International Journal of Scientific Trends- (IJST)
ISSN: 2980-4299
Volume 3, Issue 9, September- 2024
Website: https://scientifictrends.org/index.php/ijst
Open Access, Peer Reviewed, Scientific Journal

Sustainable Development of International Tourism in the Context of Climate Change

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Abstract

The article demonstrates that the sustainability of international tourism is achieved through the integration of measures to manage destination climate risks and reduce the carbon footprint of tourism activities, primarily in the transport and hotel subsystems. Key climate challenges for the industry are identified, and the role of multi-level governance and international initiatives in ensuring long-term sustainability is substantiated. The practical significance of this study lies in the development of a comprehensive approach to sustainable tourism development focused on the measurability of climate impacts, stakeholder coordination, and alignment of industry strategies with global climate goals.

Keywords: International tourism, sustainable development, climate change, decarbonization, adaptation, tourism carbon footprint, climate risks, Glasgow Declaration.

Introduction

The scientific novelty lies in a comprehensive examination of the sustainable development of international tourism through the prism of its "dual role" as a climate-vulnerable industry and, at the same time, a source of emissions, with a systematization of climate challenges and management instruments for adaptation and decarbonization at different levels of governance.

Climate change is becoming a key factor determining the development trajectory of international tourism, as the industry is both climate-sensitive (due to seasonality, comfort, natural attractors, and safety of stay) and climate-significant as a source of emissions throughout the tourism value chain. The IPCC scientific consensus emphasizes that anthropogenic warming is already leading to widespread impacts and increased risks, and adaptation and emission reductions must accelerate across all economic sectors [1].

For tourism, this problem is twofold. On the one hand, the risks to destinations and infrastructure (heat waves, fires, floods, and the degradation of coastal and mountain ecosystems) are increasing, requiring systemic adaptation. On the other hand, international tourism itself generates a significant share of climate change stress: an assessment of the carbon footprint of global tourism (based on interregional input-output tables) showed approximately 8% of global emissions for the period 2009–2013, with the transport component dominating and demand rapidly growing [2].

Institutional frameworks and industry initiatives recognize the need to transition to measurable climate action in tourism. UN Tourism emphasizes that, according to UN Tourism /ITF estimates,

tourism transport emissions under a business-as-usual scenario could increase significantly by 2030, which reinforces the need to decarbonize mobility [3]. At the same time, Glasgow The Declaration provides a common framework of commitments for tourism stakeholders to plan, reduce and report on emissions, with a focus on the goal of halving emissions by 2030 and reaching Net Zero by 2050 [4]. Practice-oriented detailing of steps towards Net The WTTC roadmap also proposes Zero for the industry [5].

In the scientific literature, the basis of analysis is based on approaches that view tourism as a system, where sustainability is determined by simultaneous progress in two areas: adaptation (managing climate risks for destinations and infrastructure) and mitigation (reducing emissions, primarily in transport and accommodation). These positions are reflected both in early fundamental UNWTO/UNEP reports on climate and tourism and in modern reviews on decarbonization of the tourism industry [6].

The purpose of the article is to summarize modern approaches to the sustainable development of international tourism in the context of climate change and to systematize management tools for adaptation and decarbonization at the levels of government, destination, and business.

In the theoretical and methodological analysis of the sustainable development of international tourism in the context of climate change, the key approach is to consider tourism within the framework of its “dual role”: as a sector highly vulnerable to climate change and, at the same time, as a significant source of anthropogenic greenhouse gas emissions.

theory perspective , tourism is a climate- sensitive economic activity, as its supply and demand are directly determined by weather conditions, seasonality, and the state of natural ecosystems. Early systemic studies by the UNWTO and UNEP emphasize that rising temperatures, more frequent extreme weather events, and degradation of natural resources increase risks to destinations, tourism infrastructure, and travel safety, necessitating adaptation strategies at the level of territorial planning and destination management [6].

Current IPCC assessments confirm that without active adaptation, climate risks will increase, especially for coastal, island and mountain tourist regions, which could lead to changes in seasonality and redistribution of international tourist flows [1].

The second methodological area concerns the analysis of tourism's climate impact. Using intersectoral input-output models, it has been shown that international tourism generates a significant carbon footprint through transport, accommodation, and associated consumption, with the growth of tourist mobility outpacing the rate of improvement in energy efficiency [2].

In this context, the theoretical basis is the concept of climate change mitigation, which entails decarbonizing tourism value chains and aligning the industry's development with global climate goals. Recent reviews emphasize that without structural changes in international mobility and tourism infrastructure, tourism sustainability will remain declarative in nature [7].

Thus, sustainable development of international tourism is methodologically based on the integration of adaptation and mitigation, which implies the simultaneous management of destination climate risks and emission reduction. This synthesis is reflected both in the scientific literature and in the UN institutional framework. Tourism and industry roadmaps to Net Zero, forming the basis for comprehensive analysis and practice-oriented solutions.

Climate change poses a complex set of interconnected challenges for international tourism, affecting both destinations ' resource base and the industry's economic and infrastructural

sustainability. Recent research and reports from international organizations highlight several of the most significant climate challenges:

1. Increasing frequency and intensity of extreme climate events. The increasing frequency of heatwaves, wildfires, floods, storms, and droughts directly impacts tourist safety and the functioning of tourism infrastructure. The IPCC emphasizes that extreme weather events are becoming more intense and prolonged, increasing operational risks for destinations and reducing their attractiveness during peak seasons.

2. Degradation of natural tourism resources. Climate change accelerates coastal erosion, coral reef bleaching, reduced snow cover, and the degradation of ecosystems that are key tourist attractors. This is particularly critical for coastal, island, and mountainous regions, where tourism is closely linked to the natural environment [6].

3. Changing seasonality and tourist demand. Rising average temperatures and increased climate variability are leading to shifting tourist seasons and a redistribution of international flows. Traditional "peak" destinations may lose their competitiveness during the summer months, while the importance of off-season and alternative tourism increases [8].

4. Growing carbon footprint of international tourism. International tourism remains a significant source of greenhouse gas emissions, primarily due to transport. Without targeted decarbonization measures, the growth of tourist mobility increases climate impacts and increases regulatory and reputational risks for the industry [2].

Table 1 - Key climate challenges for international tourism

Climate Challenge	**The main mechanism of action**	**Consequences for international tourism**
Extreme weather events	Increase in the frequency and intensity of emergencies	Reduced security, disruptions in infrastructure
Degradation of natural resources	Erosion, loss of ecosystems	Declining attractiveness of destinations
Change in seasonality	Shifting climate comfort	Redistribution of tourist flows
High carbon footprint	Dominance of transport emissions	Pressure for decarbonization and rising costs

Sustainable development of international tourism in the face of climate change relies on two complementary approaches: adaptation to climate risks and decarbonization of tourism. Scientific and institutional literature emphasizes that pursuing only one of these approaches does not ensure the long-term sustainability of the industry.

Adaptation in tourism aims to reduce the vulnerability of destinations, infrastructure, and tourists to climate risks. Key adaptation measures include climate -smart spatial planning, tourism product diversification, seasonality management, and the implementation of early warning systems and safety protocols. These approaches are substantiated in detail in joint UNWTO and UNEP reports, emphasizing the need to integrate climate risks into tourism development strategies at the national and regional levels [6].

Decarbonization (mitigation) is aimed at reducing greenhouse gas emissions throughout the tourism value chain. Research shows that the greatest potential for reducing emissions lies in the transport subsystem (primarily aviation), as well as in the accommodation sector through energy

efficiency and the transition to renewable energy sources [7]. Current industry roadmaps (WTTC) and UN Tourism initiatives emphasize the need to measure emissions and set quantitative targets aligned with global climate benchmarks.

Modern approaches rely on the need to simultaneously implement adaptation and decarbonization measures. This integration allows for climate risk reduction without increasing the carbon footprint and forms the basis for the long-term competitiveness of international tourism.

Table 2 - Approaches to sustainable development of international tourism

Direction	**Key measures**	**Expected effect**
Adaptation	Climate -oriented planning, seasonality management, and tourist safety	Reducing the vulnerability of destinations
Decarbonization	Reduction of transport emissions, energy efficiency, renewable energy sources	Reducing carbon footprint
Integrated approach	Coordination of adaptation and mitigation	Long-term sustainability of tourism

Effective implementation of sustainable international tourism development principles in the face of climate change requires the use of systemic management tools that ensure coordinated actions at the government, destination, and tourism industry levels. Scientific and practical literature emphasizes that a key condition for effectiveness is the transition from declarative sustainability goals to measurable, planned, and controllable management of climate risks and emissions.

At the national level, sustainable management tools include integrating the climate agenda into national tourism, spatial planning, and transport development strategies. Regulatory mechanisms (building standards, environmental requirements, emissions reporting) and economic incentives (subsidies, tax breaks, and programs supporting low- carbon and climate-resilient investments) play a key role. UN Tourism and UNEP emphasize the importance of aligning tourism policies with national climate commitments and sustainable development goals.

At the destination management (DMO) level, key tools are destination climate plans , which include vulnerability assessments, climate risk scenario analysis, and tourism product adaptation measures. A complementary element is the coordination of stakeholders (businesses, local communities, and government agencies) and the implementation of tourism load and carbon footprint monitoring systems. Glasgow serves as the international framework for this approach. Declaration on Climate Action in Tourism, which guides destinations through planning, reduction and public reporting.

For tourism businesses, sustainable management is implemented through corporate climate management tools: emissions inventory (Scopes 1–3), reduction targets, energy and resource conservation, sustainable procurement, and the development of low-carbon tourism products. Industry roadmaps to Net Zero emphasizes that without business engagement, decarbonization and adaptation goals remain unattainable.

Together, these instruments form a multi-level system for managing the sustainable development of international tourism, focused on long-term sustainability, reducing climate risks and increasing the competitiveness of destinations .

Table 3 - Tools for managing sustainable development of international tourism

Management level	**Basic tools**	**Target effect**
State	Sustainable tourism strategies, climate regulation, economic incentives	Reducing systemic climate risks
Destination Management Organization (DMO)	Climate plans, load and emission monitoring, stakeholder coordination	Improving resilience and adaptability
Business	Emissions accounting, energy efficiency , sustainable products	Reducing carbon footprint
Intersectoral level	Partnerships, reporting, international initiatives	Consistency and transparency of management

The analysis shows that the resilience of international tourism in the face of climate change is determined not by individual measures, but by a set of interconnected conditions that ensure the industry's ability to adapt to climate risks and simultaneously reduce its own climate impact.

First, measurability is a fundamental requirement for sustainability. Without a systematic assessment of climate risks and the carbon footprint of tourism activities, sustainable development remains declarative. Current practices and recommendations from UN Tourism and the World Tourism Organisation (WTTC) emphasize the need for emissions inventories, destination vulnerability monitoring , and regular reporting as the basis for management decisions.

Secondly, sustainability requires focusing on key impact sources. Transport, primarily aviation, accounts for the largest contribution to international tourism emissions, while coastal, island, and mountainous regions are critical for adaptation. Concentrating resources on these "bottlenecks" ensures the greatest impact both in terms of reducing climate stress and increasing destination resilience.

Third, integrating adaptation and decarbonization is crucial. Climate risk mitigation measures should not increase the carbon footprint, just as emission reduction strategies should take into account the climate vulnerability of territories. This integrated approach avoids conflicting objectives and builds the long-term resilience of tourism systems.

Fourth, sustainable development of international tourism is impossible without multi-level governance and stakeholder coordination . Coordination of actions by government, destinations , and businesses, as well as participation in international initiatives (for example, Glasgow Declaration) increase the institutional stability of the industry and reduce the risks of fragmented solutions.

Therefore, the key conditions for the sustainability of international tourism lie in the transition from fragmented climate initiatives to systemic, measurable and coordinated management aimed at long-term adaptation and decarbonization in the face of increasing climate change.

Sustainable development of international tourism in the face of climate change requires simultaneous solutions to adaptation and decarbonization challenges. Climate risks are transforming tourism products and infrastructure requirements, while tourism's carbon footprint necessitates a transition to measurable emission reduction targets, primarily in the transport and

hotel subsystems. The most effective management logic: climate plans and reporting at the level of states, destinations , and businesses, aligned with international frameworks (UN Tourism , IPCC) and industry initiatives (Glasgow Declaration , Net Zero Roadmap).

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