managing them, and consuming them.

The aim of the study presented here was to explore the perception of risk associated with climate change among key rural tourism actors. Specifically, we wanted to determine perceptions of the impact of climate change on landscapes and its potential repercussions for rural tourism businesses. A further goal was to identify the local adaptation and mitigation measures being taken by actors or likely to be implemented by them in the future, and the main barriers they identified in terms of climate action. The study area was defined as the Alt Empordà, a Catalan region located in the north-east of the well-known Costa Brava tourist destination. The results of the research can be useful for the design of political, administrative, technical and economic instruments to respond to climate change at the regional, local or business level. They may also be of interest in the necessary revision of current climate change communication and education strategies. From the point of view of geographical science, the results of the research can help to design solutions from the territorial/urban planning and tourism management of destinations. This will contribute to facing the changes to which rural territories will be subjected, adapting their economic activity to the new challenges to favour the resilience of these spaces and their inhabitants.

This document is structured in five sections. First, after the introduction, the area of study and its particularities are exposed. Next, a methodological section that precedes the results of the research is presented. Finally, the conclusions take stock of the research and its main contributions.

Study Area

The Alt Empordà region is notable for the proximity between its coastline and the mountains. With a surface area of just 1357.5 km², the region hosts a wide range of tourist accommodation options and occupies a very prominent position in Catalan tourism (Idescat, 2021). Historically, the Alt Empordà has been one of the most appealing landscapes in Catalonia from a biophysical and cultural perspective alike (Serra et al., 2004). The most characteristic landscape unit in the Alt Empordà is the Empordà plain, a broad agricultural lowland bordering the sea and composed of Quaternary detrital sediments deposited by rivers flowing down from the easternmost foothills of the Pyrenees. The plain is encircled by a series of mountain ridges that form another of the area's characteristic landscape sub-units (Figs. 5.1 and 5.2).

Agricultural production in the Alt Empordà is a fundamental element in an interpretation of the landscape and its aesthetic composition. The only exceptions to the above general description are the coastal municipalities, which are heavily built-up as a consequence of strong tourism growth up until the early 1990s. These present highly artificial environments, with ecological fragmentation of the agroforestry mosaic characteristic of the former rural landscape (Martí & Pintó, 2012). The predominantly agrarian landscape in this region has played an important role in the development of rural tourism here, thanks to its multiple associated values (literary and artistic, aesthetic, ecological, productive, social, historical, religious-spiritual, identity).

The inception of rural tourism in the Alt Empordà region dates back to the early 1990s, when the first rural tourism establishments were opened. Since then, the rural tourism sector has experienced strong growth throughout the area, in line with the rest of the northern half of Catalonia. The Alt Empordà currently holds second place in Catalonia in terms of the number of establishments, with a total of 1342 beds (Idescat, 2021). In addition to a valued landscape that serves as the primary resource and tourist attraction for the sector, other factors also help to explain this growth and leadership: (a) Support for the rural tourism sector through public policies aimed at

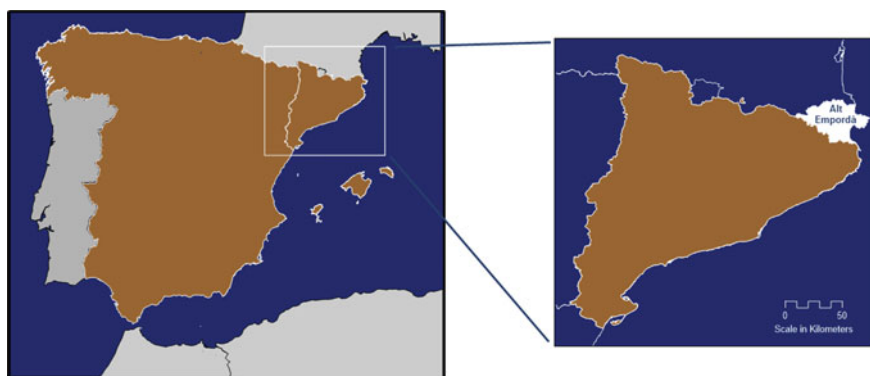


Fig. 5.1 Study area



Fig. 5.2 Main landscape units in the Alt Empordà. *Source* Photographic archives of the authors (2022)

local and rural development within the framework of the European Union's LEADER and PRODER programs; (b) the consolidation of a new tourism development model characterized by the diversification and complementarity of tourism products and services as a new economic and territorial development strategy; and (c) the presence of a mature, consolidated sun and sand and residential tourist destination (Costa Brava) that generates development synergies with other types of tourism (rural, active, cultural) (Gómez-Martín et al., 2014a, 2014b).

Promotion of the landscape's tourism potential in this region is reflected in the Alt Empordà Landscape Charter, an instrument that provides guidelines for landscape management and planning based on Law 8/2005 on the Protection, Planning, and Management of the Landscape of Catalonia. The Alt Empordà landscape is a fundamental asset that must be taken into account in development processes, hence the interest in protecting, regulating, and managing it, but the environmental changes taking place on a global scale must also be considered in landscape protection and management. The dynamics of rural landscapes in this region are not only determined by changes in economic and social systems: Changes in natural systems—including human-induced changes such as climate change—can also play an important role in their transformation. For example, the atmospheric changes forecast for the study area may generate impacts that affect both the terrestrial ecosystems of the rural landscapes themselves and the economic activities carried out in them (Fraguell

et al., 2016). Changes in climatic parameters will lead to changes in the structure, behaviour, and distribution of ecosystems in rural landscapes that may compromise their current productive, environmental, and social functions (Fig. 5.3).

Changes in the Alt Empordà landscape (Fig. 5.3) will affect its tourist attractiveness, which in turn will affect the region’s image as a tourism destination. All this could have an impact on tourist decision-making and thus affect the influx of visitors to the region. Furthermore, these changes will be in addition to (or interact with) the direct impacts caused by the phenomenon. For instance, changes in climatic parameters will generate significant changes in the region’s climatic attractiveness for tourism, possibly extending the duration of the tourist season in the summer (albeit with a reduction in comfort levels), but above all in the spring and autumn, which are highly favourable seasons for rural tourism (Fraguell et al., 2016; Gómez-Martín and Martínez-Ibarra, 2012; Gómez-Martín et al., 2014a). In contrast to this positive effect, it should also be borne in mind that a reduction in rainfall could lead to a decrease in water inflows, which would entail the need to rethink management of

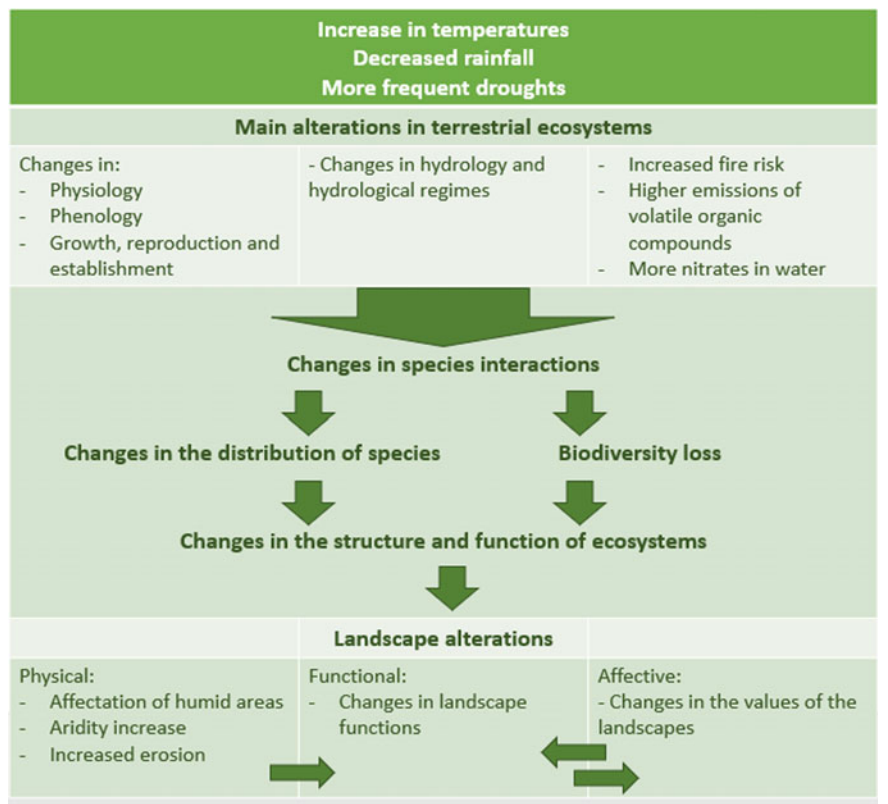


Fig. 5.3 Impacts of climate change on the Alt Empordà landscape. *Source* Modified from Hughes (2000)

current water resources in order to meet future water demand, especially as this may increase (Gabarda-Mallorquí et al., 2021; Ribas-Palom, 2020).

All these opportunities and threats posed by climate change have spurred the development of regulations and policies (sectoral or otherwise) to combat climate change that directly or indirectly have had an impact on the region and which, in most cases, involve the transfer of programs, plans, and actions from European or state level to regional and local level. Thus, at regional level, the Catalanian government has implemented several important climate change measures that have been channelled through various types of instruments, including planning, self-regulation, governance, incentives, information, and participation. These actions are repeated at local level.

Despite the beneficial effects that climate change may have on the region's climatic attractiveness, rural tourism in the Alt Empordà remains vulnerable to this phenomenon not only because of the changes it might wreak on landscapes that today act as a reference framework (tourist resource and attraction), but also because a reduction in water resources could compromise supply, which in turn would hinder maintenance of economic activities as they are carried out today. Consequently, it is important to determine perceptions of risk among the actors concerned in order to take action to combat the phenomenon.

Methodology

The research carried out here uses a mixed methodology that includes quantitative and qualitative approaches (Tashakkori & Teddlie, 1998, 2010), following the terminology of Wilbanks (2003) *located or geographically confined* to the main tourist destinations in the study area. In our case, this approach is the best way to obtain varied information on a complex phenomenon that affects the actors that interrelate in different ways in the territory (DeLyser & Sui, 2013, 2014; Sui & DeLyser, 2012). Other studies (Becken, 2005; Lorenzoni et al., 2007) have shown that the combination of these approaches makes it possible to carry out a certain degree of triangulation of the findings and complement the results. Therefore, this dual approach allows us to explore how the impacts of climate change on the landscapes of the study area are perceived, as well as the possible repercussions of these impacts on rural tourism businesses. This approach is also useful for determining the adaptation and mitigation strategies carried out by the interested actors and the strategies they will probably implement in the future, and for detecting barriers and opportunities to adaptation and decarbonization of the sector.

The data were obtained from three sources, based on interviews and/or questionnaires of survey administered to owners of agro-tourism establishments, owners of rural accommodation establishments, and organic agricultural producers. These sources were chosen because the agricultural production in the Alt Empordà area is a fundamental element for the interpretation of the landscape and its aesthetic configuration (Armesto-López et al., 2014) and because this landscape, with its strong

agrarian imprint, has played an important role in the development of rural tourism in the region. The interviews and/or the questionnaires were carried out in person in the Alt Empordà region during various field campaigns before the pandemic. The interviews follow a script in which four open questions related to the four thematic blocks indicated at the end of this section are formulated. The survey includes 18 questions related to the same thematic blocks.

The interviews with owners of agro-tourism establishments were carried out in the business itself and included a visit and tour. Eight semi-structured interviews were conducted, for a population of 36 respondents. A total of 57% of those interviewed were women and 43% were men, with a mean age of 55.

Interviews with agricultural producers in the region were carried out on the farm and also included a tour. In total 14 semi-structured interviews were carried out with a population of 29 respondents. The average respondent was a male between 40 and 55, owner of the farm, full-time worker (with family help), who ran an environmentally friendly area of between 25 and 50 hectares in which the predominant production was animal feed, cereals, horticultural and fruit crops, livestock (sheep and goats) and olive oil for self-consumption.

Finally, the owners of rural accommodation establishments were covered through 6 semi-structured interviews and 54 survey questionnaires, carried out in their establishments (for a population of 106 respondents). Sixty-three per cent of the interviewees were women and 37% men, with a mean age of 54. On the other hand, the questionnaires of survey were administered according to simple random sampling, and did not coincide with the establishments selected for interviews. For the validation of the questionnaire, a group of experts was asked about the meaning of the questions included in it. In the questionnaire, the theoretical size of the probabilistic sample depended on the values taken in the population variance (maximum uncertainty, $p = 50\%$ and $q = 50\%$), the confidence level ($\pm 2\sigma$ of the average value of the normal distribution curve, which covers 95.5% of the possible responses), the sampling error ($\pm 2\%$) and the size of the sample universe. The response percentage obtained was 100%. The descriptive analysis of the sample indicated that 50% of the establishments were owned by women, 18.5% by men and 31.5% by both women and men. As regards age, 18.5% of owners were under 40, 38.9% were between 40 and 55, and 42.6% were over 55.

The surveys and interviews were organized around four thematic blocks: (1) Knowledge, perception and degree of concern about the problem of climate change; (2) Perception of the impacts of climate change on the agricultural activity and landscapes of the region and corresponding action; (3) Perception of the impacts of climate change on rural tourism in the region and corresponding action; and (4) Barriers to and opportunities for climate change adaptation and mitigation. The results are presented in this sequence and the questions of survey are exposed in the section below.

Table 5.1 Main signs of climate change observed

Direct impacts	%
Alteration in seasons	50.0
Increase in temperature	38.5
Increase in extreme meteorological events	30.8
Increase in climate variability	30.8
Reduction in rainfall	23.1
Increase in windy days	7.2
<i>Indirect impacts</i>	
Increase in water deficit	26.9
Others (phenological alterations, alterations in fauna, rise in sea levels, etc.)	9.2

Results

Knowledge, Perception, and Degree of Concern About the Problem of Climate Change

The actors are aware of the problem of climate change, its origin and consequences: 40.7% stated that the phenomenon was of anthropogenic origin and 37% related it to the presence of impacts. Only 5.6% stated that it was a phenomenon of natural origin, while 16.7% did not express an opinion. Participants show high levels of identification of the problem: almost half (48.1%) reported having personally detected signs of climate change in their surroundings, especially the alterations in the seasons and the increase in temperatures (Table 5.1).

Their knowledge of the problem and/or the detection of evidence makes them sensitive to the phenomenon (Table 5.2). In this regard, 16.7% of the respondents fully agreed with the statement “I am concerned about the problems posed by climate change”. A total of 40.7% stated that they agree, 16.7% were undecided, 25.9% disagreed, and 0% strongly disagree.

Perception of the Impacts of Climate Change on the Agricultural Activity and Landscapes of the Region and Corresponding Action

The actors showed a high perception of the risk that climate change entails for the region’s agricultural activity. A fifth (20.4%) of respondents fully agree with the statement “Climate change will compromise agricultural activity in the region”, 64.8% expressed agreement, 5.6% were undecided, 7.4% disagreed and 1.9% strongly

Table 5.2 Selection of answers from the semi-structured interviews

Thematic blocks	Responses derived from the interviews
Knowledge, perception, and degree of concern about the problem of climate change	AG “Yes, I have talked to other farmers about the changes in temperature and lack of water and how this affects the crops on my farm. But I don’t talk about it much with the tourists ... they don’t seem to care too much about climate change” AG “The seasons have changed; it’s warmer, the rivers have less water and it’s windier” F: “Everything has moved forward; the growth of the plants, the flowering, the leaves, the fruit” F: “The problem is water... we’ll have to change what we grow ... I don’t know if we’re ready for that” RAO: “I’m worried about the water. We need to save water, but to do that we’ve got to make the tourists aware of the problem” RAO: “It’s all our fault... too many cars”
Perception of the impacts of climate change on the agricultural activity and landscapes of the region	AG “I can’t do much about climate change if the customers don’t change their habits” AG “Given the changes, I think I’m more likely to continue with the tourism business than with farming” AG “Our rural tourism business has allowed us to preserve the Masia, and the Masia is a feature of the Catalan agricultural landscape.... We wouldn’t have been able to keep it otherwise” AG “Tourism has allowed us to stay and keep the agricultural activity going. This way we can make sure that the traditional landscape of this region doesn’t disappear” AG “If it weren’t for tourism, many of us would no longer be here... we would have gone to the city” F: “Adapting means investing a large amount of money in our farms (improving irrigation systems, wells, adapting crops) and taking on a high risk. Putting all your eggs in one basket isn’t very clever. Maybe in the future we’ll make our farming compatible with rural tourism” F: “Changes in temperatures and the lack of water will mean we’ll have to give up irrigation and crops such as apple trees...we’ll have to grow new crops” RAO: “The landscape will get drier and less varied ...it’s lucky that we have the sea and the beach nearby”

(continued)

Table 5.2 (continued)

Thematic blocks	Responses derived from the interviews
Perception of the impacts of climate change on rural tourism in the region	AG “Climate change will make the landscape less attractive, at least as we understand it today ...but tourists, over time, will get used to it and will value it in different ways” AG “With the good weather more tourists will come in spring and autumn, see in fact I think climate change will benefit us” AG “We’ve adapted our tourism offer to make our visitors’ stays more comfortable ...but introducing adaptations in our farming is more difficult for us” RAO: “In the last few years, the rural tourism season has lasted longer” RAO: “Energy consumption in our business has increased in recent years... now the rooms have air conditioning... We are going to install solar panels” F: “It’s easier for the tourists visiting the Empordà to adapt to the effects of climate change than it is for the apple trees on my farm”
Barriers to and opportunities for climate change adaptation and mitigation	AG “The government doesn’t tell us anything and when you take the initiative, it always causes problems AG “Rules, laws... They’re all very nice on paper but they’re not worth anything ... They’re never applied” F: “The government should provide us with some training to help us adapt our businesses” RAO: “What the government says is contradictory: to get the best rating, we need to have a swimming pool. Is that sustainable? In my business I’m trying to save water and now they tell me that I should have a swimming pool... this is a rural tourism place!!!” RAO: “The government should give us more information and more help for adapting our businesses... Especially about renewable energy and saving water”

RAO: Rural accommodation owner; AG Agro-tourism owner; F: Farmer

disagreed. This same perception is evident in the different interviews carried out (Table 5.2).

Similarly, the respondents were very aware of the changes in the landscape that can be perceived in the territory as a consequence of climate change. Thus, 13% stated that they fully agreed with the statement “Climate change will transform the appearance of the territory of the region”; 63% stated they agree, 14.8% were undecided, 9.3%

disagreed and none strongly disagreed. These results are reinforced by the statements made in the interviews (Table 5.2).

The actors were aware of the potential impacts of climate change on the agricultural activity of the region, and reported certain effects on the reference landscape of their businesses. More than two thirds (68.5%) believed that the changes would lead to greater aridity and desertification of the landscapes (and therefore a decrease in the biological and productive potential); 3.7% stated that the changes would lead to new landscapes due to the introduction of new crops adapted to the new scenarios; and 7.4% saw effects for the fauna (decrease in pollinizing insects, proliferation of invasive species, alterations in migratory processes, among others). A fifth (20.4%) were undecided about the new future scenarios or simply did not answer. A large part of the interviewees showed similar perceptions (Table 5.2).

The above results show us how the respondents perceive the risks, at least in relation to agricultural activity and landscapes. Various studies have shown that individuals with a higher perception of risk are more inclined to take action and are, therefore, more in favour of implementing or supporting adaptation or mitigation measures for addressing climate change (Adger et al., 2009; Bord et al., 1998; O'Connor et al., 2002; Skeiryte et al., 2022). Surprisingly, this statement is not borne out by our results: 31.5% of respondents considered that nothing can be done to reduce impacts or adapt to the new situation, and 24.1% were undecided or did not answer. Only a low percentage acknowledged the possibility of adopting individual initiatives such as the substitution of vegetable/plant or crop species (5.6%), reducing water consumption (20.4%), or changing the farm's production (18.5%). In these cases, the actions mentioned were always considered from the point of view of adaptation to climate change, but not from that of decarbonization (despite the obvious synergies): Respondents did not report knowledge of the role played by crop type or agricultural practices in soil carbon sequestration and in reducing CO₂ emissions. The defeatist attitude, the lack of information or knowledge, and the high uncertainty about the actions that can be implemented to face climate change from the perspective of the landscape were also manifested in the interviews (Table 5.2).

Perception of the Impacts of Climate Change on Rural Tourism in the Region and Corresponding Action

The actors perceive that changes in agricultural activity and in the landscape will decrease the region's attractiveness. This is evidenced by the responses to the question, "Will climate change lead to a reduction in the attractiveness of the landscape in the area of the business?": 59.3% of those surveyed answered affirmatively, 18.5% negatively, and 22.2% did not know or did not answer. The actors were aware of the impacts that the phenomenon can have on the attractiveness of the region for tourists, but they are also aware that any landscape, whatever it may be, is potentially a tourist destination. With the same optimism, the actors questioned highlight the

Table 5.3 Do you think climate change affects your rural tourism business?

	Today (%)	In 20 years (%)
Yes	31.5	44.4
No	61.1	9.3
No reply	7.4	46.3
Total	100.0	100.0

beneficial effects that climate change may have on rural tourism in the region, due to the potential for expanding the tourist season (Table 5.2). From the point of view of rural tourism businesses, climate change is not perceived as an imminent threat, and is surrounded by a high degree of uncertainty (Tables 5.2 and 5.3).

In contrast to their reported attitudes towards adaptation and mitigation measures in relation to the landscape and farming, participants were more inclined towards and proactive in adaptation and mitigation in relation to the rural tourism business (Table 5.3). Thus, few respondents considered that nothing can be done (9.3%) or that the new scenarios will force them to close their business (1.9%). Many of those involved in the sector reported that they had implemented (or were in the process of implementing) measures in their businesses that would enable them to tackle detected or expected impacts and to participate in the fight against climate change.

- A total of 44.4% had installed inside and outside air conditioning systems, as they consider this the best solution for dealing with the rising temperatures and more frequent episodes of extreme weather conditions such as heat waves. A total of 13% reported be in the process of doing so.
- Meanwhile, 25.9% had opted to use other more sustainable ways (that contributed to climate change mitigation and energy savings) to control temperatures in indoor and outdoor spaces (better insulation of windows and doors, installing awnings, replacing herbaceous garden species with shrub or tree species that create more shade, etc.). A total of 11.1% reported being in the process of doing so.
- Some 70.3% had undertaken actions to reduce energy consumption and increase energy efficiency (especially as regards lighting), and 22% were in the process of doing so.
- In all, 61.1% pointed out the strategic importance of measures for optimizing water to face the decrease in water resources, stating that they have implemented measures of some kind (installation of rain tanks, consumption saving systems in taps and cisterns, use of grey water, communication savings, wells, etc.). Another 11.1% indicated that they are in the process of doing so.
- A total of 27.8% use renewable energies (solar panels, etc.) and self-sufficiency in order to face a foreseeable increase in energy consumption that could compromise the electricity supply. These measures were also considered in terms of decarbonizing the sector, although they were not always possible in all municipalities in the study area because of restrictive urban planning regulations. A total of 13% state they would like to adopt some measure in this regard.

- Some 69% were committed to promoting the consumption of local and organic products in their establishments, being aware of the role that local food can play not only in limiting emissions from long-haul agrifood chains but also in providing tourists with a fuller experience of the destination's cultural basis and reality, and 21% said they wanted to work in this way.

Barriers to and Opportunities for Climate Change Adaptation and Mitigation

Perception and knowledge of risk also influenced the creation of subjective barriers to climate change adaptation and mitigation actions. Thus, the respondents reported that they perceived the impact of climate change as a medium-term threat with a high degree of uncertainty. The perception of climate change as being an uncertain and relatively remote threat creates a barrier that can delay implementation of adaptation and mitigation measures. Similarly, over-reliance on technology to tackle many of the impacts of climate change may act as a barrier to implementation of more sustainable options. Consequently, actions that many owners perceived as being an optimal adaptation strategy may conflict with the discourses advocated by public bodies in accordance with international commitments on decarbonization and climate change mitigation.

Thus, as regards rural tourism businesses and farms, we observed a lack of knowledge among local actors and, on occasions, an absence of institutional instruments for risk management, adaptation to climate change, and decarbonization of the sector. In fact, selection and implementation of the strategies formulated to date for rural tourism businesses or farms have depended solely and exclusively on each owner's initiative or need (i.e. without the intervention of institutions external to the business or farm). In this respect, the participants could say little about actions beyond the strictly individual level, such as market strategies, risk externalization strategies aimed at sharing risk with other businesses, policy support instruments (e.g. tax exemption, direct subsidies, and low-interest loans) or specific risk management instruments within the framework of the CAP (this latter only in the case of farm owners and owners of agritourism establishments). Similarly, they were not aware of institutional actions to measure the carbon footprint of businesses engaged in rural tourism, or of accompanying mechanisms to facilitate the ecological transition of the sectors involved, be these through the drafting of climate action plans, attracting local market segments, or the optimization of tourism businesses, to cite just a few examples.

Few respondents attributed an active, efficient role to the government, whether in terms of information or action on climate change. Thus, only 5.6% of respondents reported having received help or information from the government to adapt their business to future scenarios. Participants (Table 5.2) stated that any actions were always the result of private initiative, and that the government took no part in facilitating or supporting such initiatives. They observed that although great pains had

Table 5.4 How do you think the government should act to address climate change in the tourism sector?

	(%)
Awareness building and transfer: providing information	9.3
Funding: increasing aid and subsidies	14.8
Political instruments: establishing action plans in the short and medium term	18.5
Oppose government intervention	13.0
Don't know/no reply	44.4
Total	100.0

been taken to legislate and establish regulations in line with international agreements, little effort had been made in terms of implementation (Table 5.2). Some interviewees also called attention to the rigidity and contradictions of the government itself as regards climate change adaptation and mitigation (Table 5.2). The large number of governmental levels involved in destination management and territorial and sectoral planning of tourism areas hinders coordination, coherence, and efficiency in terms of climate actions.

Perhaps this governmental “absence” means that the actors do not quite see what the government’s role in the whole process could be, or feel that it would be best for the government to remain on the sidelines (Table 5.4). Thus, to the question “How do you think the government should act to address climate change in the tourism sector?”, 44.4% did not know/did not reply while 13% said they were opposed to governmental interference.

Mistrust towards the political class and the public authorities, in part generated by their distance from and lack of connection with the population and small entrepreneurs (bearing in mind that this sector is mainly composed of small family businesses), has led to an almost complete lack of collaboration or understanding between actors and institutions. Failure to remedy this situation could jeopardize the effectiveness or efficiency of any policies designed to combat climate change whose implementation would be facilitated by the current context of opportunity arising from the subsidies for ecological transition promoted by Europe and regional governments.

Discussion and Conclusions

Actors engaged in rural tourism were conscious of the problems, origin, and consequences of climate change and were able to identify evidence in their surroundings that might have significant negative repercussions for the preservation of current landscapes and the productive activities that these sustain. Both circumstances heightened participants’ awareness of the phenomenon and prompted their interest and concern. Nevertheless, we observed differences in perception between actors who

were engaged partially or totally in primary activities (farm owners and owners of agritourism establishments) and those who were not directly involved (owners of rural accommodation establishments), with the former being more sensitive as regards detecting evidence. Actors who maintained a symbiotic relationship with the natural environment seemed better able to identify change, thus demonstrating the connection between risk perception and sociocultural and economic context (Proctor, 1998; Wildavsky & Dake, 1990). However, individuals with a greater perception of risk did not always appear to be more predisposed to take action on climate change adaptation or mitigation, contrary to the findings of research by Adger et al. (2009), Bord et al. (1998), O'Connor et al. (2002), and Skeiryte et al. (2022). It seems that the type of activity carried out, its greater or lesser dependence on the natural environment, and the socio-demographic profile of the actors all play an important role in the leadership response: In our case, coinciding with research by other authors (Hornsey et al., 2016; Poortinga et al., 2019), women and younger segments of the population, who are both more highly represented in the rural accommodation and agritourism sector, were more inclined to take action.

With regard to the identification of impacts and the adoption of adaptation measures, we found notable differences depending on the activity considered. Respondents were aware of the potential impacts of climate change on agricultural activity in the region, and even foresaw a future loss of productive potential. They believed that climate change would negatively affect agriculture and livestock farming in the study area, endangering practices that have shaped the very landscapes that sustain rural tourism in the region. They also believed that it would be difficult for farms to adopt adaptation measures without external support, exhibiting a highly fatalistic, defeatist attitude that at times raised the spectre of future abandonment of the primary activity. Perhaps this is why they criticized the government for a lack of help and information.

Focussing solely on rural tourism businesses, participants were aware of the impacts that climate change might have on the region's attractiveness as a tourist destination, but were less concerned about this as they believed that any landscape, whatever its type, was a potential tourist attraction and that therefore, the repercussions for rural tourism businesses would not necessarily be negative if the establishments were able to provide users with satisfactory levels of comfort, safety, and enjoyment. As Urry (1990) has noted, climate change will oblige us all to change the way we look at the landscapes that constitute the tourist experience. The process of adapting to these altered landscapes will be a challenge—albeit a surmountable one—not only for consumers, but also for the various agents and actors who shape them. Perhaps for this reason, and also because of the foreseeable extension of the tourist seasons, we observed greater proactivity among rural tourism businesses in terms of adaptation and mitigation. The study participants reported that they had already implemented adaptation and mitigation measures in their businesses or were in the process of doing so, and in most cases, these comprised individual, ad hoc responses to specific problems without institutional incentives or intervention. The majority of adaptation measures revolved around technology, followed by others based on management and business management and those related to behaviour and

education. Many of these adaptation measures could also be considered mitigation actions (especially those related to reducing energy demand by improving energy efficiency or reducing consumption; increasing renewable energy; and promoting carbon sequestration through carbon sinks by using nature-based actions), demonstrating the synergies between adaptation and mitigation in actions implemented at local and business level, as has been highlighted in other case studies (Ayers & Huq, 2009; Campos et al., 2013; Locatelli, 2010).

Perception and knowledge of risk influence the creation of subjective barriers to climate change adaptation and mitigation actions. Respondents reported perceiving the impact of climate change as a medium-term threat with a high degree of uncertainty. The perception of climate change as being an uncertain and relatively remote threat creates a barrier that can delay implementation of adaptation and mitigation measures. Further obstacles include the limited capacity of family-based businesses in rural areas to tackle the challenges of climate change beyond the day-to-day; the limited training on the implications of climate change provided to actors in the sector; excessive reliance on technologies that often contradict the principles of sustainability (Aall et al., 2016); the lack of government support; the lack of understanding or collaboration between the public and private sectors to tackle the challenges of climate change; and the historical lack of financial support in the shape of grants, subsidies, and low-interest loans.

Opportunities for adaptation and mitigation reside in education and the possible involvement of rural tourists—who are more environmentally aware—in actions to mitigate and adapt to climate change. The expectations of rural actors in our study do not seem to coincide with those reported in other research focussed on urban tourism (Molina-Azorín et al., 2015).

Lastly, it is worth noting that it is extremely difficult to explore the question addressed here, because the multi-functionality of rural landscapes implies the need to include all the various actors involved in shaping and managing them. In the present research, a part of the stakeholders has been considered, all of them private. However, no public sector actors have been incorporated. Hence, to overcome this limitation, future research should investigate the perception of risk shown by other stakeholders in order to complement and refine the results presented here.

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References

- Aall, C., Hall, M., & Groven, K. (2016). Tourism: applying rebound theories and mechanisms to climate change mitigation and adaptation. In *Rethinking climate and energy policies: New perspectives on the rebound phenomenon* (pp. 209–225). Springer.
- Adger, W. N., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D. R., Naess, L. O., Wolf, J., & Wreford, A. (2009). Are there social limits to adaptation to climate change? *Climatic Change*, 93, 335–354.
- Armesto-López, X., Gómez-Martín, M. B., & Cors-Iglesias, M. (2014). Paisaje agrario y turismo rural. La visión de los agentes en Cataluña en base a las incertidumbres que genera el cambio climático [Agricultural landscape and rural tourism: the vision of stakeholders in catalonia based on the uncertainties generated by climate change]. In D. Pavón, et al. (Eds.), *Revalorizando el espacio rural: leer el pasado para ganar el futuro* [Revaluing rural space: Reading the past to gain the future] (pp. 291–304). Documenta Universitaria.
- Ayers, J. M., & Huq, S. (2009). The value of linking mitigation and adaptation: A case study of Bangladesh. *Environmental Management*, 43, 753–764.
- Becken, S. (2005). Harmonising climate change adaptation and mitigation: The case of tourist resorts in Fiji. *Global Environmental Change*, 15, 381–393.
- Becken, S., Zammit, C., & Hendriks, J. (2015). Developing climate change maps for tourism essential information or awareness raising? *Journal of Travel Research*, 54(4), 430–441.
- Belle, N., & Bramwell, B. (2005). Climate change and small island tourism: Policymaker and industry perspectives in Barbados. *Journal of Travel Research*, 44(1), 32–41.
- Bicknell, S., & McManus, P. (2006). The canary in the coalmine: Australian ski resorts and their response to climate change. *Geographical Research*, 44(4), 386–400.
- Bord, R. J., Fisher, A., & O'Connor, R. (1998). Public perceptions of global warming: United States and international perspectives. *Climate Research*, 11, 75–84.
- Brouder, P., & Lundmark, L. (2011). Climate change in Northern Sweden: Intra-regional perceptions of vulnerability among winter-oriented tourism businesses. *Journal of Sustainable Tourism*, 19(8), 919–933.
- Buckley, R. (2008). Misperceptions of climate change damage coastal tourism: Case study of Byron Bay, Australia. *Tourism Review International*, 12(1), 71–88.
- Buzinde, C. N., Manuel, D., Yoo, E., & Morais, D. (2010). Tourists' perceptions in a climate of change: Eroding destinations. *Annals of Tourism Research*, 37(2), 333–354.
- Campos, M., Herrador, D., Manuel, C., & McCall, M. (2013). Estrategias de adaptación al cambio climático en dos comunidades rurales de México y El Salvador [Adaptation strategies to climate change in two rural communities in Mexico and El Salvador]. *Boletín De La Asociación De Geógrafos Españoles*, 61, 329–352.
- Cànoves, G., Herrera, L., & Villarino, M. (2005). Turismo rural en España: paisajes y usuarios, nuevos usos y nuevas visiones [Rural tourism in Spain: Landscapes and users, new uses and new perspectives]. *Cuadernos De Turismo*, 15, 63–76.
- Capstick, S., Whitmarsh, L., Poortinga, W., Pidgeon, N., & Upham, P. (2015). International trends in public perceptions of climate change over the past quarter century. *Wiley Interdisciplinary Reviews: Climate Change*, 6(1), 35–61.
- Delyser, D., & Sui, D. (2013). Crossing the qualitative- quantitative divide II. Inventive approaches to big data, mobile methods, and rhythmanalysis. *Progress in Human Geography*, 37(2), 293–305.
- Delyser, D., & Sui, D. (2014). Crossing the qualitative-quantitative chasm III. Enduring methods, open geography, participatory research, and the fourth paradigm. *Progress in Human Geography*, 38, 294–307.
- Dhoomun, L., Hytten, K. F., & Perry, P. (2022). Perceptions of climate change and climate change policies within the tourism sector in Mauritius. *Journal of the Indian Ocean Region*, 18(1), 36–59.

- Eriksen, S., & Selboe, E. (2012). The social organisation of adaptation to climate variability and global change: The case of a mountain farming community in Norway. *Applied Geography*, 33, 159–167.
- Espejo Marín, C. (2011). El paisaje como recurso turístico [The landscape as a touristic resource]. In M. R. Simancas, et al. (Coords.), *Retos y perspectivas de la gestión del Paisaje de Canarias* (pp. 337–461). Gobierno de Canarias y Universidad Internacional Menéndez Pelayo.
- Fraguell, R. M., Gómez-Martín, M. B., Llurdés, J. C., Martí, C., Ribas, A., & Saurí, D. (2016). Turisme [Tourism]. In *Tercer Informe del Canvi Climàtic a Catalunya* (pp. 383–407). Institut d'Estudis Catalans i Generalitat de Catalunya.
- Gabarda-Mallorquí, A., Garcia, X., Fraguell, R. M., & Ribas, A. (2021). Are hotel stay characteristics influencing guests' environmental behaviour? Predicting water conservation habits. *Current Issues in Tourism*, 24(16), 2342–2356.
- Gómez-Martín, M. B. (2005a). Weather, climate and tourism a geographical perspective. *Annals of Tourism Research*, 32(3), 571–591.
- Gómez-Martín, M. B. (2005b). Reflexión geográfica en torno al binomio clima-turismo [Geographical reflection on the climate-tourism binomial]. *Boletín De La Asociación De Geógrafos Españoles*, 40, 111–134.
- Gómez-Martín, M. B. (2017). Retos del turismo español ante el cambio climático [Challenges of Spanish tourism in the face of climate change]. *Investigaciones Geográficas*, 67, 31–47.
- Gómez-Martín, M. B., & Martínez-Ibarra, E. (2012). Tourism demand and atmospheric parameters: Non-intrusive observation techniques. *Climate Research*, 51, 135–145.
- Gómez-Martín, M. B., Armesto-López, X., & Martínez-Ibarra, E. (2014a). The Spanish tourist sector facing extreme climate events: A case study of domestic tourism in the heat wave of 2003. *International Journal of Biometeorology*, 58, 781–797.
- Gómez-Martín, M. B., Armesto-López, X., Cors-Iglesias, M., & Muñoz-Negrete, J. (2014b). Adaptation strategies to climate change in the tourist sector: The case of coastal tourism in Spain. *Tourism: An International Interdisciplinary Journal*, 62(3), 293–308.
- Gómez-Martín, M. B., Armesto-López, X., & Cors-Iglesias, M. (2017). Percepción del cambio climático y respuestas locales de adaptación: El caso del turismo rural [Perception of climate change and local adaptation responses: The case of rural tourism]. *Cuadernos De Turismo*, 39, 287–310.
- Gössling, S., Bredberg, M., Randow, A., Sandström, E., & Svensson, P. (2006). Tourist perceptions of climate change: A study of international tourists in Zanzibar. *Current Issues in Tourism*, 9(4–5), 419–435.
- Gössling, S., Scott, D., Hall, C. M., Ceron, J. P., & Dubois, G. (2012). Consumer behaviour and demand response of tourists to climate change. *Annals of Tourism Research*, 39(1), 36–58.
- Hall, C. M. (2006). New Zealand tourism entrepreneur attitudes and behaviours with respect to climate change adaptation and mitigation. *International Journal of Innovation and Sustainable Development*, 1(3), 229–237.
- Hernández, M. (2009). El paisaje como señal de identidad territorial: valorización social y factor de desarrollo, ¿utopía o realidad? [The landscape as a sign of territorial identity: Social valorization and development factor, utopia or reality?]. *Boletín De La Asociación De Geógrafos Españoles*, 49, 169–183.
- Hopkins, D., & Maclean, K. (2014). Climate change perceptions and responses in Scotland's ski industry. *Tourism Geographies*, 16(3), 400–414.
- Hornsey, M. J., Harris, E. A., Bain, P. G., & Fielding, K. S. (2016). Meta-analyses of the determinants and outcomes of belief in climate change. *Nature Climate Change*, 6(6), 622–626.
- Hughes, L. (2000). Biological consequences of global warming: Is the signal already apparent? *Trends in Ecology and Evolution*, 15, 56–61.
- Idescat. (2021). *Institut d'Estadística de Catalunya*. <https://www.idescat.cat/tema/turis?lang=es>
- Jovanović, R., Sánchez, D. C., Pavlović, S., & Devedžić, M. (2018). Principios de sostenibilidad en clusters de turismo rural: Los casos del Alto y el Bajo Danubio en Serbia [Principles of

- sustainability in rural tourism clusters: The cases of upper and lower Danube in Serbia]. *Revista De Geografia Norte Grande*, 70, 211–233.
- Klint, L. M., Jiang, M., Law, A., Delacy, T., Filep, S., Calgaro, E., Dominey, D., & Harrison, D. (2012). Dive tourism in Luganville, Vanuatu: Shocks, stressors, and vulnerability to climate change. *Tourism in Marine Environments*, 8(1), 91–109.
- Locatelli, B. (2010). Local, global: Intégrer atténuation et adaptation [Local, global: Integrating mitigation and adaptation]. *CIRAD, Perspective: Forêts/Changement Climatiques*, 3, 4.
- Lorenzoni, I., Nicholson-Cole, S., & Whitmarsh, L. (2007). Barriers perceived to engaging with climate change among the UK public and their policy implications. *Global Environmental Change*, 17(3), 445–459.
- Martí, C., & Pintó, J. (2012). Cambios recientes en el paisaje litoral de la Costa Brava [Recent changes in the coastal landscape of the Costa Brava]. *Documents D'anàlisi Geogràfica*, 58(2), 239–264.
- Mcevoy, D., Cavan, G., Handley, J., & Lindley, S. (2008). Changes to climate and visitor behaviour: Implications for vulnerable landscapes in the Northwest region of England. *Journal of Sustainable Tourism*, 16, 101–121.
- Mertz, O., Mbow, C., Reenberg, A., & Diouf, A. (2009). Farmers' perceptions of climate change and agricultural adaptation strategies in rural Sahel. *Environmental Management*, 43(5), 804–816.
- Molina-Azorín, J. F., Tarí, J. J., Pereira-Moliner, J., Lopez-Gamero, M. D., & Pertusa-Ortega, E. M. (2015). The effects of quality and environmental management on competitive advantage: A mixed methods study in the hotel industry. *Tourism Management*, 50, 41–54.
- O'Connor, R. E., Bord, R. J., Yarnal, B., & Wiefek, N. (2002). Who wants to reduce greenhouse gas emissions? *Social Science Quarterly*, 83, 1–17.
- Poortinga, W., Whitmarsh, L., Steg, L., Böhm, G., & Fisher, S. (2019). Climate change perceptions and their individual-level determinants: A cross-European analysis. *Global Environmental Change*, 55, 25–35.
- Prideaux, B., Coglan, A., & Mcnamara, K. (2010). Assessing tourists' perceptions of climate change on mountain landscapes. *Tourism Recreation Research*, 35(2), 187–199.
- Proctor, J. D. (1998). The meaning of global environmental change: Rethorizing culture in human dimensions research. *Global Environmental Change*, 8(3), 227–248.
- Ribas-Palom, A. (2020). Cambio climático y recursos hídricos [Climate Change and Water Resources]. In J. Farinós i Dasí, (Dir.), J. Escribano, M. P. Pizarro, J. J. Peñarrubia Zaragoza, L. Serrano, & S. Asins Velis (Coords). *Desafíos y oportunidades de un mundo en transición: Una interpretación desde la Geografía* (pp. 173–184). Editorial Tirant lo Blanch, Tirant Humanidades.
- Rice, H., Cohen, S. A., & Scott, D. (2022). Perceptions of climate change risk and sustainable adaptations in the Swedish ski industry. *Journal of Sustainable Tourism*, 1–17.
- Saarinén, J., & Tervo, K. (2006). Perceptions and adaptation strategies of the tourism industry to climate change: The case of Finnish nature-based tourism entrepreneurs. *International Journal of Innovation and Sustainable Development*, 1(3) 214–228.
- Saarinén, J., & Tervo, K. (2010). Sustainability and emerging awareness of a changing climate. In C. M. Hall, et al. (Eds.), *Tourism and change in polar regions: Climate, environments and experiences* (pp. 147–164). Routledge.
- Scott, D., Hall, C. M., & Stefan, G. (2012). *Tourism and climate change: Impacts, adaptation and mitigation*. Routledge.
- Scott, D., Jones, B., & Konopek, J. (2008). Exploring potential visitor response to climate-induced environmental changes in Canada's Rocky Mountain national parks. *Tourism Review International*, 12(1), 43–56.
- Serra, P., Saurí, D., & Pons, X. (2004). Evolució recent del paisatge agrari de l'Alt Empordà a través de teledetecció i d'índexs paisatgístics [Recent evolution of the agricultural landscape of Alt Empordà through remote sensing and landscape indexes]. *Treballs De La Societat Catalana De Geografia*, 57, 237–256.

- Skeirytė, A., Krikštolaitis, R., & Liobikienė, G. (2022). The differences of climate change perception, responsibility and climate-friendly behavior among generations and the main determinants of youth's climate-friendly actions in the EU. *Journal of Environmental Management*, 323, 116277.
- Skowronek, E., Tucki, A., Huijbens, E., & Józwik, M. (2018). What is the tourist landscape? Aspects and features of the concept. *Acta Geographica Slovenica*, 58(2), 73–85.
- Steiger, R., Scott, D., Abegg, B., Pons, M., & Aall, C. (2019). A critical review of climate change risk for ski tourism. *Current Issues in Tourism*, 22(11), 1343–1379.
- Strobl, A., Steiger, R., Peters, M., & Weiermair K. (2011). Tourismusforschung und – praxis: Wen kümmert der Klimawandel? [Tourism research and practice: Who cares about climate change?]. In T. Bieger, et al. (Eds.), *Wettbewerb im alpinen Tourismus—Herausforderungen und Innovationen. Schweizer Jahrbuch für Tourismus 2010* (pp. 105–114). Erich Schmidt Verlag.
- Sui, D., & Delyser, D. (2012). Crossing the qualitative quantitative chasm I: Hybrid geographies, the spatial turn, and volunteered geographic information (VGI). *Progress in Human Geography*, 36(1), 111–124.
- Tashakkori, A., & Teddlie, C. (1998). *Mixed methodology, combining qualitative and quantitative approaches*. Sage Publications.
- Tashakkori, A., & Teddlie, C., et al. (2010). The past and future of mixed methods research: From triangulation to mixed model design. In A. Tashakkori (Ed.), *Handbook of mixed methods in social and behavioral research* (pp. 671–701). Sage.
- Tervo-Kankare, K. (2019). Entrepreneurship in nature-based tourism under a changing climate. *Current Issues in Tourism*, 22(11), 1380–1392.
- Trawöger, L. (2014). Convinced, ambivalent or annoyed: Tyrolean ski tourism stakeholders and their perceptions of climate change. *Tourism Management*, 40, 338–351.
- Urry, J. (1990). *The tourist gaze*. Sage.
- Valls, F., & Sardá, R. (2009). Tourism expert perceptions for evaluating climate change impacts on the Euro-Mediterranean tourism industry. *Tourism Review*, 64(2), 41–51.
- Weber, E. U. (2016). What shapes perceptions of climate change? New research since 2010. *Wiley Interdisciplinary Reviews: Climate Change*, 7(1), 125–134.
- Wilbanks, T. J. (2003). Integrating climate change and sustainable development in a place-based context. *Climate Policy*, 3(1), 147–154.
- Wildavsky, A., & Dake, K. (1990). Theories of risk perception: Who fears what and why? *Daedalus*, 119(4), 41–60.
- Wolfsegger, C., Gössling, S., & Scott, D. (2008). Climate change risk appraisal in the Austrian ski industry. *Tourism Review International*, 12(1), 13–23.
- Wyss, R., Abegg, B., & Luthe, T. (2014). Perceptions of climate change in a tourism governance context. *Tourism Management Perspectives*, 11, 69–76.

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Chapter 6

Regional Resilience and Dependence on Tourism in a Changing Climate



Strategic Pathways for the Algarve Region, Southern Portugal, Through the Case Study of the Municipalities of Silves, Albufeira and Loulé

André Samora-Arvela , Patrícia Pinto, Thomas Panagopoulos, Eric Vaz, Jorge Ferreira, Helena Pina, and Diogo M. Pinto 

Abstract The Algarve region, which socio-economy is mostly based on *Sun and Sea* tourism, may experience a decline due to the loss of beach area as a tourist resource because of sea level rise. As such, an adaptation pathway to enhance the regional resilience of Mediterranean regions such as the Algarve is necessary in a changing climate. Thereby, knowing that the sector diversification conduces to

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a regional resilience enhancement, a reduction in the *Sun and Sea* tourism suitability in the Algarve region could be compensated by a strategy of economic diversification, supported by sustainable touristic products, inherently contributing to increment regional resilience and to avoid the decline considering future degradations. Therefore, a paramount opportunity lies in finding nature-based, cultural, and creative tourism products to be promoted to ensure resilient long-term prosperity through economic diversification. This chapter aims to present strategic guidelines for tourism diversification for other tourism products for the Algarve region in a changing climate. Thus, a survey was applied to 400 tourists and to 400 residents, and a Delphi survey was conducted to 3 experts, 7 decision-makers, and 15 tour operators in order to assess which tourism pathways should be followed for the sustainable development of this region.

Keywords Tourism · Diversification · Climate change · Regional resilience · Sustainability · Well-being

Introduction

A transversal development axis to all regions assumed to be Mediterranean in terms of their geographical situation and/or by their mild climate is the Sun and Sea tourism product, based mainly on the coastal sand beach resource. The tourist offer and demand in these regions are closely centered on promoting the Sun and Sea product and on valuing in many cases little qualifying coastal assets, establishing a framework of low touristic differentiation that combined with the impacts of changes, climate change dictates an imminent fragility and indelible threat to the resilience of these regions, which, above all, have their economic development base on the mainstream tourist enjoyment of their beach resources (Samora-Arvela et al., 2018, 2020a, 2020b, 2023).

Mediterranean destination regions are extremely susceptible and vulnerable to the impacts of climate change, such as the degradation of climate suitability for tourist purposes, reduction in the quantity and quality of water resources, deterioration of architectural and landscape heritage, and the sea level rise and coastal erosion. The loss of coastal beach area could lead to disruption of the Sun and Sea product and the regions that base their socio-economics on this product (Ferreira et al., 2008, p. 15; Fox-Kemper et al., 2021; IPCC, 2014; Santos & Miranda, 2006; Santos & Moita, 2001; Slangen et al., 2023).

At this point, the regions that are Sun and Sea destinations are profoundly vulnerable to the impacts of climate change (Amelung & Moreno, 2009), especially if they depend on massive and concentrated coastal beach tourism.

It will therefore be necessary to say goodbye to the coastline or, at least, to its urban appropriation patterns, which, in the Portuguese case, is highly susceptible to natural coastal erosion that will worsen with the rise in mean sea level. Its increased vulnerability derived as a result of existing human pressure due to the concentration

of 76% of the Portuguese on the coastline, and administrative ignominy, hijacked by the peddling of influences in spatial planning (Schmidt, 2016).

As regional resilience is the ability of a region to accommodate disturbances and to reconfigure its socio-economic structure in line with them, in order to maintain its long-term development (Boschma, 2015; Palekiene et al., 2015), and diversity is one factor that increases regional resilience, diversified regions have a greater capacity for reorienting and renewing their development pathways, thus having greater adaptability.

In this context, increasing regional resilience entails identify the assets and strengths of each region, reinforce socio-economic diversity, and build new development strategies by promoting its adaptive capacity, social learning, cooperation between stakeholders, and innovation (Boschma, 2015; Eraydin, 2016; Palekiene et al., 2015; Peng et al., 2017; Sutton & Arku, 2022).

In this hermeneutic, green infrastructure is, an interconnected network of natural and semi-natural spaces in urban and rural areas. This include gardens, lakes, parks, cycle paths, green roofs, wetlands, rivers, green corridors, agricultural and forest use areas sustainability, among others (EEA, 2011, pp. 30–35), can constitute a basic spatial structure for tourism-recreational diversification. Thus, it can provide an opportunity to strengthen the regional resilience of Mediterranean destination regions, whose strategy will have to start from the alliance between sustainable and qualifying spatial planning, and effective and efficient tourism promotion.

Thus, encouraging a heterogeneity of tourism products supported by green infrastructure could constitute an opportunity to increase regional resilience to present and future challenges. From this opportunity, emerges the need to know the complementary preferences of tourists who visit the Algarve region for recreation and leisure in areas near beaches. A strategy to reinforce regional resilience could involve, on the one hand, the containment of the insistent and tending intention of coastal urban expansion induced by tourism and, on the other hand, the consolidation of other tourist products. This is related to types of sustainable tourism such as alternative tourism based on the nature-based enhancement of the endogenous resources of the regional green infrastructure as an interior hinterland, not from a perspective of green growth and perpetuation of the current economic paradigm (Bina, 2013), but as a cultural and systemic adaptation strategy (O'Brien & Hochachka, 2010), a factor for attenuation of asymmetries and rebalance with Nature through integrated landscape management (Denier et al., 2015; McGonigle et al., 2020; Stenseke, 2016).

Thus, Benur and Bramwell (2015) postulate that the sustainable development of tourism can be achieved by combining the mass concentration of one or two products with diversification into niches of alternative products, an option considered to be, indeed, suitable for the region's coastal Mediterranean areas (Bramwell, 2004; Weaver, 2000, 2006).

Hence, Mediterranean destinations in a changing climate context find themselves at a crossroads that starts from the present stagnation, which forks between the potential decline derived from the impacts and the rejuvenation of the destination through product diversification, as shown in Fig. 6.1.

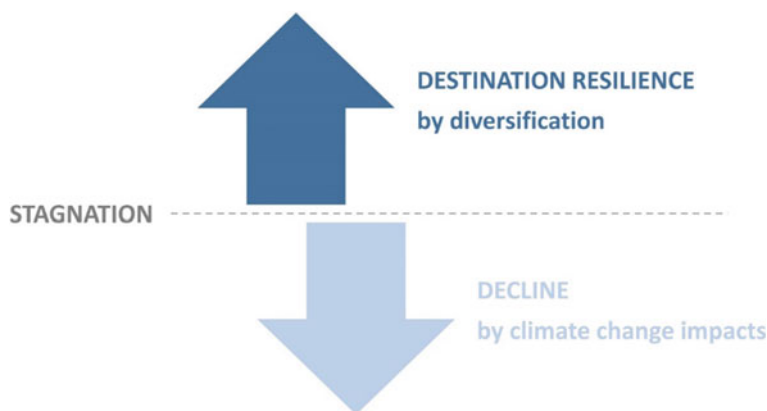


Fig. 6.1 Conceptual scheme of the resilience of tourist destination regions. *Source* Own elaboration

Thereby, the sustainable development of Mediterranean destinations can be achieved by combining the mass concentration of one or two products, as is the case of Sun and Sea, with diversification into low-cost alternative product niches. It impacts, mainly, landscape tourism products, such as ecotourism, nature tourism, rural tourism, cultural tourism, community-based tourism, and creative tourism, among others (Benur & Bramwell, 2015; Samora-Arvela et al., 2018, 2020a, 2020b, 2023),

Thus, this chapter is based on the case study of the Portuguese municipalities of Silves, Albufeira, and Loulé, representative of part of the major landscape character that marks the Algarve region, with the aim to answer the following research questions:

RQ1: Taking into account the preferences of the various stakeholders, what are the tourism diversification priorities to be enhanced in the Algarve region in a changing climate context?

RQ2: What should be the main mitigation and adaptation measures based on Algarve's green infrastructure?

RQ3: How should this strategy be planned in terms of spatial planning and tourism promotion?

This chapter is structured into four sections. After the conceptual preamble of the chapter's ethos given by the introduction, Sect. 6.2 presents the methodological approach, which is divided into subsections, namely Sect. 2.1. Study Area, which characterizes the territory of the study area and the main climate change impacts in the region, and Sect. 2.2. Methods where the participatory methodology used is discussed. Section 6.3 shows the Total Enhancement Potential for Tourism and Recreation in each landscape unit, emanating from the survey applied to the various stakeholders. This potential reveals the opportunities for tourist and recreational diversification, the priorities for enhancing the capabilities of green infrastructure

for mitigation and adaptation of the region to climate change, and the action plan to increase regional resilience supported by tourism and recreational diversification and qualification.

Methodological Approach

Study Area

From the 1960s onward, the Algarve region (Southern of Portugal), following the growth of tourism in Andalusia and the rest of the Mediterranean basin, was marked by a process of urbanization driven by leisure and consumption, based on urban densification along its coastline, and on the dispersion of construction in areas further away from the coastline (Martins, 2011). This urban expansion was consigned to the massification of two forms of accommodation, namely tourism accommodation and secondary residence (Martins, 2011).

There is an intensive use with high seasonality on the Algarve coast, already demarcated by coastal erosion resulting from its disorder and urban occupation (Simões et al., 2013).

The intermediate landscape unit between the coast and the interior is the Barrocal Midlands, characterized by its almond, fig, and carob groves and its irrigated citrus orchards, second residences have proliferated as a residential tourism structure in rural areas (Cobuci et al., 2011).

As for the innermost unit, the Interior Mountains are distinguished by its cork oak groves and phenomena of abandonment and exodus (Cancela d'Abreu et al., 2004).

This landscape unit, in the words of Amorim Girão, is a gigantic amphitheater placed between the sea and the mountain (Girão, 1941), being formed by Monchique Mountains and Caldeirão Mountains.

The choice of the study area, namely the municipalities of Silves, Albufeira, and Loulé, was because its territory encompasses the most important landscape units in the region, namely the Central Coast, Barrocal Midlands, and Interior Mountains. It expresses the dynamic and littoralized urban housing and tourist occupation with the presence of orchards and vegetable gardens in the Barrocal, and the desertification and agricultural abandonment in the mountains (Fig. 6.2).

As for the expected impacts of climate change, the Intermunicipal Plan for Adaptation to Climate Change in the Algarve (Dias & Santos, 2019) reviews the most pressing current and projected climate vulnerabilities, namely:

- *Increase in temperature*: there will be an increase in the average temperature and an increase in the amplitude between the minimum temperature and maximum temperature. It is expected an increase in the number of days with high and very high temperatures, or that is, the number of days with a maximum temperature above 30, 38, and 40.6 °C, and an increase in the number of heat waves events, more serious in the mountains than on the coast;

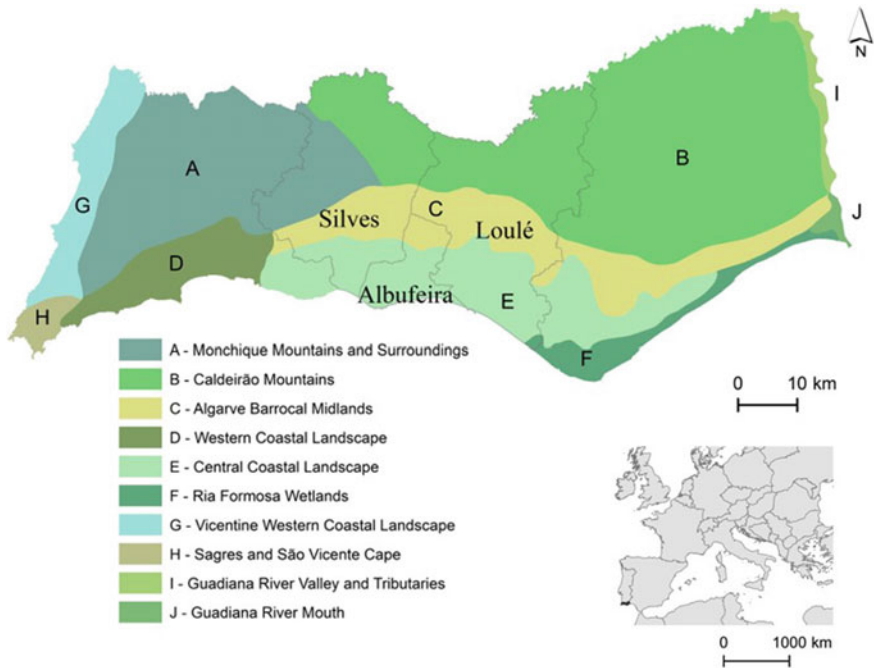


Fig. 6.2 Landscape units in the study area, extracted from Cancela d'Abreu et al. (2004). *Source* Own elaboration

- *Thermal comfort for outdoor activities*: taking into account the results of the thermal comfort index, the impacts on the thermal comfort of tourists should evolve toward very hot summers, offset by milder temperatures in the remaining periods of the year. These alterations could modify the distribution profile of the main tourist issuing markets, with a particular focus on the countries of Northern Europe, which could reduce their preference for the warmer months, amplifying the prospects of increased visits in the spring and autumn months (Dias & Santos, 2019, p. 162);
- *Wildfires*: an increase in the wildfire risk is projected in the future;
- *Response of protected habitats to climate change*: a low threat level is expected for the Central Algarve;
- *Reduction in water availability*: projections indicate a clear and serious decrease in the total precipitation value throughout the twenty-first century;
- *Floods and floods*: increase in the number of flooding events;
- *Mean sea level rise*: ranging in 0.63 and 0.98 m for the respective scenarios RCP4.5 and RCP8.

Methods

A participatory approach was outlined in order to assess which opportunities for tourism and recreational diversification should be prioritized in matters of qualification and promotion in a changing climate context.

Based on the authors' experience and the landscape context of the study area, 22 categories of tourist and recreational activities were considered alternatives to the asset Sun and Sea and were the framework of the participatory methodology applied, namely:

- Hiking, orienteering and maintenance circuits;
- BTT;
- Cycling;
- Sport practice in outdoor parks;
- River bathing recreation, canoeing, and sport fishing;
- Birdwatching;
- Climbing, abseiling and slide;
- Horse riding;
- Geocaching;
- Golf;
- Hunting;
- Accommodation in rural areas;
- Touring of built heritage, archeology and museums;
- Gastronomy and wines;
- SPAs;
- Landscape touring and picnics;
- Temporary integration in eco-villages, eco-communities or eco-farms;
- Camping;
- Caravanism;
- Outdoor shows;
- Outdoor fairs;
- Outdoor religious processions.

Between March and September 2017, a face-to-face questionnaire was applied to a stratified sample of 400 tourists and 400 residents of the municipalities of Silves, Albufeira, and Loulé in order to assess:

- Degree of preference for tourists and residents for alternative activities that could take place in each landscape unit: Interior Mountains; Barrocal Midlands; and Central Coast.

The tourists' questionnaires were applied on the beaches of these three municipalities and the residents' questionnaire was applied in the streets and squares of the parishes of the municipalities under study. The degree of preference of surveyed tourists ($N = 400$) and residents ($N = 400$) was studied using the numerical Likert

scale: 1—I don't like it at all; 2—I don't like it; 3—I relatively like it; 4—I reasonably like it; 5—I like it; 6—I like it a lot; 0—Don't know/don't answer.

Between 2017 and 2018, an online questionnaire was applied to experts ($N = 3$), decision-makers ($N = 7$), and tour operators ($N = 15$), based on the following Likert scale: 1—A not valuing; 2—To value little; 3—To value relatively; 4—To value reasonably; 5—To value; 6—To value a lot; 0—Don't know/don't answer. This time, the questionnaire intended to ask the:

- Considered potential enhancement of each tourist and recreational activity in each landscape unit.

Regarding the decision-makers, four were from regional level: (i) President of the Coordination and Regional Development Commission of Algarve; (ii) Regional Director of Administration of the Hydrographic Region of Algarve; (iii) President of the Region of Tourism of Algarve, and (iv) Coordinator of the Technical Structure of the Local Action Group for the Interior of the Central Algarve of the In Loco Association. The other three were from municipal level: (i) Mayor of Silves, (ii) Mayor of Albufeira, and (iii) Mayor of Loulé.

The aggregation of all the answers allowed the calculation of the Total Enhancement Potential for each activity in each landscape unit through a weighting method in which the opinion of each stakeholder (tourists, residents, experts, decision-makers, and tour operators) was equivalent to 20%. In turn, the final mean corresponding to the total potential enhancement of each alternative activity in each landscape unit was converted into an action priority matrix, namely: greater than 5 = ++ ; between 4 and 5 = + ; and below 4 = -.

Finally, another question was made to the residents, decision-makers, and tour operators based on the Likert scale mentioned earlier in order to assess.

- Climate change adaptation and mitigation measures supported by a green infrastructure that should be prioritized in terms of implementation.

Furthermore, the matrix of tourism and recreational diversification priorities was designated as *Total Enhancement Potential for tourism and recreation diversification in each landscape unit* (Fig. 6.3).

Total Enhancement Potential for Tourism and Recreation Diversification in Each Landscape Unit

Knowing the preferences of tourists and residents, and the opinion of experts, decision-makers, and tour operators (Samora-Arvela et al., 2020a, 2020b, 2023), it is also important, above all, to propose that the action plan for enhancing the tourist-recreational spatial structure of green infrastructures should be operationalized through the decreasing Total Enhancement Potential (Table 6.1) in each landscape unit.

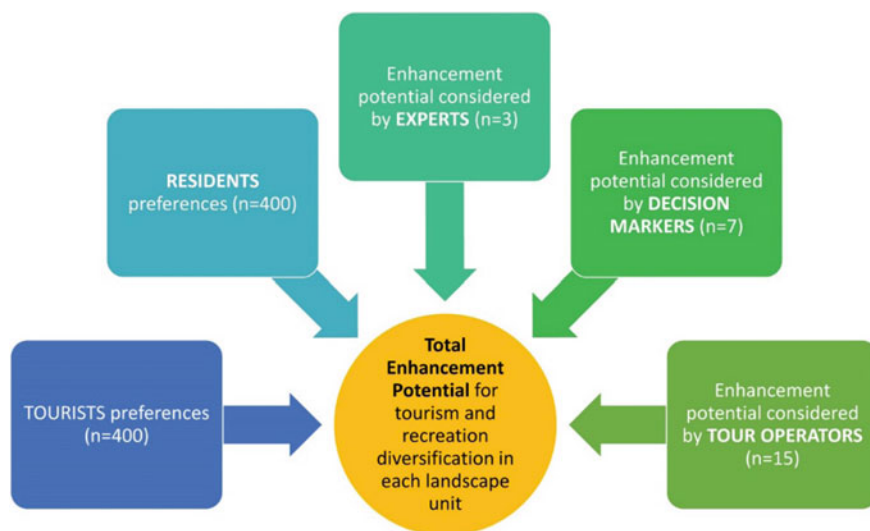


Fig. 6.3 Methodological scheme. *Source* Own elaboration

By aggregating the stakeholders' response levels regarding the identification of green infrastructure capabilities in the context of mitigation and adaptation to climate change, it is possible to define a high priority to be given to the qualification of the territory and relative tourism promotion through (Table 6.2):

- i. The delineation of pedestrian routes;
- ii. Tourist diversification through the commitment to Nature Tourism and Cultural and Landscape Touring;
- iii. Tourism enhancement of local products, revival of their production, safeguarding vernacular architecture and the landscape character;
- iv. Use of renewable energies (solar, photovoltaic, wind, among others) and recycling of waste, and delineation of cycle paths.

It should be noted that the determination of the Total Enhancement Potential for each tourist-recreational activity in each landscape unit of the case studied lays the foundations that may preside over the formulation of a territorial model of organization and plan of dynamic ways of adaptive planning of management of the green infrastructures of the study area and the region in question within a framework of full and congruent tourism promotion.

Furthermore, it is interesting to highlight which constellation of actors can benefit from the knowledge emanating from this chapter and how this strategy can be operationalized in action (Table 6.3).

This proposal can be an option of combining the mass concentration of Sun and Sea with diversification into niches of alternative products, namely the most feasible path for coastal Mediterranean regions (Benur & Bramwell, 2015; Bramwell, 2004; Samora-Arvela et al., 2018; Weaver, 2000, 2006).

Table 6.1 Prioritization matrix for tourist-recreational enhancement resulting from the definition of the total enhancement potential (++ = to highly enhance; + = to enhance; – = not to enhance)

Interior mountains	Priority
Hiking, orienteering, and maintenance circuits	++
SPAs	++
Accommodation in rural areas	++
Touring of built heritage, archeology, and museums	++
Gastronomy and wines	++
Landscape touring and picnics	++
Cycling	+
Birdwatching	+
Outdoor shows	+
Outdoor fairs	+
River bathing recreation, canoeing, and sport fishing	+
Temporary integration in eco-villages, eco-communities, or eco-farms	+
BTT	+
Sport practice in outdoor parks	+
Camping	+
Caravanism	+
Climbing, abseiling, and slide	+
Horse riding	+
Geocaching	+
Outdoor religious processions	+
Golf	–
Hunting	–
Barrocal midlands	Priority
Accommodation in rural areas	++
Hiking, orienteering, and maintenance circuits	++
Gastronomy and wines	++
Touring of built heritage, archeology, and museums	++
SPAs	++
Landscape touring and picnics	++
Cycling	+
Outdoor shows	+
Outdoor fairs	+
BTT	+
Sport practice in outdoor parks	+
Camping	+
Birdwatching	+

(continued)

Table 6.1 (continued)

Barrocal midlands	Priority
River bathing recreation, canoeing, and sport fishing	+
Temporary integration in eco-villages, eco-communities, or eco-farms	+
Caravanism	+
Horse riding	+
Geocaching	+
Outdoor religious processions	+
Climbing, abseiling, and slide	+
Golf	–
Hunting	–
Central coast	Priority
Hiking, orienteering, and maintenance circuits	++
SPA's	++
Gastronomy and wines	++
Outdoor shows	++
Touring of built heritage, archeology, and museums	++
Cycling	+
Landscape touring and picnics	+
Sport practice in outdoor parks	+
Outdoor fairs	+
Accommodation in rural areas	+
Temporary integration in eco-villages, eco-communities, or eco-farms	+
River bathing recreation, canoeing, and sport fishing	+
Birdwatching	+
BTT	+
Camping	+
Horse riding	+
Caravanism	+
Geocaching	–
Outdoor religious processions	–
Climbing, abseiling, and slide	–
Golf	–
Hunting	–

Source own elaboration based on tourist, residents, experts, decision-makers, and tour operators' replies

Table 6.2 Aggregated prioritization matrix for enhancing green infrastructure capabilities (++ = to highly enhance; + = to enhance; – = not to enhance)

Aggregated identification of the main mitigation and adaptation capacities of green infrastructure	Priority
Delineation of pedestrian routes	++
Tourist diversification through the commitment to Nature Tourism and Cultural and Landscape Touring	++
Tourist enhancement of local products, reviving of their production, safeguarding vernacular architecture and landscape identity	++
Use of renewable energies (solar, photovoltaic, wind, among others) and waste recycling	++
Delineation of cycle paths	++
Educational programming for adaptation and efficient use of resources	+
Increase in urban green spaces and green roofs	+
Reforestation	+
Preservation of drainage systems and construction, public or private, of cisterns, deposits, and water collection elements	+
Monitoring of ponds or water levels conducive to the appearance of disease-carrying insects	+
Creation of ecological corridors	+
Protection of cliffs and dunes	+

Source own elaboration based on the residents, decision-makers, and tour operators

Therefore, in a changing climate, Schott (2010) recognized the need for a focus on diverse tourist segments and on adaptive innovation (Michailidou et al., 2016; Samora-Arvela et al., 2018; Schott, 2010), diversifying and promoting emerging and alternative tourism products, where landscape tourism has to play a major role.

In view of the above, tourist diversification, expressed in this proposal, while increasing diversity and innovation as contributing factors to the regional resilience of the Algarve region, may contribute to the fulfillment of the 17 Sustainable Development Goals (SDGs) (UN, 2015) in this regional framework, mainly through:

- *Goal 1. End poverty in all its forms everywhere:* tourism diversification may have direct and indirect effects on the prosperity of communities and on reducing unemployment;
- *Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture:* this diversification could be associated with promoting local gastronomy and stimulating local agricultural production that should be aligned with it;
- *Goal 3. Ensure healthy lives and promote well-being for all at all ages:* to be guaranteed by the prosperity generated by tourism diversification and by the sustainable planning of green infrastructure;

Table 6.3 Constellation of actors that can operationalize the logos of this chapter

<i>Strategic axis</i>	
Tourist-recreational diversification of the Algarve destination region, given this study area	
<i>Main goal</i>	
Reinforcement of regional resilience by increasing diversity and innovation	
<i>Actors</i>	<i>Lines of action</i>
	<i>European Union</i>
	Advice in the context of green infrastructure planning Financing provision
	<i>National level:</i>
	Directorate-general for territory (DGT) Institute for nature conservation (ICNF) Tourism of Portugal (TP)
	Strategy for the sustainable planning of the territory, green infrastructure, and socio-economic and tourist diversification, assumed in the National program for spatial planning policy, Natura.PT and tourism 2027 strategy Budget management and submission of applications for EU funds Application of tax incentives and subsidized financing opportunities to tour operators, tourist accommodation establishments, and owners who invest in tourism projects in green infrastructure, including urban rehabilitation Financing provision

(continued)

Table 6.3 (continued)

<i>Strategic axis</i>	
Tourist-recreational diversification of the Algarve destination region, given this study area	
<i>Main goal</i>	
Reinforcement of regional resilience by increasing diversity and innovation	
<i>Regional level:</i>	
Commission for the coordination and regional development of the Algarve region (CCDRAlg)	Application of the methodology of the total enhancement valorization to the reformulation of the territorial model of the spatial program of the Algarve region, consolidating the tourist-recreation al aspect of the regional structure of environmental protection and valorization (ERPVA) Supervision, and coordination in the allocation of funds and management of the implementation of tourist-recreational diversification programs, based on the qualification of the green infrastructures of the area and region of study Development of school materials, dissemination campaigns, and training of municipal stakeholders Monitoring and creation of a system of indicators for this purpose

(continued)

Table 6.3 (continued)

<i>Strategic axis</i>		
Tourist-recreational diversification of the Algarve destination region, given this study area		
<i>Main goal</i>		
Reinforcement of regional resilience by increasing diversity and innovation		
Algarve tourism region (RTA)	Intermunicipal community of the Algarve region (CIM Algarve)	Establishment of a close collaboration between all the municipalities in order to promote the tourism-recreational diversification of the Algarve destination as a whole
		Encouraging the qualification of the offer of tourist-recreational activities studied according to the priorities determined by the total enhancement potential Support for the digital transition of tourism in the region Incentive and certification of the adoption of measures to mitigate and adapt to climate change according to the prioritization defined in this chapter, namely the delineation of pedestrian routes, tourist diversification through the commitment to nature tourism and cultural and landscape touring, tourist enhancement of local products, reviving its production, safeguarding the vernacular architecture and the landscape's identity, using renewable energies (solar, photovoltaic, wind, among others) and recycling waste, and delineating cycle paths, among others. The RTA will, as always, have to collaborate with the ATA, tour operators, municipalities, and local action groups in this regard Financing provision

(continued)

Table 6.3 (continued)

<i>Strategic axis</i>	
Tourist-recreational diversification of the Algarve destination region, given this study area	
<i>Main goal</i>	
Reinforcement of regional resilience by increasing diversity and innovation	
Algarve tourism association (ATA) + Tour operators	Promotion of tourist-recreational activities studied according to the priorities determined by the total enhancement potential for each activity in each landscape unit Promotion of the digital transition of tourism, so a promotional application at the regional level would be an opportunity Financing provision
<i>Municipal level:</i> Silves municipality council Albufeira Municipality Council Loulé municipality council	Sustainable spatial planning, according to the priorities determined by the total enhancement potential for each activity in close collaboration with the neighboring municipalities in the sense of qualifying the territory of the Algarve destination region as a whole Encouraging the adoption of measures to mitigate and adapt to climate change according to the prioritization defined in this chapter, namely the design of pedestrian routes, tourist diversification through the commitment to nature tourism and cultural and landscape touring, tourist enhancement of local products, reanimation of its production, safeguarding the vernacular architecture and the identity of the Landscape, use of renewable energies (solar, photovoltaic, wind, among others. Municipalities must, in this context, collaborate with the RTA, ATA, tour operators, local action groups, local landowners, and community Development of materials and campaigns for publicizing and training local communities

(continued)

Table 6.3 (continued)

Strategic axis	
Tourist-recreational diversification of the Algarve destination region, given this study area	
Main goal	
Reinforcement of regional resilience by increasing diversity and innovation	
Associations + Local communities	Starting from the municipalities, local action groups, associations, and local communities should be encouraged to coordinate and co-generate the adoption of mitigation and adaptation measures to climate change in line with the prioritization defined in this chapter, namely the design of pedestrian routes, diversification tourism through the commitment to Nature Tourism and Cultural and Landscape Touring, tourist enhancement of local products, resuscitation of their production, safeguarding vernacular architecture and Landscape identity, use of renewable energies (solar, photovoltaic, wind, among others) A dynamic forum for periodic convening should be created that brings together the RTA, ATA, tour operators, municipalities, local action groups, associations and relevant members of local communities with the aim of maintaining the continuous discussion on the dynamic way of planning to be follow

Source Own elaboration

- *Goal 4. Ensure inclusive and equitable quality education and promote life-long learning opportunities for all:* the strategy in question must associate environmental education as a vector;
- *Goal 5. Achieve gender equality and empower all women and girls:* everyone must participate in the process under review;
- *Goal 6. Ensure availability and sustainable management of water and sanitation for all:* the planning and sustainable use of green infrastructures will safeguard this ecosystem service;
- *Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all:* based on efficient use and production of energy by types of alternative and sustainable tourism, and on other functions of green infrastructures;
- *Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all:* the commitment to develop alternative niche products contributes to inclusive and sustainable development and to the generation of qualified employment;
- *Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation:* innovation is a supporting factor in tourism-recreational diversification, mainly from the perspective of information and communication technologies with advantages in terms of promotion and management;
- *Goal 10. Reduce inequality within and among countries:* tourist diversification, based on endogenous resources, in low-density territories, could lead to their development by increasing the number of experts in local communities, reducing inter and intra-regional asymmetries, mainly patents between the interior and the coastal areas;
- *Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable:* the adoption of a sustainable tourism model, based on enhancing the potential of green infrastructures, will contribute to the fulfillment of this objective;
- *Goal 12. Ensure sustainable consumption and production patterns:* promoting a transition path or complementing conventional tourism with alternative tourism will lead to frugal and sustainable tourist enjoyment;
- *Goal 13. Take urgent action to combat climate change and its impacts:* could come from delineating diversification strategies into alternative low-impact products by increasing the socio-economic diversity of the Mediterranean regions and the inherent contribution to regional resilience. At the contingency level, the typologies and actions of diversification of tourist activities must be sustained in the praxis of mitigation and adaptation to the impacts of climate change;
- *Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development:* along with inland green infrastructure, it is urgent to preserve blue infrastructure as a resource, especially for the purpose of promoting sustainable nautical recreation;
- *Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss:* the preservation of ecosystems as a tourist

resource and the tourist promotion of green infrastructure spaces are idiosyncratic and interdependent;

- *Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels:* encouraging sustainable tourism, respective contact, and respect for local communities is a condition for cosmopolitanism and tolerance among peoples;
- *Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development:* mobilizing additional financial resources for developing countries from multiple sources.

The Strategy for Tourism 2027 (ET27)—Leading the Tourism of the Future, defined by Turismo de Portugal, the national public touristic entity, presented the strategies for tourism development in Portugal until 2027, aiming to affirm tourism as a sustainable activity throughout the year and throughout the territory, enhancing the natural and cultural resources.

Thus, ET27 assumes ten Global Challenges for a 10-year strategy:

1. People: promote employment, qualification, and appreciation of people and increase the income of tourism professionals;
2. Cohesion: expanding tourist activity to the whole territory and promoting tourism as a factor of social cohesion;
3. Growth in value: faster pace of growth in revenues vs overnight stays;
4. Year-round tourism: extend tourism throughout the year, so that tourism is sustainable;
5. Accessibilities: ensure the competitiveness of access to the destination Portugal and promote mobility within the territory;
6. Search: reach the markets that best respond to the challenges of growing in value and that allow expanding tourism throughout the year and throughout the territory;
7. Innovation: encourage innovation and entrepreneurship;
8. Sustainability: ensuring the preservation and sustainable enhancement of cultural and natural heritage and local identity, as a strategic asset, as well as the compatibility of this activity with the permanence of the local community;
9. Simplification: simplify legislation and make public administration more agile;
10. Investment: guaranteeing financial resources and boosting investment.

Within the scope of axis 1 “enhancing the territory and communities”, it is proposed the opportunity to enhance and promote, in a sustainable way, landscape tourism in order to favor urban and regional regeneration, and to the benefit of local communities, where the hermeneutics of this chapter align.

In many regions with a Mediterranean climate, the main focus on tourism enjoyment and promotion is on the Sun and Sea product. In Portugal, ET27 (TP, 2017) defines Climate, Light, Sea, Water, History, and Culture as differentiating tourist

assets, identifying Gastronomy and Wine as an active qualifier of the tourist experience in Portuguese territory, where all categories of tourist activities studied in this chapter can be found.

In turn, the National Nature Tourism Program (PNTN), approved in 2015, is the tourism plan in protected areas of Portugal (TP, 2016), under the creation of a brand: Natura.PT.

Its main objective is to promote and assert the values and potential of the protected areas and other areas with natural and cultural values, encouraging the creation of innovative and sustainable tourist products and services (TP, 2016), namely through:

- Nature conservation;
- Local development;
- Qualification of the tourist offer;
- Diversification of tourist activity;
- Dissemination and enhancement of the natural and cultural heritage.

Again, the pathway discussed in this chapter addresses all these goals.

In this context, Covas (2020), focusing on the region where the study area is integrated, suggests a reconsideration of city-countryside relations and the socio-economics of tourism in rural areas due to the present and emerging challenges arising from climate change, the digital transformation, the inherent new rules of post-pandemic social etiquette. Thus, it is necessary to rethink the intensive and mass tourism model. Covas postulate that, as a result of mitigation policies in air transport, the deconstruction of the conventional Sun and Sea product, the search for isolation in a post-pandemic society, an experience more marked by greater mobility and nomadism, and a need for pluriactivity and pluri-income of residents, there will be a stimulus to the innovative and imaginative diversification of agriculture and tourism in rural areas of Algarve region.

Here, the potential for substantiated diversification of the Algarve tourist destination through the provision of a nature and cultural tourism products and the provision of structured services that allows the sensory-cultural enjoyment of what is produced regionally (Covas & Covas, 2015; Covas, 2020; Samora-Arvela et al., 2017).

Conclusions

The desired research questions were gradually addressed, whereby the consultation of tourists, residents, experts, decision-makers, and tour operators allowed the identification of tourism and recreational activities to be promoted as alternatives to Sun and Sea, according to the strategic axis the diversification of the regional socio-economic base and further strengthening of regional resilience to future challenges through the proposed enhancement of the existing resources of the study area's green infrastructure.

It should be noted that the research questions that presided over this chapter were largely fulfilled, and it was possible to study a potential development alternative for

the study area that would contribute to its socio-economic diversification as a way of increasing regional resilience and, therefore, a pathway of adapting to the impacts that are expected to affect the touristic regions, namely the Algarve, especially its Sun and Sea tourist segment on which they are fundamentally and strongly depend.

It can be seen that the study of this strategic option dedicated to increasing regional resilience in a changing climate context represents a contribution to the creation of knowledge that had not yet been raised by scientific research.

Still it should be stated that the approach discussed so far was based on the landscape units that permeate the territory of the municipalities in the study area, namely the Interior Mountains, Barrocal Midlands, and Central Coast, so that the recommendations raised by this chapter may have applicability on a regional scale.

The aggregation of data relating to the responses of tourists, residents, experts, decision-makers, and tour operators made it possible to identify the potential for transition and transformation of the most desired tourist use and promotion, establishing the priorities and skills for tourism and recreation qualification.

Despite the thesis that tourism diversification can figure as a way to increase regional resilience to be integrated and/or promoted in policies for transforming the territory of the study area, another convenient opportunity for future research will be to study how adaptation will evolve along the coastline of tourist areas, especially sandy beach areas, as a resource and tourist asset in the Sun and Sea segment in the study area and in the Mediterranean regions, as the continuous replacement of beach sand becomes unsustainable and unaffordable in the long term. It is also imperative to research which complementary or substitutive solutions for the beach in coastal sand can be implemented not only physically, but, also and above all, socially.

It should be noted that, being an approach at the landscape scale, this study does not specifically and locally spatialize new routes, circuits, and tourist-recreational spaces, being a proposal of what should guide the strategic planning of tourism in this region.

Another limitation is that this is a proposal for a systemic adaptation of the tourism sector in the Algarve region to climate change, requiring specific implementation at the micro-scale of local adaptation measures, which is still an opportunity for research.

Also, an opportunity for research is the design and calculation of the financing lines needed to carry out the strategic adaptation of the entire region with a view to increasing its regional resilience.

Taking into account the uncertainty in the future, the consideration of tourism-recreational diversification as a transition path will always have a win-win character, whatever the scenario that unfolds.

Competing Interests

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References

- Amelung, B., & Moreno, A. (2009). *Impacts of climate change in tourism in Europe*. Institute for Prospective Technological Studies, European Commission.
- Benur, A., & Bramwell, B. (2015). Tourism product development and product diversification in destinations. *Tourism Management*, 50, 213–224. <https://doi.org/10.1016/j.tourman.2015.02.005>
- Bina, O. (2013). The green economy and sustainable development: an uneasy balance?
- Boschma, R. (2015). Towards an evolutionary perspective on regional resilience. *Regional Studies*, 49(5), 733–751. <https://doi.org/10.1080/00343404.2014.959481>
- Bramwell, B. (2004). Mass tourism, diversification and sustainability in Southern Europe's coastal regions. In B. Bramwell (Ed.), *Coastal mass tourism. Diversification and sustainable development in southern Europe* (pp. 1–31). Channel View Publications.
- Cancela d'Abreu, A. Pinto Correia, T., & Oliveira, R. (2004). *Contributos para a Identificação e Caracterização da Paisagem em Portugal Continental* (Volume V) [Contributions to the identification and characterization of landscape in mainland Portugal (Volume V). Direção-Geral do Ordenamento do Território e Desenvolvimento Urbano.
- Cobuci, L., Kastenholz, E., & Breda, Z. (2011). O Turismo Residencial em meio rural numa perspectiva do marketing sustentável dos destinos [Residential tourism in rural areas from a perspective of sustainable destination marketing]. *Tourism and Management Studies*, 1, 497–507. <http://www.redalyc.org/articulo.oa?id=388743867045>
- Covas, A. (2020). O barrocal, serra e o turismo em espaço rural [Barrocal, Serra, and rural tourism]. *Sul Informação*. <https://www.sulinformacao.pt/2020/05/o-barrocal-serra-e-o-turismo-em-espaço-rural/>
- Covas, A., & Covas, M. M. (2015). *Multiterritorialidades – Temas e Problemas de Governança e Desenvolvimento Territoriais* [Multiterritorialities—themes and issues of territorial governance and development]. Edições Colibri.
- Denier, L., Scherr, S., Shames, S., Chatterton, P., Hovani, L., & Stam, N. (2015). *The little sustainable landscapes book*. Global Canopy Programme.
- Dias, L. F., & Santos, F. D. (2019). *Plano Intermunicipal de Adaptação às Alterações Climáticas do Algarve* [Intermunicipal plan for adaptation to climate change in the Algarve]. Universidade de Lisboa, Faculdade de Ciências, Centre for ecology, evolution and environmental change, centre

- for climate change, impacts, adaptation and modelling, Universidade do Algarve, Centre for Marine and Environmental Research, Bentley Advancing Infrastructure.
- EEA. (2011). *Green infrastructure and territorial cohesion. The concept of green infrastructure and its integration into policies using monitoring systems*. European Environment Agency. *Environment and Planning: Government and Policy*, 31, 1023–1047.
- Eraydin, A. (2016). The role of regional policies along with the external and endogenous factors in the resilience of regions. *Cambridge Journal of Regions, Economy and Society*, 9(1), 217–234.
- Ferreira, O., Dias, J. A., & Taborda, R. (2008). Implications of sea-level rise for continental Portugal. *Journal of Coastal Research*, 24(2), 317–324. <https://doi.org/10.2112/07A-0006.1>
- Fox-Kemper, B., Hewitt, H. T., Xiao, C., Aðalgeirsdóttir, G., Drijfhout, S. S., Edwards, T. L., Golledge, N. R., Hemer, M., Kopp, R. E., Krinner, G., Mix, A., Notz, D., Nowicki, S., Nurhati, I. S., Ruiz, L., Sallée, J. B., Slangen, A. B. A., & Yu, Y. (2021). Ocean, cryosphere, and sea-level change. In V. Masson-Delmotte, P. Zhai, A. Pirani, & B. Zhou, (Eds.), *Climate change 2021: The physical science basis. Contribution of working group i to the sixth assessment report of the intergovernmental panel on climate change* (pp. 1211–1362). Cambridge University Press.
- Girão de, A. A. (1941). *Geografia de Portugal* [Geography of Portugal]. Portucalense Editora.
- Martins, J. (2011). Urbanizado pelo lazer: o caso do Algarve [Urbanized for leisure: The case of the Algarve]. *Forum Sociológico*, 21.
- McGonigle, D. F., Nodari, G. R., Phillips, R. L., Aynekulu, E., Estrada-Carmona, N., Sarah, K., Jones, S. K., Koziell, I., Luedeling, E., Remans, R., Shepherd, K., Wiberg, D., Whitney, C., & Zhang, W. (2020). A knowledge brokering framework for integrated landscape management. *Frontiers in Sustainable Food Systems*, 4, 13. <https://doi.org/10.3389/fsufs.2020.00013>
- Michailidou, A. V., Vlachokostas, C., & Moussiopoulos, N. (2016). Interactions between climate change and the tourism sector: Multiple-criteria decision analysis to assess mitigation and adaptation options in tourism areas. *Tourism Management*, 55, 1–12. <https://doi.org/10.1016/j.tourman.2016.01.010>
- O'Brien, K., & Hochachka, G. (2010). Integral adaptation to climate change. *Journal of Integral Theory and Practice*, 5(1), 89–102.
- Palekiene, O., Simanaviciene, Z., & Bruneckiene, J. (2015). The application of resilience concept in the regional development context. *Social and Behavioural Sciences*, 213, 179–184. <https://doi.org/10.1016/j.sbspro.2015.11.423>
- Peng, C., Yuan, M., Gu, C., Peng, Z., & Ming, T. (2017). A review of the theory and practice of regional resilience. *Sustainable Cities and Society*, 29, 86–96. <https://doi.org/10.1016/j.scs.2016.12.003>
- Samora-Arvela, A., Vaz, E., Ferreira, J., & Panagopoulos, P. (2017). Turismo e Património Gastronómico: A valorização turística de um cabaz de doçaria algarvia [Tourism and gastro-nomic heritage: The touristic valorization of an Algarvian sweets basket]. *Public Policy Portuguese Journal*, 2(2), 55–69. <http://www.umpp.uevora.pt/publicacoes/Public-Policy-Portuguese-Journal>
- Samora-Arvela, A., Vaz, E., Ferrão, J., Ferreira, J., & Panagopoulos, T. (2018). Diversifying mediterranean tourism as a strategy for regional resilience enhancement. In H. Pinto, T. Noronha, & E. Vaz (Eds.), *Resilience and regional dynamics. Advances in spatial science* (pp. 105–127). Springer. https://doi.org/10.1007/978-3-319-95135-5_6
- Samora-Arvela, A., Ferreira, J., Panagopoulos, T., & Vaz, E. (2020a). Tourists, residents and experts rethink the future of mediterranean regions: can tourism diversification contribute to climate change adaptation? The case of the Algarve region, southern Portugal. In Vaz, E. (Ed.), *Regional intelligence: Spatial analysis and anthropogenic regional challenges in the digital age*. Springer. https://doi.org/10.1007/978-3-030-36479-3_8
- Samora-Arvela, A., Ferreira, J., Vaz, E., & Panagopoulos, T. (2020b). Modeling nature-based and cultural recreation preferences in mediterranean regions as opportunities for smart tourism and diversification. *Sustainability*, 12(1), 433. <https://doi.org/10.3390/su12010433>

- Samora-Arvela, A., Vaz, E., Ferreira, J., & Panagopoulos, T. (2023). Tourism, climate change and well-being: The products' diversity as an opportunity. In E. Vaz (Ed.), *Geography of happiness. Contributions to regional science*. Springer. https://doi.org/10.1007/978-3-031-19871-7_7
- Santos, F. D., & Miranda, P. (2006). *Alterações Climáticas em Portugal – Cenários, Impactes e Medidas de Adaptação – Projeto SIAM II* [Climate change in Portugal—Scenarios, impacts, and adaptation measures—SIAM II Project]. Gradiva.
- Santos, F. D., Forbes, K., & Moita, R. (2001). *Mudança Climática em Portugal. Cenários, Impactes e Medidas de Adaptação – SIAM – Sumário Executivo e Conclusões* [Climate change in Portugal: Scenarios, impacts, and adaptation measures—SIAM—Executive summary and conclusions]. Gradiva.
- Schmidt, L. (2016). *Portugal: Ambientes de Mudança – Erros, Mentiras e Conquistas* [Portugal: Changing environments—Errors, lies, and achievements]. Portugal, Lisbon: Temas e Debates – Círculo de Leitores.
- Schott, C. (2010). Tourism and the implications of climate change: Issues and actions. *Bridging Tourism Theory and Practice*, 3. [https://doi.org/10.1108/S2042-1443\(2010\)0000003022](https://doi.org/10.1108/S2042-1443(2010)0000003022)
- Simões, J. M., Cardoso Ferreira, C., Brito Henriques, E., Sampaio, A., Almeida, D., Boavida-Portugal, I., Policarpo, N., & Quintal, R. (2013). Coastal environmental resources and users. In J. M. Simões, C. Cardoso Ferreira, & E. Brito Henriques (Eds.), *Sustainability in the coastal urban environment* (pp. 344–406). SECOA.
- Slangen, A., Palmer, M., Camargo, C., Church, J., Edwards, T., Hermans, T., Hewitt, H., Garner, G., Gregory, J., Kopp, R., Santos, V., & van de Wal, R. (2023). The evolution of 21st century sea-level projections from IPCC AR5 to AR6 and beyond. *Cambridge Prisms: Coastal Futures*, 1, E7. <https://doi.org/10.1017/cft.2022.8>
- Stenseke, M. (2016). Integrated landscape management and the complicating issue of temporality. *Landscape Research*, 41(2), 199–211. <https://doi.org/10.1080/01426397.2015.1135316>
- Sutton, J., & Arku, G. (2022). Regional economic resilience: Towards a system approach. *Regional Studies*, 9(1), 497–512. <https://doi.org/10.1080/21681376.2022.2092418>
- TP. (2016). Guia orientador – Abordagem ao Setor do Turismo na Revisão do PDM [Guiding guide—Approaching the tourism sector in the review of the PDM]. Turismo de Portugal.
- TP. (2017). Estratégia Turismo 2027 - Liderar o Turismo do Futuro [Tourism strategy 2027—Leading tourism of the future]. Turismo de Portugal.
- UN. (2015). *Transforming our world: The 2030 agenda for sustainable development*. United Nations (UN). <https://sdgs.un.org/2030agenda>
- Weaver, D. (2000). A broad context model of destination development scenarios. *Tourism Management*, 21(3), 217–224. [https://doi.org/10.1016/S0261-5177\(99\)00054-0](https://doi.org/10.1016/S0261-5177(99)00054-0)
- Weaver, D. (2006). *Sustainable tourism—Theory and practice*. Elsevier.

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Chapter 7

Climate Change and Tourism in Spain. The Case of the Canary Islands and the Costa Blanca (Alicante)



Comparative Analysis

**Pedro Dorta-Antequera, Esther Sánchez-Almodóvar, Abel López-Díez,
Jaime Díaz-Pacheco, and Jorge Olcina-Cantos**

Abstract Tourism and climate change are closely related elements of geographical space. Tourism is one of the causal agents of climate change, as it generates transformations in land use and favors CO₂ emissions, especially due to the importance of external and internal travel in the destinations. For its part, the current process of climate change is causing alterations in climatic elements that are a key aspect in determining the influx in destinations and the establishment of tourist seasons. The paper analyses the importance of tourism activity, with a scalar approach, in the Spanish territory, with special attention to two main tourist destinations: the Canary Islands and the Costa Blanca (Alicante). It assesses the impact that both have as CO₂ emitters and the magnitude of the land transformation that they have caused in recent decades. On the other hand, the effect that climate change is already having on the alteration of important climatic elements for the sun and beach tourism activity in both destinations is studied through the use of comfort indicators. The actions for mitigating and adapting to climate change that public administrations and private

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agents are implementing to reduce its impact are studied. The future trends of the climate change process in the tourism activity of these two main destinations in Spain are assessed.

Keywords Climate change · Tourism · Carbon emissions · Canary Islands · Alicante

Introduction

Tourism is one of the most important economic sectors on a planetary scale (5.8 trillion \$, 10.3% world GDP) (WTTC, 2022). Its rapid growth in recent decades has favored an extraordinary development in many countries or regions, especially those that can offer a suitable climate for outdoor leisure and recreational activities, with special emphasis on sun and beach tourism. Spain, especially in its coastal areas, has thus become a destination and a world reference in the tourism business. In many Spanish regions, tourism represents a main economic activity due to the volume of business and the level of employment generated (Exceltur, 2023).

If we analyze the data on a national scale, we can observe, on the one hand, a clear seasonality, with a summer maximum and, on the other hand, that most visitors are concentrated on the coast. The five autonomous communities with the highest number of tourists are coastal regions: Catalonia, the Balearic Islands, the Canary Islands, Andalusia, and the Valencian Community (INE, 2022). Together with social aspects, political stability and the economic situation, the climate, especially on the Mediterranean coast and its two archipelagos, is one of the most decisive factors of the attraction of Spain, which has reached second place in the world in terms of income, after the United States, and in terms of the volume of visitors, only behind France. The country received more than 83.5 million international tourists out of almost 1.5 billion of the planet's total in 2019 (UNWTO, 2022). The country's tourist potential has allowed it to remain in the top 5, among all nations, over the last decade.

However, this large volume of business, supported by mass tourism, shows another much less friendly side, the deterioration and degradation of the Spanish coastline as a whole and the unsustainable exploitation of natural resources. In addition, the adopted model has been based on a disproportionate pressure in the exploitation of resources on the coast (Martín-Arias et al., 2020; Rico-Amoros et al., 2013; Torres-Bagur et al., 2020) or changes in land use, with a very significant increase in the area dedicated to tourism activities. This fact has generated a notable increase in the levels of risk to natural hazards, especially those of climatic origin (mainly floods, droughts, slope movements, or sea storms in the coastal area) in some territories. In this context, climate change contributes to further accentuate the risk of extreme weather events (Steiger et al., 2023) due to the already recorded increase in hazard (Olcina, 2020), which adds to the already significant level of risk exposure in coastal areas (Pérez Morales et al., 2015; Ribas Palom et al., 2020). In this sense, tourism, together with agriculture, is the economic activity most exposed to global warming

(Miró Pérez & Olcina Cantos, 2020). Thus, for example, the thermal rise of the seas and oceans means greater atmospheric convection and, consequently, torrential rainfall episodes that have worsened in recent years, with very clear examples on the Spanish Levantine coast (Miró et al., 2018). On the other hand, the increase in the intensity of heat waves, a breeding ground for the spread of large forest fires, or very severe drought episodes clearly reflect the impacts of climate change. An example of this are the serious repercussions on some ecosystems of the Canary Islands high mountains (Cubas et al., 2022). Nevertheless, the rise in sea level with the consequent erosion of beaches (Jiménez et al., 2017) or the effect on various infrastructures such as marinas or seafront promenades represents an uncertain future and the main concern directly related to climate change and the so-called sun and beach tourism.

In turn, tourism development itself, and the strong coastal shift associated with it, is generating the massive emission of large amounts of greenhouse gases (GHG) responsible for climate change (Fig. 7.1). It is known that tourism is an activity with a notable influence on the increase of the aforementioned greenhouse effect, accounting for 8% of total emissions (Lenzen et al., 2018), with transport, and especially air transport, being one of the most important sources of emissions (Dorta Antequera et al., 2021).

In other words, climate change is affecting and, above all, in the medium and long-term, will affect tourism activity on the Spanish coastline and the very activity derived from tourism in turn leads to an increase in the greenhouse effect with the consequent global warming.

In order to evaluate the importance of these processes, the main objective of this paper is to analyze the relationship between climate change and tourism in Spain, taking as a reference two of its most representative and at the same time

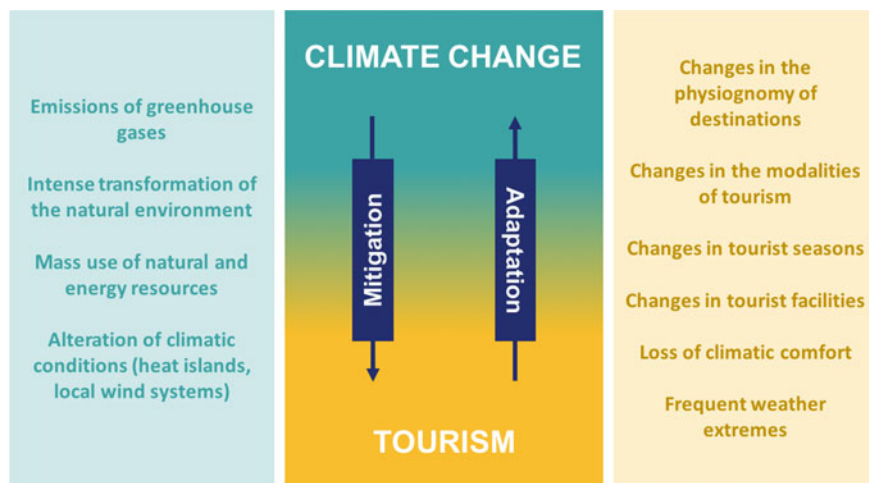


Fig. 7.1 Relationship between effects and impacts of climate change and tourism. *Source* Own elaboration

most geographically contrasted regions. One of them is continental, located on the shores of the western Mediterranean, the Costa Blanca in the autonomous community of Valencia, and the other is insular, in the south-eastern North Atlantic, the Canary archipelago. A specific study is conducted to analyze various issues: the main impacts of extreme meteorological phenomena as well as thermal and rainfall trends; the intense transformation of land use on which the development of tourism has been based; an approach to CO₂ emissions generated by one of the most polluting activities, transport due to international aviation that carries millions of travelers, mainly European, to the coast of Alicante and the Canary Islands; and, finally, some notes on the so-called climate action, adaptation and mitigation, in relation to tourism.

This chapter is structured in six sections. After the Introduction, the concepts of effects and impacts of climate change, and the interaction of climate change with tourism activity, are discussed. The second section presents the study area, consisting of two regions, the Canary Islands and the Costa Blanca (Alicante). In the third section, the research design is presented, showing the data sources consulted and the time period of the study. The fourth section analyses the impact of climate change on tourism activity in both regions. In the fifth section, tourism is considered as a factor of climate change, reviewing its influence on GHG emissions and territorial transformation. Finally, the sixth section presents the conclusions of the study.

The Regions of the Study

The selection of the two regions chosen responds to their significance in the Spanish tourism market, as the second country in the world with the most international visitors, and to the fact that they are exemplary territories in very different areas from a geographic and tourism market perspective. Despite their differences, both regions have ideal conditions for all types of leisure and recreational activities and, specifically, for the sun and beach model.

The Valencian Community, and the Costa Blanca in particular, is a continental territory relatively close to the tourist issuing regions, both international and national; it has a very marked Mediterranean climate with dry and warm summers and mild winters, although with thermal values, both atmospheric and marine, which hinder the use and enjoyment of the sea as a leisure space during the coldest months of the year. The Canary Islands, on the other hand, are an island territory much further away from the main countries of origin, especially the United Kingdom and Germany, and accessible only by air, although it is true that cruise ship tourism is becoming increasingly important. Its climate, with few annual variations, is moderately warm and dry throughout the year, which allows it to maintain the offer permanently and without any seasonality; it is even a more competitive destination in the cold months when it has little competition on the European continent.

The accentuated seasonality in the Valencian Community with respect to the Canary Islands can be seen in the tripling of visitors in summer (13.8% of the annual

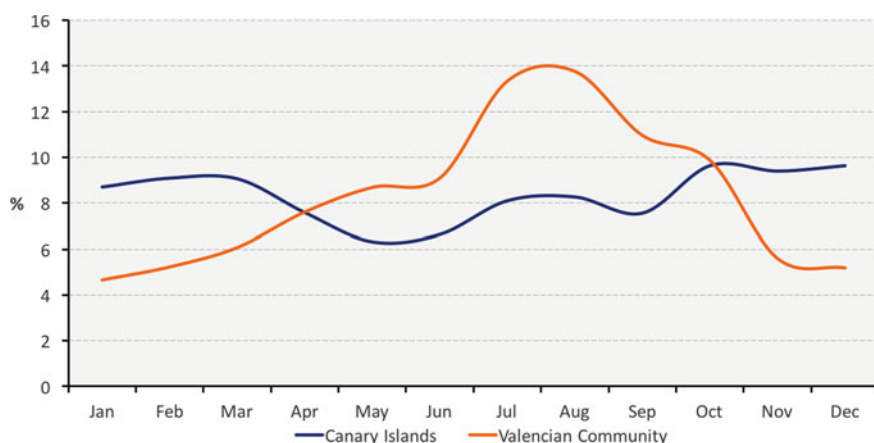


Fig. 7.2 Percentage evolution of the arrival of foreign tourists in the Canary Islands and the Valencian Community (average 2015–2019). *Source* INE, 2022

total in August) with respect to winter (4.6% in January), while in the Canary Islands the difference between the month with the highest number of visitors (December 9.6%) and the lowest (May 6.3%) is considerably lower (Fig. 7.2).

The Valencian Community receives annually about 8 million foreign tourists, being the fifth in the country and 6 million domestic tourists (3rd Autonomous Community in Spain). The Canary archipelago receives more than 13 million foreign visitors each year and slightly more than 1 million in the domestic market, making it the third Spanish region in terms of international tourism, although with very similar values to the Balearic Islands, which is in second place.

Within the study fields, two of the most relevant tourist areas, the city of Benidorm in Alicante and the southwest coast of the island of Tenerife, corresponding to the municipalities of Adeje and Arona, are taken as references for the analysis of changes in land use (Fig. 7.3).

Research Design

In order to achieve the proposed objectives, an exhaustive review of the most recent specialized literature on tourism, climate change, and climate risks in the analyzed regions have been carried out. It has also been essential to collect data from a series of official statistical sources, national and regional observatories of tourism activity, as well as various reports issued by different institutions and related to the subject. A large amount of information has been compiled from official documents of the European Commission and the European Parliament, as well as from websites specialized in air transport and the environment. Similarly, climatic information has been obtained from the Spanish State Meteorological Agency (AEMET).

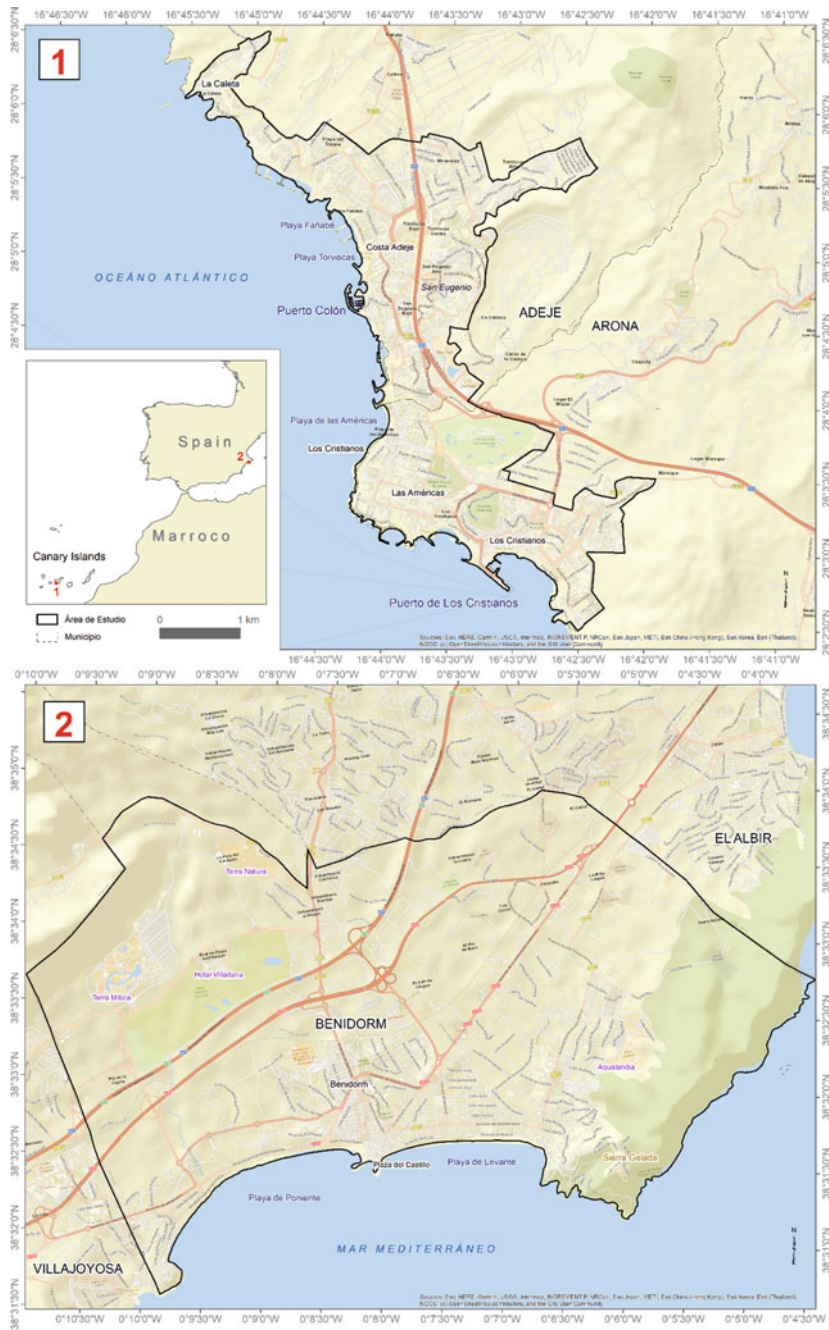


Fig. 7.3 Location of areas for the analysis of land use changes. *Source* HERE and other basemap services provided by Esri

Data on tourists and trips to the studied regions have been obtained from the Spanish National Statistics Institute (INE), the Canary Islands Statistics Institute (ISTAC) (ISTAC, 2020) and from the public company Aeropuertos Nacionales y Navegación Aérea Española (AENA, 2023), responsible for all Spanish airports. Data have been estimated for the airports of Alicante-Elche, Gran Canaria, Tenerife, Fuerteventura, Lanzarote, and La Palma.

For the estimates of CO₂ emissions from international air transport, use was made of the calculator of the International Civil Aviation Organization (ICAO), a specialized agency belonging to the United Nations (ICAO, 2021), whose information has been widely used in other scientific works (Dorta Antequera et al., 2021; Heredia Yzquierdo, 2015; Lee et al., 2021). The calculation takes into consideration different factors such as aircraft type, route-specific data, passenger load factors, and cargo carried. It also has the particularity that it is based on real flights, so it is possible to evaluate the routes covered by a given airline with the precise aircraft model. In order to obtain the results, it was necessary to search for statistical information on international passengers arriving in the Canary Islands and Alicante. The number of visitors per month, year, and nationality was identified, using tourist portals and official statistics to calculate distances and emissions per trip. An analysis period of the five-year average (2015–2019) prior to the COVID-19 health crisis was established to avoid the impact of the virus and inter-annual fluctuations and changes.

Finally, for the characterization of the evolution of urban transformations in the selected areas, a primarily cartographic task, an analysis of the information provided by the General Directorate of Cadastre (GDC) of the Spanish Ministry of Finance has been carried out.

Impacts of Climate Change on Tourism

The effects and consequences of climate change in the studied regions are already evident and are not only related to the increase in temperatures, following the general trend registered in the planet, but also to the alterations in rainfall and the development of extreme range atmospheric events.

In the case of the Canary Islands, a generalized increase in temperatures has been proved, although much more important in the minimum values and in the high mountains (Luque et al., 2014; Martín et al., 2012). In this regard, the so-called tropical nights (minimum temperatures above 20 °C), which generate high thermal discomfort, have experienced a significant increase in recent decades. In some observatories in the Canary Islands, the number of tropical nights has increased from an average of 80 in the 1970s to 130 in the last 10 years, as is the case of Gran Canaria (Fig. 7.4), which represents an increase of more than 60%.

Rainfall, on the other hand, shows trends with greater uncertainty, and with insignificant decreases. However, an increase in high intensity drought sequences is observed, again especially in the high mountains (Dorta Antequera et al., 2018). Likewise, there are some authors who indicate a certain increase in the torrentiality

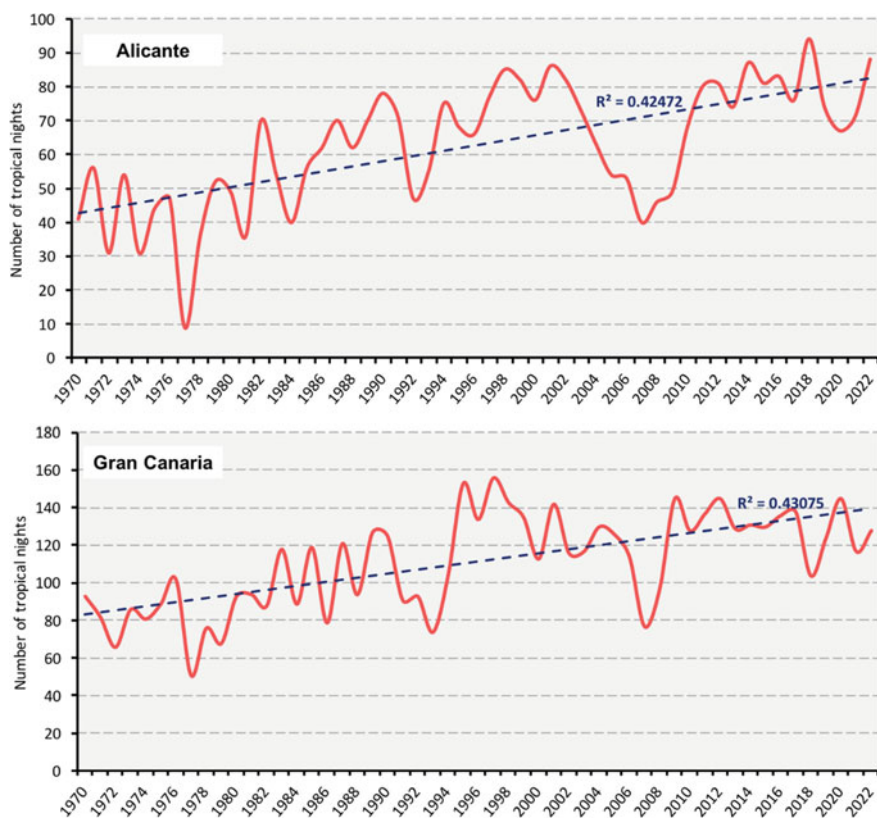


Fig. 7.4 Number of tropical nights (≥ 20 °C) in Gran Canaria airport and Alicante airport (1970–2022). *Source* AEMET, Agencia Estatal de Meteorología

of rainfall (Mayer et al., 2017; Tarife Méndez et al., 2012). This is in addition to the massive soil sealing as a result of rapid urbanization, which, despite the infrequency of heavy rains, aggravates flooding processes in tourist areas, floods already studied extensively (López Díez et al., 2019). In this context, throughout the twenty-first century there have been several extraordinary episodes of torrential rainfall. Noteworthy are the events of March 2002 in Santa Cruz de Tenerife, with very heavy damage and 9 fatalities; February 2010 with rainfall amounts exceeding 200 mm in several points of Tenerife; and, among others, October 2015 with serious damage in the east of the island of Gran Canaria.

However, among the most outstanding aspects of climate change in this region of the south-eastern North Atlantic, there are some indications of a certain tropicalization in the climate of the islands, in addition to the thermal increases already mentioned and especially relevant in nocturnal values. Firstly, there is an increase in summer rainfall in recent decades that is statistically relevant in several of the observatories of the main AEMET network (Dorta Antequera et al., 2018). It should

be recalled that the Canary Islands have a Mediterranean rainfall regime with a very marked summer drought, so these rainfall episodes in the warm months are completely anomalous. However, rainfall in the summer months is a feature of regions with tropical climates. Secondly, and of considerable importance, changes are beginning to be observed in the trajectories of unstable phenomena of tropical origin, probably as a consequence of the warming of the eastern Atlantic.

In the case of the Valencian Community, and in general on the Mediterranean coast, the effects of current climate warming are reflected in the thermal increase and the seasonal variations and hourly intensification of rainfall (Olcina Cantos, 2021). The loss of climatic comfort is notable, due to the rise in temperatures, particularly the minimum temperature, with an increase in tropical nights (Olcina Cantos et al., 2019) and, as in the Canary Islands, a loss of climatic comfort. This is a general process along the entire Spanish Mediterranean coast that is closely related to the increase in the sea surface temperature of the Mediterranean in its western basin. The results obtained by Olcina Cantos et al. (2019) not only show an increase in the frequency of these very warm nights, but also of spells with three or more consecutive tropical nights or even torrid nights with minimum temperatures above 25 °C, something also observed for the Canary archipelago. The Valencian coast has gone from registering 40 tropical nights a year in the seventies of the last century, to almost 80 currently. This represents, therefore, an increase slightly higher than that already noted for the Canary Islands. In the case of the archipelago, the number of tropical nights has always been very considerable due to its warmer climate, but the relative increase is smaller (Fig. 7.4). According to the forecasts carried out by Miró Pérez and Olcina Cantos (2020) for the period 2071–2100, the loss of climatic comfort for the summer in the Valencian Community will be marked either by excessive maximum temperatures or by the greater frequency of tropical nights, predominantly on the coast.

As in the Canary Islands, changes in rainfall in the central sector of the Spanish Mediterranean coast are not consistent and this gives rise to uncertainty in the medium and long term. It should not be forgotten that rainfall irregularity is one of the distinctive features of the climates of both the Mediterranean coast and the Canary archipelago, with coefficients of variation in large areas of both territories exceeding 35–40%. In the main rainfall series of the Spanish provinces of Castellón, Valencia and Alicante, there is still no clear trend of a generalized decrease in precipitation, although changes in the seasonal distribution and intensity of precipitation can be observed, especially in areas near the coastline. Current trends in average annual rainfall show sectors where it rains somewhat less than average (1980–2010 period) and others where rainfall is higher, as in the south coast of Valencia and north of Alicante.

The change in the type of precipitation is also evident. Since the beginning of the current century, it is observed that rains of convective origin (especially those associated with the presence of situations of “cold drops” in mid-high layers of the troposphere) are becoming increasingly important, as opposed to frontal precipitation of Atlantic origin (Miró et al., 2018). Along with this, the timing of the development of hourly intensity rainfall is also changing, occurring in any season of the year. They are not limited to autumn, as a season traditionally considered to be at risk of

flooding. Events of around or more than 100 mm in just one or two hours occur in any month. Even in summer, especially in the second half of August, there is an increase in torrential rainfall on the coast of the Gulf of Valencia, associated with events of the so-called “warm rains”, a symptom of the intense warming process experienced by the Balearic sector of the Mediterranean Sea at this time of the year.

Another relevant data is the seasonal modification in the development of rainfall, because spring rains tend to lose importance in favor of autumn rains in the annual distribution. This is especially significant in the southern end of the Iberian System, where some of the important rivers that run through Spain have their source, either flowing into the Mediterranean Sea (Júcar, Turia) or into the Atlantic (Tajo). Several papers point out the progressive gain of territorial extension experienced by the typically Mediterranean rainfall regime (maximum rainfall in autumn) toward the interior of the Iberian Peninsula, where the main peak of rainfall is generally located in spring (eastern sector of the Iberian mountain range) (De Luis et al., 2010; Miró Pérez, 2014). This fact has a direct impact on hydrological planning, since spring waters are very important for the accumulation of water reserves, in reservoirs and aquifers, to meet the increased expenditure in the warm months of the year, precisely the peak of the tourist season.

The increase in extreme weather events recorded since 2000 on the Spanish Mediterranean coast is notable. Episodes of heavy rainfall, which generate intense precipitation (up to 100 mm in 1 h) show an increasing trend throughout the twenty-first century and, moreover, torrential rainfall is not necessary to generate high economic damage in the affected territories, a fact also noted and already mentioned for the Canary Islands archipelago. In line with this, the risk has also increased in the last twenty years in terms of vulnerability and exposure in the face of extraordinary atmospheric events due to the establishment of housing and facilities in flood-prone areas. Especially intense have been the last sea storms on the Spanish Mediterranean coast. Since 2015 there have been 3 storms in succession (2017, 2020, 2021) with serious effects on infrastructures and housing located on the coastline. Especially strong was the storm caused by “Gloria” (January 2020) (AEMET, 2020) that caused significant economic losses throughout the Levantine coast.

All these changes experienced in the climatic elements and in the extreme range atmospheric phenomena of the two study areas are closely related to two atmospheric-oceanic processes: (1) the alterations in the general atmospheric circulation of mid-latitudes and subtropics; and (2) the increase in seawater temperature along the Spanish coasts.

Regarding the first aspect, the changes in the intensity and seasonality of rainfall in the Spanish Mediterranean area are related to the changes in the atmospheric circulation in the middle latitudes of the northern hemisphere. There are studies that show that the average speed of the polar jet stream would have been reduced by 14% since 1980 (Francis & Vavrus, 2012; Martín León, 2019). This implies a greater rippling of the jet, i.e., more frequent generation of planetary waves (ridges and troughs) with faster movements of warm air masses toward northern latitudes and of polar or arctic air toward the south. In this regard, Muñoz et al. (2020) have recently confirmed the increase in the atmospheric circulation of “cold drops” in

planetary mid-latitudes, which in the northern hemisphere would have meant an increase of 20% from 1960 to 2017. Furthermore, in the European mid-latitude sector, the areas where the occurrence of these isolated depressions at high atmospheric levels (DANA) would have been concentrated would correspond to the Gulf of Cadiz and the Western Mediterranean as a whole. Taking the 200-hPa pressure level as a reference, in Europe the number of DANAs per year between 1960 and 1990 remained stable, with about 30. However, since 1990 there has been a significant increase, currently around 35–40 (Muñoz et al., 2020). The current process of planetary thermal warming seems to be largely to blame for this, as it has been shown that the jet streams have been shifting toward the poles (Pena-Ortiz et al., 2013), as well as the Hadley cell and the intertropical convergence zone; not to mention the contraction of the polar vortex (Martin, 2015) and the cooling of the stratosphere (Williams, 2006). With a more undulating jet, blockages that favor the appearance of weaker subtropical and polar branches occur, something closely related to the increase observed in Europe in the number of cold drops.

In the Canary Islands, although DANAs are also important as the main generators of torrential rainfall events, the most important transformations have to do with tropicalization and the aforementioned changes in the trajectories of unstable phenomena of tropical origin. In the last two decades, the waters near the islands have been affected by easterly waves, tropical and subtropical storms and, marginally, by tropical cyclones. The most recent studies show an increase of these phenomena in the surroundings of the Macaronesian region, in which the Canary archipelago is located.

The path of these tropical disturbances is extending toward the center of the Atlantic, which is why they are increasingly approaching Madeira, the Canary Islands and even the Iberian Peninsula (Dorta Antequera et al., 2023), where tropical cyclone Vince arrived in October 2005 as a tropical depression (Vaquero et al., 2008), or storm Alpha in September 2020, which affected the continental coast of Portugal (Brown, 2021). In this context, surface ocean temperature seems to be a key factor, especially for the development of *major hurricanes* (Kossin et al., 2020; Vecchi et al., 2021), so it is to be expected that the current and projected ocean warming in the coming decades will not only increase the risk of affecting tropical unstable systems in the Macaronesia but even episodes of high atmospheric instability on the European Atlantic coast (Baatsen et al., 2015).

In this sense, the warming of sea surface temperatures is a significant fact along the entire Spanish coast. The waters of the Mediterranean basin have experienced a warming, but specially in the eastern and western ends of the basin. In the western sector, the data provided by CEAM (2022) show a warming of 1.4 °C between 1980 and 2022. This means that the accumulated heat in the sea basin is higher than the warming experienced in the air itself in the same time interval, according to the data recorded in the observatories of the Spanish Mediterranean coast (CEAM, 2022; Pastor et al., 2018). For the Canary Islands, the sea surface temperature would have increased by 0.7 °C since 1950 (Table 7.1), that is, half that of the Spanish Levantine coasts.

Table 7.1 Evolution of the sea surface temperature on the Spanish coast (maritime zones), 1950–2021

Maritime zone	Minimum	Year	Maximum	Year	Mean	Increase 1950–2021
Alboran	17.7 °C	1977	19.2 °C	2015	18.4 °C	+0.7 °C
Balearics	17.7 °C	1972	19.8 °C	2017	18.7 °C	+1.2 °C
Cabrera	18.3 °C	1972	20.3 °C	2017	19.3 °C	+1.1 °C
Cádiz	18.0 °C	1972	19.6 °C	2020	18.9 °C	+1.0 °C
Canary Islands	20.3 °C	1972	21.9 °C	1997	21.1 °C	+0.7 °C
Cantabrian	14.6 °C	1972	16.5 °C	2006	15.7 °C	+1.0 °C
Finisterre	14.6 °C	1972	16.1 °C	1997	15.4 °C	+0.6 °C
León	15.7 °C	1974	17.8 °C	2018	16.7 °C	+0.8 °C
Menorca	17.5 °C	1972	19.4 °C	2020	18.4 °C	+1.0 °C
Palos	18.4 °C	1977	19.6 °C	2017	19.0 °C	+0.9 °C

Source Own elaboration based on Report on the state of the climate in Spain 2021 (AEMET, 2022)

It should be noted that the increase in seawater temperature has two direct effects on climatic elements: loss of thermal comfort, especially in summer, due to the increase in warm nights between late spring and early autumn; and genesis of intense rainfall due to the transfer of heat from the sea surface to the atmosphere in convection processes.

The water-atmosphere relationship also shows up with effects on sea level rise and its consequences on the coastal strip. The IPCC Special Report on Oceans and the Cryosphere (IPCC, 2019) expresses great concern about the sea level rise effect already recorded in coastal areas of large ocean basins (Pacific and Atlantic).

In the Canary Islands, the increase in sea level experienced in recent decades is remarkable (Marcos et al., 2013; Pérez et al., 2014), as well as the foreseeable future increase (Strauss et al., 2015). The consequence of this is an increase in the danger of marine storms whose impacts on the coastline will become more noticeable as the planet warms. Likewise, not only is the virulence of these phenomena worsening with a higher sea level, but some studies are also beginning to address the hypothesis of a more than foreseeable increase in the frequency of this type of events (Yanes Luque et al., 2021). In this context, it should not be forgotten that the tourist activity

of the analyzed regions (Alicante and the Canary Islands) is confined specifically to the coast, so that sun and beach tourism will be subject to a greater risk due to coastal phenomena, firstly, and secondly, due to the loss of beaches and facilities.

For the Mediterranean basin, the problem is not as evident yet, but the effect that seawater dilation (warming) and the higher frequency of sea storms (easterly storms on the Spanish Mediterranean coast) will have on the coastal strip is noted. These conclusions have been endorsed in the paper on the effects of climate change on the world's coasts (Kulp and Strauss, 2019) and in the report on the effects of climate change on the Spanish coast (Losada et al., 2014).

Finally, the thermal rises recorded and expected in both destinations have an impact on the thermal comfort of travelers, as it has already been seen for tropical nights. Along these lines, the estimated changes in climatic conditions in the near future may generate transformations in tourist typologies and flows. Among the most widely used climate-tourism indicators to evaluate this issue is the Mieczkowski climate comfort index. Its application to the analyzed territories shows a significant loss of comfort, especially in the warm months, which could contribute to a loss in the competitiveness of both destinations (Alonso-Pérez et al., 2021; Miró Pérez & Olcina Cantos, 2020). However, the geographical location of the eastern coastline on the shores of the Mediterranean, a sea that warms very intensely and more rapidly than the Atlantic (Pastor et al., 2018), as noted, means that summers on the Costa Blanca could have very high temperatures in the coming decades, which could clearly be more detrimental to the aforementioned destination (Bujosa Bestard & Rosselló Nadal, 2011) than to the Canary archipelago.

Tourism, a Factor in Climate Change

In recent decades, the rapid development of tourism has culminated in the incorporation into international markets of a volume of travelers that has reached around 1.5 billion per year before the COVID-19 pandemic. As mentioned above, this mass tourism activity obviously has important environmental repercussions. Among the most significant are, on the one hand, GHG emissions, especially from air transport, and, on the other, the intensive transformations in land use that have taken place mainly in recent decades.

Greenhouse Gas Emissions

It is well known that the tourist activity generates a relevant carbon footprint since it requires large amounts of energy, with increases of more than 60% between 2005 and 2016, as pointed out in the Glasgow Declaration (COP26, 2022), a document arising from COP26 with the aim of increasing the sustainability of tourism. The data are compelling: tourists' transfer from their place of residence to their destination

accounts for as much as 5% of global GHG emissions; in 2017, 3.7 billion passengers traveled by air on a planetary scale with an estimated growth of 4.7% per year (Becken & Carmignani, 2020) and, in Europe, almost 4% of their emissions were due to air travel (European Commission, 2020). On that continent, where global GHG emissions have clearly declined, commercial aviation in the last 30 years has gone from emitting 54 million tons (Mt) in 1990 to 133 Mt in 2019 (EEA, 2023). A very substantial part of all these emissions is directly related to the use of air transport for tourism.

In the analyzed regions it is observed that the main country of origin of tourists is the United Kingdom. In Alicante the prevalence of British travelers is absolute, so that almost half of the visitors come from that country. In the Canary Islands, however, the origin of tourists is more distributed so that the British also represent the main group, with a third of the total, but with an important weight of German visitors with just over a fifth. Thus, British, and German tourists account for almost two thirds of the total on the islands. In both destinations, numerous nationalities represent small percentages, Dutch, Scandinavian, French, etc. (Fig. 7.5).

In the case of the Canary Islands, almost all tourist travel is by plane and, obviously, the greater the distance traveled, the greater the emissions. The archipelago is located at an average distance of approximately 3000 km from the emitting countries. Each British or German tourist emits about half a ton of CO₂ on their round trip to the islands (Table 7.2). Following the calculation method described above, it has been estimated that GHG emissions due only to international air traffic to the

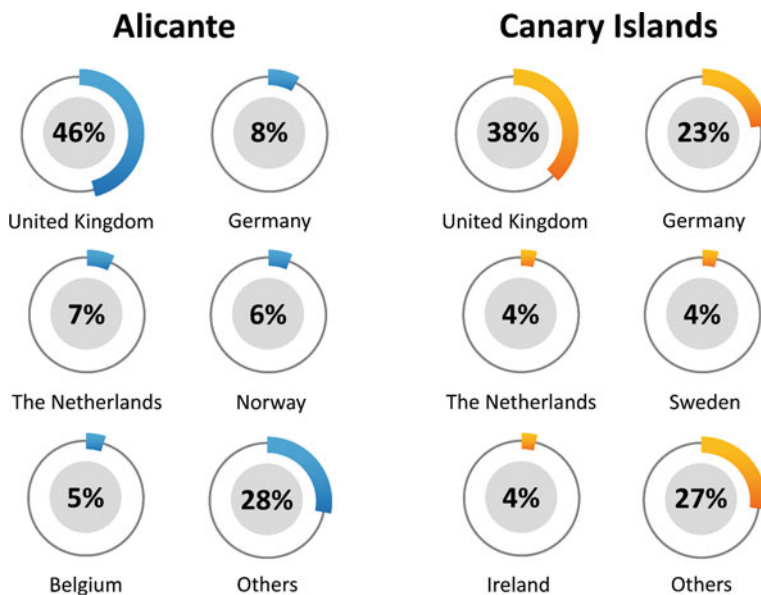


Fig. 7.5 Percentage distribution of tourist arrivals to Alicante and Canary Islands (2015–2019).
Source ISTAC, 2020 & EEA, 2023

Table 7.2 Main tourist data and estimated GHG emissions from international air traffic in the Canary Islands and Costa Blanca/Alicante (average 2015–2019)

	Canary Islands	Alicante	Total	Spain ¹ /Europe (EU27) ²
International tourists (mil)	13.3	5.9	19.2	83.5. ¹
Passenger's traffic (mil)+	44.682	15.048	59.730	275.247. ¹
Operations (mil)+	0.402	0.101	0.504	2.361. ¹
GHG (tons × 10 ⁶)	6.4	1.8	8.2	122.23 ²
GHG per passenger flying from the United Kingdom (tons) ^a	0.454	0.296		

Notes + 2019, ^aFrom Manchester airport

Source Own elaboration based several reports (AENA, 2023; EEA, 2023; INE, 2022)

Canary Islands are equivalent to half of all emissions produced by the Canary Islands economy as a whole annually, 6.4 Mt due to aviation compared to 13.6 Mt (Dorta Antequera et al., 2021).

The Costa Blanca is closer to the main emitting countries, approximately half as close as the Canary Islands and, in addition, part of the transfers is made by land, which reduces emissions, although it is true that they are much more diffuse and difficult to account for. In any case, total emissions, due exclusively to international air traffic to the destinations analyzed, are around 8.2 Mt of CO₂ each year (Table 7.2). To put this figure into context, it should be noted that the European Union emits slightly more than 122 Mt of GHG per year (2019),¹ which shows the significant carbon footprint attributed to the regions studied, the vast majority of which is due to tourism activity.

In the case of Alicante, emissions from international air traffic account for almost 20% of all emissions due to transport in the Valencian Community according to the emissions inventory of that community (Generalitat Valenciana, 2022). As context, the entire Spanish economy emitted an annual average (2015–2019) of 309,193.8 Mt (EEA, 2023).

Along these lines, Alicante airport receives the most air traffic in the Valencian Community and has the highest number of international flights, ranking fifth in terms of passenger traffic in Spain. In sixth and seventh place are Gran Canaria and Tenerife South respectively. The total number of passengers in Alicante and all airports with international traffic in the Canary Islands together stood at around 60 million and more than half a million operations in 2019 (AENA, 2019). It is therefore evident the great impact of international air traffic on the volume of GHG emissions (Table 7.2).

¹ It should be noted that the two analyzed territories also receive tourists from outside the European Union (Norway, Switzerland, Russian Federation, etc.).

Change in Land Use

In addition to the carbon footprint due to activities, and in particular the carbon footprint of international air traffic, it is necessary to add the generalized, intensive, and extensive changes in the coastal areas of the study areas. The occupation by all types of tourist facilities, infrastructures, accommodation, leisure areas, etc., have important environmental repercussions and greater exposure to climate risks and their increase because of climate change. Thus, in the processes of assessment and management of risks related to climate change, land use represents a fundamental element within the complex set of interactions that end up defining its impacts (IPCC, 2014).

On the one hand, the transformation of the environment through what we call land use and/or land cover changes contributes to the increase in the volume of GHG emissions. In this way, natural processes linked to the carbon cycle are modified directly, such as deforestation, photosynthesis, soil respiration, and indirectly, by linking land use change with the appearance of polluting activities, e.g., residues, transport, building, colling, etc. On the other hand, land use change, and specifically those transformations related to urban land growth, increase exposure, vulnerability and, therefore, disaster risk, making climate change adaptation and mitigation processes more complex.

For the cases under study, the urbanization processes have evolved, above all, fluctuating at the pace and intensity imposed by the economy and the demand of the sector in each period. In Benidorm, Adeje, and Arona, land use transformations are due to their great tourist relevance, as evidenced by their enormous accommodation capacity. In December 2022, Benidorm was the 4th municipality in Spain in number of hotel beds with 37,441, Adeje was the 5th and Arona the 8th, although the latter two, if we add them together (51,000 beds), are only surpassed by Madrid and Barcelona (INE, 2022). Moreover, the urban tourist areas of these places share common beginnings, arising from emerging coastal and local settlements dedicated to traditional activities of the primary sector (fishing and agriculture). These tourist urbanizations went from covering 101 ha in 1970 to 973 in 2020, in the case of Benidorm, or from not exceeding 15 ha in 1970, in the case of the South of Tenerife, to exceeding 650 ha in 2020 (Table 7.3).

In Benidorm, until 1960 there was a small population center concentrated in a small elevation between the beaches of Poniente and Levante, known as El Castillo, which extended northward following an irregular network of narrow streets. Until that decade the population subsisted thanks to fishing. The investment in tourism as an alternative for economic development would have its beginning in 1956 when the General Urban Development Plan was drafted, currently considered one of the most advanced of those carried out at that time (Mazón Martínez, 2016), where a regular grid with wide streets for pedestrian and vehicle traffic around both beaches was planned.

Originally, this plan was not intended for the emergence of high-rise buildings such as those that now stand along the coast of the municipality but followed the

Table 7.3 Evolution of the built-up area in Benidorm and south of Tenerife

Year	Growth (ha)		Relative growth (%)		Accumulated growth (ha)	
	Benidorm	Tenerife	Benidorm	Tenerife	Benidorm	Tenerife
< 1960	55	2	4.9	0.3	184	2
1961–1970	101	11	9.1	1.7	156	13
1971–1980	122	60	10.9	9.3	279	74
1981–1990	154	218	13.8	33.6	432	292
1991–2000	158	158	14.2	24.3	590	450
2001–2010	364	174	32.7	26.8	955	625
2011–2021	18	26	1.6	4.1	973	651

Source Own elaboration based on Spanish Cadastral Information Service (2021)

model of a garden city with single-family homes. This arrangement changed rapidly in later years, first allowing housing blocks of up to 5 heights in the first two strips parallel to both beaches, and later, in 1963 with the liberalization of the height of buildings in this same area (Martínez-Medina & Oliva-Meyer, 2015). Therefore, the first urban expansion of Benidorm took place in the 1960s, with a consolidation of the historic center and with the construction of the first properties destined for “sun and beach” tourism. In the 1970s, with a total opening to European mass tourism, Benidorm grew inland, occupying plots of land, mainly in the area around Levante Beach, and erecting new skyscrapers throughout this sector.

In addition, this process was favored by the improvement of accessibility with the inauguration of the Alicante-Elche airport and the construction of the AP-7 highway (Morote & Hernández, 2016). From 1980 onwards, building activity spread to the foothill areas of the Serra Gelada, following in this case another building model where single-family housing developments predominated. It would be in this area where Aqualandia would be built, which was the largest water park in Europe, with an extension of 14 ha, until the construction of Siam Park in Adeje, precisely in Tenerife. Building also continued in areas farther away from the coast and with a steeper slope, as is the case of the sector between the railroad line and the Emilio Ortuño road. However, as can be seen in Table 7.3 and Fig. 7.6, the first decade of the twenty-first century is the one with the largest built-up area, with 364 ha, although this was not due to a large building process but to the construction of theme parks, tourist complexes and luxury resorts, such as Terra Mítica, Terra Natura, and the Hotel Villaitana, which occupy more than 270 ha, and were built to the north of the AP-7. The onset of the real estate and economic crisis in 2007 practically paralyzed Benidorm’s urban development activity, displacing some of the city’s star projects such as the InTempo building, the tallest residential skyscraper in Europe (Ventura Cisternas, 2021) which, after 14 years of construction, was not completed until 2021. Today, Benidorm’s tourism model, compact and high-rise (Hernández-Hernández, 2013), is considered more sustainable compared to others that are more extensive and predatory of the territory, such as the nearby Torrevieja, also in the province of Alicante.

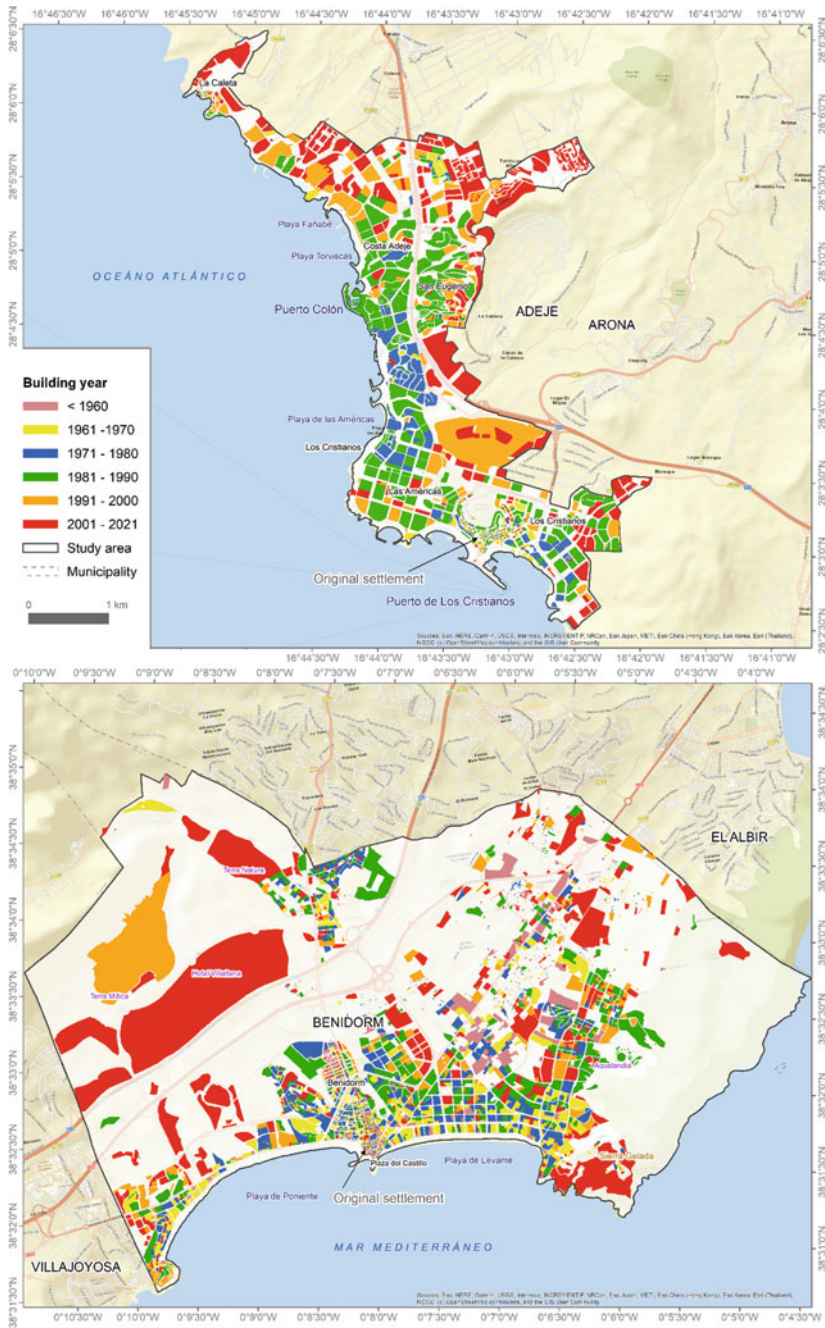


Fig. 7.6 Evolution of the built-up area in Benidorm and Adeje-Arona. *Source* General Directorate of Cadastre (GDC) and basemap services provided by Esri

In the case of Tenerife, the development of the large tourist urbanization of the SW of the island is currently made up of the nuclei of Los Cristianos and Las Américas in the municipality of Arona and Fañabé and La Caleta in the municipality of Adeje. In total, they occupy an urbanized area of 625 ha, less than that of Alicante, but quite large in the insular context (Table 7.3). The current layout of these areas is the result of the continuous transformation of the coast, which, as a result of the explosion of mass tourism (sun and beach) on the island from the 1960s onwards, replaced export agriculture and cultivation under plastic as the basis of the Canary Islands economy (Pérez-Chacón et al., 2007). Since then, the entire maritime façade that encompasses the study area has been occupied by rapid urbanization that is poorly adapted to the environment.

The beginnings of urbanization take place in Los Cristianos, related to the conversion of a small fishing and local agricultural products loading dock at its NW end into a commercial complex, for tourist, sports, recreational use, and passenger traffic on regular lines with the islands of La Gomera, La Palma and El Hierro (Ferrer Valero et al., 2017). Tourist urbanization accelerated its rate of growth in Tenerife toward the end of the 1970s, somewhat later than in Alicante, mainly due to its link with the start-up and consolidation of the Reina Sofía Airport (1978). At this stage, high-rise apartment complexes and urban development in which very partial initiatives are added, practically linked to the initiative of each complex erected, predominate. So much so, that in the preliminary considerations of the General Urban Development Plan of the municipality of Arona, in the mid-eighties, reference was made to the development of a good number of urban development operations that are proposed with total autonomy and even contradictory due to the lack of a general frame of reference (Ayuntamiento de Arona, 1984).

The attempt to impose coherence to the exacerbated growth of the urbanized land associated with the tourist lodging offer has an important reflection in the first advance of the Tenerife Island Management Plan or Plan Insular de Ordenación de Tenerife (PIOT) of 1994. These island-wide plans are promoted by Territorial Law 1/1987, of March 13, 1987, and the Tenerife plan did not come into force until 1999. Even then, the plan pointed out the need to subordinate real estate mechanisms to the interests of creating a tourist area that could guarantee sufficient competitiveness for its future maintenance (Cabildo de Tenerife, 1994).

The accelerated and enormous urban expansion in the eighties incorporated the municipality of Adeje in the urbanizing tourist race through the development of new nuclei. These are associated with the creation of sandy beaches, contained by dikes and artificial breakwaters, such as those of Fañabé and Torviscas. In addition, in the case of San Eugenio in Las Américas, for the first time there is a rise in urbanization toward higher coastal strips, occupying spaces further away from the coast (Figs. 7.6 and 7.7). All this produces a paving of the slope of the volcanic structure of Caldera del Rey. It is in this area where the first large water park on the island is located. The removal of torrents and small streams that drained the western slope of the mountain has contributed to the generation of recent and historical flash flood phenomena closely related to this fact (Díaz-Pacheco et al., 2019).

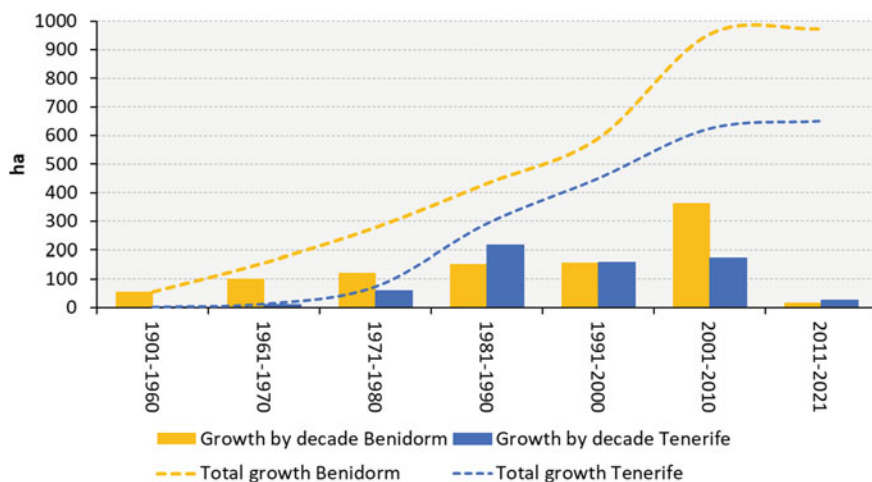


Fig. 7.7 Urban growth in Benidorm and Tenerife South (Arona, Adeje). *Source* General Directorate of Cadastre (GDC)

At the beginning of the 1990s and related to the economic recession of those years, there was a significant interruption in the rate of growth of this tourist urbanization. The later economic acceleration experienced from the middle of this decade onwards, finally ended with 158 ha more of new urbanized area, that is, an increase of 24.3% (Table 7.3 and Fig. 7.7). This growth in absolute terms of urban land coincides exactly with the magnitude that occurred in Benidorm for the same decade. The growth rate continues in the first decade of the 2000s, even through a development of tourist beds detached from the tourist and accommodation demand (Simancas Cruz, 2019). Concern about the excessive development of the so-called “urbanizing tsunami” and the continuous escalation of real estate tourism, which consumed landscape and resources, ended up forging the development of a legislative package aimed at putting territorial order in tourism and stopping the process through the so-called “moratorium” in the Canary Islands (Simancas Cruz et al., 2011). As in previous periods, the slowdown only came hand in hand with a devastating global crisis of real estate origin that began in 2007 (García-Hernández et al., 2018). Thus, between 2011 and 2021, the increase in tourist urbanization, does not exceed 5%, the lowest decadal value observed since 1970 (Table 7.3 and Fig. 7.7).

This area of the SW of Tenerife, which was natural, arid, fragile, covered with scarce coastal vegetation and structured by volcanic formations modeled by gullies and ravines that lead to natural beaches mostly of pebbles and gravel, has today been transformed into an urban continuum specialized in the reception of tourists. The coastline is usually marked by promenades and commercial terraces and wide avenues that allow travel in private vehicles. The consumption of water, energy and food exceeds the carrying capacity of the space itself and also that of the island. The lack of planning and management, especially of urban development in the initial and intermediate stages (1970–1990), poses challenges linked to climate hazards

and their increase due to climate change. The rise in sea level will also create a problem of vulnerability and exposure in non-cliff areas, not only for buildings, but also for the artificial infrastructures of the coastline, including beaches. In short, the adaptation of these transformed spaces, which are already fragile due to their link to the volatility of the tourism sector that feeds them, will be a process, more complex than that of changing the land uses that have allowed their development.

Climate Change, Tourism, and Climate Action

In recent years, various actions have been carried out to reduce the impact of climate change on tourism in Spain. The European Union has set emission reduction targets for 2030 and 2050 that all member countries are committed to meet. This has led to the approval in Spain, in 2020, of the “Long Term Strategy for a Modern, Competitive and Climate Neutral Spanish Economy in 2050” (ELP 2050). This document responds to Spain’s commitments as a member state of the European Union and to the Paris Agreement and sets the path to achieve climate neutrality no later than 2050. This document is an essential piece that completes the Spanish Government’s Energy and Climate Framework together with the Climate Change and Energy Transition Law, the Just Transition Strategy, the Energy Poverty Strategy, the National Climate Change Adaptation Plan and in particular the Integrated National Energy and Climate Plan (2021–2030).

One of the key elements is the Climate Change and Energy Transition Law (Law 7/2021) in which the tourism sector is affected by the indications established for territorial, coastal, water, and sustainable mobility planning. Currently, the Ministry of Ecological Transition is drafting the new Climate Change Adaptation Plan (horizon 2030), which will contemplate actions for the main economic sectors of the country.

The Spanish Ministry of Industry, Trade and Tourism has included, by 2022, climate change mitigation and adaptation actions as a priority line of action in its Tourism Sector Modernization and Competitiveness Plan, incorporated into the Spanish Government’s Recovery, Transformation, and Resilience Plan.

For their part, the Autonomous Communities have approved regulations and plans to organize and promote mitigation and adaptation actions in the territories and their economic activities, among which tourism plays an important role, as it is a major sector in many regions such as those analyzed in this study.

Thus, in the Valencian Community, the Law on Climate Change and Ecological Transition (Law 6/2022) has been approved, which contains a specific section on climate change and tourism activity (Art. 69). The law calls for the promotion of a tourism model that evaluates the new situations, both opportunities and threats, derived from the impacts of climate change. Likewise, specific actions include the obligation to address the sustainability of the tourism sector as a whole, including resources, products and destinations, and to raise awareness and inform both tourism workers and tourists about the sustainable use of resources. And finally, the need to carry out land planning and management in tourist municipalities, given the risks and

vulnerabilities as a result of climate change, with special mention of the restoration of coastal areas. Tourist municipalities are obliged to guarantee, within the framework of the current process of climate change, basic municipal services during the peak tourist season and must support them. These basic services include drinking water supply, energy supply, waste management, transport, urban wastewater treatment, primary health care, and telecommunications services.

In this context, some tourist municipalities have developed the idea of Climate Change Adaptation Plans (Climate and Sustainable Energy Action Plans. Art. 18). Art. 18). This is the case of the municipality of Benidorm, the leading tourist destination on the Spanish Mediterranean coast, which has developed a roadmap with actions to be carried out in the coming years to adapt the city and its economic sectors (essentially tourism) to the expected effects of global warming (Ayuntamiento de Benidorm, 2021). For its part, the Valencian Institute of Tourism Research has published, in 2020, a manual for the adaptation of Valencian tourist destinations to climate change (Invattur, 2020).

Similarly, in the Canary Islands in recent years, legislative initiatives have been implemented that have directly contributed to climate action. Within this framework, the Law on Climate Change and Energy Transition of the Canary Islands (Law 6/2002) stands out, which establishes that the territorial and urban planning model to be developed in the coming years must be aimed at energy transition and mitigating the impacts of climate change on the archipelago (Art. 20 and 21). Likewise, and closely related to the previous point, tourism is addressed as a differentiated and key sector for the implementation of actions aimed at both reducing GHG emissions and reducing territorial vulnerabilities to the impacts of climate change (Art. 56). The main objective of these two actions is to position the Canary Islands as a sustainable and environmentally friendly destination, a fact that is corroborated by the Canary Islands Climate Action Strategy (ECAC 2040) which, although pending final approval, will constitute the framework planning instrument for climate action in the Canary Islands. In addition, the ECAC sets out several lines of action for the sector, the main objective of which is to achieve a “carbon zero” tourist destination. In line with these approaches, some of the main tourist centers of the islands are developing initiatives similar to those defined for the Valencian Community. In addition to the well-known climate emergency declarations made by most of the Canary Islands tourist municipalities in 2019, there are more ambitious initiatives such as the “Local strategic plan against climate change” developed by Adeje or initiatives of great scientific interest such as the participation of the municipality of Puerto de la Cruz in a Life Project of the European Commission to identify vulnerabilities and design adaptation strategies adapted to the local context.

Finally, a large part of the documents mentioned above converge in the necessary involvement of the sector in the sustainable management of its activity. That is why it is worth mentioning how some tourist companies (hotels, apartments) have been developing efficiency actions in the management of water and energy in their facilities, under European, state, regional, or provincial programs of economic aid for the reconversion of tourist facilities. Obtaining certificates or quality seals (ISO 5001 or Biosphere hotels seal) has become a brand image of the tourism company that is committed to sustainability and adaptation to climate change.

In short, it seems clear that there is a clear institutional concern for the effects that climate change may have on tourism and for trying to increase the environmental sustainability of destinations. All of this is reflected in the brand image of the analyzed destinations (Ayuntamiento de Benidorm, 2023; Cabildo de Tenerife, 2023). However, it is very difficult to reconcile the current volume of visitors with a neutral carbon footprint, so it is necessary to intensify the sustainability policies of tourist municipalities to the new reality imposed by both adaptation and mitigation of climate change.

Conclusions

The analysis of two of the geographical areas with the largest impact on tourism activity in Spain, the second world power in the sector, shows the close relationship between climate and the predominant sun and beach tourism model in the Canary Islands and the Costa Blanca in Alicante. The brand image of both destinations is based on the good weather conditions for all kinds of leisure and recreational activities on the coast. Consequently, the climate, moderately warm and with high sunshine, has become the main attraction factor for international visitors who are overwhelmingly European. Over the last 50–60 years, approximately, there has been a tourist development that could be described as explosive, both in terms of supply and extensive occupation of the territory.

The specific areas under analysis show a first stage, until the 1980s, in which development took place with very lax and sometimes non-existent planning, both in terms of the management of the actual and potential demand of the sector (services and number of tourists), as well as the management of the space where the lodging activity is located and where the main tourist activities are carried out. In a second stage, in response to the alarm of the negative effects on the landscape, the consumption of resources, the generation of waste, and environmental deterioration; laws, plans, and management instruments were drawn up with the aim of slowing down, rationalizing and ordering the growth and urban transformations of these coastal areas, which, in many cases, had a high natural and heritage value. In spite of this, the reduction in the rate of growth has only taken place when the real estate investment that accompanied the moments of the economic situation of national and global impact failed. This was the case in the first five years of the 1990s and following the financial crisis that began in 2007. Perhaps we are witnessing a third stage that began at the end of the first decade of the 2000s, in which, as discussed in this paper, urban growth translated into an increase in hectares of artificial land, has finally begun to significantly reduce its rate of expansion. To a large extent, not because the construction-tourism binomial has changed, but because the studied areas and their available land already show signs of collapse and the phenomenon can continue to operate on the ground in other areas/municipalities in expansion.

Thus, both for the case of Benidorm and for the tourist urbanization of Arona and Adeje in Tenerife, the actions being taken to overcome possible stagnation in the life

cycle of the destination (Butler, 2004), must inevitably be linked to adaptation actions to reduce its vulnerability to the threats posed by climate change. In this regard, mitigation policies that greatly influence demand should also be taken into account, such as, for example, the reduction of the carbon footprint of tourism activities, but especially those due to transportation, due to its great impact, as has been shown. All of this represents a great challenge for the future in terms of the alleged sustainability of the mass tourism model (sun and beach) based on the transfer of millions of people every year from the North to the South of Europe.

Finally, and derived from the above, the increase in exposure to extreme climatic phenomena, as well as general thermal and rainfall trends, suggest the need to increase adaptation policies, based on a clear acceleration of the effects of climate change in the coming decades. This will be particularly serious in coastal areas specializing in tourism. In addition, mitigation policies themselves imply great challenges in the world of tourism. This is the case of aviation taxes in Europe with a foreseeable increase in prices and the costs arising from strategic changes aimed at drastically reducing GHGs at all levels and scales in order to limit global warming.

Regarding the limitations of the work, it is worth highlighting the complexity when calculating the approximate emissions per passenger from their places of origin to the two destinations analyzed. There are notable differences in the results of calculating the carbon footprint depending on the calculator used to quantify CO₂ emissions. In this study, the ICAO calculator has been used because it is the most precise and specialized, although there are others such as CFL or Cero CO₂ that offer somewhat lower results than those obtained here. With regard to future lines of research, it is intended to expand the study to other regions with similar characteristics such as the Balearic Islands and other sectors of the Mediterranean. In the same way, we want to extend the study period, analyze the effects derived from the post-pandemic situation of COVID-19 and, lastly, characterize in detail the vulnerabilities presented by the analyzed territories in order to face the impacts derived from climate change.

References

- AEMET. (2020). *Borrasca Gloria*. Borrascas Con Gran Impacto. https://www.aemet.es/es/conocermas/borrascas/2019-2020/estudios_e_impactos/gloria
- AEMET. (2022). *Informe sobre el estado del clima de España 2021* [Report on the state of Spain's climate 2021]. https://www.aemet.es/es/conocermas/recursos_en_linea/publicaciones_y_estudios/publicaciones/detalles/informe_estado_clima
- AENA. (2019). *Informe anual 2019* [2019 Annual Report]. <https://www.aena.es/es/estadisticas/informes-anuales.html>
- AENA. (2023). *Estadísticas de tráfico aéreo* [Air traffic statistics]. <https://www.aena.es/es/estadisticas/consultas-personalizadas.html>
- Alonso-Pérez, S., López-Solano, J., Rodríguez-Mayor, L., & Márquez-Martinón, J. M. (2021). Evaluation of the tourism climate index in the Canary Islands. *Sustainability*, 13(13), 7042. <https://doi.org/10.3390/su13137042>
- Ayuntamiento de Arona. (1984). Plan General de Ordenación Urbana de Arona, PGOU. https://www.arona.org/Portals/0/documentos/0_14784_1.pdf

- Ayuntamiento de Benidorm. (2021). *Plan de Adaptación ante el cambio climático de Benidorm* [Benidorm's climate change adaptation plan]. Ayuntamiento de Benidorm.
- Ayuntamiento de Benidorm. (2023). *Visit Benidorm*. <https://www.visitbenidorm.es/ver/3869/sostenibilidad-benidorm.html>
- Baatsen, M., Haarsma, R. J., Van Delden, A. J., & de Vries, H. (2015). Severe autumn storms in future Western Europe with a warmer Atlantic Ocean. *Climate Dynamics*, 45(3), 949–964. <https://doi.org/10.1007/s00382-014-2329-8>
- Becken, S., & Carmignani, F. (2020). Are the current expectations for growing air travel demand realistic? *Annals of Tourism Research*, 80, 102840. <https://doi.org/10.1016/j.annals.2019.102840>
- Brown, D. P. (2021). *Subtropical Storm Alpha (AL242020) 17–19 September 2020*. https://www.nhc.noaa.gov/data/tcr/AL242020_Alpha.pdf
- Bujosa Bestard, Á., & Rosselló Nadal, J. (2011). Cambio climático y estacionalidad turística en España: Un análisis del turismo doméstico de costa [Climate change and touristic seasonality in Spain: An analysis of domestic coastal tourism]. *Estudios de Economía Aplicada*, 29(3), 863–880. <https://www.redalyc.org/articulo.oa?id=30122405011>
- Butler, R. (2004). The Tourism Area Life Cycle in the Twenty-First Century. En A. A. Lew, C. M. Hall, & A. M. Williams (Eds.), *A companion to tourism* (pp. 159–170). BlackwellPublishing Ltd. <https://doi.org/10.1002/9780470752272.ch13>
- Cabildo de Arona. (1984). *Plan General de Ordenación Urbana de Arona* [General urban planning plan of Arona]. https://www.arona.org/Portals/0/documentos/0_14784_1.pdf
- Cabildo de Tenerife. (2023). *Tenerife. Turismo sostenible* [Tenerife. Sustainable tourism]. <https://www.webtenerife.com/turismosostenible/>
- Cabildo de Tenerife. (1994). Plan Insular de Ordenación del Territorio de Tenerife. PIOT.
- CEAM. (2022). *Informe TSM Mediterráneo. Verano 2022*. 15, 2–7. http://www.ceam.es/ceamet/SST/REPORTS/CEAM_Mediterranean_SST_report_Issue15_Summer2022-cast.pdf
- COP26. (2022). *The Glasgow declaration: A commitment to a decade of tourism climate action*. https://www.oneplanetnetwork.org/sites/default/files/2021-11/GlasgowDeclaration_EN_0.pdf
- Cubas, J., Martín-Esquivel, J. L., Marrero-Gómez, M., Díaz, J. R. D., Rodríguez, F., & González-Mancebo, J. M. (2022). Climate change causes rapid collapse of a keystone shrub from insular Alpine ecosystems. *Journal for Nature Conservation*, 69(126263). <https://doi.org/10.1016/J.JNC.2022.126263>
- De Luis, M., Brunetti, M., Gonzalez-Hidalgo, J. C., Longares, L. A., & Martín-Vide, J. (2010). Changes in seasonal precipitation in the Iberian Peninsula during 1946–2005. *Global and Planetary Change*, 74(1), 27–33. <https://doi.org/10.1016/j.gloplacha.2010.06.006>
- Díaz-Pacheco, J., Yanes, A., López-Díez, A., Máyer, P., & Dorta, P. (2019). Relación entre episodios de lluvia intensa y daños producidos por inundaciones en áreas turísticas costeras de clima árido: el Sur de Tenerife (1980–2018) [Relationship between intense rainfall episodes and flood damage in coastal touristic areas with arid climate: Southern Tenerife (1980–2018)]. In *X Jornadas de Geomorfología Litoral. Libro de ponencias*.
- Dorta Antequera, P., Díaz Pacheco, J., López Díez, A., & Bethencourt Herrera, C. (2021). Tourism, transport and climate change: The carbon footprint of international air traffic on islands. *Sustainability*, 13(4), 1795. <https://doi.org/10.3390/SU13041795>
- Dorta Antequera, P., Domínguez Hernández, A., Díaz Pacheco, J., López Díez, A., & Martín Raya, N. (2023). Perturbaciones tropicales en el Atlántico norte suroccidental. Estado de la cuestión y perspectivas de futuro [Tropical disturbances in the Southeastern North Atlantic. State of the Art and Future Perspectives.]. *Investigaciones Geográficas* (79), 33–50. <https://doi.org/10.14198/INGEO.22559>
- Dorta Antequera, P., López Díez, A., & Díaz Pacheco, J. S. (2018). El calentamiento global en el Atlántico Norte Suroccidental. El caso de Canarias. Estado de la cuestión y perspectivas de futuro [Global warming in the Southeastern North Atlantic. The case of the Canary Islands. State of the art and future perspectives]. *Cuadernos Geográficos*, 57(2), 27–52. <https://doi.org/10.30827/cuadgeo.v57i2.5934>

- EEA. (2023). *EEA greenhouse gases*. <https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer>
- European Commission. (2020). *Reducing emissions from aviation*. https://climate.ec.europa.eu/eu-action/transport-emissions/reducing-emissions-aviation_es
- Exceltur. (2023). *PIB Turístico Español* [Spanish tourism GDB]. <https://www.exceltur.org/pib-turistico-espanol/>
- Ferrer Valero, N., Hernández-Calvento, L., & Hernández Cordero, A. (2017). Evolución costera y diversidad geomórfica en archipiélagos de punto caliente: el caso de las islas Canarias [Coastal evolution and geomorphic diversity in hotspot archipelagos: The case of the Canary Islands]. *Geotemas (Madrid)*, 17, 199–202. <https://dialnet.unirioja.es/servlet/extart?codigo=6398561>
- Francis, J. A., & Vavrus, S. J. (2012). Evidence linking Arctic amplification to extreme weather in mid-latitudes. *Geophysical Research Letters*, 39(6), 1–6. <https://doi.org/10.1029/2012GL051000>
- García-Hernández, J. S., Díaz-Rodríguez, M. del C., & García-Herrera, L. M. (2018). Auge y crisis inmobiliaria en Canarias: desposesión de vivienda y resurgimiento inmobiliario [Boom and real estate crisis in the Canary Islands: Housing dispossession and real estate resurgence]. *Investigaciones Geográficas*, 69, 23–39. <https://doi.org/10.14198/INGEO2018.69.02>
- General Direction of the Cadastre. (GDC). Sede Electrónica del Catastro [Electronic headquarters of the Cadastre]. <https://www.sedecatastro.gob.es/OVCInicio.aspx>
- Generalitat Valenciana. (2022). *Inventario de emisiones. Una herramienta en la lucha contra el cambio climático* [Emissions inventory: A tool in the fight against climate change]. <https://agroambient.gva.es/documents/163279113/356229181/Documento+sintesi+Inventario+Municipios+CAS.pdf/60062fa5-ab45-7092-86e6-2a887125e34d?t=1648477341069>
- Heredia Yzquierdo, F. J. (2015). El mercado de derechos de emisión de CO₂ y otros gases de efecto invernadero: el sector de la navegación aérea y su impacto en el turismo [The market for CO₂ and other greenhouse gas emission rights: The air navigation sector and its impact on tourism]. *Derecho y Cambio Social*, 12(40). <https://dialnet.unirioja.es/descarga/articulo/5460324.pdf>
- Hernández-Hernández, M. (2013). Análisis de los procesos de transformación territorial en la provincia de Alicante (1985–2011) y su incidencia en el recurso hídrico a través del estudio bibliográfico [Analysis of territorial transformation processes in the Province of Alicante (1985–2011) and their impact on water resources through bibliographic study]. *Documents d'Anàlisi Geogràfica*, 59(1), 105–136. <https://rua.ua.es/dspace/handle/10045/33111#.XlK2hXdOKCc.mendeley>
- ICAO (2021). *Carbon emissions calculator*. <https://applications.icao.int/icec/Home/Index>
- INE. (2022). *Estadística de movimientos turísticos en frontera. Frontur* [Statistics of tourist movements at borders. Frontur]. https://ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736176996&menu=ultiDatos&idp=1254735576863
- Invattur. (2020). *Manual para la adaptación de los destinos turísticos al cambio climático* [Manual for the adaptation of tourist destinations to climate change]. https://invattur.es/uploads/entorno_37/ficheros/626913f3572001394984318.pdf
- IPCC (2014). *Climate change 2014. Impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects. Contribution of working group ii to the fifth assessment report of the intergovernmental panel on climate change*. In C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea, & L. L. White (Eds.). Cambridge University Press. <https://www.ipcc.ch/report/ar5/wg2/>
- IPCC. (2019). Summary for policymakers. En H.-O. Pörtner, D. C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, & N. M. Weyer (Eds.), *IPCC special report on the ocean and cryosphere in a changing climate* (pp. 3–35). Cambridge University Press. <https://doi.org/10.1017/9781009157964.001>
- ISTAC. (2020). *Estadística de Movimientos Turísticos en Fronteras de Canarias* [Statistics of tourist movements at borders of the Canary Islands]. http://www.gobiernodecanarias.org/istac/temas_estadisticos/sectorservicios/hosteleriayturismo/demanda/E16028B.html

- Jiménez, J. A., Valdemoro, H. I., Bosom, E., Agustín Sánchez-Arcilla, Robert, & Nicholls, J. (2017). Impacts of sea-level rise-induced erosion on the Catalan coast. *Regional Environmental Change*, 17(2), 593–603. <https://doi.org/10.1007/s10113-016-1052-x>
- Kossin, J. P., Knapp, K. R., Olander, T. L., & Velden, C. S. (2020). Global increase in major tropical cyclone exceedance probability over the past four decades. *Proceedings of the National Academy of Sciences*, 117(22), 11975–11980. <https://doi.org/10.1073/pnas.1920849117>
- Kulp, S. A., & Strauss, B. H. (2019). New elevation data triple estimates of global vulnerability to sea-level rise and coastal flooding. *Nature Communications*, 10(1). <https://doi.org/10.1038/s41467-019-12808-z>
- Lee, D. S., Fahey, D. W., Skowron, A., Allen, M. R., Burkhardt, U., Chen, Q., Doherty, S. J., Freeman, S., Forster, P. M., Fuglestad, J., Gettelman, A., De León, R. R., Lim, L. L., Lund, M. T., Millar, R. J., Owen, B., Penner, J. E., Pitari, G., Prather, M. J., ... Wilcox, L. J. (2021). The contribution of global aviation to anthropogenic climate forcing for 2000 to 2018. *Atmospheric Environment*, 244, 117834. <https://doi.org/10.1016/j.atmosenv.2020.117834>
- Lenzen, M., Sun, Y. Y., Faturay, F., Ting, Y. P., Geschke, A., & Malik, A. (2018). The carbon footprint of global tourism. *Nature Climate Change*, 8(6), 522–528. <https://doi.org/10.1038/s41558-018-0141-x>
- López Díez, A., Máyer Suárez, P., Díaz Pacheco, J., & Dorta Antequera, P. (2019). Rainfall and flooding in coastal tourist areas of the Canary Islands (Spain). *Atmosphere*, 10(12), 809. <https://doi.org/10.3390/atmos10120809>
- Losada, I., Izaguirre, C., & Díaz, P. (2014). Cambio climático en la costa española. Ministerio de Agricultura, Alimentación y Medio Ambiente (MAGRAMA). <http://publicacionesoficiales.boe.es/>
- Luque, A., Martín, J., Dorta, P., & Mayer, P. (2014). Temperature trends on Gran Canaria (Canary Islands). An example of global warming over the subtropical Northeastern Atlantic. *Atmospheric and Climate Sciences*, 4(1), 20–28. <https://doi.org/10.4236/acs.2014.41003>
- Marcos, M., Puyol, B., Calafat, F. M., & Woppelmann, G. (2013). Sea level changes at Tenerife Island (NE Tropical Atlantic) since 1927. *Journal of Geophysical Research: Oceans*, 118(10), 4899–4910. <https://doi.org/10.1002/jgrc.20377>
- Martín-Arias, J., Martínez-Santos, P., & Andreo, B. (2020). Modelling the effects of climate change and population growth in four intensively exploited Mediterranean aquifers. The Mijas range, southern Spain. *Journal of Environmental Management*, 262(110316). <https://doi.org/10.1016/J.JENVMAN.2020.110316>
- Martin, J. E. (2015). Contraction of the Northern Hemisphere, Lower-Tropospheric, Wintertime Cold Pool over the Past 66 Years. *Journal of Climate*, 28(9), 3764–3778. <https://doi.org/10.1175/JCLI-D-14-00496.1>
- Martín, J. L., Bethencourt, J., & Cuevas-Agulló, E. (2012). Assessment of global warming on the island of Tenerife, Canary Islands (Spain). Trends in minimum, maximum and mean temperatures since 1944. *Climatic Change*, 114(2), 343–355. <https://doi.org/10.1007/s10584-012-0407-7>
- Martín León, F. (2019). Los inviernos serán más cálidos, pero también con irrupciones más frías [Winters will be warmer, but also with colder spells]. *Revista de Aficionados a La Meteorología*. <https://www.tiempo.com/ram/507091/los-inviernos-seran-mas-calidos-pero-tambien-con-irrupciones-mas-frias/>
- Martínez-Medina, A., & Oliva-Meyer, J. (2015). *Vértigo de altura: elogio de un rascacielos. La torre Coblancia-I, Juan Guardiola Gaya, Benidorm, 1963–1965* [Vertigo at Heights: Eulogy of a Skyscraper. Coblancia-I Tower, Juan Guardiola Gaya, Benidorm, 1963–1965]. Fundación Alejandro de la Sota and Ministerio de Fomento (España) <http://rua.ua.es/dspace/handle/10045/53121>
- Mayer, P., Marzol, M. V., & Parreño, J. M. (2017). Precipitation trends and a daily precipitation concentration index for the mid-Eastern Atlantic (Canary Islands, Spain). *Cuadernos de Investigación Geográfica*, 43(1), 255–268. <https://doi.org/10.18172/cig.3095>

- Mazón Martínez, T. (2016). Orígenes y desarrollo turístico en Alicante: del veraneo al turismo de masas [Origins and touristic development in Alicante: From summer vacationing to mass tourism]. *Canelobre*, 66, 38–51. <http://hdl.handle.net/10045/57366>
- Miró, J. J., Estrela, M. J., Caselles, V., & Gómez, I. (2018). Spatial and temporal rainfall changes in the Júcar and Segura basins (1955–2016): Fine-scale trends. *International Journal of Climatology*, 38(13), 4699–4722. <https://doi.org/10.1002/joc.5689>
- Miró Pérez, J. J. (2014). *Downscaling estadístico de series climáticas mediante redes neuronales: reconstrucción en alta resolución de la temperatura diaria para la Comunidad Valenciana. Interpolación espacial y análisis de tendencias (1948–2011)* [Universidad de Alicante]. <http://hdl.handle.net/10045/36538>
- Miró Pérez, J. J., & Olcina Cantos, J. (2020). Cambio climático y confort térmico. Efectos en el turismo de la Comunidad Valenciana [Climate Change and Thermal Comfort: Effects on Tourism in the Valencian Community]. *Investigaciones Turísticas*, 20, 1–30. <https://doi.org/10.14198/INTURI2020.20.01>
- Morote, Á. F., & Hernández, M. (2016). Población extranjera y turismo residencial en el litoral de Alicante (1960–2011): Repercusiones territoriales. *Eure*, 42(126), 55–76. <https://doi.org/10.4067/S0250-71612016000200003>
- Muñoz, C., Schultz, D., & Vaughan, G. (2020). A midlatitude climatology and interannual variability of 200- And 500-hPa cut-off lows. *Journal of Climate*, 33(6), 2201–2222. <https://doi.org/10.1175/JCLI-D-19-0497.1>
- Olcina Cantos, J. (2021). Calentamiento climático actual [Current Climate Warming]. Un problema global. In J. Romero & J. Olcina (Eds.), *Cambio climático en el mediterráneo. Procesos, riesgos y políticas* (pp. 19–42). Tirant Humanidades.
- Olcina Cantos, J., Serrano-Notivol, R., Miró, J., & Meseguer-Ruiz, O. (2019). Tropical nights in the Spanish Mediterranean coast: Recent evolution (1950–2014). *Climate Research*, 78(3), 225–236. <https://doi.org/10.3354/cr01569>
- Olcina, J. (2020). Clima, cambio climático y riesgos climáticos en el litoral mediterráneo. Oportunidades para la geografía [Climate, climate change, and climatic risks in the Mediterranean Coast. Opportunities for geography]. *Documents d'Anàlisi Geogràfica*, 66(1), 159–182. <https://doi.org/10.5565/rev/dag.629>
- Pastor, F., Valiente, J. A., & Palau, J. L. (2018). Sea surface temperature in the Mediterranean: Trends and spatial patterns (1982–2016). *Pure and Applied Geophysics*, 175(11), 4017–4029. <https://doi.org/10.1007/S00024-017-1739-Z/FIGURES/7>
- Pena-Ortiz, C., Gallego, D., Ribera, P., Ordonez, P., & Del Carmen Alvarez-Castro, M. (2013). Observed trends in the global jet stream characteristics during the second half of the 20th century. *Journal of Geophysical Research Atmospheres*, 118(7), 2702–2713. <https://doi.org/10.1002/JGRD.50305>
- Pérez-Chacón, E., Hernández-Calvento, L., & Yanes, A. (2007). Transformaciones humanas y sus consecuencias sobre los litorales de las Islas Canarias [Human transformations and their consequences on the coastlines of the Canary Islands]. In S. Etienne & R. Paris (Eds.), *Les littoraux volcaniques. Une approche environnementale* (pp. 173–191). Press Universitaires Blaise-Pascal.
- Pérez, B., Payo, A., López, D., Woodworth, P. L., & Alvarez Fanjul, E. (2014). Overlapping sea level time series measured using different technologies: An example from the REDMAR Spanish network. *Natural Hazards and Earth Systems Sciences*, 14(3), 589–610. <https://doi.org/10.5194/nhess-14-589-2014>
- Pérez Morales, A., Gil Guirado, S., & Olcina Cantos, J. (2015). Housing bubbles and the increase of flood exposure. Failures in flood risk management on the Spanish south-eastern coast (1975–2013). *Journal of Flood Risk Management*, 11, 1–12. <https://doi.org/10.1111/jfr3.12207>
- Ribas Palom, A. M., Olcina Cantos, J., & Sauri Pujol, D. (2020). More exposed but also more vulnerable? Climate change, high intensity precipitation events and flooding in Mediterranean Spain. *Disaster Prevention and Management: An International Journal*, 29(3), 229–248. <https://doi.org/10.1108/DPM-05-2019-0149>

- Rico-Amoros, A. M., Sauri, D., Olcina-Cantos, J., & Vera-Rebollo, J. F. (2013). Beyond megaprojects? Water alternatives for mass tourism in coastal Mediterranean Spain. *Water Resources Management*, 27(2), 553–565. <https://doi.org/10.1007/S11269-012-0201-3/TABLES/1>
- Simancas Cruz, M. (2019). Especulación urbanística y burbuja inmobiliaria en espacios litorales: Factores explicativos del tercer boom turístico de Canarias [Real estate speculation and property bubble in coastal areas: Explanatory factors of the third tourism boom in the Canary Islands]. *Cuadernos De Turismo*, 43, 471–497. <https://doi.org/10.6018/turismo.43.18>
- Simancas Cruz, M. R., García Cruz, J. I., Dorta Rodríguez, A., & Falero González, R. A. (2011). El impacto territorial de la moratoria turística de Canarias. *Geografía y desafíos territoriales en el siglo XXI* (Vol. 2, pp. 715–726). Asociación de Geógrafos Españoles. <https://dialnet.unirioja.es/servlet/articulo?codigo=3806043&orden=1&info=link>
- Steiger, R., Demiroglu, O. C., Pons, M., & Salim, E. (2023). Climate and carbon risk of tourism in Europe. *Journal of Sustainable Tourism*, 31. <https://doi.org/10.1080/09669582.2022.2163653>
- Strauss, B. H., Kulp, S., & Levermann, A. (2015). Carbon choices determine US cities committed to futures below sea level. *Proceedings of the National Academy of Sciences*, 112(44), 13508–13513. <https://doi.org/10.1073/pnas.1511186112>
- Tarife Méndez, R., Hernández Barrera, S., Gamiz Fortis, S. R., Castro Díez, A. Y., & Esteban-Parra, M. J. (2012). Análisis de los extremos pluviométricos en las Islas Canarias y su relación con el índice NAO [Analysis of rainfall extremes in the Canary Islands and their relationship with the NAO index]. In C. Rodríguez Puebla, A. Ceballos Barbancho, N. González Reviriego, E. Morán Tejeda, M. A. Hernández Encinas (coord.), *Cambio climático. Extremos e impactos: [ponencias presentadas al VIII Congreso Internacional de la Asociación Española de Climatología]* (pp. 659–668). <https://dialnet.unirioja.es/servlet/articulo?codigo=7336445&orden=0&info=link>
- Torres-Bagur, M., Ribas, A., & Vila-Subirós, J. (2020). Understanding the key factors that influence efficient water-saving practices among tourists: A Mediterranean case study. *Water*, 12(8), 2083. <https://doi.org/10.3390/w12082083>
- UNWTO. (2022). *145 Key Tourism Statistics*. <https://www.unwto.org/tourism-statistics/key-tourism-statistics>
- Vaquero, J. M., García-Herrera, R., Wheeler, D., Chenoweth, M., & Mock, C. J. (2008). A historical analog of 2005 Hurricane Vince. *American Meteorological Society*, 89(2), 191–202. <https://doi.org/10.1175/BAMS-89-2-191>
- Vecchi, G. A., Landsea, C., Zhang, W., Villarini, G., & Knutson, T. (2021). Changes in Atlantic major hurricane frequency since the late-19th century. *Nature Communications*, 12(1), 4054. <https://doi.org/10.1038/s41467-021-24268-5>
- Ventura Cisternas, C. (2021). Edificio Intempo, en Benidorm (Alicante). Una atalaya Ssobre el Mediterráneo [A watchtower over the Mediterranean]. *CERCHA*, 150, 20–33. <http://hdl.handle.net/20.500.12251/2280>
- Williams, G. P. (2006). Circulation sensitivity to Tropopause height. *Journal of the Atmospheric Sciences*, 63(7), 1954–1961. <https://doi.org/10.1175/JAS3762.1>
- WTTC. (2022). *Economic Impact 2022: Global trends*. <https://wttc.org/Portals/0/Documents/Reports/2022/EIR2022-Global%20Trends.pdf>
- Yanes Luque, A., Rodríguez-Báez, J. A., Máyer Suárez, P., Dorta Antequera, P., López-Díez, A., Díaz-Pacheco, J., & Pérez-Chacón, E. (2021). Marine storms in coastal tourist areas of the Canary Islands. *Natural Hazards*, 109(1), 1297–1325. <https://doi.org/10.1007/s11069-021-04879-3>

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Chapter 8

Coastal Tourism Adaptation to Climate Change in Brazil



Practices and Alternative Solutions

Isabel Jurema Grimm

Abstract The scientific consensus on the anthropogenic causes of climate change and its effects on the economy and society have led the international community, nation-states, supranational institutions, companies, and civil society to engage in reducing the magnitude of this phenomenon (mitigation) and to become more resilient to its effects (adaptation). The Brazilian coast, which is more than 9 thousand km long and known for its tourist and economic importance, is susceptible to the impacts of climate change. Since it is threatened by events that raise the sea level and cause beach degradation, adaptive solutions such as beach nourishment have been implemented to protect the coast from erosion and storm surges damage and to widen the beach to optimize its space for tourism. In light of this, we present adaptation practices and solutions, based on empirical evidence, to the main current and future challenges of the impacts of extreme weather events on Brazilian shores carried out on the beaches of Copacabana, in the city of Rio de Janeiro, and Balneário Camboriú and Piçarras, in the state of Santa Catarina.

Keywords Coastal tourism · Adaptation · Planning · Brazil

Introduction

Tourism is one of the most weather- and climate-dependent economic sectors since both supply and demand for its services depend on the quality and management of environmental attributes, which creates multiple vulnerabilities and new opportunities resulting from climate change. Among the climatic elements, temperature, solar radiation, precipitation, wind, and humidity are the most influential on the tourism

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system (Arabadzhyan et al., 2020; Gómez Martin, 2005; Grimm, 2016; Lenzen et al., 2018; Moreno, 2010; Neger et al., 2021; Scott & Jones, 2006; Tsai et al., 2018).

According to Bano et al. (2022), tourism accounts for 10% of the global GDP and 30% of service exports and provides one in every 11 jobs. Moreover, it contributes to the UN's Sustainable Development Goals (SDGs) as it helps reduce inequality by engaging the local population in the development and economy of the community. However, various elements—such as conflicts, wars, terrorism, environmental disasters, intertropical convergence zones, and epidemics—can interfere with the tourist flow of a region, impacting tourist destinations (Baumert, 2016; Nhamo et al., 2020; Qiu et al., 2020; Rocha and Mattedi, 2015). In this sense, extreme weather events are challenges that also require adaptation from the tourism economy.

The climate change impacts produce a higher degree of uncertainty than those from other sectors, such as agriculture and energy. Nonetheless, they can negatively affect tourism demand and, consequently, local economies by disrupting access and altering physical conditions, including those resulting from adaptation and recovery efforts (Seetanah and Fauzel, 2018; Seekamp et al., 2019).

Coastal tourism, one of the sectors vulnerable to climate change, is threatened by events that raise the sea level and cause beach degradation and narrowing. In addition, more frequent and severe heat waves, as well as reduced beach availability due to rising sea levels, influence the recreational experience at the destination, affecting tourist demand and expenditure (Arabadzhyan et al., 2020). According to Oliveira and Rehbein (2022), climate change has already changed the dynamics of coastal systems, both due to sea level rise and increased rainfall in water basins, resulting in urban flooding, beach erosion, or saltwater intrusion at the hydrostatic level.

Sandy beaches are highly dynamic environments in both geomorphological and hydrological terms. In Brazil, the long sandy coast has been suffering from erosion, which affects between 70 and 80% of the world's coasts and results from retrogradation (retreat) due to the loss of sand (Bird, 2008; Pilkey et al., 2009). Moreover, during the twentieth century, the Brazilian mean sea level (MSL) (measured in the cities of Belém, Fortaleza, Recife, Canavieiras, Salvador, Ilha Fiscal, Rio de Janeiro, Ubatuba, Cananéia, Imbituba, among others) showed a 3–4 mm/year rate of increase (Mesquita, 2004; Mesquita et al., 2013).

In response to these factors, governmental actions have been aiming at adaptive solutions, such as beach nourishment, to protect the coast from the damage caused by erosion, storm surges, and sea level rise. These adaptations aim at increasing beach width for better use for leisure and tourism. In light of this, this chapter presents adaptation practices and solutions for the main current and future challenges regarding the impacts of extreme weather events affecting coastal tourism in Brazil. It describes initiatives developed in the cities of Rio de Janeiro (state of Rio de Janeiro, Brazil), Balneário Camboriú (state of Santa Catarina, Brazil), relevant tourist destinations internationally known, as well as in Balneário Piçarras (state of Santa Catarina). The focus on coastal tourism is justified because coastal tourist destinations are primarily developed around the 3S (sea, sun, and sand), and their geographic position exposes them to extreme weather events.

This chapter is structured in five sections. After the introduction, we deal with the impacts of climate change on tourism, highlighting the Brazilian coast, its vulnerabilities, form of occupation, and how the rise in sea level is reducing the sand strip and harming coastal tourism. We highlight detailed research on the subject in different regions of the world. In the third section, we discuss the research methodology. In the fourth, an assessment is made on the adaptation of tourism to climate change and adaptation strategies for coastal tourism to cope with extreme events. We end with discussions about the research results.

Impacts of Climate Change on Coastal Tourism

Changes in climatic conditions affect a range of economic sectors. In this sense, tourism is one of the most affected by the impacts resulting, especially, from extreme weather events (Grimm et al., 2013), putting local economies and populations, as well as tourists, at risk (Becken et al., 2020; Grimm, 2016, 2019; Hoogendoorn et al., 2020; Moreno, 2010; Scott, 2021; Seetanah and Fauzel, 2018; Steiger et al., 2019; Wilkins et al., 2017; Wolf et al., 2021). However, the effects of climate change on tourism have not been fully investigated, and its impact varies according to the country's income level (Dogru et al., 2019).

The climate system is composed of five major components, the atmosphere, hydrosphere, cryosphere, biosphere, and the earth's surface (lithosphere), which interacts with tourism since system-dependent conditions such as temperature, sunshine hours, snow, rain, wind, and humidity influence the tourism destination choice (IPCC 2007a, b). To Santos and Marengo (2020), climate variations, rising sea levels, and climate extremes, which may lead to natural disasters, have impacted populations, causing social damage, political turmoil, and economic losses in several countries. Thus, since tourism is particularly sensitive to climate change, interest in this research field has considerably increased (Fang et al., 2020; Santos & Marengo, 2020).

Among the climate change challenges for tourism over the next 30 years, Scott (2021) highlights the need to transition to a low-carbon economy and adapt to environmental and socioeconomic impacts. Furthermore, UN (2015) data show that tourism transport-related emissions are expected to account for 5.3% of all man-made carbon dioxide (CO₂) emissions by 2030. In 2005, tourism contributions were estimated at approximately 5% of global anthropogenic carbon dioxide emissions (Grimm, 2016); however, they are currently estimated at 8% (Lenzen et al., 2018).

Climate change has far-reaching consequences, triggering negative or positive impacts that vary according to the type of tourism activity and its seasonality. Some business types, tourism destinations, and even countries may suffer losses in terms of tourism demand (Gössling et al., 2018; Grimm, 2016; Machete, 2011), meaning that climate change will represent an increasing barrier to the contributions of tourism to SDG achievement. Socioeconomic impacts, with effects on properties, infrastructure, and facilities, are identified by Arabadzhyan et al. (2020) as having the highest degree of coherence between physical and economic impacts.

The IPCC Assessment Reports (AR), namely the fourth (IPCC 2007a, b), fifth (IPCC, 2014), and sixth (IPCC, 2021), highlight the effect of heat on tourism and the water competition between this and other economic sectors. In the case of coastal tourism, the direct impacts of extreme events on its infrastructure (e.g., beach resorts, roads) stand out, as well as the indirect ones (e.g., coastal erosion, coral bleaching) and those on the short-term adverse tourism perception after extreme events (floods, tropical storms, storm surges) (IPCC, 2007a, 2007b, 2014, 2021).

Due to their characteristic climatic factors, coastal regions have traditionally been studied in the fields of meteorology and climatology. Moreover, they have relevant aspects for environmental (biodiversity, geomorphology) and socioeconomic (population, tourism, and leisure) analyses (Vanhoni & Mendonça, 2008). In coastal zones, sustainability depends on the balance between natural and anthropic processes; thus, research and diagnosis of vulnerability are necessary to understand the dynamic context of these areas (Lopes et al., 2021).

For coastal tourism, sea level rise causes beach degradation. This leads to physical impacts, such as beach surface reduction, which, in turn, affects both supply and demand of tourism activities (Arabadzhyan et al., 2020), meaning that adaptation (via nourishment or erosion control structures) is an alternative to its maintenance. Beach nourishment projects have often been developed, for instance, on the east coast of the USA, where urbanization and hurricane seasons lead to beach narrowing. In Brazil, cities like Balneário Camboriú, Florianópolis, Balneário Piçarras, the three cities in the state of Santa Catarina, Rio de Janeiro in the state of Rio de Janeiro, Recife in Pernambuco, Fortaleza in Ceará and Vitória in the state of Espírito Santo, chose this intervention in an attempt to preserve its beaches from the damage caused by erosion and storms, leaving them wider and more structured.

Brazil, whose coast is more than 9 thousand Km long and is subjected to climate change impacts, has 26.6% of its population living in coastal zone cities, corresponding to 50.7 million people. It ranks 17th among the most vulnerable countries to sea level rise. Furthermore, among the 17 Brazilian municipalities with more than 1 million inhabitants, eight are directly connected to the ocean or inland bays.

Part of the population that resides in coastal areas is involved, directly or indirectly, in activities related to tourism, oil and natural gas production, fishing, and services meeting the economic dynamics created by these and nearby municipalities (IBGE, 2010). In Brazil, important vulnerabilities are observed in the socio-environmental and climatic areas with negative effects on the economy. The increase in the frequency and intensity of extreme weather events has greatly impacted the population, the economy, and the functioning of ecosystems. Extreme weather events impact agricultural production, coastal infrastructure, the availability of water resources, and the environmental quality of cities, among many other effects. Deforestation of the Amazon rainforest has a strong impact on global warming and affects the regional climate of South America, with changes in water vapor transport and surface albedo (Artaxo & Rodrigues, 2019).

The Brazilian regions at higher risk of future flooding due to rising sea levels are Recife (the most vulnerable), Pernambuco, Rio de Janeiro, Baixada Santista, and Santa Catarina. Regarding impacts, the sea level rise may cause problems in

coastal cities such as Recife, Aracaju, and Maceió, where urbanization has expanded to low-lying areas with flood occurrence, especially when heavy rainfall coincides with spring tides. In addition, Porto Alegre, Santos, Salvador, Recife, Fortaleza, and São Luís are the most threatened cities by the sea level rise (Climate Central, 2022).

As for the climate change impacts on Brazilian beaches, one of the forcing conditions is wave climate since climate change alters wind regimes, the major influence on wave formation. Once the wind changes the waves' direction and strength, they redraw the beaches' shape, remaking their morphology. Erosion may occur at some points and deposition of material at others, causing a beach to narrow, change shape, and even increase in size. Another influential factor is sea level rise, which causes the waves to have a higher range and reach new points on the coast. In some regions, however, human activity has been more influential in these changes than the forces of nature.

Despite the growing interest of scientists, policymakers, and tourism managers, many impacts and tourism activities in the Brazilian coastal zone remain virtually unexplored. In other words, there are knowledge gaps in this area that, when filled, may provide a basis for future research (Grimm, 2016, 2019). Ângulo (2004) points out that, even if the sea level rise forecasts are confirmed, its effect on coastal zones will vary according to their characteristics and evolutionary history. Thus, each case must be local, while considering regional and global variables. According to the author, these phenomena are complex and marked by the interaction between several agents, as well as by regular and irregular processes of internal and external nature, which shape the coastal zone dynamics. Dias et al. (2012) highlight that coastal zones are also positively or negatively affected by interventions carried out in water basins, climate and wave propagation changes, and transformations that induce lithospheric.

Recognizing that climate change impacts on coastal tourism will not be the same for all world regions, Seetanah and Fauzel (2018) empirically evaluated the relationship between climate change and tourist arrivals in 18 small island developing states from 1989 to 2016. The authors found a negative impact on tourism demand, both in the long and short terms, which leads to adverse effects on the economy of these countries, mainly low growth and employment rates.

In a study the direct and indirect impacts of climate change on the tourism sector of New Providence and Paradise Island (Bahamas), Pathak et al. (2021) highlighted that the storm surge zones reach tourist properties and that the range of properties at risk will increase in a sea level rise scenario. The authors point out that 28% of the hotels and resorts on the two islands will suffer from coastal flooding and erosion, and 60% of the tourism infrastructure will be impacted. Although the tourism economic relevance of these locations is based on the beach and visitor expenditures, these will decrease, increasing local economic vulnerability, with significant losses in revenue and employment (Pathak et al., 2021).

Climate information is crucial for sectors sensitive to climate change, including urban planning, shipping, and tourism (IPCC AR6, 2021). Droughts, aridity, fires, and other climate impact drivers will be challenges, for example, for agriculture, silviculture, water and ecosystems, and health in southwestern and western South America. In addition, according to the AR6, water and supply shortages in many large

cities and the economic and social impacts of the water crisis may be significant and cause tourism revenue losses (IPCC, 2021).

Scott (2021) points out that climate change poses a major challenge to society, influencing tourism industry investment, planning, operations, and demands. A collective response to address the impacts of climate change on tourism requires substantial commitments to: (i) improve communication and knowledge mobilization; (ii) increase capacity and collaboration for interdisciplinary research; (iii) establish strategic policy and planning engagement. Thus, in order to shape the future of tourism in a decarbonized, post + 3 °C world, tourism businesses must adapt and mitigate their contributions to GHG emissions (Scott, 2021).

Methodology

Based on the proposed objective, we developed a qualitative, descriptive research. As a method, we used bibliographical and documental research. Data collection was performed on the CAPES Portal (Periódicos CAPES) and Google Scholar. The articles were selected and passed through narrowing criteria due to the characteristics of their content. We prioritize works published in the last 5 years. However, temporal refinement showed a shortage of published works. The option was to broaden the search to identify tourism adaptation actions to climate change in Brazil and in the world, highlighting beach replenishment strategies.

Complementary documents were consulted: (a) Environmental Impact Report (RIMA) of Artificial Feeding of the Central beach of Balneário Camboriú/SC and (b) Integrated Management Plan for the Orla (PGI) revision 2003–2019 Balneário Camboriú/SC. Documents from Rio de Janeiro and Piçarras were not found. The institutional websites of the municipalities surveyed were consulted as well as news published about the process of beach replenishment in the regions mentioned.

Research protocol: (a) selection of keywords: climate change, tourism, coastline and adaptation (in Portuguese and their English correspondent); (b) database organized in an Excel spreadsheet with the following control items: year, authors, abstract, keywords, journal, access link of the selected material; (c) sample refinement through keyword association with the most relevant content that contributes to the achievement of the objectives; (d) exploration of the material and its content and, (e) analysis/interpretation for compilation of the results.

The Adaptation of Tourism to Climate Change

Tourism can be an ally in implementing a proactive agenda to face the challenges posed by climate change, as it may incorporate in its policies and strategies actions to strengthen the resilience and adaptive capacity of its destinations. However, different approaches to climate change surround this sector—while some believe that these

changes will have no negative consequences for business, others overestimate their own ability to adapt. Both perspectives may delay the implementation of adaptation strategies. Nevertheless, educational programs, direct actions for adaptation (Moreno, 2010; Scott, 2021), and interdisciplinary research aimed at promoting sustainable adaptation to climate change (Salim et al., 2021) may minimize this effect.

The relationship between tourism and climate creates risks, opportunities, and challenges. Risk, in this case, is understood as the actual probability that the climate will affect the sector, causing significant impacts on its activities. Opportunities, in turn, are the possibilities or options that arise in each destination because of climate change, allowing the exploitation of benefits to develop the activities sustainably. Finally, the challenges lie in finding mitigation and adaptation actions allied to sustainability principles (Grimm, 2016).

Regarding adaptation, Brooks et al. (2005) and Adger et al. (2007) note that resilience has been proven to be a necessary condition to perceive and implement effective adaptation strategies aimed at reducing the likelihood and magnitude of harmful outcomes resulting from climate change. Tourism has a unique ability to adapt because it is dynamic and continuously adjusting to demographic and economic changes, the emergence of new markets, demand trends, and technological progress. Including adaptation and integration into the decision-making process of the tourism sector and government should be a continuous task carried out worldwide (Becken et al., 2020; Simpson et al., 2008). In this sense, adaptive capacity is the ability of a system to respond successfully to climate change variability, which includes adjusting behavior, resources, and technologies (Brazilian Panel for Climate Change [PBMCC] 2014).

The climate change adaptation measures combine subsets of activities, such as (a) infrastructure development, (b) optimization of technological processes, (c) institutional change, (d) integrated management of natural resources, such as water basins and coastal zones, (e) financial services, including risk transfer, and (f) information systems (BRASIL 2016). In Brazil, some national and regional adaptation plans that integrate climate change include urban improvement programs, planning and preparation for natural disasters, city master plans, sectoral plans, integrated water resource management, coastal zone management, ecosystem-based management, fisheries management, and community-based adaptation.

Adaptation must be implemented at all levels, from the individual to the organizational one, including the public and private sectors. In addition, it must consider the specific characteristics of each destination and adopt ways to manage the amount of carbon from businesses, highlighting measures for its reduction (Grimm, 2019).

In the coming decades, society and economic sectors will inevitably need climate change adaptation strategies (IPCC, 2007a, 2007b), which is already the case for many economic sectors, including tourism. However, some countries and regions are more vulnerable than others since economic and geographical characteristics determine the exposure and sensitivity to the impacts of climate change, as well as the adaptive capacity (IPCC, 2007b). The United Nations Development Program

(UNDP, 2007) provides guiding principles for adaptation that may be relevant to tourism (Table 8.1):

The principles identified in Table 8.1 contain elements that must be considered in any adaptation strategy. In places where climate change is a known risk, but there is little information to assess the types and severity of its impacts on tourism, substantial investment in information and science might be necessary. As for destinations where the nature of climate change risks is well established, implementing a formal planning process with defined responsibilities for tourism and stakeholders is the most appropriate focus (Simpson et al., 2008).

Table 8.1 Guiding principles for adaptation to climate change

Principle	Context
Adaptation in the developmental context	Climate change could negatively affect sustainable development, including water resources, energy, health, agriculture, and biodiversity—all which influence tourism. Tourism adaptation must not be isolated but set along with other sectors within the broader context of sustainable development policies and strategies
Build on current adaptive experience to cope with future climate variations	Tourism has experience in dealing with climate variability, and assessing its coping range is a necessary starting point for adaptation. The entire tourism system must be engaged in the process to fully benefit from its diverse experience and expertise in adapting to current climate variability
Recognize that adaptation occurs at different levels, particularly at the local one	Adaptation may be strategically performed at the national level, but its implementation often occurs at the destination, business, or local project level. Climate change is a challenge for governments but also for tourism, whose operations are and will be affected
Recognize that adaptation is a continuous process	Strategies must recognize that the adaptation process is continuous and requires an implementation and evaluation rate that follows the dynamics of climate conditions, which continue to evolve throughout this century

Source Grimm (2016), adapted from UNDP (2007)

Adaptation Strategies for Coastal Tourism to Cope with Extreme Events

In Brazil, tourism corresponds to approximately 3.7% of the Gross Domestic Product (GDP) and accounts for 3% of the country's total employment (Barbosa et al., 2020). However, due to the outbreak of the Covid-19 pandemic in 2020, Brazil lost 4 million tourists, which resulted in a 28.5% decrease in the federal revenues related to the sector. In 2021, the tourism companies' revenues reached R\$ 7.1 billion—a 77% increase over the previous year, although still 44% below 2019, according to the Brazilian Ministry of Tourism (MTur, 2021).

From a socioeconomic perspective, beaches are an important leisure area and offer the potential for intense use for tourism activities, including informal ones. The Brazilian coastal income, or sea economy, accounted for 19% of the country's GDP in 2019, or R\$ 1.3 trillion. In 2018, the coastal tourism revenue was approximately R\$ 82 billion (CNN Brazil Business, 2022). Nevertheless, Brazilian coastal cities are sensitive to sea level rise, changes in storm frequency and intensity, precipitation and ocean temperature increase, and wave regimes. In several tourist cities along the coast, where beaches play a key role in the tourism industry, adaptive solutions using beach nourishment are being carried out to preserve the coast from erosion and wave damage, thus expanding the space and boosting the tourism and economy of these regions.

According to Dronkers et al. (1990) and Lee (2014), protection, accommodation, and retreat (Table 8.2) are the main adaptation strategies to respond to sea level rise and storms since they aim at controlling erosion and potential flooding.

Beach nourishment is an engineering work that replenishes the natural sediment deficit. This strategy offers erosion protection measures and influences the harmony of the coastal sediment, promoting better use of the coastal areas by expanding the recreational space. In addition, it has aesthetic and entertainment advantages and is often used for reconstructing certain areas. The system consists of building a bank with sand of the same size, density, and granulometry as the original beach material. The intervention can be associated with other coastal protection efforts, such as the construction of groins, breakwaters, and moles (Alfredini and Araski, 2014; Finkl and Walke, 2002; Goes Filho, 2004).

Globally recognized, beach nourishment may be the least impactful intervention for not using environmentally foreign materials and structures. Therefore, it is often used to protect and increase recreational areas in tourist cities. The technique can be divided into three types: backshore nourishment, beach nourishment, and shoreface nourishment (Alfredini and Araski, 2014; Finkl & Walker, 2002).

The first step of this process is to develop a project that considers and identifies the submerged borrow sites or sand deposits, evaluates the energy levels at the intervention site, and monitors the characteristics and the quality of the material to be deposited on the beach. In addition, a five-year minimum retention time must be ensured for possible sand replenishment. The impact of the work must also be

Table 8.2 Recommended adaptation strategies on sandy beaches to sea level rise

Adaptive technique		Purpose
Protection	Seawall and revetment	To establish the shoreline
	Beach nourishment	Coastal erosion control (primary) Flooding control (secondary)
	Dune and sand fence building	Natural protective barrier
	Dikes, Levees Sea, walls	For hard-to-move facilities and infrastructure on flat ground
	Mangroves, wetlands, sand dunes, tidal Flats	Maintain shoreline in locations with existing coastal forests or sand dunes
Accommodation	Establishment of building standards designed for the coastal area	To allow continued use and occupation
	Systematic and continuous monitoring of sandy beaches	To identify and avoid threats beforehand
Retreat	Drainage system	For redevelopment projects or facilities at sites without high ground nearby
	Establishment of a setback line Relocation Abandonment	To restrict occupation in vulnerable areas For residential and public facilities at sites with low-risk uplands nearby
Attack	Land Reclamation Piers Ports Harbors	For facilities requiring direct access to water

Source Adapted from Dronkers et al. (1990); Lee (2014)

through an Environmental Impact Statement (EIS), including mandatory monitoring before, during, and after its conclusion.

Due to its aesthetic appeal, artificial nourishment has become a relevant mechanism for beach restoration and expansion for recreation, as well as an adaptive strategy for tourism-dependent coastal cities. This structure has a high implementation and maintenance cost, requiring material availability, environmental impact assessment, and durability studies. A work without such precautions, as Keller (1942) points out, can impact surrounding areas or even destroy the beach that was supposed to be recovered.

According to Martins and Veloso-Gomes (2011), beach nourishment may not be technically or economically feasible, especially in areas with high erosion rates. However, when done properly, it is beneficial, justifying and offsetting its high costs. In Brazil, the National Coastal Management Plan was created to manage the country's extensive coast. According to it, each state must define its coastal zone and establish laws and public policies to address the problems caused by population concentration and the productive activities in these regions. This is the case of tourism, which has grown as one of the most recent economic phenomena of the globalized world.

Along the Brazilian coast, beach-based tourism and recreational practices are often the main drivers of local and regional economic development. In the city of

Rio de Janeiro, beach nourishment was implemented in the 1970s in Copacabana, internationally known for its fine white sand. The work was carried out by the Lisbon National Laboratory of Civil Engineering (LNEC, acronym in Portuguese) under the coordination of Rio de Janeiro's Superintendence of Urbanization and Sanitation (SURSAN, acronym in Portuguese). Several interventions have already been done on the beach to minimize the damage caused by storm surges and for aesthetic, tourism, and recreational purposes (Lins-de-Barros & Guerra, 2020; Lins-de-Barros et al., 2019). It is worth mentioning that, before the nourishment, other projects were developed in Copacabana to protect its coast, such as the construction of two groins and breakwaters in 1936. However, few results were achieved because heavier storm surges destroyed them (Young, 2021).

To nourish Copacabana, sand from Botafogo (a cove approximately 3 km distant) was used, although it is darker and more coarse-grained. Despite the beach having lost its original characteristics, the work has contributed to flooding control since it has moved the sea 80 m away from the original surf zone. In addition, the project included the widening of Avenida Atlântica (Portuguese for Atlantic Avenue) (Figs. 8.1 and 8.2) and the construction of parking lots and the traditional promenade in Portuguese stone with the black and white wave pattern.

For many years, the place was protected against high tides and storm surges. Nevertheless, even with the maintenance service, from 2009 to 2019, the distance between the promenade and the sea decreased by more than 10% (Fig. 8.3).

Although the main reason for the nourishment of Copacabana Beach was to protect the shore from storm surges and erosion, its use for leisure and tourism has always thrived, with hotels and businesses operating all year round. Certainly, the widening of the beach berm and the increase of Avenida Atlântica and the recreational area on the shore are essential elements for this success. The artificial nourishment was completed in 1970 and considered a success for its purpose, which was to mitigate the storm surge damage caused to urban constructions, in addition to providing more space for the increasing number of beachgoers and duplicating Avenida Atlântica, improving the traffic (Silva and Lins-de-Barros, 2021).



Fig. 8.1 Copacabana Beach before (1956) the restoration of the sand strip. *Source:* Observatório de Justiça e Conservação (2020)



Fig. 8.2 Copacabana Beach after (2007) beach widening. *Source* Observatório de Justiça e Conservação (2020)



Fig. 8.3 Copacabana Beach, Rio de Janeiro. *Source* Google Maps (2023)

The name Copacabana was given after *Eugenia Copacabanensis*, one of the many restinga (Brazilian coastal tropical moist forest) plant species existing at the time (CNCFlora, 2012). The plant was eliminated during the urbanization process, and it could have protected the beach from storm surges that, over the years, covered the beach berm and threatened the buildings. However, as Dias (2018) points out, the nourishment of Copacabana can be considered a successful regeneration—furthermore, even though the sand has receded in some portions of the shore, this beach is

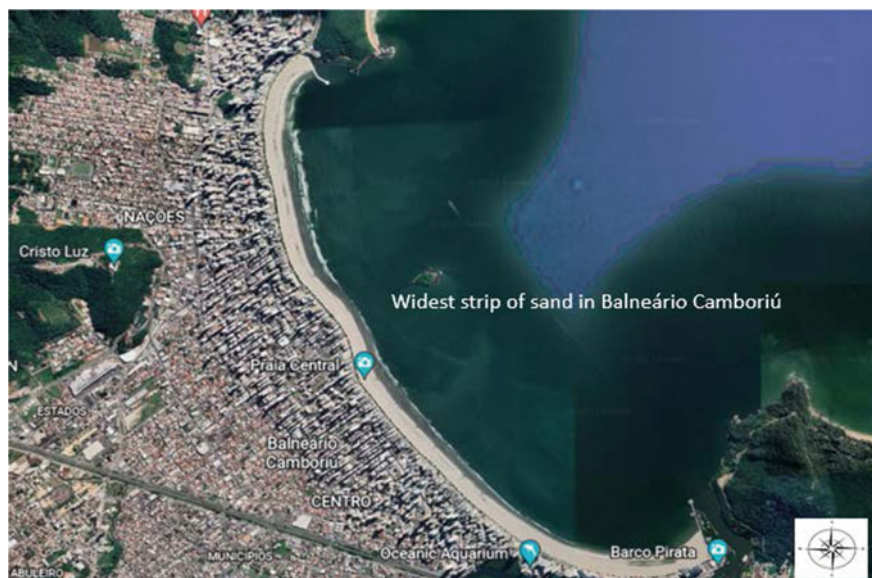


Fig. 8.4 Praia Central (Central Beach) in Balneário Camboriú (state of Santa Catarina) after beach nourishment. *Source* Google Earth (2023)

more protected due to its location and the presence of the adjacent islands, which minimize the direct action of the waves.

In Balneário Camboriú (state of Santa Catarina, southern Brazil), the nourishment of Praia Central (Portuguese for Central Beach) (Fig. 8.4) widened the beach, sports practice, and tourism. In addition, a new bike lane and landscaping works are planned for the next few years.

The project was concluded in December 2021 and increased the sand berm from an average of 25–70 m (Fig. 8.5). It covered a length of 5.8 km and, in addition to protecting the coast from advancing tides, allowed the creation of privileged spaces for residents and tourists, who reach up to three million people in the peak season.

Nourishment had been discussed since the 1970s because it was considered a strategy for the city's economic growth. In Balneário Camboriú, tourism accounts for 16% of the city's wealth, which is composed of other sectors, such as food, small business, architecture, and engineering. The work started in March 2019 after the Preliminary Environmental License approval for restructuring the beach and the publication of a public procurement notice to choose the company responsible for the execution. Approximately 2.2 million cubic meters of sand were extracted from a deposit 15 km from the coast and 30–40 m deep.

In addition to sun and beach tourism, events created by the city government offer options during the year (e.g., the *Réveillon Show*, or New Year's Eve Show, considered the biggest fireworks display in southern Brazil, the Balneário Camboriú Carnival,



Fig. 8.5 Balneário Camboriú beach before and after nourishment (2021). *Source* Balneário Camboriú City Hall (2022)

which attracts more than half a million visitors, among others), placing the city in the national and international tourism scenario.

After the beach nourishment, the company hired to study, monitor, and evaluate the work provided a report comparing the shoreline in December 2021 and December 2022. The results showed that the beach is stable both in the emerged and submerged parts. Despite the strong storm surges and rainfall that occurred throughout 2022, which resulted in the appearance of scarps and lagoons, already expected effects, there was no significant change in the beach profile, demonstrating that the project fulfills its function of coastal protection. However, ten months after its completion, an unevenness of approximately 1.70 cm in height and 150 m in length appeared at Praia Central (Fig. 8.6). This is a natural phenomenon in which a giant step named *scarp* appears, and that may occur over time due to the conformation and equilibrium process of the beach. Storm surges are one of the reasons for these occurrences.

Follow-up and monitoring programs are planned in the nourishment project, among which we highlight: Program for Monitoring Wave Climate and Beach Dynamics (PACOAP, or Programa de Acompanhamento do Clima de Ondas e da Dinâmica Praial, in Portuguese), Beach Profile Monitoring Program (PMPP, or Programa de Monitoramento do Perfil Praial, in Portuguese), and the Program for Monitoring the Bathymetric Height of the Balneário Camboriú Cove (PMCBEB, or Programa de Monitoramento das Cotas Batimétricas da Enseada de Balneário Camboriú, in Portuguese). The main goal of the programs is to follow up on the physical-oceanographic parameters involved in the ocean circulation and the bathymetric levels of the cove and monitor the potential morphological changes in the beach profile of the emerged portion of Praia Central. This information is crucial to evaluate the behavior of the sediments deposited on the beach and whether it corresponds to what was expected and evaluated in previous studies, such as the



Fig. 8.6 Unevenness at Balneário Camboriú's Praia Central 10 months after beach nourishment. *Source* O Globo (2023)

Environmental Impact Statement (EIS), the Environmental Impact Report (EIR), and the nourishment's Executive Project.

Tourism and property valuation stand out as outcomes of this project. Water-front properties appreciated 30% and those under construction between 2.5 and 3%. In addition, the demand for tourist season rental properties in the expanded area increased by 8% (Arantes, 2023).

In Brazil, tourist cities along the coast have chosen beach nourishment to both preserve their shores from erosion and storm surges and better exploit the tourism industry through larger and more structured beaches. Balneário Piçarras (state of Santa Catarina), for example, underwent three nourishment works because the city was continuously dealing with sea rise and storm surges that were removing the sand from the central coast. Furthermore, the waves also affected the urban infrastructure and jeopardized drainage networks, residential sewage systems, and the promenade on Avenida Beira Mar, a waterfront avenue.

The city was facing economic stagnation and a crisis in the tourism sector, one of its economic pillars, when it had its first beach nourishment work in 1998. However, it received no maintenance and presented problems and new projects were executed in 2008 and 2012, totaling an area of 2.2 km in length. To help contain the sand, two groins (Fig. 8.7) 153 m long and ten meters wide were built. Although not scenically beautiful, they mitigate the effects of storm surges.

Annually, the city was losing 15 m³ of sand per linear meter of length but, after the 2008 maintenance with finer sand, this proportion increased to 50 m³ (Observatório de Justiça e Conservação, 2020). The grain size of the sand is an influential factor

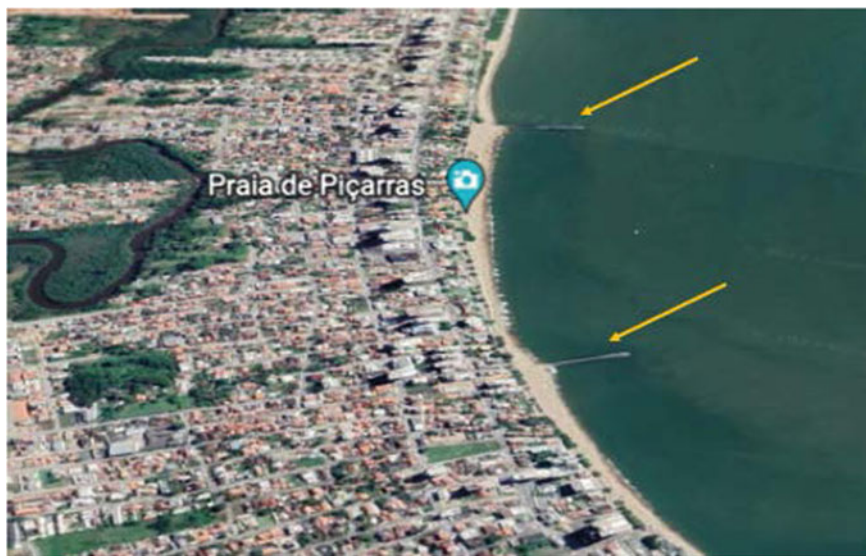


Fig. 8.7 Groin implantation at the beach at Balneário Piçarras. *Source* Adapted from Google Earth (2023)

in the durability of the work: finer sand is removed faster by the sea, whereas the coarser one remains for a longer time. Consequently, further nourishment work is still necessary on the beach of Balneário Piçarras.

The Brazilian coast has many examples of beach nourishment as an adaptive strategy to sea level rise and protection from extreme events. However, the works will neither prevent sea level rise nor erosion processes. It is necessary, therefore, to maintain the restinga vegetation, responsible for beach stability, although it is seldomly considered by cities that have opted for beach nourishment as an adaptive solution to the sea level rise.

Another relevant aspect is the absence of restinga vegetation in nourishment projects. The restinga is the interface between sea, beach, and land vegetation and works as a physical barrier against storm surges, preventing degradation and alteration of the beach environment. Furthermore, it helps maintain water resources, shelters endemic, endangered, and economically significant species, prevents dune expansion, and contributes to shoal maintenance. However, urban sprawl removes the vegetation, leaving the coastline even more vulnerable to sea level rise and storm surges.

Final Considerations

The Brazilian coastal areas are degraded by severe erosion, irregular occupations invading the coastline, river mouths with water potentially contaminated by illegal sewage networks, landscaping with no criteria (resulting in the introduction of exotic species in the restinga), construction of leisure and beach access infrastructure with no criteria (resulting in the suppression of both dunes and restinga), and construction in public domain areas. These conditions may intensify coastal vulnerability resulting from heavy rainfall, sea level rise, storm surges, and other phenomena, significantly impacting coastal communities and their activities.

Real estate speculation is one of the main reasons that adaptation policies are constantly being developed since the high investments in the urbanized sandy beaches create a pressure to maintain the situation stabilized. In this context, beach nourishment is a coastal protection alternative that brings social, economic, and environmental benefits since it adds value to tourism by creating employment and income, increasing revenues for the city.

Regarding the sea level rise, it is worth discussing measures aimed at the following: avoid the construction of new buildings in risk areas; identify ways to protect the built patrimony of coastal cities from sea level rise; research alternatives to ensure the maintenance of activities responsible for local economic support, which may cease to exist if the sea level rise significantly affects the areas in which they are established.

It is important to highlight that there is no single set of adaptation measures. The entire tourism system must act to reduce emissions associated with the activity and adopt strategies to adapt to the uncertainties and impacts of extreme weather events. In this chapter, we observe the execution of works to widen the sand strip, used as an adaptation measure to manage risks, and minimize the vulnerability of tourist destinations. This seeks to preserve the shore from damage caused by erosion and storm surges and expand the sand strip for leisure and tourism. However, good practices and alternative solutions, such as beach nourishment, are challenges for the public sector and for tourism. Although considered a light work, it is an aggressive action that can impact the landscape, fauna, and flora and damage the image of the tourist destination. Beach nutrition does not prevent erosion and each project has a finite lifespan. The economic cost of nutrition projects is considered high and must be included in the annual budget.

Several cities in Europe and the USA have already experimented with artificial beach feeding solutions. In Brazil, tourist cities are adopting this practice, which must be supported by studies and reports of environmental impacts. A well-designed and executed project can minimize environmental impacts, as being a nature-based solution, it is lighter than stone walls and spikes built for coastal containment. It is also necessary not to occupy the widened sand strips with urban structures, to restore the restinga vegetation, to associate plans to revitalize the shoreline with proper use and occupation, creating a more natural environment.

Finally, it is important to highlight that some limitations were identified in this study: (a) scarcity of literature on the subject in Brazil; (b) unavailability of documents (EIA, RIMA; Local Development Plans; Waterfront Management Plans) of the municipalities that carried out beach nourishment, and (c) association of the beach nourishment technique as a strategy for adapting tourist destinations to weather changes. As a suggestion for future research, it is evident the need for theoretical deepening: to produce technical-didactic material on the practice of widening the sand strip as a strategy for adapting tourism to climate change, aimed at students and public managers.

References

- Adger, W. N., Agrawal, S., Mirza, M. M. W., Conde, C., O'Brien, K. L., Pulhin, J., Pulwarty, R., Smit, B., & Takahashi, K. (2007). Assessment of adaptation practices, options, constraints, and capacity. In M. L. Parry, O. F. Canziani, J. P. Palutikof, C. E. Hanson, P. J. van der Linden (Eds.), *Climate change 2007: Impacts, adaptation and vulnerability. Contribution of working group II to the fourth assessment report of the intergovernmental panel on climate change* (pp. 719–743). Cambridge University Press.
- Alfredini, P., & Arasaki, E. (2014). Engenharia portuária: a técnica aliada ao enfoque logístico [Port engineering: Technique allied with logistic approach]. Editora Blucher.
- Ângulo, R. J. (2004). Aspectos físicos das dinâmicas dos ambientes costeiros, seus usos e conflitos [Physical aspects of dynamics in coastal environments, their uses, and conflicts]. *Revista Desenvolvimento e Meio Ambiente. Ed. UFP*, 10, 175–185.
- Arabadzhyan, A., Figini, P., García, C., González, M., & González, L. C. (2020). Climate change, coastal tourism, and impact chains—A literature review. *Current Issues in Tourism*, 24, 2233–2268.
- Arantes, F. (2023). Let's talk about the Widening of the Itapema Sand Strip. <https://www.fabricioarantes.com.br/blog/vamos-conversar-sobre-o-alargamento-da-faixa-de-areia-de-itapema>. Accessed May 02, 2022.
- Artaxo, P., & Rodrigues, D. (2019). The scientific basis of climate change. In *Climate litigation: New frontiers for environmental law in Brazil*. São Paulo: Editora Revista dos Tribunais. <http://publicasbi.if.usp.br/PDFs/LitiganciaClimatica.pdf>. Accessed May 19, 2022.
- Bano, S., Liu, L., & Khan, A. (2022). Dynamic influence of aging, industrial innovations, and ICT on tourism development and renewable energy consumption in BRICS economies. *Renewable Energy*, 192, 431–442.
- Barbosa, L. G. M., Coelho, A. M., Motta, F. A. T., & Guimarães, I. L. B. (2020). *Impacto econômico do COVID-19: Propostas para o turismo brasileiro [Impact of COVID-19 on the Brazilian tourism: Proposals for economic recovery]*. FGV Projetos.
- Baumert, T. (2016). Terrorismo y turismo: una revisión de la literatura acerca de la repercusión de los atentados sobre el sector turístico [Terrorism and tourism: A literature review on the impact of attacks on the tourism sector]. *Información Comercial Española*, 893, 51–70.
- Becken, S., Whittlesea, E., Loehr, J., & Scott, D. (2020). Tourism and climate change: Evaluating the extent of policy integration. *Journal of Sustainable Tourism*, 28, 10, 1603–1624. <https://doi.org/10.1080/09669582.2020.1745217>. Accessed February 09, 2022.
- Bird, E. (2008). *Coastal Geomorphology: An introduction* (2nd ed.) Wiley.
- Brasil. Ministerio do Turismo (MTur). (2021). In full recovery, tourism operators record records in 2021 and surpass pre-pandemic numbers. <https://www.gov.br/turismo/pt-br/assuntos/noticias/em-plena-retomada-operadoras-deturismo-registram-record-in-2021-and-exceed-pre-pandemic-numbers>. Accessed June, 12, 2022.

- Brasil. Portaria n. 150, de 10 de maio de 2016. (2016). Plano Nacional de Adaptação à Mudança do Clima [National plan for climate change adaptation]. https://www.in.gov.br/materia/-/asset_publisher/Kujrw0TZC2Mb/content/id/22804297. Accessed February 23, 2022.
- Brooks, N., Adger, N., & Kelly, M. (2005). The determinants of vulnerability and adaptive capacity at the national level and the implications for adaptation. *Global Environmental Change*, 15, 51–163.
- Climate Central. (2022). Climate and energy choices this decade will influence how high sea levels rise for hundreds of years. Which future will we choose? <https://picturing.climatecentral.org/>. Accessed May 09, 2022.
- CNCFlora. (2012). *Eugenia copacabanensis*. In: *Red list of Brazilian flora version 2012.2*. National Flora Conservation Center. http://cncflora.jbrj.gov.br/porta1/pt-br/profile/Eugenia_copacabanensis. Accessed June 09, 2022.
- CNN Brasil. (2022). PIB do mar ainda tem potencial a ser explorado no Brasil, dizem especialistas [GDP of the sea still has potential to be explored in Brazil, say experts]. <https://www.cnnbrasil.com.br/business/pib-do-mar-ainda-tem-potencial-a-ser-explorado-no-brasil-dizem-especialistas/>. Accessed February 09, 2022.
- Dias GTM. (2018). Introdução [Introduction]. In Muehe, D. (org) *Panorama da Erosão Costeira no Brasil*. Ed. MMA, 15–18.
- Dias, J. Á., Mahiques, M. M., Cearreta, A. (2012). Gestão Costeira: resultado de uma relação dúbia entre o Homem e a Natureza [Coastal management: Result of a dubious relationship between man and nature]. *Revista de Gestão Costeira Integrada/Journal of Integrated Coastal Zone Management*, 12, 1, 3–6.
- Dogru, T., Marchiob, E., Bulut, U., & Suessb, C. (2019). Climate change: Vulnerability and resilience of tourism and the entire economy. *Tourism Management*, 72, 292–305.
- Dronkers, J., Gilbert, J. T. E., Butler, L. K., Carey, J. J., Campbell, J., James, E., McKenzie, C., Madsorp, R., Quin, N., Ries, K. L., Schroder, P. C., Spradley, J. R., Titus, J. G., Vallianos, L., & Dadelszen, J. (1990). *Strategies for adaptation to sea level rise. Report of the IPCC coastal zone management subgroup: Intergovernmental panel on climate change*. Intergovernmental Panel on Climate Change.
- Fang, Y., Yin, J., & Wu, B. (2020). Climate change and tourism: A scientometric analysis using CiteSpace. *Journal of Sustainable Tourism*, 26(1), 108–126.
- Finkl, C. W., & Walker, H. J. (2002). Beach nourishment. In J. Chen, K. Hotta, D. Eisma, & H. D. Walker (Eds.) (Vol. 1, p. 22). Kluwer.
- Goes Filho, H. A. (2004). *Dragagem e Gestão dos Sedimentos [Dredging and sediment management]*. Tese (Mestrado em Ciências em Engenharia Civil)—Instituto Alberto Luiz Coimbra de Pós-Graduação e Pesquisa de Engenharia, Universidade Federal do Rio de Janeiro, Rio de Janeiro.
- Gómez Martin, M. B. (2005). Geographic reflection around the climate-tourism binomial. *Boletín de la Asociación de Geógrafos Españoles*, 40, 11–134.
- Gössling, S., Scott, D., & Hall, M. (2018). Global trends in length of stay: Implications for destination management and climate change. *Journal of Sustainable Tourism*, 26(12), 2087–2101. <https://doi.org/10.1080/09669582.2018.1529771>
- Grimm, I. J. (2016). Mudanças climáticas e o turismo: estratégias de adaptação e mitigação [Climate change and tourism: Adaptation and mitigation strategies]. Tese (Doutorado)—Programa de Pós-Graduação em Meio Ambiente e Desenvolvimento da Universidade Federal do Paraná. Curitiba.
- Grimm, I. J. (2019) Impactos das mudanças climáticas no sistema turístico: o caso Brasileiro [Impacts of climate change on the tourism system: The Brazilian Case]. *Caderno Virtual de Turismo*, 19(1), 32. <http://www.ivt.coppe.ufrj.br/caderno/index.php/caderno/article/view/1392/616>
- Grimm, I. J., Prado, L., Giacomitti, R., Mendonça, F. A. (2013). Mudanças climáticas e o Turismo: desafios e possibilidades [Climate change and tourism: Challenges and opportunities]. *Revista*

- Brasileira de Climatologia*, 8, 19–26. <https://revistas.ufpr.br/revistaabclima/article/view/29717/20846>.
- Hoogendoorn, G., Stockigt, L., Saarinen, J., & Fitchet, J. (2020). Adapting to climate change: The case of snow-based tourism in Afriski. *Lesotho, African Geographical Review*, 40, 92–104.
- Instituto Brasileiro de Geografia e Estatística (IBGE). (2010). Censo Demográfico [Demographic census]. Accessed February 23, 2022. <https://censo2010.ibge.gov.br/noticias-censo.html?busca=1&id=1&idnoticia=2036&t=ibge-parceria-marinha-brasil-lanca-atlas-geografico-zonas-costeiras-oceanicas&view=noticia>.
- Intergovernmental Panel on Climate Change (IPCC). (2007a). Climate change: Mitigation. Contribution of working group III to the fourth assessment report of the intergovernmental panel on climate change: AR4 climate change 2007: Synthesis report. <https://www.ipcc.ch/report/ar4/wg3/>. Accessed May 23, 2022.
- Intergovernmental Panel on Climate Change (IPCC). (2007b). De Davos a Bali: la contribución del turismo al reto del cambio climático [From Davos to Bali: The contribution of tourism to the challenge of climate change]. <https://www.unwto.org>. Accessed May 23, 2022.
- Intergovernmental Panel on Climate Change (IPCC). (2014). Resumen para responsables de políticas. En: Cambio Climático 2014: Bases físicas [Summary for policy makers. In *Climate change 2014: Physical basis*]. <https://www.ipcc.ch/report/ar5/syr/>. Accessed February 23, 2022.
- Intergovernmental Panel on Climate Change (IPCC). (2021). Climate change 2021. The physical science base. Working group, I contribution to the sixth assessment report of the intergovernmental panel on climate change summary for policymakers. <https://www.ipcc.ch/report/ar6/wg2/>. Accessed February 23, 2022.
- Keller, E. A. (1942). Introduction to environmental geology (4th ed). Upper Saddle River. <https://pdf.pub/introduction-to-environmentalgeology-4th-edition.html>
- Lee, Y. (2014). Estratégias de planejamento costeiro para adaptação ao aumento do nível do mar: um estudo de caso de Mokpo, Coreia [Coastal planning strategies for adaptation to sea level rise: A case study of Mokpo, Korea]. *Journal of Building Construction and Planning Research*, 2, 74–81. <https://doi.org/10.4236/jbcr.2014.21007>
- Lenzen, M., Sun, Y. Y., Faturay, F., Ting, Y. P., Geschke, A., & Malik, A. (2018). The carbon footprint of global tourism. *Nature Climate Change*, 8, 522–528.
- Lins-De-Barros, F. M., & Guerra, J. V. (2020). Do centro ao Pontal: as transformações das praias cariocas. *Ciência Hoje* [From the Center to Pontal: Transformations of Rio's Beaches. *Ciência Hoje*]. <https://cienciahoje.org.br/>. Accessed May 23, 2022.
- Lins-De-Barros, F. M., Sauzeau, T., Guerra, J. V. (2019). Historical evolution of seafront occupation in France (Bay of Biscay) and Brazil (Rio de Janeiro) face to coastal erosion vulnerability and risks (19th–21st centuries). *Revista Confins*, 39.
- Lopes, D. N., Silva, M. T., Duarte, R. C., Grigi, A. M., Damasceno, A. M., & Rodrigues, L. I. C. (2021). Análise da Vulnerabilidade Natural e Ambiental do Município de São Gonçalo do Amarante, litoral do Estado do Ceará [Analysis of the Natural and Environmental Vulnerability of the Municipality of São Gonçalo do Amarante, Coast of the State of Ceará]. *Revista Brasileira De Geografia Física*, 14, 3057–3066.
- Machete, R. (2011). Clima e turismo num contexto de mudanças climáticas [Climate and tourism in the context of climate change]. *Finistera*, XLVI, 91, 139–154.
- Martins, H., & Veloso-Gomes, F. (2011). Alimentação artificial de praias em ambientes energéticos intermédios [Artificial feeding of beaches in intermediate energy environments]. In *Jornadas de Hidráulica, Recursos Hídricos e Ambiente*, FEUP. https://paginas.fe.up.pt/~shrha/publicacoes/pdf/JHRHA_6as/4_HMartins_Alimenta%C3%A7%C3%A3oArtificial.pdf
- Martins, M. B., War A. J. T., Vasconcelos, F. P., & Silva, E. V. (2013). Integrated geoenvironmental diagnosis of APA Dunas da Lagoinha, Paraíba, Ceará, Brazil. *GEOMAE Magazine - Geography, Environment and Teaching*, 4(1), 13–34.
- Mesquita, A. R. (2004). Nível relativo do mar (O enigma) e os terrenos de marinha [Relative Sea Level (The Enigma) and the Maritime Lands]. *Afro-America Gloss News*, 8, 1. <http://www.mares.io.usp.br/aagn/aagn8/enigma/oenigma5.html>

- Mesquita, A., Franco, A. S., Harari, J., & França, C. A. S. (2013). O nível do mar ao longo da costa brasileira [The sea level along the Brazilian Coast]. *Jornal Brasileiro de Geofísica*, 31, 33–42. <https://sbgf.org.br/revista/index.php/rbgf/article/view/387/147>
- Moreno, Á. (2010). *Turismo y Cambio Climático en España: Evaluación de la Vulnerabilidad del Turismo de Interior frente a los Impactos del Cambio Climático* [Tourism and climate change in Spain: Assessment of vulnerability of Inland tourism to climate change impacts]. Maastricht University.
- Neger, C., Pretenthaler, F., Gössling, S., & Damm, A. (2021). Carbon intensity of tourism in Austria: Estimates and policy implications. *Journal of Outdoor Recreation and Tourism*, 33. <https://doi.org/10.1016/j.jort.2020.100331>
- Nhamo, G., Dube, K., & Chikodzi, D. (2020). *Counting the cost of Covid-19 on the global tourism industry*. Springer: s. l.
- Observatório de Justiça e conservação. (2020). A engorda de praia já funcionou em algum lugar do Brasil? [Has beach nourishment ever worked anywhere in Brazil?]. *Jornal Justiça e Conservação*, 6, 15. Available at: https://issuu.com/justicaeco/docs/ojc_jornal_6_online. Accessed May 20, 2022.
- Oliveira, A., & Rehbein, M. O. (2022). Vulnerabilidade social no litoral lagunar do Rio Grande do Sul: mapeamento de índice de vulnerabilidade social para a orla municipal de Pelotas-RS [Social vulnerability in the Lagoon Coast of Rio Grande do Sul: Mapping of social vulnerability index for the municipal shoreline of Pelotas-RS]. *Geosp*, 26, 3. <https://www.revistas.usp.br/geosp/article/view/192343>
- Painel Brasileiro de Mudanças Climáticas (PBMC). (2014). Contribuição do Grupo de Trabalho 3 ao Primeiro Relatório de Avaliação Nacional do Painel Brasileiro de Mudanças Climáticas. Sumário Executivo do GT3 [Contribution of working group 3 to the first national assessment report of the Brazilian panel on climate change. Executive summary of WG3]. PBMC, Rio de Janeiro, Brazil.
- Pathak, A., Beynen, P., Akiwumi, F., & Lindeman, K. (2021). Impacts of climate change on the tourism sector of a small island developing state: A case study for the Bahamas. *Environmental Development*, 37.
- Pilkey, O. H., Neal, W. J., & Bush, D. M. (2009). Coastal erosion. In F. Isla, & O. Iribarne (Eds.), 540.
- Programa das Nações Unidas para o Desenvolvimento (PNUD). (2007). Relatório de Desenvolvimento Humano 2007/2008: Combater as alterações climáticas: Solidariedade humana num mundo dividido [Combating climate change: Human solidarity in a divided world]. www.pnud.br. Accessed June 02, 2022.
- Qiu, R. T. R., Park, J., Li, S., & Song, H. (2020). Social costs of tourism during the Covid-19 pandemic. *Annals of Tourism Research*, 84.
- Rocha, M. M., & Mattedi, M. A. (2015). Turismo e Desastres: o caso das enchentes e deslizamentos na destinação turística Costa Verde e Mar–Santa Catarina (Brasil) [Tourism and Disasters: The Case of Floods and Landslides in the Tourist Destination Costa Verde e Mar – Santa Catarina (Brazil)]. *Turismo & Sociedade*, Curitiba, 9(2), 1–23.
- Salim, E., Ravanel, L., Deline, P., & Gauchon, C. (2021). A review of melting ice adaptation strategies in the glacier tourism context. *Scandinavian. Journal of Hospitality and Tourism*, 21(2), 229–246.
- Santos, E. S., & Marengo, J. A. (2020). Desafio e impacto del cambio climático en el turismo: El escenario brasileño [Challenge and impact of climate change on tourism: The Brazilian Scenario]. *Estudios y Perspectivas en Turismo - 30º Aniversario*, 29, 864–885.
- Scott, D. (2021). Sustainable tourism and the grand challenge of climate change. *Sustainability*, 13. <https://www.mdpi.com/2071-1050/13/4/1966>
- Scott, D., & Jones, B. (2006). Climate change and seasonality in Canadian outdoor recreation and tourism. Waterlô: Report prepared for the Government of Canada Climate Change Action Fund, University of Waterlô.

- Seekamp, E., Jurjonas, M., & BitsurA-Meszaros, K. (2019). Influences on coastal tourism demand and substitution behaviors from climate change impacts and hazard recovery responses. *Journal of Sustainable Tourism*, 34, 2.
- Seetannah, B., & Fauze, L. S. (2018). Investigating the impact of climate change on the tourism sector: Evidence from a sample of island economies. *Tourism Review*, 74(2), 194–203.
- Silva, P. L., & Lins-de-Barros, F. M. (2021). A alimentação artificial da Praia de Copacabana (RJ) após 51 anos [The Artificial Feeding of Copacabana Beach (RJ) After 51 Years]. *Terra Brasilis [Online]*, 16. <https://journals.openedition.org/terrabrasilis/9980>
- Simpson, M. C., Gossling, S., Scott, D., Hall, C. M., & Gladin, E. (2008). *Climate change adaptation and mitigation in the tourism sector: Frameworks, tools, and practices*. UNEP, University of Oxford, UNWTO, WMO.
- Steiger, R., Scott, D., Abegg, B., Pons, M., & All, C. (2019). A critical review of climate change risk for ski tourism. *Current Issues in Tourism*, 22(11), 1343–1379.
- Tsai, K. T., Tzu-Ping, L., Yu-Hao, L., Chien-Hung, T., & Yi-Ting, C. (2018). The carbon impact of international tourists to an island country. *Sustainability*, 10.
- United Nations Development Program (UNDP). (2007). *Human development report 2007/2008: Combating climate change: Human solidarity in a divided world*. www.pnud.br. Accessed April 04, 2022.
- United Nations, UN. (2015). Transport emissions from tourism are expected to account for 5.3% of all man-made emissions by 2030. <https://news.un.org/pt/story/2019/12/1696711>. Accessed May 11, 2022.
- Vanhoni, F. J., & Mendonça, F. (2008). O clima no litoral do Paraná [The climate in the coastal region of Paraná]. *Revista Brasileira De Climatologia, Curitiba*, 3(4), 49–63.
- Wilkins, E., Urioste-Stone, S., Weiskitte, L. A., & Gabe, T. (2017). Effects of weather conditions on tourism spending: Implications for future trends under climate change. *Journal of Travel Research*, 1(12)
- Wolf, F., Leal Filho, W., Singh, P., Scherle, N., Reiser, D., Telesford, J., Miljković, I. M., Havea, P. H., Li, C., Surroop, D., & Kovaleva, M. (2021). Influences of climate change on tourism development in small Pacific Island states. *Sustainability*, 13, 4223. <https://www.mdpi.com/2071-1050/13/8/4223>
- Young, R. (2021). 50 anos da inauguração da Nova Copacabana [50 Years Since the Inauguration of Nova Copacabana]. *Ângulos: Revista do Crea Rio*. <https://angulos.crea-rj.org.br/geografia-urbana/50-anos-da-inauguracao-da-nova-copacabana/>

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Chapter 9

A Debate on Turkey Tourism's Adaptation to Climate Change



Gamze Coban Yildiz and Onur Sevket Yildiz

Abstract This chapter aims to present a debate on Turkey tourism's adaptation to climate change by providing some key information about each geographical region and developing suggestions. Considering the characteristics of tourism activities and the expected changes in the climate, adaptation and mitigation strategies are proposed. Due to Turkey's climatic/geographical variety, local strategies are also proposed along with general recommendations. From a methodological perspective, this chapter uses secondary data which include the relevant literature, tourism development information, and meteorological measurements and projections to interpret the climate change-tourism relation and adaptation/mitigation possibilities of Turkey's geographical regions as tourism destinations. This study aims to trigger adaptation and mitigation discussions and efforts of Turkey tourism and provoke the industry and governing institutions to take actions. Making very detailed plans might take quite a lot of time for the practitioners; thus, some guiding information will be useful. A pioneering discussion, which this debate also addresses by examining all regions and developing recommendations with this literature-wise early setting, is required for better planning and decision-making for the future of tourism in such a challenging era of global climate change. The results and recommendations developed in this study may provide a starting point both for practitioners and researchers.

Keywords Climate change · Climate change adaptation · Climate change mitigation · Turkey tourism

Introduction

Human beings have been using the nature for their needs since their existence but as the industrial activities became more intense, the negative impact of human activity has been a serious issue and ultimately a threat to the nature itself. Search for a more

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eco-friendly, thus sustainable, way of doing things is somehow being a prerequisite for the survival of the economies. Climate change is defined as the long-term shift in the climate, thus in temperatures and other weather patterns (UN, 2023). The recent issue with climate change is that the human activities spoiled the natural shift and accelerated some negative impact such as temperature increases. The vital nature of climate change makes it relevant to any subject but some areas such as tourism, agriculture, water management, and biodiversity management could be expected to be affected more directly. The term global warming is usually highlighted since the rise in global temperatures is a major issue (NASA, 2023). Although global warming and climate change are distinct terms, the climate change that human beings have to challenge today is generally characterized by temperature increases (NASA, 2010) but also accompanied with extreme meteorological events. Increase in average surface temperatures and undesirable changes in the precipitation seem worrisome (the Turkish State Meteorological Service (TSMS), 2015) and there are already reports of extreme meteorological events in Turkey (TSMS, 2022).

There are studies which deal with tourism—climate change link including adaptation and mitigation. These studies reflect the issues such as vulnerability discussions (Amelung & Viner, 2007; Wall, 2007), thermal comfort levels (Çalışkan, 2011; Çalışkan & Matzarakis, 2012), snow issues (Demiroglu et al., 2019; Steiger et al., 2019), destination choices (Ngxongo, 2021; Pröbstl-Haider et al., 2015), tourism's contribution to climate change (Bows et al., 2009), and adaptation (Lopes et al., 2022). Since the issues of climate change are interrelated, some studies inevitably dealt with more than one of these concepts (see, e.g., (Scott et al., 2012)). Specifically, the perception of mitigation seems to be interrelated with carbon emissions of the tourism industry (Gössling et al., 2023); however, general mitigation efforts, such as reforestation (Trabucco et al., 2008), could also be used by the tourism industry. The interest in adaptation and mitigation matters gained momentum since 1984 in climate change and tourism studies (Lopes et al., 2021). The reason behind this might be the clarity of facts which signal climate change and its seriousness. Adaptation itself is a multifaceted issue (Njoroge, 2015); thus, any efforts on it should focus on the aforementioned issues of climate change as well.

Turkey is located right in the middle of Europe and Asia, and the Anatolian Peninsula constitutes most of its land. The country has a coastline of 8592 km, except for the islands, (the Ministry of Environment Urbanization, and Climate Change (MEUCC), 2021a) 3216 km of which is protected coastline as of 2021 (MEUCC, 2023a) and rising sea levels due to melting glaciers (NASA, 2010) could be considered as a major problem for the coastal tourism. Turkey has officially seven geographical regions (the Turkish Geographical Association (TGA), 2023) with also some variety within each region.¹ These geographical parts are expected to be affected by climate change at different levels and in different forms. For example, the Black Sea Region is estimated to become less pluvial whereas the already dry climate of the Central Anatolia

¹ See the relevant maps in the links: Regions Map of Turkey (CografyaHarita, 2023a) and Various Climatic Maps of Turkey (CografyaHarita, 2023b).

Region is expected to become harsher (TSMS, 2015). Temperature increase problems might be considered as the highest risk for the Mediterranean and the Aegean Regions (TSMS, 2015) due to the already high temperatures in tourism seasons. There is also a general expectation that cooler areas of the world will gain more popularity whereas the warmer ones are considered to be more at risk (Bigano et al., 2005). This point of view supports the idea that the Mediterranean climate regions in Turkey (i.e., the Mediterranean and the Aegean Regions) which include major tourism destinations seem to be at risk. Moreover, climate change has implications for tourism activities, especially for those highly depend on nature such as sea-sun-sand (3S) tourism, many types of special interest tourism such as cycling, trekking, golf, mountaineering, ski tourism, and those indirectly depend on nature—which can also be inferred from their seasonal character—such as conventional tours. The destinations in the Mediterranean and the Aegean Regions include many of these activities (GoTurkiye, 2023a, 2023b), which further confirms a worrisome future if no effective precaution is taken.

Climate change is an issue with many implications and difficult to manage everywhere but some details in Turkey tourism make it even more challenging to both define and manage climate change-related problems. Turkey is a major tourism destination and possesses many natural and archeological/historical attractions. More than 51 million people visited the country in 2022 (the Ministry of Culture and Tourism (MCT), 2023a). However, tourism development is very diverse in different parts of the country. As exemplified in the following pages, there are major destinations which host millions of visitors each year, whereas there are some other destinations which are at the beginning level of tourism development. All these make climate change and tourism relation in Turkey more complicated. Since the preliminary impact of climate change is more observable in the nature, nature-based tourism activities might be considered to be more at risk but the consumption impact of tourism is also a primary issue since the tourism industry is a contributor to climate-changing factors (Pang et al, 2013). Thus, hosting many people might not always be very desirable and the mass tourism movements in Turkey, despite their economic contribution, are to be reconsidered. The tourism industry is already very sensitive to any change characteristically, and a major factor such as climate change is arguably expected to create dramatic results. Although it is not specific to Turkey tourism industry, this fact further complicates adaptation and mitigation efforts of the country. Moreover, the dilemma between economic gain and nature preservation is not very easy to overcome for developing countries including Turkey (Tosun, 2001).

In order to provide a debate on the issue, some key literature and the major projections on climate were reviewed. The related factual information, such as the climate characteristics and statistics on the number of visitors in a region, was also considered so that the arguments in this chapter are based on both factual information and/or findings of related past studies. In line with this, the variety in Turkey's tourism industry and climatic facts of the regions were taken into consideration while developing recommendations.

This study uses secondary data to interpret on climate change and tourism in Turkey. Use of secondary data enhances the reliability of the study, and it is also

thought to enhance the quality (Clark, 2005). Since this chapter discusses a complicated issue in the context of a country with various climatic facts and an important tourism industry, use of secondary data provided the authors with more reliable resources which give specific data on tourism, climate, and etc. to base arguments by linking them altogether. In addition to the relevant literature, meteorological measurements and projections were interpreted by considering tourism development of each region. Since tourism development is connected with other facts such as the level industrialization and presence of tourism assets, the interpretations were made based on the characteristics of the regions and the major cities/destinations in the regions were also considered. The recommendations developed in this study aim to be more applicable rather than merely ideal. Thus, controversial issues such as sustainability-economic gain are considered with this vision.

This chapter is structured into 4 sections. The introduction includes the relevant literature and key concepts, some major information on Turkey's geographical regions and tourism as well as the major climate risks the country is facing. The second section discusses the link between climate change and tourism in the country by highlighting climatic factors and presenting some key information on the tourism industry. The third section includes the recommendations for climate change mitigation and adaptation with a focus on tourism and with a base on the climatic and economic facts. Each region is examined in subtitles each of which gives information about the relevant region's climate, tourism, the implications of climate change, and adaptation and mitigation recommendations. Finally, the closing section includes a brief conclusion as well as the limitations and future study directions. As the final part of this study suggests, these and other limitations could be compensated by future studies; and the recommendations developed in this study may provide a starting point both for practitioners and researchers.

Climate Change and Tourism in Turkey

Turkey constitutes of seven different geographical regions; namely, the Mediterranean, Aegean, Black Sea, Marmara, Central Anatolia, Southeastern Anatolia, and Eastern Anatolia Regions (TGA, 2023). Climatically, these regions show very distinct characteristics from each other while there is also moderate to high variety in each region. For example, the Mediterranean Region, which is famous for its sea-sun-sand tourism, has also mountainous regions which are climatically different from the coastal area (Kahraman, 2018; Özçağlar, 2012). Maturity of tourism industry is also at different levels depending on both geographical and economical facts. For example, the city of Istanbul is located in the Marmara Region and has a very mature economy due to its history; thus, the tourism industry matured relevantly (the Governorship of Istanbul, 2023). The Mediterranean coast has also a mature tourism industry due to the historical heritage, natural advantage, and tourism investments. However, the latter is more tourism-dependent in comparison with Istanbul. There are also some destinations, such as the province of Yozgat, which are almost at the

beginning stage in terms of tourism development despite their valuable assets (MCT, 2023b; the Governorship of Yozgat, 2023).

Despite the variety of climatic conditions within Turkey, projections indicate some temperature increase and precipitation decrease in each and every region (TSMS, 2015). Thus, water issues are expected to increase in all over Turkey, although they have been discussed for a while in many areas such as agriculture. Recent changes in the climate, as—somehow—the ‘already witnessed climate change’, are worrisome, too. For example, average temperature of 2021 in Turkey was 1,4 °C higher than 1981–2010 and 1°C higher than 1991–2020 while the record high temperature (49,1 °C) in the history of Turkey was also measured in 2021 (TSMS, 2022). Yearly precipitation in 2021 was 9% lower than 1991–2020 average (TSMS, 2022); and 2022 precipitation average was 12,1% lower than the same period (TSMS, 2023a). The year 2022 witnessed the record number of extreme meteorological events according to the same report; and 2021 and 2022 reports both indicate an increasing trend in extreme meteorological events in the last 20 years. When all these considered together with the worrisome projections, it is not difficult to foresee many issues for the tourism industry in the future.

The tourism industry is one of the major industries in Turkey, and it is specifically important for the country's economy since the trade deficit has been an issue for years (the Central Bank of the Republic of Turkey, 2023a, 2023b, 2023c, 2023d). Moreover, tourism income constitutes an important proportion of the gross domestic product, and the ratio of tourism income to exports is quite high in Turkey (Association of Turkish Travel Agencies, 2023). Thus, any problem in tourism industry is a threat to Turkey's economy and may result in many other related issues.

Duman and Kozak (2010) indicate sea-sun-sand tourism, historical tourism (including religious tourism), environmental tourism such as adventure and hunting tourism, cultural heritage tourism, thermal tourism, and urban tourism as the primary tourism types in Turkey, although classification of these activities might differ depending on the approach. Moreover, these tourism types inevitably overlap each other. For example, Cappadocia, located in the Central Anatolia, has a rich historical and cultural heritage, and this heritage is both linked and accompanied with unique geological formations. Except for those who have a special interest in a very specific area (such as historical churches), many tourists both visit the historical places and participate in some nature-based activity such as trekking. The classifications are still useful while analyzing the tourism activities for future projections or any other reason. In addition to some major tourism types such as sea-sun-sand tourism, the Ministry of Culture and Tourism lists some others as health and thermal tourism, winter tourism, highland tourism, cave tourism, hunting tourism, congress (event) tourism, golf tourism, yacht tourism, Silk Road tourism, religious tourism, aviation sports tourism, mountaineering tourism, rafting tourism, diving tourism, and ornithology tourism (MCT, 2023c). Turkey's tourism industry is still growing and being further diversified. The diversity in tourism types might complicate any projection but it also provides the tourism industry with some tools for risk distribution and alternative products in case of a crisis or a major change such as climate change.

Adaptation and Mitigation Efforts for Turkey Tourism

As mentioned above, Turkey has officially seven geographical regions. Four of these regions are coastal regions, and the remaining three regions show continental climate characteristics at different levels. Each region is examined under a subtitle in this part. After presenting the climate characteristics and tourism activity of the related region, implications and recommendations for adapting to or minimizing the risks of climate change are presented considering climate projections from the point of tourism industry.

The Mediterranean Region

Climate Characteristics and Tourism Activity

The climate of the Mediterranean Region is characterized by warm and rainy winters and hot and dry summers (Kahraman, 2018; TSMS, 2023b). Climatic projections for the Mediterranean seem worrisome since the average temperatures are already high. MCT's (2022) report also points the extreme meteorological events which have been frequently observed in Antalya in addition to recent bushfires. Although extreme meteorological events are in a rising tendency in all over Turkey, southern parts of the country including the Mediterranean Region have been experiencing these events more frequently (Kelebek et al., 2017). Moreover, all Mediterranean coasts, including those in Turkey, indicate more serious extreme meteorological events in comparison with whole EURO-MED region (Kelebek et al., 2021). Turan et al. (2016) also point the biodiversity issues in the Mediterranean, Aegean, and Black Sea, namely increase in invasive Indo-Pacific species, at least partly due to climate change. Being in the southernmost among these, the Mediterranean might suffer more severely. The Mediterranean Region covers quite a large area, and there are many tourism assets both in the coastal part and mountainous inner parts. Tourism types include cave, highland, mountain, and thermal tourism (Kahraman, 2018). So far, the coastal region has benefited from the climatic conditions for 3S tourism while moderate winters and summer-like spring and autumn climate lengthened the higher season. Tourism investments, most of which are various resort hotels with all-inclusive system, are quite intense in the coastal area. There are also city hotels, which also very usually host holiday-makers, in the larger city centers such as Antalya. In addition, there are some golf resorts; specifically, Belek area in Serik district is popular with its golf resorts. All-inclusive system is usually criticized due to the fact that it somehow prevents the tourists from spending their time out of the hotel (Cevirgen & Unguren, 2009). Thus, the tourists' experience is mostly limited with the hotels they stay. In other words, the hotels might be considered as sub-destinations. 100.406.055 overnight stays occurred in the province of Antalya, being

the most popular destination on the Mediterranean coast of Turkey, in 2022 (MCT, 2023b).

Implications and Recommendations

Since the region is quite large, the destination management efforts should focus on a more even distribution of tourism activities. Especially, travel agencies and tour operators could develop new products for this purpose rather than relying on the conventional consumption patterns. Since there is already a mature tourism market, targeting more tourists will not be suitable for a sustainable way of development. It is not easy to compensate the current mass tourism market but it is possible to limit the development of mass tourism and focus more on niche types of activities. Therefore, new marketing efforts could be made to improve the niche markets while aiming for more income from the mass tourism market without increasing the volume, i.e., increasing the revenue per tourist. This is another reason for rethinking the tourism products in the region since the current concepts are not very cost effective. For example, in 2022, average revenue per tourist was 901 US dollars (the Turkish Statistical Institute, 2023) and the average occupancy rate of the hotels in Turkey was 54.15%, the busiest destinations being Antalya and Istanbul with occupancy rates of 65.12% and 62.59% respectively (MCT, 2023b).

Having that much investment and problem together makes the province of Antalya very susceptible to any sort of crisis. The hotels in Antalya and other coastal parts of the Mediterranean Region could reconsider their concepts for less consumption but it is also a legal issue since there are some criteria for hotel star system regulations (the Official Gazette of the Republic of Turkey, 2023a). Regulations should be revised so that the official criteria do not contradict with the efforts on climate change mitigation and adaptation. There should be more incentives for hotels which aim to transform into an eco-friendly system. A more radical approach would be to oblige all establishments to transform into eco-friendly systems but it might not be legally applicable even if financial resources are sufficient for that sort of a transformation. All-inclusive system could also be regarded as a trigger of excessive consumption, especially food consumption (Çuhadar & Çuhadar, 2017), but it also limits transportation activities which might be interpreted as less CO₂ emissions. However, the current tourism facilities in the region are mostly resort hotels which offer many services to guests; thus, even if they do not apply all-inclusive system, they could still make the guest spend some important amount of time within the establishment. Some more product development efforts for in-hotel services could strengthen these 'sub-destination'-type hotels.

The irrigation issue with golf resorts is particularly important since they consume plenty of water. In a region which is expected to face drought, alternative ways should be sought. For example, rather than conventional grass breeds, the golf courses could use some drought-tolerant alternative vegetation (Çetin & Mansuroğlu, 2018; Shaddox et al., 2022; Watkins et al., 2010) or even some other natural material such as sand which has already uses in golf (Eurosport, 2023). Being a special interest,

technical details of how to convert these golf courses for drought could be studied in detail with golf players and relevant experts such as agricultural engineers so that the golf tourism facilities offer a good experience without consuming too much water. Winter rains, in the short term, might also help if rainwater harvest systems are installed to either facilities or destinations which host many golf resorts such as Belek.

The marine biodiversity issue (Bindoff et al., 2019) might have some more direct impact on diving tourism, by for example decreasing its differentiation capability due to the loss of endemic species, but it is more difficult to estimate the impact on sea-sun-sand tourism [see, e.g., (Demiroglu et al., 2018)]. Nevertheless, any shift in natural composition is directly or indirectly relevant to tourism activities which depend on nature. The indirect but very important impact might be food-related; for example, as fishery and other food supplies from the sea are at risk, the consumption of tourists and the inflationist pressure of tourism industry could cause more problems for the local people's food security. Possessing consumption giants in a negatively changing climate is not a desired situation at all although the business benefits cannot be ignored. However, this sort of destinations should focus on creating more income without increasing the number of tourists. It is, of course, a difficult task but the current trend is far from being sustainable; thus, sooner or later it will create serious issues.

In case of raised sea level, the coastal tourism facilities are likely to be impacted. Some hotels are too close to the shoreline and some are in peninsulas. Those peninsulas are in various sizes and altitudes so the impact might depend on the specific physical conditions. According to the 3621 Coastal Law, there are limitations, despite some exceptions for some tourism, recreation, and security/defense facilities, on making buildings within 100 m distance to the shoreline (the Official Gazette of the Republic of Turkey, 2023b) but previously built hotels are many. Moreover, there is much debate on the use and property rights of the coasts (BBC, 2020; Evrensel, 2018; Haberturk, 2016; Sabah, 2016). First of all, risk levels of the facilities which are very close to shoreline should be evaluated. There are already some scientific methods and actual evaluations for the risk of coastal cities (Simav et al., 2015). Then, using these evaluations, more detailed plans could be made for monitoring, and when possible, relocating, the riskiest facilities.

Another issue related to sea is pollution which seems to be quite worrisome (the Turkish Marine Research Foundation, 2023). Conventional tourism facilities and marine tourism activities constitute a direct or indirect risk of more pollution. Thus, the tourism industry should focus on more eco-friendly ways of operations in this area, too. Water sports and other recreational water activities could be regulated to limit the impact. 'Softer' types of these activities, such as canoeing, could be encouraged rather than those which use more resource such as yachting or cruise tours although the financial appetite is inclined to focus on the latter.

The Aegean Region

Climate Characteristics and Tourism Activity

Technically being part of the Mediterranean, the climate of the Aegean Region is quite similar to the Mediterranean Region except for slightly lower air and sea temperatures (TSMS, 2023b, 2023c). Moreover, extreme meteorological events have occurred relatively more frequently in the Aegean Region, too (Kelebek et al., 2021). Projections indicate an increase in winter precipitation until 2040 and serious temperature increases in summer and spring in the longer term (TSMS, 2015). There are many cultural heritage elements, natural assets, and a few large cities such as İzmir in the Aegean Region. There are many peninsulas and small islands in the region. The tourism industry is not as big as it is in the Mediterranean Region but there is still plenty of tourism activity. Tourism types include 3S, culture/religious tourism, thermal/health tourism, shopping tourism, sports/adventure tourism, events tourism, yachting, and agrotourism (Çoban et al., 2015; GoTurkiye, 2023a; Köksal, 1988). The plentitude of tourism assets has relatively benefited the tourism industry although there is still room for development.

Implications and Recommendations

Not only in the Aegean Region but also in all over Turkey, there are efforts for a more sustainable tourism development (GoTurkiye, 2023c). However, the main characteristics of mass tourism could be the issue especially in case of serious climate change. Thus, the special interest tourism types should be the focus for the Aegean Region and efforts on increasing the number of slow cities, benefiting more from harvest tourism by improving local production, using the rich cultural heritage for creative tourism activities in which the tourists focus on the valuable experience they are to gain by being part of the everyday life could be very useful. The mass tourism activities, on the other hand, could be transformed into a more sustainable, preferably to a carbon neutral or negative, system by the above-mentioned sustainable tourism efforts. The other suggestions for the Mediterranean Region are also useful for the Aegean Region. Specifically, rainwater harvest systems seem even more useful for the Aegean Region due to the expected increase in winter precipitation. In the shorter term, thermal comfort levels especially in the northern parts of the region may not seem worrisome but that should not disillusion the destination managers and the industry from taking precautions since the longer-term projections indicate serious temperature increase. The islands and peninsulas should be monitored for any rise in the sea level and new tourism facilities should not be allowed on the riskier ones. Other tourism activities which do not require serious infrastructure may be still practiced in these areas so that they do not remain idle. Managing the Aegean coast might be more challenging due to the fact that the Aegean coastline is the longest in

the Anatolian peninsula although other factors, such as elevation, are important, too (Simav et al., 2015).

The Black Sea Region

Climate Characteristics and Tourism Activity

The Black Sea region is the most pluvial region in Turkey. Its climate is characterized by relatively cooler summers, warmer winters in the coastal parts, and cold and snowy winters in the higher altitudes; and every season is pluvial to some degree (TSMS, 2008). However, there is some tendency toward being less pluvial in winters recently (Partal & Yavuz, 2020). Moreover, extreme weather events are observed in many coasts of the Black Sea (Kostianaia & Kostianoy, 2021; TSMS, 2023a). Technical measures in 2022 indicate that the regions around Artvin (the easternmost province in the Black Sea Region) and Trabzon (located in the eastern part of the Black Sea Region) suffered drought (TSMS, 2023a) despite the fact that the eastern part of the Black Sea Region is usually more pluvial (TSMS, 2008). Rising sea level is considered as one of the major risks for any coastal region since it is to cause more erosion and floods, thus all four coastal regions of Turkey, namely the Mediterranean, Aegean, Black Sea, and Marmara Regions, are to suffer similar issues (TSMS, 2008). The Black Sea Region does not benefit from the 3S tourism as much as the Aegean and the Mediterranean Regions, and it is not considered as a tourism activity with good potential due to cooler sea, less sunshine, unstable weather conditions, bigger waves, rip currents, and very steep coastal structure which both makes the coastline shorter and causes the sea get suddenly deeper in a short distance from the shoreline (Sezer, 2018; Yeşiltaş et al., 2009). The highlands of the region, especially those in the eastern part, offer many opportunities for tourism activities with their natural wealth such as fauna and flora, scenery, and quality fresh air (Yeşiltaş et al., 2009). Some of these highlands have been declared as tourism centers by the Ministry of Culture and Tourism (MCT, 2023d). The nature of the region offers many opportunities for hunting tourism, mountain tourism, sports tourism, and eco-tourism as also mentioned by Yeşiltaş et al. (2009).

Implications and Recommendations

The Black Sea Region seems to have many advantages with its relatively pluvial climate, thus a relative resilience against drought and other water issues and the natural assets should be the most valuable assets for tourism activities. This relative advantage should not be interpreted as a comfortable future. The natural areas may face a risk of overuse if carrying capacity is miscalculated especially by ignoring the impact of climate change. In order to prevent overuse, the efforts should focus on lengthening the season and distributing the tourism activities as homogeneously

as possible. For highland tourism, the existing infrastructure, such as the traditional highland houses, should be used rather than building new facilities which would further destruct the nature. Water saving activities, such as rainwater harvesting, should be used as the rainfall is still at relatively higher levels. Dialectically, it might be the most difficult action in terms of convincing the policy-makers or even the local people since they are used to the abundance of water.

The Marmara Region

Climate Characteristics and Tourism Activity

The Marmara Region is less pluvial than the Mediterranean and the Black Sea Regions; the precipitation is majorly in winters, and the warmest month is July with an average temperature of 23–24 °C (TSMS, 2023b). Projections on the Marmara Region's climate include temperature increases and precipitation decreases in the shorter term whereas some projections indicate an increase in precipitation in different seasons in the longer term but still an increase in temperatures (TSMS, 2015). Thus, water issues could be expected for the Marmara Region due to higher temperatures, at times less precipitation, more evaporation, and more domestic and industrial consumption. In terms of climate change, the most challenging detail on the Marmara Region is that it is also the region with major production capability. In other words, the Marmara Region is the most industrialized region in Turkey and agricultural production capability is rather high, too (MEUCC, 2023b). Industrialization creates jobs and ultimately the industrialized places become more populated. Pollution resulting from human activity is observed more in the Marmara Region (MEUCC, 2020).

There are two major islands in the north of the Aegean Sea which are officially part of the Marmara Region; namely Bozcaada and Gökçeada. There are also some islands in the Marmara Sea and the largest one of them is Büyükada. Some islands in the Marmara Sea, including Büyükada, have been declared as protected areas (MEUCC, 2021b), and there are already limitations on motorized vehicles on these islands (Akpolat & Kavaz, 2022; Garipağaoğlu & Özcan, 2015). In Büyükada example, locals prefer bicycles and those who are younger than 66 are not allowed to use individual small electric vehicles which used to be very popular among locals before this limitation; as a result, there is some debate on the issue, including the mass transportation facilities, and how to solve it (Anadolu Agency, 2021).

Tourism types in Marmara include 3S tourism, nature tourism, urban tourism, culture tourism, ornithology tourism, thermal tourism, health tourism, harvest tourism, gastronomy tourism, diving tourism, shopping tourism, and ski tourism (MCT, 2023c). Tourism facilities in the Marmara Region include many city hotels such as those in Istanbul as well as resort hotels in vacation-oriented destinations. The highly populated cities are also demand creators for tourism.

Implications and Recommendations

Transforming all facilities into an eco-friendly system requires time and financial resource for the whole region. However, conventional systems are not sustainable at all, and the region is vital for Turkey's economy. Thus, the Marmara Region could be the priority in changing to more eco-friendly methods. Possibly, civil initiatives, rather than governmental incentives or regulations, in the Marmara Region might be more important to achieve all these. In the Marmara Region, the impact-limiting efforts should primarily focus on transportation since this is both vital for any economic activity including tourism.

Regulations might be needed in order to manage climate change or other environmental problems but these steps should be taken considering all stakeholders. The structure of mass transportation could be reconsidered, for example in Büyükada case mentioned above, by also benefiting from recent technological developments such as autonomous vehicles. Considering the risks, the islands in the Marmara and Aegean Seas might need a specialized plan against climate change due to their unique characteristics.

Precipitation issues might specifically force ski destinations to focus more on other types of tourist profile such as trekking tourists; and those big cities might be still demand creators for this type of activities. Permaculture projects could specifically be helpful in highly populated areas since they encourage eco-friendly and on-location production of food while also providing opportunities for tourism industry such as harvest tourism in cities.

The Central Anatolia Region

Climate Characteristics and Tourism Activity

The Central Anatolia's climate is characterized by cold winters and hot and dry summers. The temperatures are not as high as the Mediterranean but being less pluvial makes the region more prone to drought. The average temperature of the coldest month (January) is $-0,7^{\circ}\text{C}$ while the warmest one (July) has an average of 22°C . Most of the precipitation occur in winter and spring (TSMS, 2023c). As a recent worrisome measure, the average temperature in January 2023 was $1,7^{\circ}\text{C}$ which is higher than the long-term average (TSMS, 2023d). There are big cities in the region, such as Ankara, which already consume plenty of water. Ankara's water is supplied by 8 different dams (Ankara Water and Sewage Department, 2023), which is already difficult to manage. Projections indicate serious decrease in precipitation especially in the longer term and temperature increases (TSMS, 2015), which together translates into water issues. Tourism activities in the Central Anatolia include culture/religion tourism, congress/event tourism, sports tourism including winter sports, highland tourism, eco-tourism (Güngör, 2018), and shopping tourism (the Municipality of Ankara, 2014). Heterogeneity in the distribution of tourism activities in the Central Anatolia

is another issue and the complexity of the problems enhances when combined with vulnerability. For example, there are some destinations, such as Cappadocia, which are both already susceptible to erosion (Yılmaz et al., 2009) and host many tourists (MCT, 2023b). Similar to other regions in Turkey, the tourism assets, on the other hand, are scattered well throughout the Central Anatolia; thus, there is potential for a more homogenous distribution of tourism activities.

Implications and Recommendations

Considering the precipitation and temperature issues, the water issues should be the primary concern in the region. Rainwater harvest could be useful, especially in larger cities, but probably insufficient. Deforested lands such as anthropogenic steppes in the region should be reforested and some more delicate plan might be needed to limit evaporation and encourage precipitation in the natural way. The forests to be planted could be used for agricultural production such as fruit and/or honey production and for eco-tourism activities so that sustainability efforts do not clash with commercial interests. Moreover, vineyards, which are very common in the region and quite drought-tolerant, offer a good opportunity for harvest tourism activities. There are already some efforts on developing drought-tolerant variations of several agricultural products (the Ministry of Agriculture and Forestry (MAF), 2022), which means more potential for similar activities. These efforts should be combined with relevant tourism development efforts. In other words, those agricultural activities can be used for eco-tourism, harvest tourism, and gastronomy tourism purposes. Same efforts might help to limit erosion impact.

The consumption issue, especially water consumption, of bigger cities such as Ankara could trigger discussions on the benefit/impact balance of tourism activities as the production capability becomes more under pressure. Considering both the uneven distribution of tourism activities and consumption aspect of tourism activity, while providing incentives for creating more destinations in less popular areas with good tourism potential, some regulations on limiting the number of tourists in the busiest destinations might be useful for distributing tourism activities all around the region. The transportation methods, as well, should be reconsidered and more eco-friendly ways of transportation such as cycling should be encouraged. The southern parts of the region offer good potential for solar energy (the Ministry of Energy and Natural Resources (MENR), 2023); thus, tourism industry, especially the larger facilities, should benefit from this potential and limit their contribution to carbon emissions.

The Southeastern Anatolia Region

Climate Characteristics and Tourism Activity

The Southeastern Anatolia is thought to suffer more from climate change due to drought issues. The region's climate is characterized by warm winters and hot summers. The average yearly precipitation is 565.7 mm, and only 2.6% of this precipitation occurs in summer which, in combination with high summer temperatures and already lower average of relative humidity (53.6%), translates into a long summer drought (TSMS, 2023c). Climate projections for the region indicate less precipitation and higher temperatures (TSMS, 2015) which look quite worrisome for the already dry region. Thus, water issues are even more difficult to solve, and the region seems more vulnerable than the others. Thermal comfort levels could be another issue especially in summer. Tourism activities in the Southeastern Anatolia Region include culture/religion tourism, nature tourism, mountain tourism, eco-tourism, gastronomy tourism, and health/thermal tourism (Çelik, 2018; GoTurkiye, 2023d). The biggest strength is, arguably, the rich history of the region since it is partly in Mesopotamia. Two major rivers are Dicle (Tigris) and Fırat (Euphrates) which also characterize the Mesopotamia region. There are slow cities in the region, such as Halfeti (GoTurkiye, 2023e), which reflect the region's potential for sustainable tourism.

Implications and Recommendations

Since water issue is more serious in the Southeastern Anatolia, nature-healing projects should focus on the sustainability of Dicle (Tigris) and Fırat (Euphrates) rivers if it is technically possible. Although rainwater harvest systems could help to some extent, more proactive efforts are needed. Reforestation efforts could be very helpful for this region, too; however, more drought resistant trees should be chosen probably in combination with some other vegetation which can resist dry conditions and shade the soil to minimize evaporation. Number of slow cities should be increased so that a lower impact tourism system develops. Since the region has good potential for solar energy (MENR, 2023), tourism facilities, themselves, could also generate the energy they need. Urbanization in the region could also be reconsidered and the buildings such as Harran Conical Houses, which are naturally insulated against cold and hot, (GoTurkiye, 2023f) should inspire urbanization plans. Thermal comfort risks could be eliminated to some extent by creating new tourism facilities in a similar way and developing indoor activities. The outdoor activities, on the other hand, are more at risk in summer, then the tourism industry should focus on other seasons for that type of activities. Gastronomy of the region is particularly important but the changing climate has the potential to impact on it through changing agricultural products. Some products are already drought-tolerant but irrigation issues might impact other agricultural products. Moreover, the new drought-tolerant variations of local agricultural products could easily change the taste of local food. For

this reason, gastronomy tourism could focus on developing new products according to new conditions. In other words, drought-tolerant agriculture will inevitably create a different gastronomic variety, and tourism industry could benefit from this by proactively developing new products rather than waiting to be impacted by some unpredictable gastronomic culture.

The Eastern Anatolia Region

Climate Characteristics and Tourism Activity

The Eastern Anatolia Region's climate is characterized by quite cold and long winters and cooler summers except for the lower-altitude areas (TSMS, 2023c). The average elevation is 1829 m which is quite higher than Turkey's average elevation (1141 m); moreover, higher-altitude areas are abundant (Elibüyük & Yılmaz, 2010). The coldest month January has an average temperature of $-4,2^{\circ}\text{C}$ whereas the warmest month July has an average of $24,2^{\circ}\text{C}$, and average yearly precipitation is 579.4 mm only 9.5% of which occurs in summer whereas the most precipitation occurs in winter and spring (TSMS, 2023c). Projections indicate a decrease in precipitation, especially in summer precipitation which is already low, and an increase in temperatures (TSMS, 2015). These all mean that water issues are to become quite challenging in summer and autumn. On the other hand, the high elevation seems to be a relative advantage in a warming planet.

Tourism activities in the region include mountain tourism, highland tourism, winter tourism, thermal tourism, health tourism, botanic tourism, water sports tourism, culture tourism (Özgen, 2010), religion tourism, and gastronomy tourism (GoTurkiye, 2023d). The Eastern Anatolia is relatively less industrialized, and there is a good amount of organic agricultural production (Merdan & Kaya, 2013; MAF, 2023). As expected from a less industrialized region, the cities are relatively less populated (the Ministry of Interior, 2021). Although there are endemic plants in all over Turkey (Ankara Commodity Exchange, 2012), the endemic plants in the Eastern Anatolia provide some more opportunity for tourism activities (Özgen, 2010) partly due to less spoiled nature. The geological formations also constitute a valuable asset for tourism (Özgen, 2010) but the erosion issue could be a problem especially in the long term due to climate change.

Implications and Recommendations

The combination of good amount of organic agricultural production and less industrialization provides opportunities for more eco-friendly ways of tourism development. For example, organic agriculture could be used for improving harvest tourism. In this less populated region, domestic consumption may provide more room for tourists'

consumption especially if tourism development is well-planned based on local agricultural production. The endemic plants and less spoiled nature could be used for tourism purposes. However, this type of tourism activities should be done in small groups; thus, niche markets, such as those who aim to photograph these plants, could be focused. Focusing on niche markets and operating with smaller groups could also prevent challenges of transportation in the mountainous Eastern Anatolia Region. Alternatively, botanic parks could be created for the endemic plants to facilitate preservation efforts.

Considering the vulnerability and value of geological formations of the region, declaring new appropriate areas as geoparks could be very useful both for preservation and marketing. Projects on minimizing erosion in the region are needed especially for preserving the primary geological assets. Forestation could be useful for this and also for reconstructing the natural water cycle. Some innovative rainwater harvest system could be developed in higher-altitude, thus cooler, areas. All carrying capacity issues should be taken very seriously so that the region does not become a mass tourism destination. From this point of view, marketing efforts should focus on operability without spoiling the nature in any way. In other words, promotion of tourism activities should not focus on attracting more tourists but operating sustainably. Thus, niche tourism activities could be the main focus of the region. Avoiding to grow mass tourism activities in the Eastern Anatolia might be the key for a more sustainable tourism development and a wiser preparation of tourism system both for adapting to and retarding climate change issues especially in the long term. Building new accommodation facilities do not make sense from this point of view; thus, home-stays should be encouraged.

The geographical regions in Turkey show distinct characteristics, and this is the reason and criteria for the official classification of these regions. Although the variety within each region is not ignored, this chapter has also focused on the main characteristics of the regions while analyzing risks and developing possible adaptation/mitigation strategies (Table 9.1). However, some territories close to the boundaries of the regions show a combination of the relevant regions' climate. For example, the province of Malatya reflects a combination of the Eastern Anatolia, Central Anatolia, Mediterranean, and Southeastern Anatolia climate characteristics (Malatya Directorate for Culture and Tourism, 2023). Thus, inter-regional coordination is vital, and tourism experts should work together with the other relevant experts. Destination management bodies should also cooperate with each other as well as other relevant institutions such as the Ministry of Agriculture and Forestry and the Ministry of Environment, Urbanization, and Climate Change.

Preventing the cities from occupying more land and developing smart cities could be useful for minimizing climate change issues. Smart cities can, by especially using 'smarter' technology as their name suggests, develop unique solutions for water issues, consumption issues, waste management, transportation, and other infrastructure. This could result in the creation of smart destinations not only for urban environments but also for rural areas.

Table 9.1 Climate change adaptation/mitigation strategies for Turkey tourism

Region	Major issues/risks	Adaptation/mitigation strategies
The Mediterranean Region	Higher temperatures Marine biodiversity issues Overconsumption of tourism industry Extreme meteorological events Sea level increase	Focus on niche tourism for new product development Focus on higher income from mass tourism without increasing tourist number Develop new in-hotel services Rainwater harvest for large tourism facilities Rethink overconsuming and polluting tourism activities Monitor sea level/develop detailed future plans
The Aegean Region	Higher temperatures Water issues Sea level increase	Focus on special interest tourism Increase the number of slow cities Harvest tourism through local production Creative tourism through cultural heritage Gradual transformation of the current mass tourism industry to a carbon neutral/carbon negative one Apply only the tourism activities which require no/little infrastructure on the islands and peninsulas Rainwater harvest Monitor sea level/develop detailed future plans
The Black Sea Region	Extreme meteorological events Unstable weather Relative drought despite being naturally pluvial Sea level increase	Benefit from highlands' tourism potential without building new infrastructure Focus on special interest tourism Focus on lengthening the season and distributing the tourism activities homogeneously Be very strict with carrying capacity issues Take drought issue seriously despite being still pluvial and act proactively for systems such as rainwater harvest Monitor sea level/develop detailed future plans

(continued)

Table 9.1 (continued)

Region	Major issues/risks	Adaptation/mitigation strategies
The Marmara Region	High levels of domestic and industrial consumption Pollution Water issues Higher temperatures Sea level increase	Civil initiative in changing to more eco-friendly methods in all industries Impact-limiting efforts which primarily focus on transportation Include all stakeholders for solving the issues in a more sustainable way without decreasing the life quality/comfort Develop permaculture systems in the cities and benefit from them also for tourism Monitor sea level/develop detailed future plans especially for the islands
The Central Anatolia Region	Higher temperatures Water issues with relatively higher risk of drought Relatively high domestic consumption Erosion of some geological assets	Focus primarily on water issues Reforest anthropogenic steppes Adopt rainwater harvest systems in large cities for the short-term solution but focus on natural encouragement of precipitation in the long term Benefit from the reforested land economically Benefit from the local drought resilient agricultural products for tourism Limit the number of visitors in the already-busy destinations and encourage other destinations with good potential Develop and encourage eco-friendly ways of transportation Benefit from the solar energy potential especially in larger tourism facilities

(continued)

Table 9.1 (continued)

Region	Major issues/risks	Adaptation/mitigation strategies
The Southeastern Anatolia Region	Higher temperatures with relatively higher threat against thermal comfort levels Water issues with relatively higher risk of drought	Focus primarily on nature-healing projects Reforest appropriate land keeping loyal to detailed technical plans Increase the number of slow cities and focus on low-impact tourism models Benefit from the solar energy potential domestically and industrially Adopt naturally insulated local building examples for urbanization and tourism facilities; develop indoor activities accordingly Reschedule outdoor tourism activities considering thermal comfort levels Develop alternative gastronomy products based on drought-tolerant agricultural products
The Eastern Anatolia Region	Relatively lower risk of higher temperature impacts Water issues especially in summer and autumn Vulnerability of geological assets in the long term	Benefit from organic agriculture activities for tourism Base new tourism products on local agricultural products Value the advantage of less industrialization/urbanization and do not develop new mass tourism activities Monitor carrying capacity and focus on not exceeding it for not losing the relative advantages Encourage alternative accommodation such as home-stays, rather than building new facilities Focus on niche markets and operate with smaller groups while benefiting from endemic plants and unspoiled nature for tourism purposes Direct promotion efforts with a focus on operability and sustainability rather than the attraction of more visitors Declare new appropriate areas as geoparks Develop erosion-limiting/preventing and natural water cycle healing projects such as reforestation Seek innovative solutions for rainwater harvesting in higher-altitude areas

Conclusion

There are preliminary steps which address climate change and tourism relation in Turkey (MCT, 2023e; 2023f) but the issue should be considered as an emergency and further actions should be taken. The complexity of economic issues, use of natural resource, and the significance of the tourism industry in Turkey make it more difficult to manage the climate change but the eco-friendly technological advancements and eco-friendly global trends could somehow help to resolve the conflict between economical gain and nature preservation. Promotional activities fostering climate change resilience applications could help to prevent the doomy outlook and ignorance of the significance of climate change from undermining climate change management efforts. Since the issue of climate change is, in fact, a global problem, cooperation seems to be the key for successful adaptation/mitigation efforts. This cooperation should not be limited at the national level; in other words, international cooperation is vital.

Turkey's climatic variety and tourism industry's current significance in the country's economy make it more challenging to reform tourism activities considering climate change. The biggest risk might be the preference of immediate economic gain rather than focusing on sustainability. On the other hand, the Black Sea Region and the Eastern Anatolia Region seem to be more promising destinations due to their relatively less industrialized territory, more focus on niche tourism types, and slightly more positive outlook than the other regions in terms of climate change. Thus, Turkey may primarily focus on climate change mitigation in 5 regions (the Southeastern Anatolia, Central Anatolia, Mediterranean, Aegean, and Marmara) and adaptation in 2 regions (the Eastern Anatolia and the Black Sea). After some major advancement, the mitigation efforts should ideally be accompanied with adaptation efforts.

Working with stakeholders, as it is in all sustainability efforts, is also key for climate challenges. Turkey has a wide variety of governing institutions such as relevant ministries and the directorates as well as professional organizations such as travel agency and hotel unions. In such an abundance of formal organizations, local people should not be ignored as they might be the most important part of climate change efforts and even some heritage of Turkish nomadic culture might inspire an eco-friendly way of doing things both in daily life and commercial settings.

In case of a failure in climate change adaptation and mitigation for any reason, the businesses should be ready for operating in the most undesirable conditions. In other words, single businesses should be aware that climate change will still be a threat despite every effort; thus, they should have plans for the worst scenarios although a single business is likely to have very limited resources. For example, a small-scale hotel should plan its water management and energy systems and develop some innovative products such as in-hotel entertainments even if it operates in a vibrant destination full of alternative activities. A local travel agency might prefer to cooperate with hotels and develop unique climate-resilient activity tours.

Lastly, climate change is a broad-scale issue and even a threat to human beings' existence. Although it constitutes many threats, it may also create some encouragement for any unlikely cooperation between countries, institutions, businesses, and people due to the fact that it is a 'common enemy'. Thus, it might even result in a more cooperative global culture and more sustainable approaches to economy. For example, today's 'ideal climate' regions could cooperate with those already suffer from harsh climatic conditions such as extreme heat. While one region could learn how to operate in a worse climate, the other one could take the opportunity for a potential promotional cooperation; or a two-destination tour for the visitors might benefit both sides. In this example, the destinations could also send more tourists to each other while learning from each other. Being in a similar climate and facing similar risks, the Mediterranean countries could also work together especially for active mitigation efforts such as reforestation. Any other cooperation might provide a starting point for a more cooperated world against climate change.

The main limitation of this study is that it relies on literature and future projections which are already limited in terms of findings due to the fact that climate change topics are historically new. It is not to reject the scientific value of those studies but the accumulation of knowledge takes time. Future projections are also only projections and despite being of great significance and value, they are susceptible to error. This is also reflected as a limitation of this chapter since the projections are considered while evaluating the risks and developing recommendations. Lastly, the endless details on the climatic characteristics, economical structure, and other factors of each region are not possible to examine in a single chapter; thus, the focus is given to the major properties, which could be considered as another limitation.

The future research might primarily focus on the aforementioned cooperation issue and examine some global or inter-regional factors of a successful cooperation or the main barriers against it. Since the climate and tourism are different areas of specialization, the researchers from these branches could make unique contributions with collaborative studies. These studies could further clarify the link between the tourism industry and the major climate related issues such as drought and other water issues, extreme heat and other extreme meteorological events, and coastline issues. Stakeholder focused studies are also recommended since climate change is one of the broadest—in other words major—issues and cooperation with all stakeholders is crucial.

References

- Akpolat, Y., & Kavaz, İ. (2022). Trafik Sosyolojisi Bağlamında Bir İnceleme: Büyükada'da Yaşayanlar [An examination in the context of traffic sociology: day trippers and rental bicycles through the eyes of residents living in Büyükada]. *Gözünden Günübirlik Ziyaretçiler ve Kiralık Bisikletler. Dokuz Eylül Üniversitesi Edebiyat Fakültesi Dergisi*, 9(1), 52–89.
- Amelung, B., & Viner, D. (2007). The vulnerability to climate change of the Mediterranean as a tourist destination. In B. Amelung, K. Błażejczyk, & A. Matzarakis (Eds.), *Climate change*

- and tourism—assessment and coping strategies (pp. 41–54). Institute of Geography and Spatial Organization. Polish Academy of Sciences.
- Anadolu Agency. (2021). *Adalar halkı akülü araç yasağına yeni düzenleme istiyor* [The islanders demand new regulations regarding the ban on electric vehicles]. <https://www.aa.com.tr/tr/gundem/adalar-halki-akulu-arac-yasagina-yeni-duzenleme-istiyor/2380061>
- Ankara Commodity Exchange. (2012). *Türkiye’de endemik bitki türler* [Endemic plant species in Turkey]. https://www.ankaratb.org.tr/lib_upload/128_T%C3%BCrkiye%E2%80%99de%20Endemik%20Bitki%20T%C3%BCrleri_23_07_2012.pdf
- Ankara Water and Sewage Management Department, ASKİ. (2023). *Water Resources*. <https://www.aski.gov.tr/TR/ICERIK/Su-Kaynaklarimiz/32>
- Association of Turkish Travel Agencies. (2023). *Proportion of tourism income in gross domestic income and ratio of tourism income to exports*. <https://www.tursab.org.tr/istatistikler-icerik/gsmh-payi>
- BBC. (2020). *Plajlarda ücret alınması yasal mı, tüketicilerin plaj kullanımıyla ilgili hakları neler?* [Is it legal to charge fees on beaches, what are consumers’ rights regarding beach use?]. <https://www.bbc.com/turkce/haberler-turkiye-53951704>
- Bigano, A., Goria, A., Hamilton, J., & Tol, R. S. (2005). The effect of climate change and extreme weather events on tourism. In A. Lanza, A. Markandya, & F. Pigliaru (Eds.), *The economics of tourism and sustainable development* (pp. 173–190). Edward Elgar.
- Bindoff, N. L., Cheung, W. W. L., Kairo, J. G., Arístegui, J., Guinder, V. A., Hallberg, R., Hilmi, N., Jiao, N., Karim, M. S., Levin, L., O’Donoghue, S., Purca Cuicapusa, S. R., Rinkevich, B., Suga, T., Tagliabue, A., & Williamson P. (2019) Changing ocean, marine ecosystems, and dependent communities. In H.-O. Pörtner, D. C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegria, M. Nicolai, A. Okem, J. Petzold, B. Rama, & N. M. Weyer (Eds.). *IPCC special report on the ocean and cryosphere in a changing climate*. Cambridge University Press, pp. 447–587. <https://doi.org/10.1017/9781009157964.007>
- Bows, A., Anderson, K., & Peeters, P. (2009). Air transport, climate change and tourism. *Tourism and Hospitality Planning & Development*, 6(1), 7–20. <https://doi.org/10.1080/14790530902847012>
- Central Bank of the Republic of Turkey. (2023). *Current account*. <https://evds2.tcmb.gov.tr/index.php?evds/portlet/MalIgFReIbM%3D/en>
- Ceviren, A., & Unguren, E. (2009). Yöre esnafının her şey dahil sistemine yönelik tutumları [The attitudes of local merchants towards the all-inclusive system]. *Ege Academic Review*, 9(2), 637–658.
- Clark, G. (2005). Secondary data. In R. Flowerdew & D. Martin (Eds.), *Methods in human geography: A guide for students doing a research project* (2nd ed., pp. 57–74). Pearson. <https://doi.org/10.4324/9781315837277>
- CografyaHarita. (2023a). *Regions map of Turkey*. http://cografyaharita.com/haritalarim/4mturkiye_cografi_bolgeleri_haritasi.png
- CografyaHarita. (2023b). *Various climatic maps of Turkey*. http://cografyaharita.com/turkiye_i_klim_haritalari.html
- Çalışkan, O. (2011). Nevşehir’ın İklim ve Canlı İkliminin Turizm Açısından Değerlendirilmesi [Evaluation of Nevşehir’s climate and living climate from a tourism perspective]. *Marmara Coğrafya Dergisi*, 24, 370–381.
- Çalışkan, O., & Matzarakis, A. (2012). The climate and bioclimate of Nevşehir from the perspective of tourism. In C. G. Helmis & P. T. Nastos (Eds.), *Advances in meteorology, climatology and atmospheric physics* (pp. 397–402). Springer Atmospheric Sciences Springer-Verlag Berlin Heidelberg. https://doi.org/10.1007/978-3-642-29172-2_56
- Çelik, S. (2018). Güneydoğu Anadolu Bölgesi’nin turizm coğrafyası [The tourism geography of the Southeastern Anatolia region]. In Ö. Sertkaya Doğan & E. Duran (Eds.), *Türkiye Turizm Coğrafyası* (pp. 543–580). Paradigma Akademi.
- Çetin, N., & Mansuroğlu, S. (2018). Akdeniz koşullarında kurakçıl peyzaj düzenlemelerinde kullanılabilecek bitki türlerinin belirlenmesi [Utilization of Xeriscaping in Mediterranean

- conditions. Determination of plant species: Example of Antalya/Konyaaltı]. Antalya/Konyaaltı örneği. *Ege Üniversitesi Ziraat Fakültesi Dergisi*, 55(1), 11–18. <https://doi.org/10.20289/zfd.erg.390690>
- Çoban, G., Avcıkurt, C., & Özbek, V. (2015). Midilli'den Ayvalık'a gelen turistlerin alışveriş tercihlerinin ve alışverişten memnuniyet düzeylerinin belirlenmesine yönelik bir araştırma [A study on determining the shopping preferences and satisfaction levels of tourists arriving from Lesbos to Ayvalık]. *International Journal of Economic & Administrative Studies*, 8(15).
- Çuhadar, M., & Çuhadar, Y. (2017). Konaklama işletmelerinde herşey dahil sisteminin yiyecek içecek yönetimi üzerine etkileri: Bodrum örneği [The effects of the all-inclusive system on food and beverage management in accommodation establishments: The case of Bodrum]. *Journal of Tourism and Gastronomy Studies*, 5(4), 439, 453. <https://doi.org/10.21325/jotags.2017.159>
- Demiroglu, O. C., Akbas, A., Turp, M. T., Ozturk, T., An, N., & Kurnaz, M. L. (2018). Case study Turkey: Climate change and coastal tourism: Impacts of climate change on the Turquoise Coast. In A. Jones & M. Phillips (Eds.), *Global climate change and coastal tourism: Recognizing problems, managing solutions and future expectations* (pp. 247–262). CABI.
- Demiroglu, O. C., Lundmark, L., Saarinen, J., & Müller, D. K. (2019). The last resort? Ski tourism and climate change in Arctic Sweden. *Journal of Tourism Futures*, 6(1), 91–101. <https://doi.org/10.1108/JTF-05-2019-0046>
- Duman, T., & Kozak, M. (2010). The Turkish tourism product: Differentiation and competitiveness. *Anatolia*, 21(1), 89–106. <https://doi.org/10.1080/13032917.2010.9687092>
- Elilibüyük, M., & Yılmaz, E. (2010). Türkiye'nin coğrafi bölge ve bölümlerine göre yükselti basamakları ve eğim grupları [Elevation levels and slope groups according to the geographical regions and subdivisions of Turkey]. *Coğrafi Bilimler Dergisi*, 8(1), 27–56. https://doi.org/10.1501/Cogbil_0000000104
- Eurosport. (2023). *Golfe Giriş #101*. https://www.eurosport.com.tr/golf/golfe-giris-101_sto8058825/story.shtml
- Evrensel. (2018). *Sahiller halkın kullanımına kapatılamaz!* [Beaches cannot be closed to public use!]. <https://www.evrensel.net/haber/360109/sahiller-halkin-kullanimina-kapatilamaz>
- Garipağaoğlu, N., & Özcan, S. (2015). İstanbul Adaları'nda Beşeri Ortam Koşullarına Ait Sorunlar ve Yönetimi. [Human environment conditions and management issues in the islands of İstanbul]. *Marmara Coğrafya Dergisi*, (32), 171–195. <https://doi.org/10.14781/mcd.83208>
- GoTürkiye. (2023a). *Türk Aegean*. https://aegean.goturkiye.com/homepage?_gl=1*1g6p9c9*_ga*MTMyODA4MDc2NS4xNjc5NjU5NDY4*_ga_5PSZPVK8NK*MTY3OTY1OTQ2OC4xLjEuMTY3OTY1OTQ3Ny4wLjAuMA
- GoTürkiye. (2023b). *Mediterranean*. https://mediterranean.goturkiye.com/homepage?_gl=1*18oz0su*_ga*MTc5MzQxNjMzOC4xNjg5MzI3ODI0*_ga_9HP46EL2MV*MTY4OTMyNzgyNC4xLjEuMTY4OTMyNzk4NC41OS4wLjA.*_ga_5PSZPVK8NK*MTY4OTMyNzgyNC4xLjEuMTY4OTMyNzk4NC4wLjAuMA
- GoTürkiye. (2023c). *Türkiye's sustainable tourism program*. <https://goturkiye.com/turkiyes-sustainable-tourism-program?pageIndex=0>
- GoTürkiye. (2023d). *Homepage*. <https://goturkiye.com/>
- GoTürkiye. (2023e). *Halfeti*. <https://goturkiye.com/halfeti>
- GoTürkiye. (2023f). *Şanlıurfa*. <https://sanliurfa.goturkiye.com/touch>
- Governorship of İstanbul, Republic of Turkey. (2023). *Türkiye'nin Ticaret, İş, Yatırım, Finans ve Turizm Başkenti: İstanbul* [The trade, business, investment, finance, and tourism capital of Turkey: İstanbul]. <http://www.istanbul.gov.tr/turkiyenin-ticaret-is-yatirim-finans-ve-turizm-baskenti-istanbul>
- Governorship of Yozgat, Republic of Turkey. (2023). *Basic indicators of culture and tourism (including tourism assets)*, 2018. <http://yozgat.gov.tr/kultur-turizm-verileri>
- Gössling, S., Balas, M., Mayer, M., & Sun, Y. Y. (2023). A review of tourism and climate change mitigation: The scales, scopes, stakeholders and strategies of carbon management. *Tourism Management*, 95, 104681. <https://doi.org/10.1016/j.tourman.2022.104681>

- Güngör, Ş. (2018). İç Anadolu Bölgesi'nin turizm coğrafyası [The Tourism Geography of the Central Anatolia Region]. In Ö. Sertkaya Doğan & E. Duran (Eds.), *Türkiye Turizm Coğrafyası* (pp. 501–541). Paradigma Akademi.
- Habertürk. (2016). *Kıyılar otellerin işgali altında* [The coasts are under occupation by hotels]. <https://www.haberturk.com/ekonomi/is-yasam/haber/1258990-kiyilar-otellerin-igali-altinda>
- Kahraman, M. (2018). Akdeniz Bölgesi'nin turizm coğrafyası [The tourism geography of the Mediterranean Region]. In Ö. Sertkaya Doğan & E. Duran (Eds.), *Türkiye Turizm Coğrafyası* (pp. 413–432). Paradigma Akademi.
- Kelebek, M. B., Batıbeniz, F., & Önel, B. (2017). Analysis of climate extremes index over Turkey. In O. Şen & C. Kahya (Eds.), *The 8th atmospheric sciences symposium ATMOS2017, November 01–04, 2017*, (pp. 536–539.). Istanbul, Turkey.
- Kelebek, M. B., Batıbeniz, F., & Önel, B. (2021). Exposure assessment of climate extremes over the Europe-Mediterranean Region. *Atmosphere*, 12(5), 633–655. <https://doi.org/10.3390/atmos12050633>
- Kostianaia, E. A., & Kostianoy, A. G. (2021). Regional climate change impact on coastal tourism: A case study for the black sea coast of Russia. *Hydrology*, 8(3), 133. <https://doi.org/10.3390/hydrology8030133>
- Köksal, A. (1988). Ege Bölgesinin turizm coğrafyası [The tourism geography of the Aegean Region]. *Ankara Üniversitesi Dil Ve Tarih-Coğrafya Fakültesi Dergisi*, 32(1–2), 57–61.
- Lopes, H., Remoaldo, P., Silva, M., Ribeiro, V., & Martín-Vide, J. (2021). Climate in tourism's research agenda: Future directions based on literature review. *Boletín de la Asociación de Geógrafos Españoles* (90). <https://doi.org/10.21138/bage.3116>
- Lopes, H. S., Remoaldo, P. C., Ribeiro, V., & Martín-Vide, J. (2022). Pathways for adapting tourism to climate change in an urban destination—Evidences based on thermal conditions for the Porto Metropolitan Area (Portugal). *Journal of Environmental Management*, 315, 115161. <https://doi.org/10.1016/j.jenvman.2022.115161>
- Malatya Directorate for Culture and Tourism. (2023). *Climate and vegetation*. <https://malatya.ktb.gov.tr/TR-58266/iklim-ve-bitki-ortusu.html>
- Merdan, K., & Kaya, V. (2013). Türkiye'deki organik tarımın ekonomik analizi [Economic analysis of organic farming in Turkey]. *Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 17(3), 239–252.
- Ministry of Agriculture and Forestry, Republic of Turkey. (2022a). *New drought plan in agriculture*. <https://www.tarimorman.gov.tr/Haber/5504/Tarimda-Yeni-Kuraklik-Plani>
- Ministry of Agriculture and Forestry, Republic of Turkey. (2023a). *Organic agriculture statistics*. <https://www.tarimorman.gov.tr/Konular/Bitkisel-Uretim/Organik-Tarim/Istatistikler>
- Ministry of Culture and Tourism, Republic of Turkey. (2022b). *Research report on defining climate change-adaptive planning principles in tourism areas*. <https://yigm.ktb.gov.tr/Eklenti/109193,turizm-alanlarinda-iklim-degisikligine-uyumlu-mekansal-planlama-ilkelerinin-belirlenmesi-raporu.pdf?0>
- Ministry of Culture and Tourism, Republic of Turkey. (2023a). *Tourism statistics*. <https://yigm.ktb.gov.tr/TR-9851/turizm-istatistikleri.html>
- Ministry of Culture and Tourism, Republic of Turkey. (2023b). *Accommodation Statistics, 2022*. <https://yigm.ktb.gov.tr/TR-201121/isletme-bakanlik-belgeli-tesis-konaklama-istatistikleri.html>
- Ministry of Culture and Tourism, Republic of Turkey. (2023c). *Tourism*. <https://www.ktb.gov.tr/TR-96268/turizm.html>
- Ministry of Culture and Tourism, Republic of Turkey. (2023d). *The list of tourism centers and culture & tourism protection & development centers*. <https://yigm.ktb.gov.tr/Eklenti/111188,tmliste23022023.xlsx.xlsx?0>
- Ministry of Culture and Tourism, Republic of Turkey. (2023e). *Research report on defining the conceptual framework of climate change and tourism relation at national level*. <https://yigm.ktb.gov.tr/Eklenti/109192,iklim-degisikligi-ve-turizm-iliskilerinin-ulusal-olcekte-kavramsal-ercevesinin-belirlenmesi-arastirma-raporu-2022pdf.pdf?0>

- Ministry of Culture and Tourism, Republic of Turkey. (2023f). Report on defining the principles of climate change-adapted spatial planning in tourism destinations. <https://yigm.ktb.gov.tr/Eklenti/109193,turizm-alanlarinda-iklim-degisikligine-uyumlu-mekansal-planlama-ilkelerinin-belirlenmesi-raporupdf.pdf?0>
- Ministry of Energy and Natural Resources, Republic of Turkey. (2023). *Solar energy*. <https://enerji.gov.tr/bilgi-merkezi-enerji-gunes>
- Ministry of Environment, Urbanization, and Climate Change, Republic of Turkey. (2020). *The evaluation report on Turkey's environmental problems and priorities*. The Directorate General of Environmental Impact Assessment, Permit, and Inspection. https://webdosya.csb.gov.tr/db/ced/icerikler/tu-rk-yeccevresorunlariveoncel-kler-_2020-20210401124420.pdf
- Ministry of Environment, Urbanization, and Climate Change, Republic of Turkey. (2021a). *Environmental indicators*. https://webdosya.csb.gov.tr/db/environmentalindicators/haberler/csidb_cevresel_gostergeler_2022en_31agustos-20221007135859.pdf
- Ministry of Environment, Urbanization, and Climate Change, Republic of Turkey. (2021b). *The declaration of Marmara sea and islands as special environmental protection zone*. <https://tvk.csb.gov.tr/marmara-denizi-ve-adalar-ozel-cevre-koruma-bolgesi-olarak-ilani-duyuru-421209>
- Ministry of Environment, Urbanization, and Climate Change, Republic of Turkey. (2023a). *Protected coastline length*. <https://cevreselgostergeler.csb.gov.tr/korunan-kiyi-uzunlugu-i-85779>
- Ministry of Environment, Urbanization, and Climate Change, Republic of Turkey. (2023b). *The geographical properties of Marmara Region*. <https://mthmm.csb.gov.tr/bolgemiz-i-85694>
- Ministry of Interior, Republic of Turkey. (2021). *Population map of Turkey*. <https://www.icisleri.gov.tr/turkiyenin-nufus-haritasi-10072021>
- Municipality of Ankara. (2014). *3rd shopping fest starts on June 6th*. <https://www.ankara.bel.tr/haberler/3-shopping-fest-6-haziranda-baslayacak-5972>
- NASA. (2010). *Global Warming*. <https://earthobservatory.nasa.gov/features/GlobalWarming>
- NASA. (2023). *Global warming vs. climate change*. <https://climate.nasa.gov/global-warming-vs-climate-change/>
- Ngxongo, N. A. (2021). The impact of climate change on visitor destination selection: A case study of the Central Drakensberg Region in KwaZulu-Natal. *Jambá: Journal of Disaster Risk Studies*, 13(1), 1161 <https://doi.org/10.4102/jamba.v13i1.1161>
- Njoroge, J. M. (2015). Climate change and tourism adaptation: Literature review. *Tourism and Hospitality Management*, 21(1), 95–108. <https://doi.org/10.20867/thm.21.1.7>
- Official Gazette of the Republic of Turkey. (2023a). *Bylaw on the properties of tourism facilities*. <https://www.mevzuat.gov.tr/MevzuatMetin/21.5.1134.pdf>
- Official Gazette of the Republic of Turkey. (2023b). *Coastal law*. <https://www.mevzuat.gov.tr/mevzuatmetin/1.5.3621.pdf>
- Özçağlar, A. (2012). *Akdeniz Bölgesi* [Mediterranean Region]. Lecturer notes. <http://geography.humanity.ankara.edu.tr/wp-content/uploads/sites/277/2015/08/ADANA-B%C3%96LGES%C4%B0-1.pdf>
- Özgen, N. (2010). Doğu Anadolu Bölgesi'nin doğal turizm potansiyelinin belirlenmesi ve planlamaya yönelik öneriler [Determination of the natural tourism potential of the Eastern Anatolia Regional and planning suggestions]. *Uluslararası İnsan Bilimleri Dergisi*, 7(2), 1407–1438.
- Pang, S. F. H., McKercher, B., & Prideaux, B. (2013). Climate change and tourism: An overview. *Asia Pacific Journal of Tourism Research*, 18(1–2), 4–20. <https://doi.org/10.1080/10941665.2012.688509>
- Partal, T., & Yavuz, E. (2020). Batı Karadeniz Bölgesi'nde kuraklık indisleri üzerine trend analizi uygulanması. *Journal of Natural Hazards and Environment*, 6(2), 345–353. <https://doi.org/10.21324/dacd.643161>
- Pröbstl-Haider, U., Haider, W., Wirth, V., & Beardmore, B. (2015). Will climate change increase the attractiveness of summer destinations in the European Alps? A survey of German tourists. *Journal of Outdoor Recreation and Tourism*, 11, 44–57. <https://doi.org/10.1016/j.jort.2015.07.003>

- United Nations. (2023). *Climate change*. <https://www.un.org/en/climatechange/what-is-climate-change>
- Wall, G. (2007). The tourism industry and its adaptability and vulnerability to climate change. In B. Amelung, K. Błażejczyk, & A. Matzarakis (Eds.), *Climate change and tourism—assessment and coping strategies* (pp. 5–19). Institute of Geography and Spatial Organization. Polish Academy of Sciences.
- Watkins, E., Hollman, A. B., & Horgan, B. P. (2010). Evaluation of alternative turfgrass species for low-input golf course fairways. *HortScience*, 45(1), 113–118. <https://doi.org/10.21273/HORTSCI.45.1.113>
- Yeşiltaş, M., Çeken, H., & Öztürk, İ. (2009). Karadeniz Bölgesi'ndeki turizm olanaklarının SWOT analizi ile değerlendirilmesi [SWOT analysis of tourism opportunities in the Black Sea Region]. *Adıyaman Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 2(3), 250–269.
- Yılmaz, H. M., Yakar, M., Mutluoğlu, Ö., Kavurmacı, M., & Yurt, K. (2009, May 11–15). Kapadokya Bölgesindeki toprak aşınmasının araştırılması [Investigation of Soil Erosion in the Cappadocia Region]. *TMMOB Harita ve Kadastro Mühendisleri Odası 12. Türkiye Harita Bilimsel ve Teknik Kurultayı*, Ankara.

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Chapter 10

Conservation-Based Tourism Development, Climate Change, Inclusion of Locals, and Post-human-Wildlife Co-existence Conflicts



A Case Study of Gonarezhou National Park

Tawanda Makuyana , Regina Makoni, and Serena Lucrezi

Abstract There is a growth in knowledge on complex interaction between people and parks. However, conservation-based tourism development, climate change, local inclusion, and post-human-wildlife co-existence conflicts in African Transfrontier Conservation Areas, is still limited especially as joint field. The study area is described and presented using maps and cartographic illustrations to picture territorial boundaries. The discussion upholds evidence on symbiotic linkage between the effects of climate change and communities whose livelihoods are impacted by these effects. The increase in population and migration into lands close to national parks has led to humans encroaching on wildlife habitats, exacerbating human-wildlife co-existence conflicts. On the other hand, conservation-based tourism development initiatives are perceived by locals as only involving elite communities, excluding many. The COVID-19 pandemic and lockdowns have exacerbated the impact of the above-raised factors. There is a paucity of information about this complexity from the perspective of the human behavioural lens. In this context, effects, challenges, trends, opportunities, and solutions/practices are yet to be explored. This chapter aimed to fill the gap by assessing trends and patterns in research-based knowledge, with Gonarezhou National Park, Zimbabwe, as a case study while setting a research agenda for the research community in post-COVID-19 health crisis. A critical-scoping review analysis was used while following Creswell qualitative analysis framework to analyse research data from Google Scholar, Scopus, Web of Science, Science Direct and Sabinet databases between 2000 and 2023. Based on maps, and cartographic illustrations, there are territorial changes over the period as

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society (territorial boundaries, activities, cultures and learnt behaviours of people), environment (climatic changes, and composition of biodiversity) and COVID-19 pandemic and lockdown measures propelled a ‘cause-effect’ for human-wildlife co-existence conflicts (illegal hunting of wildlife and over-harvest of herbs and wood included). Within this context, the study unveiled four areas, namely: (i) limited evidence on local community/household (stakeholders) engagement; (ii) a paucity of human-behavioural focused models/theories in post-human-wildlife conflicts; (iii) limited knowledge of the nexus between the topics under consideration and multi-disciplinary research; and (iv) the need to document theory-in-practice, strategies, potential opportunities, and solutions to challenges. The study assessed the trends and patterns prevailing in conservation-based tourism development, climate change, local inclusion, post-human-wildlife co-existence conflicts and effects of the COVID-19 pandemic and lockdown measures in communities around Gonarezhou National Park, Zimbabwe. There are changes in vegetation, land use as well as the composition of biodiversity. Conservation authorities should balance perceived value on the wellbeing of communities and biodiversity in initiatives aimed at conserving the biodiversity in the Gonarezhou National Park. The study derived insights that can be used to establish actionable strategies for local community participation and involvement in conservation-based tourism, empowerment and alternative livelihoods that brings resilience and better conservation and preservation of biodiversity using indigenous knowledge systems (community intelligence) while mitigating climatic changes and effects of the COVID-19 pandemic and lockdowns. The study recommends future in-depth empirical research on the complexity of interactions between conservation-based tourism development, climate change, local inclusion, and post-human-wildlife co-existence conflicts. It also emphasises the importance of conducting research using a human-behavioural lens.

Keywords Conservation-based tourism · Climate change · Local inclusion · Human-wildlife conflict · COVID-19 · Transfrontier conservation areas

Introduction

Human activities influence the state of Earth (Musakwa et al., 2020a, 2020b). There is a relationship between livelihoods and how humans exploit natural resources in responding to household needs which alters and induces complex interactions in land use (Steffen et al., 2015a, 2015b). The phenomenon mentioned above is described by Steffen et al. (2007) as humans overwhelming the forces of nature, compromising aspects like biodiversity conservation regardless of the establishment of designated protected areas. The narrative given by Steffen et al. (2007) justifies the establishment of global challenges by the United Nations that have intersectional linkage on land usage, communities and their well-being, climate, land degradation, and loss of biodiversity (see also UN-SDG report, 2022).

African landscapes have visible impacts of human interactions with nature (Griscom et al., 2010), which exhibit competing interests like conservation, livelihoods, farming, and resettlements in drylands of sub-Saharan Africa (Kihara et al., 2020; Shackleton, 2018). Within this context of competing interests, Musakwa et al., (2020a, 2020b) view terrestrial interactions as ecosystem services that need relevant management by humans. In addition, unlike most urban societies, rural communities have structures and processes that nurture effectiveness and resilience if the locals are engaged compared to top-down instructive management (Wisely et al., 2018). Therefore, it is crucial to understand the dynamics of the social fabric of rural communities around conservation areas.

Interestingly, Africa has 18% of its land allocated and converted into conservation areas. In Zimbabwe, only 27% is designated for similar purposes (UNEP-WCMC, 2020). Subsequently, the changes in landscape impact the livelihoods of communities around or living in the designated conservation areas (Kamwi et al., 2015; Shackleton, 2018). Taking a step back, creating conservation areas came with social, economic, and political transformations within the communities (Wu, 2013). For instance, the creation of Gonarezhou National Park (GNP) in 1975 influenced growth in biodiversity conservation and tourism; however, locals were displaced, and their livelihoods were negatively affected (Musakwa et al., 2020a, 2020b). The impact of climate change like extreme temperatures, droughts, and sometimes floods from cyclones that the south-eastern lowveld is consistently experiencing worsens concerns about people's livelihoods.

Sustainable Development Goal-13-Climate Action is one of the areas that even the UN has indicated as needing more support in receiving data from developing countries, predominantly rural and vulnerable communities (UN-SDG report, 2022). From the same standpoint, climate change induces disruptive changes in humans, biodiversity, and landscape in conservation areas (Steg, 2018). The changes include consistent low rainfall and droughts, resulting in the loss of forests, woodlands, habitats, animals, and infrastructure that support tourism (Pettorelli et al., 2012), and extreme hazards like cyclones (Eline, Idai, Freddy). The impact on people includes loss of livelihoods due to forced migration and food insecurity (Gandiwa & Zisadza, 2011; Otto-Mentz, 2019). Furthermore, it affects the relationship between access and ownership of resources, land use, and weather that continues to be uncondusive for subsistence farming in drylands. An increase in the population in 2000 due to land reform in Zimbabwe led to consistent migration into lands close to national parks and encroaching into wildlife habitats. The resulting alternative means to support livelihoods through activities like poaching exacerbates human-wildlife co-existence conflicts and challenges in recovery in post-human wildlife co-existence conflicts (P-HWCC). Human-wildlife co-existence conflicts comprise a wide range of situations where either wild animals or humans encounter where they attack each other for different reasons (Masse, 2016; Thondlana et al., 2020). While post-human wildlife co-existence conflicts is a term that refers to the life of either wild animals or humans in the aftermath of the attacking encounter (s) (Thondlana et al., 2020). Consequently, the authors of this chapter believe, challenges are faced when implementing conservation-based tourism developmental initiatives, which locals perceive

as vehicles to compromise neoliberalism because they involve the elite community members only while excluding the regular residents.

A critical-scoping review analysis was used while following Creswell's qualitative analysis framework to analyse research data extracted from Google Scholar, Scopus, Web of Science, Science Direct, and Sabinet databases as international databases with research conducted from 2000 to 2022. These were augmented by the lived experience of one of the researchers who grew up in the Mahenye rural community and his social network. Furthermore, the chapter searched, identified, selected and synthesised extant literature and shared experiences of life after human life co-existence conflicts that have implications on knowledge and insights that can guide future community-based collaborations for biodiversity conservation initiatives. Within this context, the study provides knowledge that has an impact on the processes of physical, human, and wildlife-based geography in addressing where sources and sociobehavioural challenges influence and shape the distribution of nature and human interactions in Gonarezhou National Park and surrounding communities. In the end, the chapter provides insights towards understanding the foundation of knowledge on the topic. Identify areas of prior scholarship to prevent duplication and give credit to other researchers. Identify inconstances: gaps in research, conflicts in previous studies, open questions left from other research aimed at the advancement of spatial science (physical geography, community-based biodiversity conservation and ecosystems, and human socio-economic geography) in the south-eastern lowveld region of Zimbabwe.

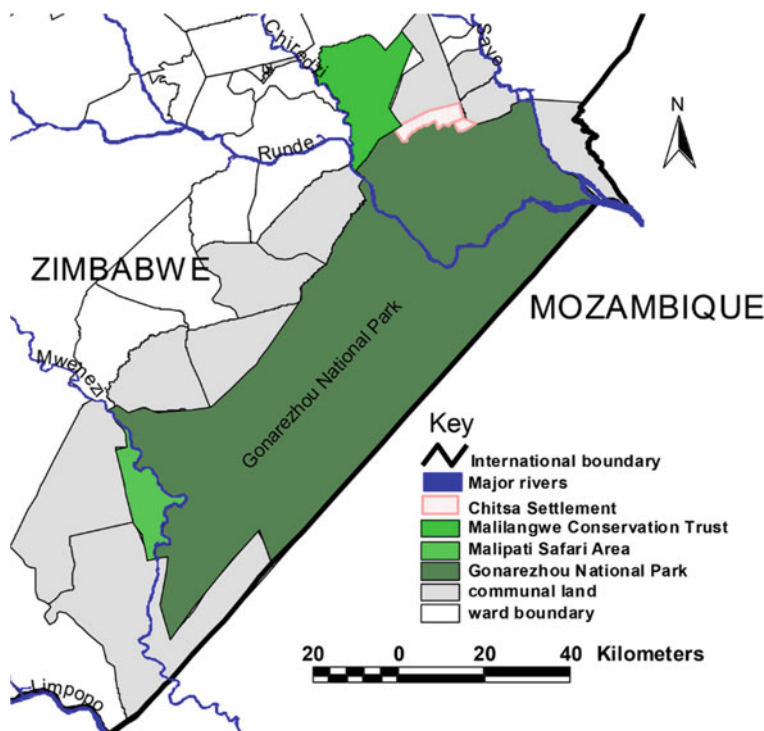
The structure of the chapter is as follows. First, the background to study. Second, is the material and method used by the researchers which includes the approach and analytic framework. Third, the findings and discussion which entails the literature review for the study established conclusions, and the contribution to postulate future research agenda on areas which are still 'blind and blanks' for the topic understudy.

Background to Study

Study Area

GNP is located in the south-east of Zimbabwe alongside the border with Mozambique, stretching between the Mwenezi and Save Rivers, 21°00'–22°15' S and 30°15'–32°30' E (see Map 10.1, 10.2 and 10.3; Martini et al., 2016; Ntuli & Muchapondwa, 2018). The present chapter considered research on ten communal areas around GNP (Ntuli & Muchapondwa, 2018, see Map 10.1). The communities have been participating in wildlife conservation and tourism in various ways while experiencing impacts of climatic change and post-human-wildlife co-existence conflicts since GNP was established in 1975 (Martini et al., 2016).

GNP has a roughly rectangular strip of land varying in some areas 35 km, while others 45 km in width and approximately 135 km long (Martini et al., 2016; see also



Map 10.1 Map of GNP (in dark green) and the communal areas (in grey) bordering the national park (Martini et al., 2016; Ntuli & Muchapondwa, 2018, p. 143)

Map 10.1). Together with the adjacent Malapati Safari Area, the total size of the study area is approximately 5053 km² (Martini et al., 2016; Ntuli & Muchapondwa, 2018). GNP forms part of the Create Limpopo Transfrontier Conservancy Areas, which comprises a conjunction of Kruger National Park (KNP) of South Africa and the Limpopo (LNP), Banhine (BNP) and Zinave (ZNP) National Parks of Mozambique (Martini et al., 2016; Ntuli & Muchapondwa, 2018; see also Map 10.2). GNP has rugged terrain and is located away from the main tourist routes, resulting in a more extensive pristine wilderness (Ntuli & Muchapondwa, 2018; see Map 10.3).

The Existing Knowledge Gap Within the Zimbabwean Lens

GNP received research attention both from an empirical and literature review lens since 1935 when it was considered a game reserve. By then, it was in the hands of Zimbabwe National Parks and Wildlife Management Authority (ZNPWMA), but now it is a national park under Gonarezhou Conservancy Trust (a partnership between ZNPWMA and Frankfort Zoology). Musakwa et al., (2020a, 2020b) explored

community perception of landscape and climate change, ecosystem services, and livelihoods. Other studies considered facets like forests (Mero Dowo et al., 2018), carbon sequestration, and human-wildlife co-existence conflict (Gandiwa et al., 2013; Mandudzo, 2019; Mombeshora & Le Bel, 2009), sustainable livelihoods (Muboko & Bradshaw, 2018; Mutanga et al., 2017), landscape change (Tafangenyasha, 1997), and climate change and its impacts (Frischen et al., 2020; Gandiwa et al., 2016) as separate fields and research in these areas is still limited and scattered. The studies in conservation and people have yet to link conservation-based tourism development, the inclusion of locals, climate change and post-human-wildlife co-existence conflicts and livelihood. Hence a better picture can be obtained first by mapping extant literature. The chapter loosely considers territorial boundaries analysis while attempting to explore existing knowledge on complex interactive relationships of biodiversity spatial distribution, the inclusion of locals in activities aimed at responding to climate change and conservation-based-tourism development and P-HWCC as a joint field of study.

Conservation-based tourism development is a concept that is proposed and derived from Community Based Natural Resources and Wildlife Management by the authors of this chapter. The aim is to preserve and conserve biodiversity and add value to the tourism value chain through consumptive and non-consumptive resources that attract visitors from other places. The effective participation of the hosting community can improve people's livelihoods (Giampiccoli, 2015). Community members around GNP consider the conservation area brought changes in access to resources like biodiversity. However, they were neither included (involved) nor consulted in creating the conservancy area, and GNP is part of the conservancy area. The communities around it feel that the creation of the corridor displaced the residents of their heritage (Defe & Matsa, 2021; Narula et al., 2017). While there can be negative effects on local cultures and environments (Giampiccoli & Glassom, 2020), local cultural behaviours benefit from community inclusion in conservation and tourism (Rasoolimanesh et al., 2017). Conservation-based tourism development initiatives face 'mixed bag reactions' during implementation. Speculations that the designated Sengwe-corridor will be used in animal feed production for a Zimbabwean dairy company worsen the situation. Therefore, including local communities is vital in Transfrontier Conservancy Area planning processes (Deegan, 2012).

Climate change is defined by focusing on the post-effect lens of greenhouse gas on weather patterns over a period of time (Pielke, 2005). This understanding is derived from the Framework Convention on Climate Change (FCCC), which considers climate change as the transformation of climate as attributed to direct and indirect human activities that alter the composition of the global atmosphere and natural climate variability over comparable periods (Pielke, 2005). The Intergovernmental Panel on Climate Change (IPCC) holds the same view and describes it as any change in climate over time, whether due to natural variability or human activity (IPCC, 2001). Therefore, the chapter upholds the above definitions because they share a similar meaning that nurtures the current discussion. This chapter's focus is not on debating the definition of climate change. However, it consolidates extant knowledge and evidence for a proposition for new ways of thinking that nurture social

innovation from a residents' human behaviour lens, at the same time indicating the research agenda to keep pursuing sustainability and resilience within the nexus of concepts under study (Defe & Matsa, 2021).

Within this context, the chapter provides insights towards managing dynamics in territorial boundaries and interactions, climate variability and distressing effects on communities from extreme weather and human-wildlife co-existence conflicts causing loss of life, human suffering and the destruction of infrastructure and natural resource base which livelihoods depend on (Defe & Matsa, 2021; FAO, 2015; UNEP, 2010). The insights would contribute to interventions on harmful interactions between the environmental, human, social, and economic capital within the local economy of communities and the national park (Adams, 2008; Defe & Matsa, 2021; Narula et al., 2017). Local inclusion is essential for a comprehensive understanding of social dynamics and interactions between community, tourism, conservation, and climate change as a joint field within the lens of sustainable practices (Giampiccoli & Glassom, 2020). Deegan (2012) considered that the inclusion of locals in Transfrontier Conservancy issues and business beyond political leadership is still at the infant stage of development and accountability.

It is, therefore, essential to explore extant literature on the interactions as mentioned above using a human behavioural lens under the following objectives.

- a. To explore the trends and patterns in conservation-based tourism development, climate change, local inclusion, and post-human-wildlife co-existence conflicts around GNP.
- b. To explore the stimuli underlying the attitudes, perceptions, and behaviours among individuals and households involved in human-wildlife co-existence conflicts towards conservation-based tourism development, coping mechanisms for livelihoods amid the impact of climatic change, and the extent of their inclusion in conservation-based tourism.
- c. To postulate a post-human-wildlife co-existence conflict human behavioural model that augments societal healing within social capital from impacts of climate change, human-wildlife co-existence conflicts, and inclusion of locals in conservation-based tourism development in GNP.

This chapter is the first study to take a specific focus on Gonarezhou National Park and its surrounding community from a joint lens of conservation-based tourism development, climate change, the inclusion of locals (rural communities around the national park located in a designated Transfrontier Conservancy Area) and post-human wildlife co-existence conflicts as a scoping review that considered pre-2020 to 2023. The set period is demarcated by the health pandemic that brought transformations that implicates rural community-behavioural intentions towards biodiversity and their inclusion into pathways towards conservation-based tourism development in Zimbabwe. Hence, the chapter identified, selected, and synthesised related extant literature and grey literature on Gonarezhou National Park, though the studies do not have a joint perspective on the phenomena in a single study like what the current chapter presents after the extant literature points out and reinforced the existence of the gap.

Methods

Approach

A critical scoping review (Creswell, 2014; Creswell & Poth, 2018) analysed research data obtained from Google Scholar, Scopus, Web of Science, Science Direct, and Sabinet as one of the largest databases that contain a wide range of research that only regard GNP and its surrounding communal areas from 2000 (before the COVID-19 pandemic and lockdown measures and in most countries after the COVID-19 pandemic) to 2023. The critical-scoping review did not establish a time-bound electronic search because the issues under study are not necessarily 21st contemporary issues but residential challenges that require scholars to keep building knowledge towards a better comprehension of the complex interactions between humans, biodiversity, and nature from research-based identifiable gaps and concerns. The data collection is presented in summary in Fig. 10.1.

Analytic Framework

Our research employed a critical discourse analysis in combination with a qualitative case study approach (Jennings, 2001) to analyse available data. A critical scoping review of current and relevant literature on the subject matter was carried out, with specific attention given to biodiversity in GNP and local communities around it. The literature was critically analysed, focusing on assessing the nature and complexity of interactions among conservation-based tourism development, the inclusion of locals, climate change, and post-human-wildlife co-existence conflicts initiatives using the common property resources principles. Consequently, data analyses were based on a case study design (Yin, 2003). The data analysis was done using Creswell's (2014) qualitative framework that supports the use of manual thematic analysis from a Common Property Resource (CPR) lens.

CPR theory served as the basis for developing a conceptual framework in this chapter because of its emphasis on how natural resources, particularly those shared by local communities, can be sustainably and optimally utilised. In addition, studies show Zimbabwe, among other African countries, cannot adapt the communities around parks and the tourism sector to the impact of climate change and post-human-wildlife co-existence conflicts. Recovery strategies are not in place, and the involved stakeholders are uncertain due to a lack of comprehensive tourism-climate-human-wildlife co-existence conflicts data coupled with inadequate research funding (Hoogendoorn & Fitchett, 2018; Kilungu, 2023; Kilungu et al., 2017). The situation gets complicated when seeking and making biodiversity conservation funding go beyond the 'fence' of wildlife-protected areas by incorporating local communities and their livelihoods. However, the local communities (social capital) bear scars

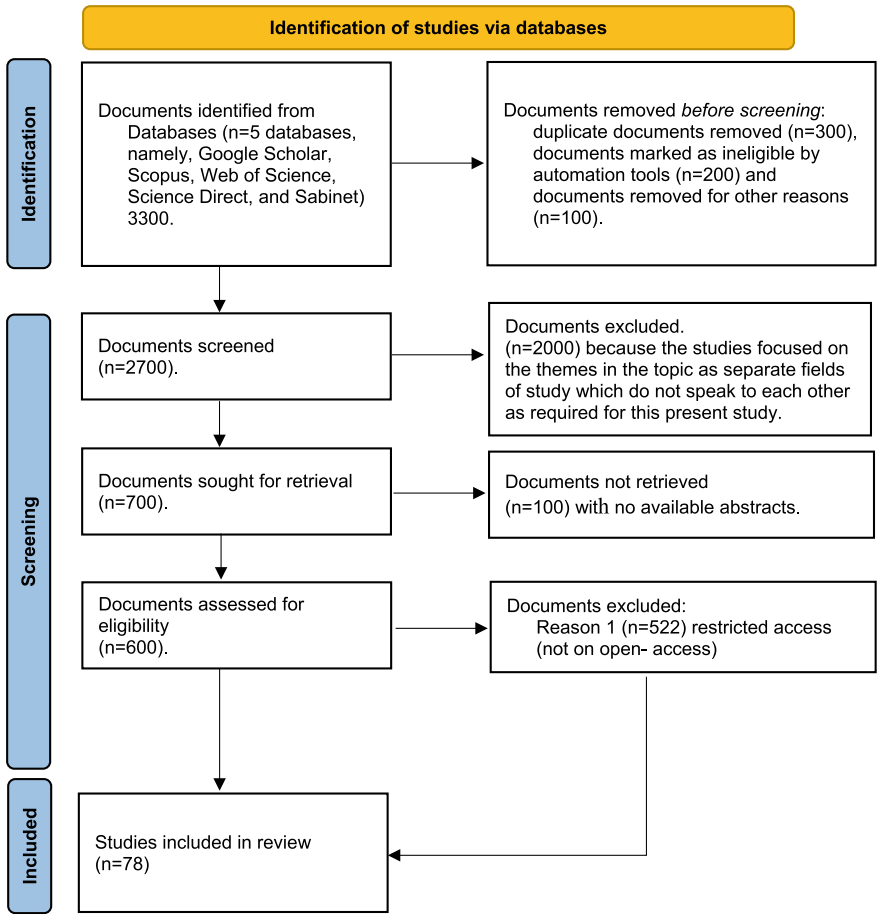


Fig. 10.1 Summary of the research approach in data collection for analysis. *Source* Adopted in part from Page, M.J. et al., 2020, PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021; 372: n71. <https://doi.org/10.1136/bmj.n71>

from human-wildlife co-existence conflicts, which give them mixed feelings about tolerating and valuing biodiversity beyond traditional norms and cultures.

Common Property Resources (CPR)

The increased frequency of natural and man-made disasters like floods, droughts, degeneration of biodiversity, pollution, loss of agricultural land, loss of wildlife, and overgrazing is now witnessed in the Global North and South. The theory of CPR explains the above challenges from a need to manage the utilisation of resources

from an interactive process-activity-based behavioural lens. Ostrom (1990) alludes that natural and environmental resources are presented as common pool resources that one exploits in a manner that leads to a reduction of the resource availability for others (subtractability); then, the exclusion of additional users becomes problematic and costly (difficulty of exclusion). Therefore, the CPR theory considers how community-shared resources can be utilised sustainably.

Scholars of CPR argues that all resources like forests, biodiversity, minerals, air, water, and water bodies such as rivers, lakes, and oceans held in common will inevitably be overexploited (Araral, 2014; Bromley, 1992, 1998a, b; Ostrom, 1990; Ostrom, 1999; Ostrom et al., 1999; Agrawal & Ostrom, 1999). They base this argument on how these resources, as mentioned earlier, have no private owner, access, and usage depend on one's purpose, and it is in no one's intuitive interest to protect (preserve and conserve) them or use them sustainably. Based on the CPR lens, privately owned natural resources are generally conserved compared to publicly owned ones (Ostrom, 1990). Within this stand view, economists investigated the effects of ownership rights on exploitation rates. They concurred that private ownership of natural resources has vast benefits like structured systems to conserve the resources while ensuring efficient use, reducing transactional costs and overcapitalisation (Ostrom, 2007; Ostrom & Nagendra, 2007). Therefore, waste-off externalities depend on the extent of a sense of ownership, access, and control. However, there are also other factors like effects of interactions of the people and the resources like human-wildlife co-existence conflicts, indigeneity issues from displacements and exclusion of local/indigenous knowledge systems (community intelligence included), livelihoods against hunger and poverty and effects of climate change that are intriguing in some contexts of residents. These factors make them feel and behave in ways that show conviction that it is more 'rational' for users to overexploit natural resources than conserve them (Ostrom, 2009; Scott, 1993).

Hawkshaw et al. (2012) interpreted the 'catastrophe of the commons' by Hardin in 1968 as furthering the opinion that the users of natural resources are caught up in a process that leads to the destruction and degradation of the natural assets upon which they (the ordinary people) and their development depend. In this context, despite those indigenous knowledge systems nurtured by the traditional leadership as the custodian of shared-natural resources, the natural resources (assets) are not individually managed or controlled. Therefore, the ability, strategies, and approaches to manage and regulate them, including human behaviours, become a consistent challenge in practice. The above viewpoint has been debated by other scholars. They regard the inclusion of locals (community members) as conservation agents through their existing 'common-property resource management' strategies like indigenous knowledge systems. In this sense, the local people have restricted access to natural resources by invoking certain sanctions and procedural rules for their sustainable use (Berkes, 1989; Feeny et al., 1990; Ostrom et al., 1990; Pinkerton, 1992, 1989). Consequentially, the CPR lens is ideal for exploring the extant literature as a basis to critique and scope for further research endeavours and discussion concerning conservation-based tourism development, climate change, the inclusion of locals, and the post-human-wildlife co-existence conflicts.

Findings and Discussion

Maps and Cartographic Illustrations

The present chapter presents maps and cartographic illustrations on territorial changes in line with local societies' territorial boundaries, activities, cultures and learnt behaviours, and responses to environmental changes (climatic changes and biodiversity composition included) as shown in Fig. 10.2.

Natural Biodiversity Spatial Distribution

Based on Fig. 10.2, the GNP is located in natural region five of Zimbabwe, with characteristics of very dry with meagre agricultural potential and has ten classes of land cover that include grassland, dense and sparse shrubs, dense and sparse vegetation, woodland, agricultural area, bare land, built-up area and water (Dunham & Van der Westhuizen, 2016; Ntuli & Muchapondwa, 2018). Thus, the vegetation in GNP is typical semi-arid savanna, dominated by *Colophospermum mopane* woodlands (Gandiwa & Kativu, 2009; Ntuli & Muchapondwa, 2018, see also Map 10.3).

Several vegetation studies have been carried out for the GNP (Gandiwa et al., 2011, 2012; O'Connor & Campbell, 1986; Tafangenyasha, 1997, 2001; Wild, 1955; Zisadza-Gandiwa et al., 2013), and their focus was only on specific areas or species. Only one study produced a comprehensive vegetation map describing 15 vegetation types (Sherry, 1970). However, it was primarily based on work carried out in 1959–1960 concerning tsetse fly control operations (Farrell, 1968). Martini et al. (2016) provides a comprehensive woody vegetation survey of the GNP to analyse the relationships between vegetation types and environmental factors and to produce a map of potential natural vegetation (see also Map 10.2). Martini et al. (2016) identified fourteen vegetation types under three main physiognomies: mopane, miombo, and alluvial woodlands. However, in all these studies, the impact of climatic change, post-human-wildlife co-existence conflicts, the inclusion of locals, and conservation-based tourism interactions have not been included. Nevertheless, they must be included in evaluating the main threats to the vegetation types. Incorporating them would add value in developing appropriate conservation and management measures and monitoring landscape changes within the framework of the conservancy area (Fig. 10.3).

Musakwa et al., (2020a, 2020b) attributed the transformation of land cover in GNP between 2007 and 2017 to Government policy, the Fast Track Land Reform Program (FTLRP) in Zimbabwe, that led to the conversion of forests and grasslands to crop fields. The assertion is confirmed by the land cover maps that show an increase in agricultural land, bare land, and built-up areas driven by agriculture, settlement increase, and soil erosion, resulting in the consumption of pristine forests and grasslands (Musakwa et al., 2020a, 2020b). The continued expansion of agriculture and

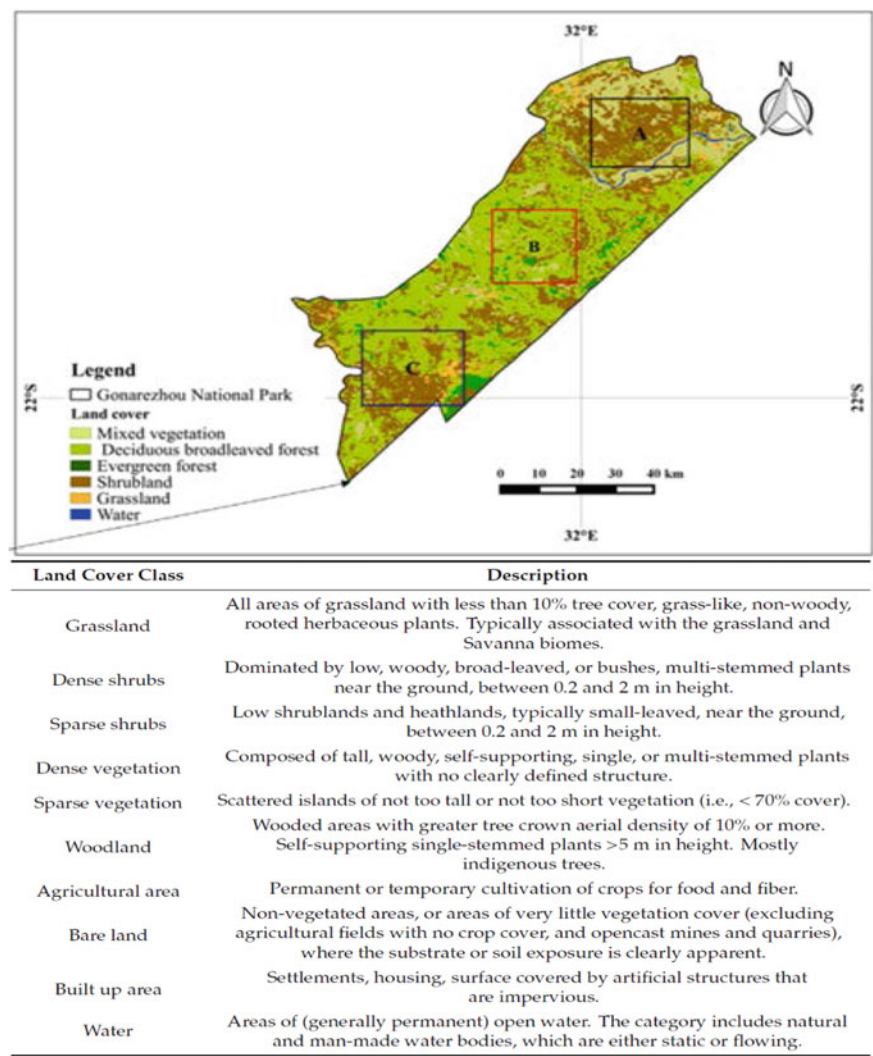


Fig. 10.2 Location of GNP in Zimbabwe and land cover description (Murwendo et al., 2023, p. 300)

settlements at the expense of other land cover classes posed a threat to conservation reports of the Gonarezhou Conservation Trust (Musakwa et al., 2020a, 2020b). Agriculture and built-up areas gained from sparse shrubs, bare land, and grasslands (Musakwa et al., 2020a, 2020b). The positive transformation of dense shrubs was encouraging from a conservation perspective, suggesting the conservation reports of the GCT were starting to bear fruit (Musakwa et al., 2020a, 2020b). Woodland remaining the same may also mean that conservation reports led to less destruction

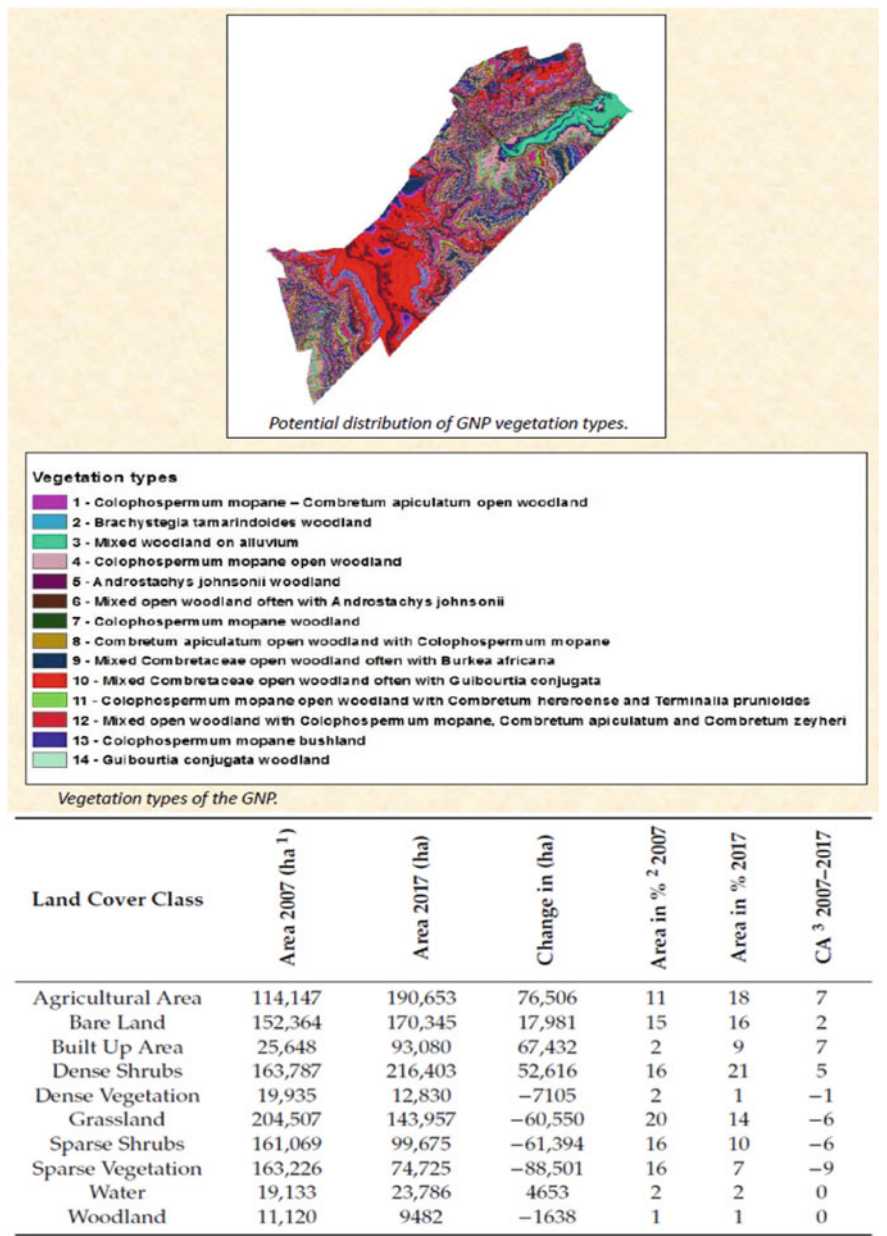
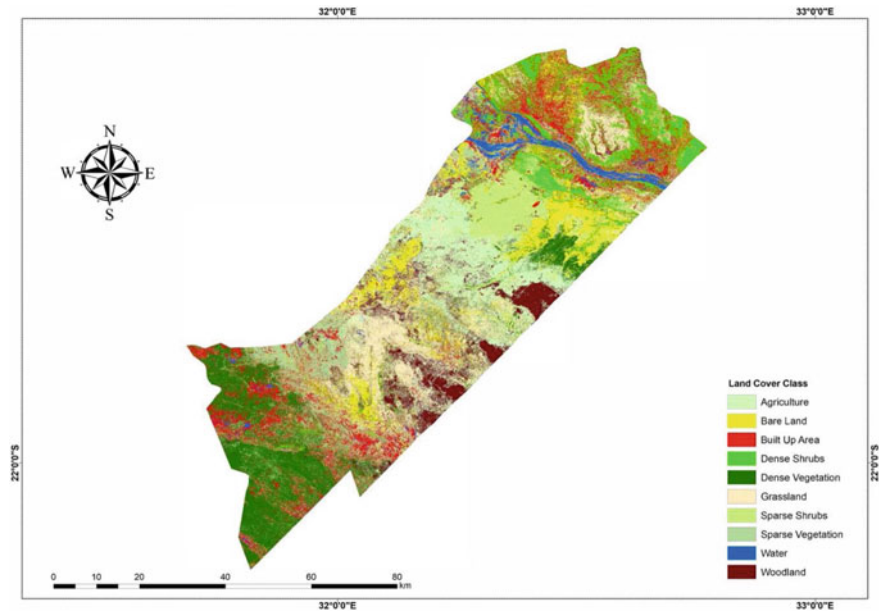
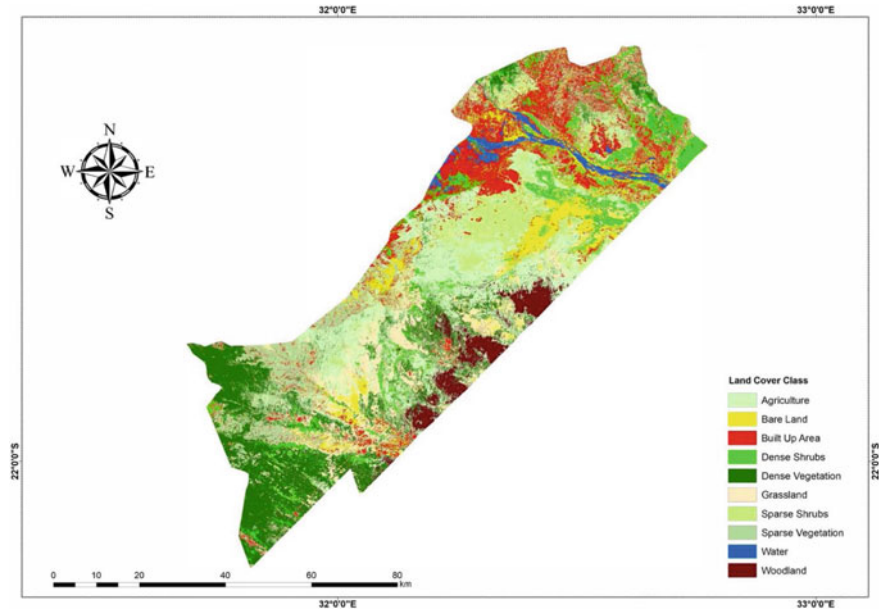


Fig. 10.3 Vegetation distribution as postulated by Martini et al. (2016) and the landscape changes from 2007 to 2017 (Musakwa et al., 2020a, 2020b, p. 9)



Map 10.2 Land cover for GNP in 2007 (Musakwa et al., 2020a, 2020b, p. 9)



Map 10.3 Land cover in GNP in 2017 (Musakwa et al., 2020a, 2020b, p. 9)

of forests (Musakwa et al., 2020a, 2020b). The remote sensing analysis of landscape change is crucial in showing the magnitude of change, but it does not explain the drivers of change (Musakwa et al., 2020a, 2020b). Therefore, combining landscape change using remote sensing with other methods, such as interviews, and surveys. The researcher postulates that participatory research or citizen science is essential to comprehend the drivers of changes fully.

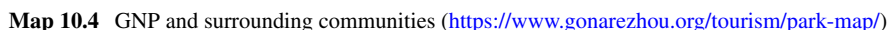
Socio-economic Environment

GNP is surrounded by various tribal groups with diverse cultures and ceremonial rituals, values, and norms that uphold sacred places and nature (biodiversity included) located in GNP (Musakwa et al., 2020a, 2020b; Ntuli & Muchapondwa, 2018). Communities are sparsely populated and predominantly occupied by the Shangani, Venda, Ndaou, Ndebele, and Kalanga people (Ntuli & Muchapondwa, 2018). The creation of GNP forced the migration of tribal groups as they paved the way for the park; however, this came with denying them access to their sacred cultural sites (Musakwa et al., 2020a, 2020b; Ntuli & Muchapondwa, 2018; see also Map 10.1 and 10.4).

The area under study is approximately 100 km from the nearest town, Chiredzi (see Map 10.4). Due to its proximity to the South African border and lack of employment opportunities, most school children hardly proceed beyond the primary level of education (Ntuli & Muchapondwa, 2018). Although peasant farmers in the area engage in a diversified portfolio of economic activities, including wildlife conservation, the most dominant livelihood activities are livestock production and drought-tolerant crop cultivation, like sorghum, millet, groundnuts, and cotton (Ntuli & Muchapondwa, 2018). The mode of production is primarily subsistence in nature, and out of the 30 communities under study, 25 were CAMPFIRE projects, while the remainder were resettlement schemes, with less than 1% of the communities involved in wildlife conservation (Ntuli & Muchapondwa, 2018; see also Map 10.4). Resettlement schemes differ from communal areas in that land tenure is governed by a lease agreement under the former, while the latter have communal tenure (Ntuli & Muchapondwa, 2018).

Human-Wildlife Co-existence Conflict

Despite a growing acknowledgement of the need for human-biodiversity co-existence in shared landscapes outside of protected areas, there is limited consensus on how this can be achieved (Merz et al., 2023; Pooley, 2021; Pooley et al., 2021). Co-existence is feasible when sustainable populations of humans and wildlife develop appropriate adaptations that enable them to live together in an integrated human and natural



system (Carter & Linnell, 2016; Merz et al., 2023). However, efforts to promote co-existence between people and wildlife exclude livelihoods and climate change. This is because of the complex interactions of the multifaceted and interconnected drivers and impacts of human-wildlife co-existence conflicts. These complications range from direct interactions within geopolitical ecology control systems for the biodiversity to psychological (emotionally included) and physical needs among stakeholders and the extent of inclusion of locals in reaping benefits or bearing costs (Merz et al., 2023).

Most human-wildlife conflict and co-existence literature focus on the direct economic costs, such as livestock losses, crop raiding, and benefits like jobs and income generation as the primary drivers of human-wildlife co-existence (Aiyadurai, 2016; Madden & McQuinn, 2014; Van Schendel, 2022). Indirect costs, like the societies' emotional domain, are left unattended even from a research angle. The importance of the perceived legitimacy of institutions governing natural resources for the sustainability of common pool resources is well-documented (Murphree, 2009; Ostrom, 2009). However, there is a need for research that focuses on the post-human-wildlife co-existence conflict experiences, climate change, and inclusion of locals within conservation-based tourism development as a joint field that has intersectional and symbiotic linkage with human well-being and conservation of biodiversity.

The first author (TM), who spent his childhood (6 years-18 years) as a member of the Mahenye community, visited some relatives in March-December 2020. Based on an ethnographic lens, the TM has lived within the society and researched it is people and culture through a process of sustainable observations and participation. Exploratory interviews aimed at ascertaining the existence of the gap reflected sentiments and anecdotal evidence from residents in Mahenye and Chizvirizvi. The residents alluded that community reactions to wildlife conservation are, to some extent, caused by unattended emotional and societal scars from unfulfilled vengeance and bitterness towards wildlife (biodiversity) among human-wildlife co-existence survivors/victims and their support structure (social capital). The above-mentioned situation is worsened by the wildlife preservation and conservation policies, practices, programmes/initiatives, and interventions that overlook the human survivor/victim's post-human-wildlife conflict experiences and life in society. The post-human-wildlife co-existence conflicts experiences (post-event trauma recovery mechanism and processes) in a household or individual are critical sources of negative attitudes, perceptions, and behaviours against biodiversity. These experiences cultivate a negative attitude towards wildlife within the societal conscience and sub-conscience, which manifests whenever circumstances allow, regardless of initiatives to promote tourism-wildlife preservation, conservation, protection, and community development.

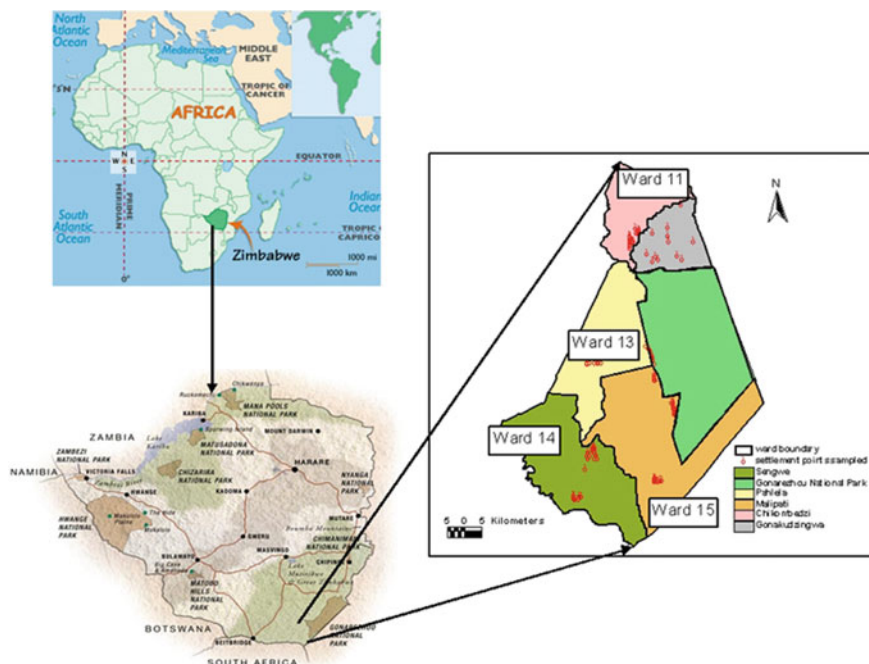
As a Ndaui myself (TM), the Ndaui and Tshonga societal culture upholds a secretive social fabric in terms of sharing their feelings; the societies do not quickly open up to strangers, especially concerning personal heart-breaking issues and experiences. They regard opening up to strangers as a sign of weakness as a translation from Ndaui sayings like (i) 'chidembo hachivhiyirwi pane anhu' and (ii) 'hauvhuri hapwa kunemutorwa' meaning one should not disclose personal hurts or show any weaknesses of the family and society. Therefore, based on such feedback obtained by the first author from his relatives, he and the co-authors explored extant literature. Six societal domains that may be a stronghold of unattended scars were identified as emerging from: (i) the negative societal image of the victim and the victim's family in context of sociocultural socialisation (e.g. when a person is attacked by animals like baboons, it a sign of bad luck among other African superstitions, myths, beliefs, and values); (ii) limited, if not lack of access to medical care after the incident; (iii)

limited, if not lack of compensatory facilities for the human victims; (iv) transformation on household economic sustenance (economic livelihood) of the family and the victims after the encounter especially when the bread-winners are the victims; (v) prevalence of community (societal trauma), family members (relatives included) and the human survivors/victims of human-wildlife conflicts who will be traumatised by the encounter; and (vi) the community's ignorance about integrated (modern) wildlife conservation knowledge with cultural-oral tribal understanding buried in the community common knowledge/'common sense' and passed through generations by oral tradition. Such includes the hunting and gathering culture that defines manhood. All these unattended domains might seem 'normal'; however, they have a bearing on societal attitudes, perceptions, and behavioural patterns. When triggered by other factors, these compromise the wildlife's socio-economic values in the context of conservation, preservation, stewardship, and community/nature-based tourism development. Unfortunately, the said domains are scarcely found in people-parks literature and are not addressed by the Wildlife Act/policies and practices in Zimbabwe, among other African states.

Within the human-wildlife co-existence conflicts context, subsistence poaching is a threat to biodiversity conservation-based tourism, yet it is a form of livelihood to marginalised communities (Ntuli et al., 2021). Ntuli et al. (2021) found that subsistence poaching incidences in communities with previous hunting habits are prevalent in areas with more young men, plenty of wildlife, and experiencing wildlife conflict. However, Ntuli et al. (2021) found less poaching in communities where local people trust each other, respect institutions, perceive that the park management is good, and view wildlife as an asset. The extant literature shows a missing link between human-wildlife co-existence conflicts, the inclusion of locals, and livelihoods as induced by the effects of climate change from a behavioural understanding of individual and community-level factors (social capital). This is because of the lack of data and the literature's predominant focus on commercial poaching (Ntuli et al., 2021).

Territorial Boundaries

Mombeshora and Le Bel (2009) believe the expansion of the network of national parks into conservancy areas has enabled the conservation of biodiversity and habitats. However, the acquisition of vast areas into the park system has often been achieved through the displacement of local communities. Displaced people are exposed to various impoverishment risks resulting in the strengthening of hostility towards parks (Musakwa et al., 2020a, 2020b). The research reported here seeks to understand the critical issues involved in the occupation of a section of GNP by Headman Chitsa's people (Mombeshora & Le Bel, 2009). Mombeshora and Le Bel (2009) examined how the relationship between the history of displacement and dispossession, demographic pressures, limited economic opportunities, the 'fast track' land reform programme, and dynastic politics are stimulating the land conflict between Gonarezhou and Chitsa community. Mombeshora and Le Bel (2009) noted



Map 10.5 Communal boundaries post-1975 when GNP was created (<https://www.ecologyandsoecity.org/vol16/iss4/art8/figure1.html>)

that secondary actors with diverse interests have come into the picture, while official efforts to resolve the conflict using a top-down approach have yielded little success (see also Musakwa et al., 2020a, 2020b). Hence, the need to use traditional mechanisms to resolve a chieftaincy dispute that implicates the wide-ranging parks-people land conflict was exposed. The latter assertion lays the foundation for this chapter while upholding lessons practical to local culture, livelihood needs, and power dynamics to the extent possible, eschewing forcible relocations. Interestingly, Mombeshora and Le Bel (2009) found consistency and broader contradiction between policies promoting wildlife conservation and those promoting agriculture to guide stakeholders in parks-people conflicts post-expansion of game reserve into GNP (1975) (see Map 10.5).

COVID-19 Pandemic and Lockdown Measures

The COVID-19 pandemic and lockdown measures propelled illegal hunting of wildlife and over-harvest of herbs and wood (Merz et al., 2023). However, these issues have been prevalent even before the health crisis due to various reasons, including changes in the weather pattern. Despite the challenges induced by climate

change, the community in the dry savannah region of the south-eastern lowveld must survive (Merz et al., 2023). Human-wildlife co-existence conflicts exist whenever there is shared space between wildlife-protected areas and surrounding communities in Africa (Merz et al., 2023). The present chapter applauds the Communal Areas Management Programme for Indigenous (CAMPFIRE), among other CBNRM initiatives, as robust wildlife preservation and conservation community-engaged models.

Prior to COVID-19, and amidst of successful pursuit of CAMPFIRE, a handful of policy and practice gaps were highlighted by Giampiccoli and Saayman (2016, 2018) and Giampiccoli et al. (2014). However, their assertions focused on pro-poor tourism and the inclusion of locals as part of responsible tourism (Saayman & Giampiccoli, 2016). All the approaches mentioned above and models, among other discourses on wildlife-community-related tourism development, focus on the reconciliation and harmonious co-existence of societies around demarcated biodiversity habitation and wildlife species. However, the reconciliation excludes the locals in the context of their power structures and dynamics among the Tshonga, and Ndaou, among other tribal groups. These societies are composed of static (influenced by traditional/tribal ways of living with wildlife) and dynamic (influenced by the internationalisation of wildlife-community developmental approaches) cultural phenomena.

Nevertheless, wildlife is of socioeconomic value to urban and rural communities (Merwe et al., 2014; Van der Merwe & Saayman, 2005). These scenarios permeate human-wildlife conflicts and consistently compromise the survival and livelihood of people. Masse (2016) questioned the wildlife and people's power and authority to manage because the cohesion and empathy within social capital in the societies around GNP are higher than in urban counterparts.

Post-Wildlife-Human Co-existence Conflicts and Conservation-Based Tourism Development

Hemson (2004) and Hemson et al. (2009) opined that each area has its own economic, ecological, political, and sociological profile that may ultimately determine the potential for mitigations to succeed. Karidozo et al. (2016) were commissioned to assess mitigating human-wildlife co-existing conflicts in GNP. They found: (i) a lack of capacity to mitigate all prevalent conflicts; (ii) the mitigating methods are not sustainable as they lack efficacy, cost-effectiveness and need to address the context of the societies; (iii) insurance-based approaches are regarded as the ideal; (iv) solutions are provided if the aim is to address the root cause of human-wildlife co-existing conflicts and pay attention to people rather than wildlife only.

In addition, conferences were held in Southern Africa, such as the one held in the Boli community close to GNP in 2019. The aim was to find scholarly and practical sustainable ways to alleviate human-wildlife co-existence conflicts while upholding sustainable livelihoods. In the past few decades, human victims have been given

attention through hospitalisation only in post-human-wildlife conflicts. In contrast, animal victims get attention through physical and emotional resuscitation facilities and care from vast facets like sanctuaries, and orphanages, to mention a few. In these facilities, animals would get proper recovery from trauma for life sustenance, and human victims/survivors and their households are left to find their ways to recover from the trauma and physical and emotional wounds.

Stoldt et al. (2019) opined that the most common problems caused by wildlife were crop damage (87.9%) and livestock predation (69.7%). Loss of human life (18.2%) and damage to households (9.1%) were less frequent than crop damage and livestock predation. The locals experienced human-wildlife co-existence conflicts a few times yearly (59.1%). Within this context, Ntuli et al., (2019a, 2019b) researched drivers for subsistent poaching to ascertain what matters in community-wildlife conservation in Great Limpopo Transfrontier Conservancy Area. Their findings indicated no evidence of the role of education, employment, and livestock ownership in poaching. However, factors such as age, gender, trust, group size, local institutions, resource quality, and perceptions about park management influenced subsistence poaching. Ntuli et al., (2019a, 2019b) suggested a need for capacity building in local institutions, training related to wildlife management, and public awareness campaigns that policymakers could use to influence people's perceptions and behaviours in this context.

The societies around the GNP are composed of the human victims and survivors of human-wildlife co-existence conflicts, who bear unattended scars embodied in their physical being and psycho-social and emotional quotient (Thondlana et al., 2020). These scars might have infested the societal conscious and subconscious network. This would imply that the social capital comprises a network of households who share bitterness from past incidents and hurts suffered by individuals or households. This perpetuates societally justified wildlife killing or subsistence poaching, regardless of the efforts of CBNRM initiatives. Hence, such actions may impede the effectiveness and efficiency of community-based wildlife conservation and preservation initiatives and tourism development around wildlife-protected areas.

Climate Change, Weather Patterns, and Inclusion of Locals

It is observable that the mean annual rainfall in the area of GNP is around 499 mm, with a standard deviation of about 195 mm (Musakwa et al., 2020a, 2020b; Ntuli & Muchapondwa, 2018). The average maximum monthly temperature ranges from less than 25.9 °C in winter to over 36 °C in summer, while the average monthly minimum ranges from 9 °C to 24 °C in winter and summer, respectively (Gandiwa, 2011; Musakwa et al., 2020a, 2020b; Ntuli & Muchapondwa, 2018). The climate variability and weather changes worsen the erratic rainfall and high temperatures resulting in consistent droughts that lead to a decline in crop harvest, loss of livestock, loss of vegetation, and drying of water bodies (Musakwa et al., 2020a, 2020b; see also Fig. 10.4, 10.5 and 10.6).

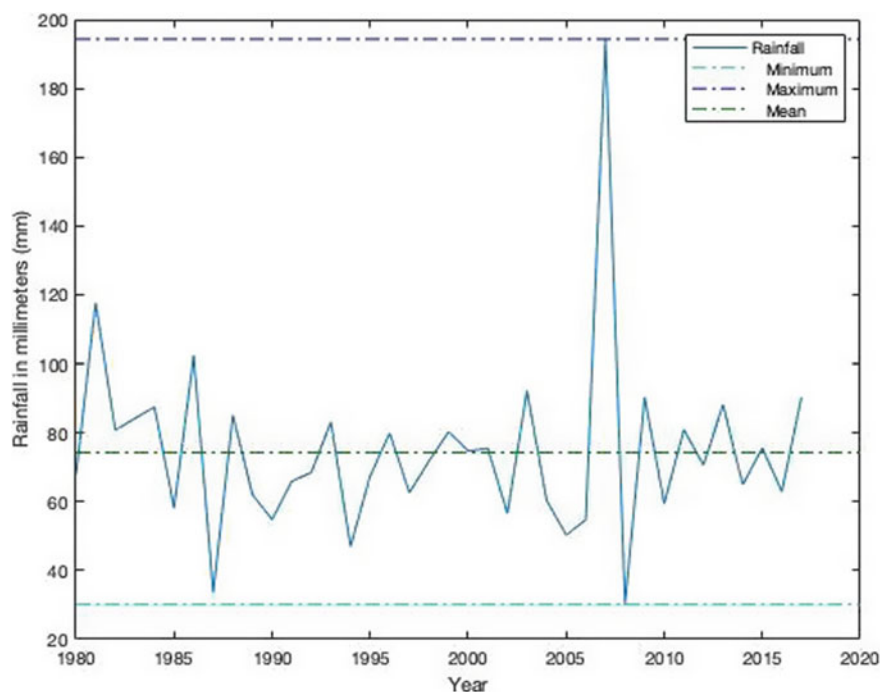


Fig. 10.4 Rainfall

Climate variability in Gonarezhou from 1980 to 2017, Fig. 10.4-rainfall, Fig. 10.5-maximum temperature, and Fig. 10.6-minimum temperature adopted from Musakwa et al. (2020a, 2020b, p. 11).

Based on Figs. 10.4, 10.5, and 10.6, droughts result in local communities turning to subsistence poaching of small game or harvesting natural resources for survival (Musakwa et al., 2020a, 2020b). Thus, droughts have influenced deagrarianisation and food security decline (Musakwa et al., 2020a, 2020b). Hence, as indicated in Figs. 10.4, 10.5, and 10.6, low rainfall and high temperatures threaten the lives of wildlife in GNP because they depend on natural water sources (Musakwa et al., 2020a, 2020b).

Figures 10.7 and 10.8 present findings from Musakwa et al., (2020a, 2020b), which show the results of climate change indicated by increased natural disasters. They indicate cyclones and droughts as the most prevalent disasters around GNP (Musakwa et al., 2020a, 2020b). Research suggests that most droughts experienced are induced by El Niño weather conditions and were witnessed in the 1990s, 2004–2005, and 2015–2016 (Fitchett & Grab, 2014; Musakwa et al., 2020a, 2020b). Hence, communities are encouraged to destock their livestock to reduce losses and to plant drought-resistant crops like sorghum and millet. In addition, Cyclone Leon-Eline in 2000 (Fitchett & Grab, 2014; Musakwa et al., 2020a, 2020b) was the most destructive due to higher volumes of loss of life and destruction of infrastructure, including the

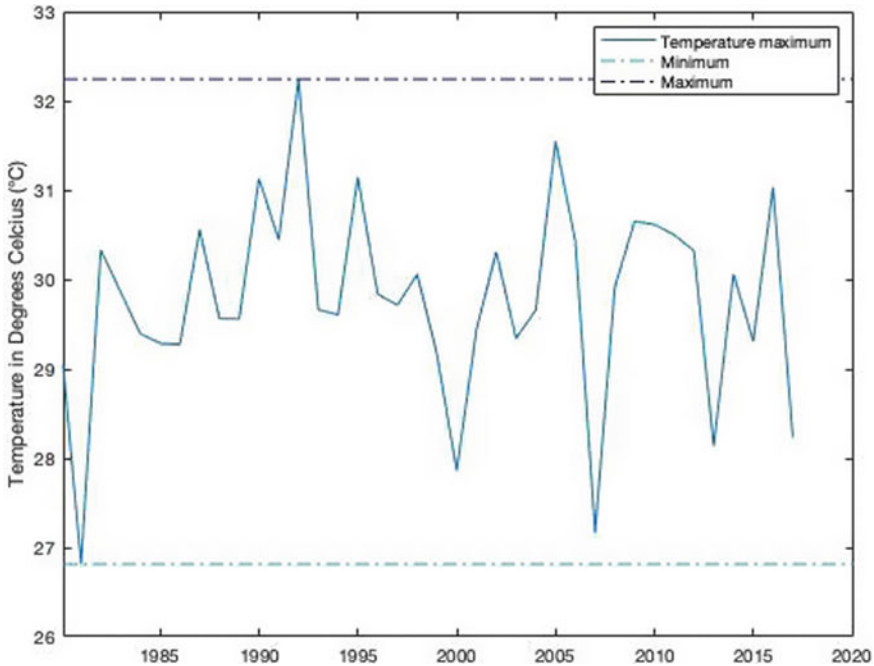


Fig. 10.5 Maximum temperatures

bridge on the Runde River, which connects north and south Gonarezhou. Wildfires occasionally happen, but they have had little to no impact due to conservational efforts like fireguards and rapid response from the Gonarezhou Conservation Trust (Mpofu & Nyathi, 2020; Mpofu et al., 2012).

Conclusion and Contributions

It is worth noting that animal distribution and volumes were excluded from the discussion as the chapter took a blanketing lens to avoid triggering the poaching of certain species. However, trends and patterns in conservation-based tourism development, climate change, the inclusion of locals, and post-human-wildlife co-existence conflicts around GNP were unveiled by the analysis of extant literature. Thereby alluding to the stimuli underlying the attitudes, perceptions and behaviours among individuals and households involved in human-wildlife co-existence conflicts towards conservation-based-tourism development. The chapter also highlights coping mechanisms for livelihoods amidst climate change impacts and the extent of their inclusion in conservation-based tourism. It summarised and illustrated relationships by postulating a post-human-wildlife conflict human behavioural lens to augment societal healing through initiatives that aim to bring interventions

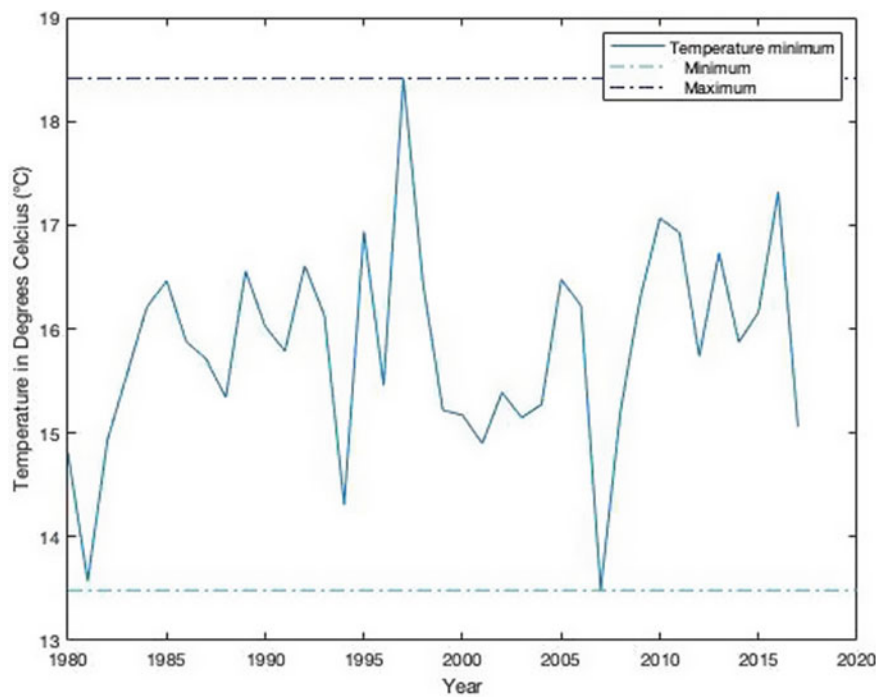


Fig. 10.6 Minimum temperatures

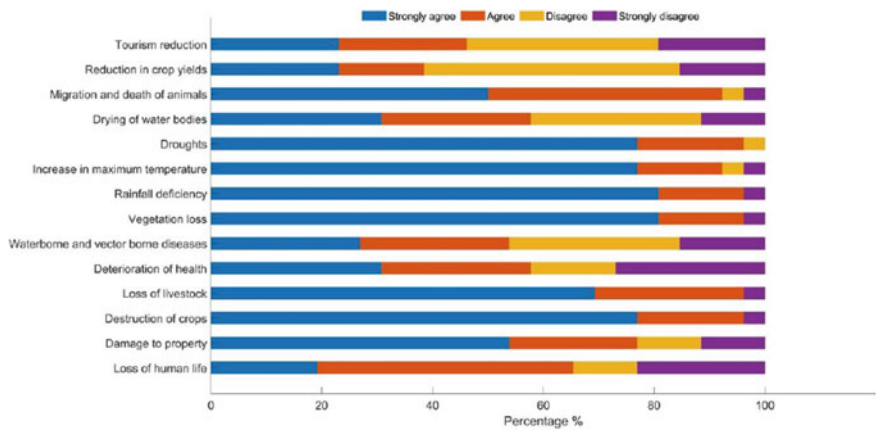


Fig. 10.7 Perceived impacts of climate change (Musakwa et al., 2020a, 2020b, p. 13)

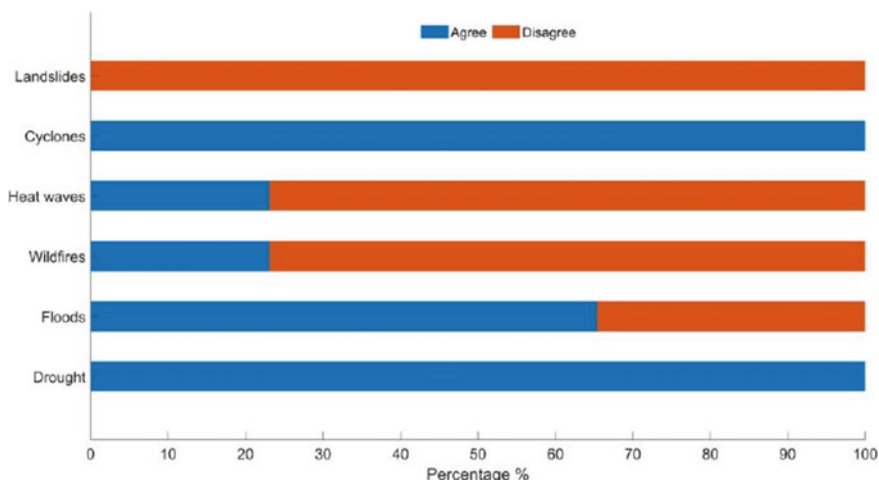


Fig. 10.8 Perceived association between climate change and natural catastrophes (Musakwa et al., p. 13)

on impacts of climate change, human-wildlife co-existence conflicts, the inclusion of locals into conservation-based tourism development in GNP.

The chapter contributes by showing a knowledge gap for further investigation to incorporate conservation, tourism, the inclusion of locals, effects of climate change and post-human-wildlife co-existence conflicts interventions in the suggested model (Fig. 10.9). The model also provides insights into new ways of thinking and dimension within the research agenda for the research community to consider in parks-people relationships.

In addition, the chapter contributes insights on evaluating parks-people from impacts that go beyond the amounts of financial resources spent and quantifiable infrastructures/superstructures as critical measures. Such a traditional matrix ended up overshadowing/understating the non-quantifiable impacts (indicators), which would have informed the indication of the existence of socioeconomic problems caused by human-wildlife toxic interactions in the societies around the Trans frontier Conservancy Areas (TFCAs). Therefore, this chapter informs gaps and, at the same time, can be positioned to:

- (i) inform policymakers and management/leadership of the organisations (public and private) concerned about wildlife, tourism, and communities around protected areas on the aspects they can incorporate in their policies, strategies and implementation of CBNRM initiatives;
- (ii) give insights towards addressing the community's (individuals and households) psycho-emotional healing process that supports the betterment of social capital towards reducing toxic behavioural patterns (see Fig. 10.9);

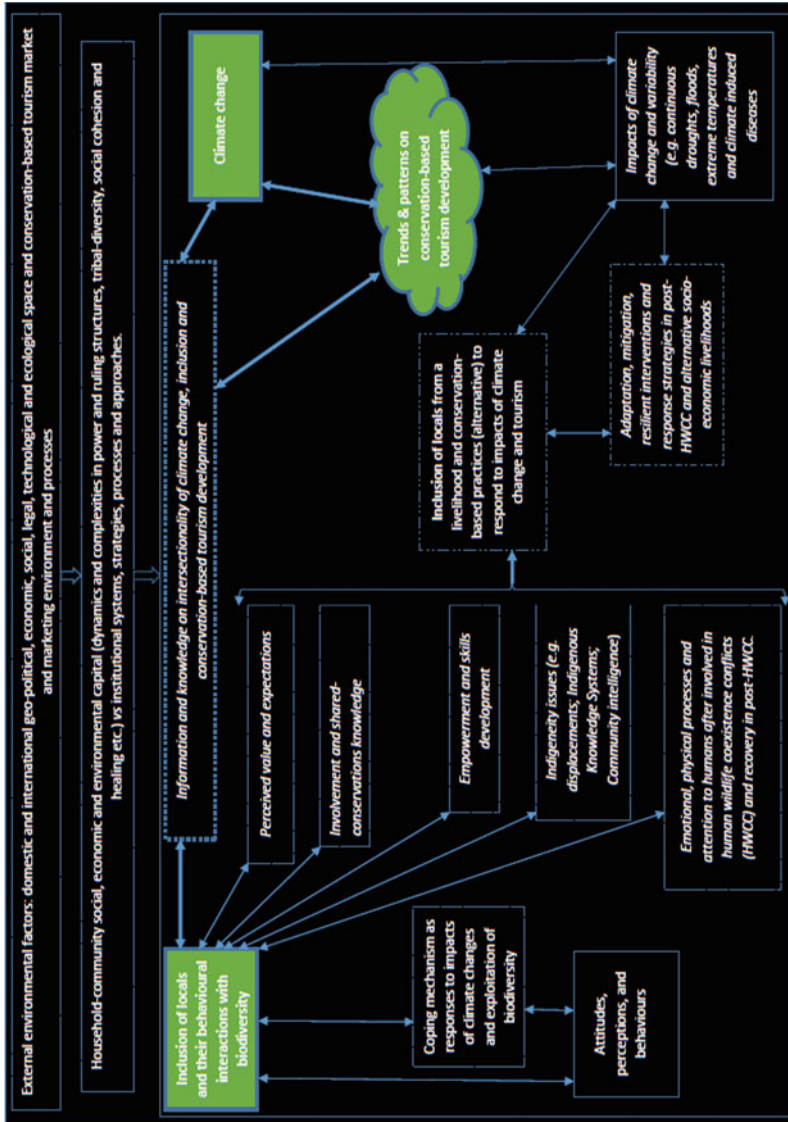


Fig. 10.9 Proposed a conceptual human-behaviour model for conservation-based tourism, the inclusion of locals, post-human wildlife co-existence conflicts, and climate change

- (iii) provide insights on the need to incorporate citizen science for co-creating knowledge that adds and complements the existing sustainable community-based wildlife and tourism (CBNRM) knowledge and practice among stakeholders actively involved in wildlife and conservation-based tourism development;
- (iv) scope literature and suggest a conceptual, behavioural model that can contribute towards addressing local community members' attitudes and behavioural patterns as a foundation that complements efforts in planning and implementing CBNRM initiatives/programmes/activities like CAMPFIRE, among other conservation-based tourism initiatives. Such a model can be relevant for developing means to handle post-human wildlife co-existence conflicts and climate change while upholding alternative means of livelihood through socioeconomic participation, involvement and empowerment of the locals (see Fig. 10.9).

The model considers macro and micro environmental factors as external factors influencing household and community well-being. However, these macro and micro environmental factors were not necessarily part of the scoping. The said environmental factors, directly and indirectly, influence conservation-based tourism development, including locals, post-human-wildlife co-existence conflicts, and climate change, as indicated in the dotted box and arrow lines. There are three facets (inclusion of locals, trends, and patterns in conservation-based tourism development, and climate change) highlighted in green colour. These fundamental elements have a symbiotic link that influences in dual approach to information and knowledge on intersectionality. Each facet has sub-variables that have a dual linkage; however, the end game flows into conservation-based tourism development.

The results inform the proposal of a conceptual post-human-wildlife co-existence conflict human behavioural model that augments societal healing within social capital from impacts of climate change, human-wildlife co-existence conflicts, and inclusion of locals in conservation-based tourism development in GNP (see Fig. 10.9). In conclusion, Fig. 10.9 is informed by the findings that were interpreted and then informed the proposed framework that is illustrating the linkages of the factors (based on trends and patterns) deduced from the extant literature towards conservation-based tourism development that embeds climate change, post-human wildlife co-existence conflicts, and inclusion of locals. Nonetheless, the study has limitations in that. On the one hand, it only considered secondary data and an ethnographic-based lens on the phenomena understudy, without engaging all stakeholders. On the other hand, the study inclusive of Fig. 10.9 proposes areas for future/further studies and as another layer into climate change, local inclusion, and conservation-based tourism development debate in areas around Transfrontier Conservation Areas in Southern Africa.

Based on the findings, the chapter suggests that the research community to further engage in empirical studies on post-human wildlife co-existence conflicts from a community's behavioural intentions and pro-conversation of wildlife behaviour. In addition, there is a need for further investigation on community-wildlife

conservation-based concern/worry and how community-based knowledge influences their co-existence with wildlife in post-human wildlife conflict(s). Added to that, the research community can bring a Southern and Eastern African perspective on post-human wildlife conflicts because these sub-Saharan regions thrive in wildlife tourism found in protected areas, while there are communities living around the designated wildlife conservation areas.

References

- Adams, W. M. (2008). Conservation, carbon and transition to sustainability. *Oryx*, 42(4), 469–470.
- Agrawal, A., & Ostrom, E. (1999). Collective action, property rights, and devolution of forest and protected area management
- Aiyadurai, A. (2016). ‘Tigers are our brothers’ understanding human-nature relations in the Mishmi Hills Northeast India. *Conservation and Society*, 14(4), 305–316.
- Araral, E. (2014). Ostrom, Hardin and the commons: A critical appreciation and a revisionist view. *Environmental Science & Policy*, pp. 36, 11–23.
- Berkes, F. (1989). *Common property resources. Ecology and community-based sustainable development*. Belhaven Press.
- Bromley, D. W. (1992). The commons, common property, and environmental policy. *Environmental and resource economics*, 2, 1–17. <https://doi.org/10.1007/BF00324686>
- Bromley, D. W. (1998a). Determinants of cooperation and management of local common property resources: Discussion. *American Journal of Agricultural Economics*, 80(3), 665–668.
- Bromley, D. W. (1998b). Searching for sustainability: the poverty of spontaneous order. *Ecological economics*, 24(2–3), 231–240
- Carter, N. H., & Linnell, J. D. (2016). Co-adaptation is key to coexisting with large carnivores. *Trends in Ecology & Evolution*, 31(8), 575–578.
- Communal boundaries post-1975 when GNP was created. Accessed from <https://www.ecologyanddsociety.org/vol16/iss4/art8/figure1.html>
- Creswell, J. W. (2014). *Research design: Qualitative, quantitative and mixed methods approaches* (4th ed.). Sage Publications.
- Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.
- Deegan, N. (2012). The local-global nexus in the politics of World Heritage: Space for community development? *Community Development Through World Heritage* 77–83.
- Defe, R., & Matsa, M. (2021). The contribution of climate-smart interventions to enhance sustainable livelihoods in Chiredzi District. *Climate Risk Management*, 33, 100338.
- Dunham, K. M., & der Westhuizen, V. (2016). Aerial survey of elephants and other large herbivores in Gonarezhou National Park (Zimbabwe) and Some Adjacent Areas: 2016. *Gonarezhou Conservation Trust: Chiredzi, Zimbabwe*.
- FAO. (2015). Status of the world’s soil resources (SWSR)—main report. Food and agriculture organisation of the United Nations and intergovernmental technical panel on Soils, Rome, Italy, p. 650.
- Farrell, J. A. K. (1968). Preliminary notes on the vegetation of the lower Sabi-Lundi basin, Rhodesia. *Kirkia*, 6(2), 223–248.
- Feeny, D., Berkes, F., McCay, B. J., & Acheson, J. M. (1990). The tragedy of the commons: Twenty-two years later. *Human Ecology*, 18, 1–19.
- Fitchett, J. M., & Grab, S. W. (2014). A 66-year tropical cyclone record for southeast Africa: Temporal trends in a global context. *International Journal of Climatology*, 34, 3604–3615.

- Frischen, J., Meza, I., Rupp, D., Wietler, K., & Hagenlocher, M. (2020). Drought risk to agricultural systems in Zimbabwe: A spatial analysis of hazard, exposure, and vulnerability. *Sustainability*, 12(3), 752.
- Gandiwa, E. (2011). Wildlife tourism in Gonarezhou National Park, southeast Zimbabwe: Opportunities for wildlife viewing. *Journal of Sustainable Development in Africa*, 13(1), 304–315.
- Gandiwa, E. (2012). Local knowledge and perceptions of animal population abundances by communities adjacent to the northern Gonarezhou National Park, Zimbabwe. *Tropical Conservation Science*, 5(3), 255–269.
- Gandiwa, E., & Kativu, S. (2009). Influence of fire frequency on *Colophospermum mopane* and *Combretum apiculatum* woodland structure and composition in northern Gonarezhou National Park, Zimbabwe. *Koedoe: African Protected Area Conservation and Science*, 51(1), 36–48.
- Gandiwa, E., & Zisadza, P. (2011). Wildlife management in Gonarezhou National Park, Southeast Zimbabwe: Climate change and implications for management. *Nature and Fauna*, 25(1), 101–110.
- Gandiwa, E., Gandiwa, P., & Muboko, N. (2012). Living with wildlife and associated conflicts in a contested area within the Northern Gonarezhou National Park, Zimbabwe. *Journal of Sustainable Development in Africa*, 14(6), 252–260.
- Gandiwa, E., Heitkönig, I. M., Eilers, P. H., & Prins, H. H. (2016). Rainfall variability and its impact on large mammal populations in a complex of semi-arid African savanna protected areas. *Tropical Ecology*, 57(2), 163–180.
- Gandiwa, E., Heitkönig, I. M., Lokhorst, A. M., Prins, H. H., & Leeuwis, C. (2013). CAMPFIRE and human-wildlife conflicts in local communities bordering northern Gonarezhou National Park, Zimbabwe. *Ecology and Society*, 18(4).
- Gandiwa, E., Magwati, T., Zisadza, P., Chinuwo, T., & Tafangenyasha, C. (2011). The impact of African elephants on *Acacia tortilis* woodland in northern Gonarezhou National Park Zimbabwe. *Journal of Arid Environments*, 75(9), 809–814.
- Giampiccoli A., Saayman, M., & Jugmohan, S. (2014). Developing community-based tourism in South Africa: Addressing the missing link. *African Journal for Physical, Health Education, Recreation and Dance*, 20(3:2), 1139–1161.
- Giampiccoli, A., & Saayman, M. (2018). Community-based tourism development model and community participation. *Acta Commercii*, 7, 1–27.
- Giampiccoli, A. (2015). Community-based tourism: Origins and present trends. *African Journal for Physical Health Education, Recreation and Dance*, 21(2), 675–687.
- Giampiccoli, A., & Saayman, M. (2016). Community-based tourism: From a local to a global push. *Acta Commercii*, 16(1), a372.
- Giampiccoli, A., & Glassom, D. (2020). Community-based tourism in protected areas benefits communities and conservation: A model. *Advances in Hospitality and Tourism Research (AHTR)*, 9100, 1–26.
- Gonarezhou National Park—Tourism Map. Accessed from <https://gonarezhou.org/tourism/park-map/>
- Griscom, H. R., Miller, S. N., Gyedu-Ababio, T., & Sivanpillai, R. (2010). Mapping land cover change of the Luvuvhu catchment, South Africa, for environmental modelling. *GeoJournal*, 75, 163–173.
- Hawkshaw, R. S., Hawkshaw, S., & Sumaila, U. R. (2012). The tragedy of the “Tragedy of the commons”: Why coining too good a phrase can be dangerous. *Sustainability*, 4(11), 3141–3150.
- Hemson, G. A. (2004). *The ecology of conservation of lions: Human-wildlife conflict in semi-arid Botswana*. Doctoral dissertation, University of Oxford.
- Hemson, G., MacLennan, S., Mills, G., Johnson, P., & Macdonald, D. (2009). Community, lions, livestock and money: A spatial and social analysis of attitudes to wildlife and the conservation value of tourism in a human–carnivore conflict in Botswana. *Biological Conservation*, 142(11), 2718–2725.

- Hoogendoorn, G., & Fitchett, J. M. (2018). Tourism and climate change: A review of threats and adaptation strategies for Africa. *Current Issues in Tourism*, 21(7), 742–759.
- IPCC, (2001). IPCC third assessment report: Climate change 2001: Synthesis report. Summary for Policy Makers. <http://www.ipcc.ch/pub/un/syeng/spm.pdf>
- Jennings, G. (2001). *Tourism research*. John Wiley and Sons Australia, Ltd.
- Kamwi, J. M., Chirwa, P. W., Manda, S. O., Graz, P. F., & Kätsch, C. (2015). Livelihoods, land use and land cover change in the Zambezi Region, Namibia. *Population and Environment*, 37, 207–230.
- Karidozo, M., La Grange, M., & Osborn, F. V. (2016). Assessment of the human-wildlife conflict mitigation measures being implemented by the Kavango-Zambezi Transfrontier Conservation Area (KAZA TFCA) partner countries. *Report to the KAZA TFCA Secretariat*. BMZ No.: 2009 66 788 and BMZ No.: 2006 65 646.
- Kihara, J., Bolo, P., Kinyua, M., Nyawira, S. S., & Sommer, R. (2020). Soil health and ecosystem services: Lessons from sub-Saharan Africa (SSA). *Geoderma*, 370, 114342.
- Kilungu, H. (2023). Decade of climate change and tourism research in Tanzania: Where are we? *Tanzania Journal of Forestry and Nature Conservation*, 92(1), 185–201.
- Kilungu, H., Leemans, R., Munishi, P. K., & Amelung, B. (2017). Climate change threatens major tourist attractions and tourism in Serengeti National Park, Tanzania. *Climate Change Adaptation in Africa: Fostering Resilience and Capacity to Adapt*, 375–392.
- Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 30, 607–610.
- Madden, F., & McQuinn, B. (2014). Conservation's blind spot: The case for conflict transformation in wildlife conservation. *Biological Conservation*, 178, 97–106.
- Mandudzo, W. C. (2019). People and parks: On the relationship between community development and nature conservation amid climate change in Southeastern Zimbabwe. *Climate Change-Resilient Agriculture and Agroforestry: Ecosystem Services and Sustainability*, 471–491.
- Marpsat, M., & Razafindratsima, N. (2010). Survey methods for hard-to-reach populations: Introduction to the special issue. *Methodological Innovations Online*, 5(2), 3–16.
- Martini, F., Cunliffe, R., Farcomeni, A., De Sanctis, M., Attorre, F., & d'Ammando, G. (2016). Classification and mapping of the woody vegetation of Gonarezhou National Park, Zimbabwe. *Koedoe: African Protected Area Conservation and Science*, 58(1), 1–10.
- Massé, F. (2016). The political ecology of human-wildlife conflict: Producing wilderness, insecurity, and displacement in the Limpopo National Park. *Conservation and Society*, 14(2), 100–111.
- Mero Dowo, G., Kativu, S., & de Garine-Wichatitsky, M. (2018). Local perceptions of tree diversity, resource utilisation and ecosystem services provision at the periphery of Gonarezhou National Park, Zimbabwe. *Forests, Trees and Livelihoods*, 27(1), 1–21.
- Merwe, P., & Saayman, M. (2005). Game farms as sustainable ecotourist attractions. *Koedoe: African Protected Area Conservation and Science*, 48. <https://doi.org/10.4102/koedoe.v48i2.100>.
- Merwe, P., Saayman, M., & Rossouw, R. (2014). The economic impact of hunting: A regional approach. *South African Journal of Economic and Management Sciences*, 17(4), 379–395.
- Merz, L., Pienaar, E. F., Fik, T., Muyengwa, S., & Child, B. (2023). Wildlife institutions highly salient to human attitudes toward wildlife. *Conservation Science and Practice*, e12879.
- Mombeshora, S., & Le Bel, S. (2009). Parks-people conflicts: The case of Gonarezhou National Park and the Chitsa community in southeast Zimbabwe. *Biodiversity and Conservation*, 18, 2601–2623. <https://doi.org/10.1007/s10531-009-9676-5>
- Mpofu, E., & Nyathi, N. A. (2020). Local community perceptions on landscape change, ecosystem services, climate change, and livelihoods in Gonarezhou National Park, Zimbabwe. *Sustainability*, 12(11), 4610.
- Mpofu, E., Gandiwa, E., Zisadza-Gandiwa, P., & Zinhiva, H. (2012). Abundance, distribution and status of African baobab (*Adansonia et al.*) in dry savanna woodlands in southern Gonarezhou National Park, southeast Zimbabwe. *Tropical Ecology*, 53(1), 119–124.

- Muboko, N., & Bradshaw, G. J. (2018). Towards resolving local community and protected area management conflicts: Lessons from the Chitsa community and Gonarezhou National Park, Zimbabwe. *International Journal of Development and Conflict*, 8, 62–79.
- Murphree, M. W. (2009). The strategic pillars of communal natural resource management: benefit, empowerment and conservation. *Biodiversity and Conservation*, 18, 2551–2562.
- Murwendo, T., Murwira, A., & Masocha, M. (2023). Vegetation phenology patterns in semi-arid savannah woodlands of Gonarezhou National Park, Southeastern Zimbabwe. *International Journal of Geoheritage and Parks*, 11(2), 298–309.
- Musakwa, W., Gumbo, T., Paradza, G., Mpofu, E., Nyathi, N. A., & Selamolela, N. B. (2020a). Partnerships and stakeholder participation in the management of national parks: Experiences of the Gonarezhou National Park in Zimbabwe. *Land*, 9(11), 399.
- Musakwa, W., Mpofu, E., & Nyathi, N. A. (2020b). Local community perceptions on landscape change, ecosystem services, climate change, and livelihoods in Gonarezhou National Park, Zimbabwe. *Sustainability*, 12(11), 4610.
- Mutanga, C. N., Muboko, N., & Gandiwa, E. (2017). Protected area staff and local community viewpoints: A qualitative assessment of conservation relationships in Zimbabwe. *PLoS ONE*, 12(5), e0177153.
- Narula, S. A., Magray, M. A., & Desore, A. (2017). A sustainable livelihood framework to implement CSR projects in the coal mining sector. *Journal of Sustainable Mining*, 16(3), 83–93.
- Ntuli, H., & Muchapondwa, E. (2018). The role of institutions in community wildlife conservation in Zimbabwe. *International Journal of the Commons*, 12(1).
- Ntuli, H., Jagers, S. C., Linell, A. et al. (2019a). Factors influencing local communities' perceptions towards conservation of transboundary wildlife resources: The case of the Great Limpopo Transfrontier Conservation Area. *Biodivers Conserv*, 28, 2977–3003. <https://doi.org/10.1007/s10531-019-01809-5>
- Ntuli, H., Sundström, A., Sjöstedt, M., & Muchapondwa, E. (2019b). Understanding the drivers of subsistence poaching in the Great Limpopo Transfrontier Conservation Area: What matters for community wildlife conservation? econrsa.org
- Ntuli, H., Sundström, A., Sjöstedt, M., Muchapondwa, E., Jagers, S., & Linell, A. (2021). Understanding the Drivers of subsistence poaching in the Great Limpopo Transfrontier Conservation Area: What Matters for community wildlife conservation? *Ecology and Society*, 26(1).
- O'Connor, T. G., & Campbell, B. M. (1986). Classification and condition of the vegetation types of the Nyahungwe area on the Lundi River, Gonarezhou National Park, Zimbabwe. *South African Journal of Botany*, 52(2), 117–123.
- Ostrom, E. (1990). *Governing the Commons: The evolution of institutions for collective action*. Cambridge University Press.
- Ostrom, E. (1999). Coping with tragedies of the commons. *Annuals of Reviews Political Sciences*, 2, 493–535.
- Ostrom, E. (2007). Collective action and local development processes. *Sociologica*, 1(3), 0–0.
- Ostrom, E. (2009). Building trust to solve commons dilemmas: Taking small steps to test an evolving theory of collective action. *Games, Groups, and the Global Good*, 207–228.
- Ostrom, E., & Nagendra, H. (2007). More than tenure is required: Monitoring is essential. *Environmental Economics and Policy Studies*, 8, 175–199.
- Ostrom, E., Burger, J., Field, C. B., Norgaard, R. B., & Policansky, D. (1999). Revisiting the Commons: Local lessons, global challenges. *Science*, 284(5412), 278–282.
- Ostrom, V., Fenny, D., & Picht, H. (1990). Institutional analysis and development: Rethinking the terms of choice. Rethinking institutional analysis and development. *International Centre for Economic Growth, USA*.
- Otto-Mentz, V. (2019). Cyclone Idai and the importance of resilience. *MoneyMarketing*, 2019(5), 16–16.
- Pettorelli, N., Chauvenet, A. L., Duffy, J. P., Cornforth, W. A., Meillere, A., & Baillie, J. E. (2012). Tracking the effect of climate change on ecosystem functioning using protected areas: Africa as a case study. *Ecological Indicators*, 20, 269–276.

- Pielke, R. A., Jr. (2005). Misdefining “climate change”: Consequences for science and action. *Environmental Science & Policy*, 8(6), 548–561.
- Pinkerton, E. (Ed.). (1989). *Co-operative management of local fisheries: new directions for improved management and community development*. UBC Press.
- Pinkerton, E. (1992). Translating legal rights into management practice: Overcoming barriers to the exercise of co-management. *Human Organization*, 51(4), 330–341.
- Pooley, S. (2021). Coexistence for whom? *Frontiers in Conservation Science*, 2, 726991.
- Pooley, S., Bhatia, S., & Vasava, A. (2021). Rethinking the study of human–wildlife coexistence. *Conservation Biology*, 35(3), 784–793.
- Rasoolimanesh, S. M., Jaafar, M., Ahmad, A. G., & Barghi, R. (2017). Community participation in World Heritage site conservation and tourism development. *Tourism Management*, 58, 142–153.
- Saayman, M., & Giampiccoli, A. (2016). Community-based and pro-poor tourism: Initial assessment of their relation to community development. *European Journal of Tourism Research*, 12, 145–190.
- Scott, A. (1993). Obstacles to fishery self-government. *Marine Resource Economics*, 8(3), 187–199.
- Shackleton, S. E. (2018). Exploring long-term livelihood and landscape change in two semi-arid sites in Southern Africa: Drivers and consequences for social–ecological vulnerability. *Land*, 7(2), 50.
- Sherry, B. Y. (1970). *Vegetation map of Gonarezhou National Park*. Unpublished map.
- Smith, T. (2012). *Surveying hard-to-reach populations in a comparative perspective*. GSS Cross-National Report No. 33.
- Steffen, W., Broadgate, W., Deutsch, L., Gaffney, O., & Ludwig, C. (2015a). The trajectory of the Anthropocene: The great acceleration. *The Anthropocene Review*, 2(1), 81–98.
- Steffen, W., Crutzen, P. J., & McNeill, J. R. (2007). The Anthropocene: Are humans now overwhelming the great forces of nature? *Ambio-Journal of Human Environment Research and Management*, 36(8), 614–621.
- Steffen, W., Richardson, K., Rockström, J., Cornell, S. E., Fetzer, I., Bennett, E. M., et al. (2015b). Planetary boundaries: Guiding human development on a changing planet. *Science*, 347(6223), 1259855.
- Steg, L. (2018). Limiting climate change requires research on climate action. *Nature Climate Change*, 8(9), 759–761.
- Stoldt, M., Göttert, T., & Mann, C. et al. (2019). Transfrontier conservation areas and human–wildlife conflict: The case of the Namibian component of the Kavango-Zambezi (KAZA) TFCA. *Scientific Report*, 10, 7964 (2020). <https://doi.org/10.1038/s41598-020-64537-9>
- Tafangenyasha, C. (1997). Tree loss in the Gonarezhou National Park (Zimbabwe) between 1970 and 1983. *Journal of Environmental Management*, 49(3), 355–366.
- Tafangenyasha, C. (2001). Decline of the mountain acacia, *Brachystegia glaucescens* in Gonarezhou National Park, southeast Zimbabwe. *Journal of Environmental Management*, 63(1), 37–50.
- Thondhlana, G., Redpath, S. M., Vedeld, P. O., van Eeden, L., Pascual, U., Sherren, K., & Murata, C. (2020). Non-material costs of wildlife conservation to local people and their implications for conservation interventions. *Biological Conservation*, 246, 108578.
- UNEP. (2010). Global environmental governance: Design, leadership, location. *Global Environmental Politics*, 10(1), 30–59.
- UNEP-WCMC, I. U. C. N. (2018). NGS. (2018). *Protected planet report*, 70.
- United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) (2019–2020). Annual Review. <https://www.unep-wcmc.org/en/news/unep-wcmc-publishes-annual-review-2019-2020>
- United Nations-Sustainable Development Goals report (2022). Accessed from <https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf>.
- Van Schendel, W. (2022). Commons and wildlife conservation. In *The Routledge Companion to Northeast India* (pp. 73–80). Routledge India.
- Wild, H. (1955). Common Rhodesian weeds. *Common Rhodesian weeds*. cabdirect.org.

- Wisely, S. M., Alexander, K., & Cassidy, L. (2018). Linking ecosystem services to livelihoods in southern Africa. *Ecosystem Services*, 30, 339–341.
- Wu, J. (2013). Key concepts and research topics in landscape ecology revisited: 30 years after the Allerton Park workshop. *Landscape ecology*, 28, 1–11.
- Yin, R. K. (2003). Designing case studies. *Qualitative Research Methods*, 5(14), 359–386.
- ZimStat.2014.http://www.zimstat.co.zw/sites/default/files/img/publications/Other/Compendium_2014.pdf. Date of access: September 14, 2022.
- ZimStat-CensusPreliminary Report. (2012). https://unstats.un.org/unsd/demographic/sources/census/wphc/Zimbabwe/ZWE_CensusPreliminary2012.pdf. Date of access: September 14, 2022.
- Zisadza-Gandiwa, P., Mabika, C. T., Kupika, O. L., Gandiwa, E., & Murungweni, C. (2013). Vegetation structure and composition across different land uses in a semi-arid savanna of southern Zimbabwe. *International Journal of Biodiversity*, 2013, 1–5.

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