

ORIGINAL RESEARCH ARTICLE

Toward sustainable river tourism in the
Brahmaputra River Basin: A socio-ecological
perspective on climate adaptation, smart
tourism, and community well-being

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Abstract

River tourism has emerged as an important means of promoting sustainable regional development, especially in ecologically and culturally important destinations. However, increasing climatic variability, technological transformation, and growing community expectations pose significant challenges to the long-term sustainability of the river tourism system. This study explores the future of sustainable river tourism in the Brahmaputra River Basin, Assam, India, through a socio-ecological perspective informed by resilience theory and socio-ecological systems (SES) theory. Using a qualitative exploratory case study design, the research investigated stakeholders' perceptions of climate adaptation, smart tourism, community well-being, and governance processes. A total of 24 semi-structured interviews were conducted between February and November 2025 with key stakeholders involved in the development of river tourism, including community leaders, tourism entrepreneurs, service providers, government officials, environmental practitioners, and tourism researchers. The data were analyzed using thematic analysis involving open, axial, and selective coding. The results revealed four interconnected themes that shape the future of sustainable river tourism: (i) climate resilience and adaptive planning, (ii) smart tourism and digital governance, (iii) community participation and social inclusion, and (iv) integrated governance for sustainable tourism futures. The study shows that sustainable tourism thrives through the dynamic interplay between environmental resilience, digital adaptive capacity, community legitimacy, and adaptive governance. Based on these findings, the study proposes an adaptive sustainability framework that extends existing resilience-based tourism research by integrating environmental, technological, and social aspects in the context of a socio-ecological system. These findings provide practical insights for policymakers and destination managers looking to strengthen climate adaptive capacity, promote inclusive governance, and encourage sustainable tourism transformation in ecologically fragile river destinations.

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1. Introduction

Sustainable tourism has become a central concern in contemporary debates over environmental governance, regional development, and socio-economic transformation. As tourism destinations face the impacts of climate change, technological disruption, and changing stakeholder expectations, questions about how tourism systems can remain resilient and adaptable are gaining renewed importance. The exploration of sustainability in tourism now encompasses environmental stewardship, community well-being, institutional adaptability, and holistic governance beyond economic development.

River tourism represents one of the fastest-growing segments of nature-based and cultural tourism worldwide. The river system supports a variety of tourism activities, including recreational boating, eco-tourism, wildlife watching, pilgrimage, cultural tourism, and community-based tourism initiatives. In addition to creating economic opportunities, river tourism contributes to cultural exchange, heritage conservation, and the diversification of local livelihoods. Nevertheless, river tourism destinations are often highly susceptible to ecological disturbances, variable hydrological conditions, infrastructure constraints, and administrative complexities. These vulnerabilities underscore the need for integrated approaches capable of addressing the interconnected environmental, social, and technological aspects of sustainable tourism.

The Brahmaputra River Basin in Assam, India, offers a particularly relevant context for examining these challenges. As one of Asia's largest and most dynamic river systems, the Brahmaputra River serves as an important environmental, cultural, and economic resource for millions of people. The basin supports a variety of tourism activities, including river cruises, eco-tourism, cultural festivals, religious tourism, wildlife-based tourism, and recreational experiences related to river landscapes. At the same time, the region experiences recurrent flooding, riverbank erosion, environmental degradation, and socio-economic inequalities that directly affect the development of tourism and community livelihoods.

Climate change has intensified concerns about the long-term sustainability of tourist destinations around the world. Increasingly unpredictable weather patterns, extreme weather events, and environmental degradation threaten tourism infrastructure, destination attractions, and visitor experiences. River-based destinations such as the Brahmaputra Basin are particularly susceptible to these climate pressures due to their dependence on ecological systems and hydrological stability. As a result, climate adaptation and long-term adaptability have emerged as essential components of sustainable tourism planning.

Along with environmental change, technological innovation is transforming how tourist destinations are managed and experienced. The emergence of smart tourism technologies, digital communication platforms, online booking systems, and data-driven decision-making tools has reshaped tourism governance and destination competitiveness. The COVID-19 pandemic has accelerated digital transformation in the tourism sector, highlighting the role of technology in maintaining service continuity and supporting adaptive responses during disruptions. However, unequal access to digital resources and technological capabilities raises important questions about the inclusivity and sustainability of smart tourism initiatives.

Equally important is the fact that tourism sustainability depends largely on the well-being and participation of the local community. Tourism development that excludes local voices can undermine social legitimacy, create conflict, and produce unequal outcomes. Local participation fosters local ownership, strengthens community trust, and facilitates community responses to environmental and socio-economic challenges. Participatory governance is therefore increasingly being recognized as the cornerstone of sustainable tourism transformation.

Although most of the available research examines climate adaptation, smart tourism, and community participation, these aspects are often explored independently. As a result, tourism sustainability continues to be interpreted through fragmented conceptual lenses that inadequately capture the complex interactions between ecosystems, technological capabilities, governance structures, and social processes. In addition, limited attention has been given to the river tourism system in Northeast India despite its ecological importance and development potential. To address these gaps, this study explores sustainable river tourism futures in the Brahmaputra River Basin through a socio-ecological perspective informed by resilience theory and socio-ecological systems (SES) theory. Specifically, the study seeks to:

- (i) Explore stakeholder perspectives on climate adaptation and tourism resilience within the Brahmaputra River Basin;
- (ii) Examine the role of smart tourism practices and technological innovation in supporting sustainable tourism development;
- (iii) Investigate how community well-being and participatory processes contribute to tourism sustainability; and
- (iv) Develop a comprehensive understanding of how environmental, technological, and social aspects interact to shape the future of sustainable river tourism.

The main contribution of this study lies in advancing tourism resilience scholarship through the development of an adaptive sustainability framework that integrates adaptive governance with environmental resilience, digital adaptive capacity, community legitimacy, and socio-ecological perspectives. Rather than treating climate adaptation, technological innovation, and community well-being as separate areas, the proposed framework demonstrates how these dimensions interact to facilitate sustainable change within ecologically fragile tourism destinations.

Focusing on the Brahmaputra River Basin, this study provides empirical insights from an underrepresented geographical context and practical guidance for policymakers, tourism planners, and destination managers looking to build a resilient, inclusive, and sustainable river tourism system.

2. Theoretical foundations

2.1. Resilience theory and sustainable tourism

Resilience theory has emerged as one of the most influential frameworks for understanding sustainability, adaptation, and transformation in complex environmental and social systems. Originally developed in the ecological sciences, resilience refers to the capacity of a system to absorb disturbances, reorganize, and continue functioning while maintaining its essential structure and identity.¹ This concept has subsequently been extended to social, economic, and governance systems, including tourism destinations that face increasing environmental and socio-economic uncertainty.^{2,3}

In tourism studies, resilience has been widely applied to examine how destinations respond to natural disasters, climate change, economic crises, and public health emergencies.^{4,5} Resilient destinations are characterized not only by their ability to recover from disturbances but also by their capacity to anticipate risks, adapt to changing conditions, and transform governance structures when necessary.⁶ Such adaptive capacities are increasingly important as tourism destinations face escalating environmental pressures associated with climate change.

Climate-related risks, including flooding, riverbank erosion, biodiversity loss, and extreme weather events, pose significant challenges for river tourism destinations.⁷ These risks can disrupt tourism infrastructure, reduce visitor satisfaction, threaten local livelihoods, and undermine destination competitiveness. Consequently, resilience has become a central concept in sustainable tourism planning because it provides a framework for understanding how destinations can maintain functionality under changing

environmental conditions.

The COVID-19 pandemic has further increased the relevance of resilience thinking within tourism research. The crisis demonstrated that tourism sustainability depends not only on environmental adaptation but also on institutional flexibility, stakeholder collaboration, technological innovation, and adaptive governance. Recent studies emphasize that resilient tourism systems require integrated responses that combine environmental preparedness with social inclusion and digital transformation.^{8,9}

In the context of the Brahmaputra River Basin, socio-ecological resilience is particularly relevant as tourism develops within a dynamic riverine environment characterized by repeated floods, erosion, and environmental fragility. It is therefore essential to understand how stakeholders develop and implement adaptive strategies to promote sustainable tourism in the region.

2.2. Socio-ecological systems theory

While resilience theory mainly focuses on adaptive capacity and system sustainability, SES theory provides a broad framework for understanding interactions between the environment and social systems. SES theory conceptualizes human and environmental systems as interconnected, co-evolutionary entities whose sustainability depends on continuous interaction and feedback mechanisms. According to SES theory, environmental resources, collaborative management, economic activities, technological systems, and social actors should not be examined separately because changes in one element inevitably affect the others. This approach is particularly relevant for tourism destinations, where natural resources, local communities, visitors, businesses, and policymakers intersect within complex and dynamic systems.^{5,10}

Tourism destinations are highly dependent on ecological resources while also influencing ecological and social conditions. Sustainable tourism therefore requires coordinated institutional approaches capable of balancing conservation objectives, economic development, and community interests.¹¹ SES theory highlights the importance of adaptive administrative collaboration, stakeholder collaboration, and participatory decision-making in addressing sustainability challenges within such complex systems.^{5,9}

The current tourism literature increasingly takes a socio-ecological approach to examine destination resilience, sustainable change, and adaptive management. Researchers argue that sustainable outcomes arise not from isolated interventions but from integrated interactions

among the environmental, institutional, technological, and social aspects of destination development.^{6,11}

For river tourism destinations, SES theory provides a particularly useful lens because river systems are inherently dynamic and characterized by strong interdependencies between ecological processes and human activity. Environmental changes affect tourism opportunities, while tourism development affects resource utilization, administrative structures, and community well-being. As a result, the future of sustainable tourism depends on striking a balance between these interconnected aspects.

2.3. Adaptive sustainability framework

Based on resilience theory and SES theory, this study proposes an adaptive sustainability framework to understand the future of sustainable river tourism. This framework is based on the idea that tourism destinations act as adaptive SES in which environmental resilience, technological innovation, institutional coordination, governance systems, and community well-being interact to drive sustainable outcomes.

The first element of the framework is climate adaptation. Climate adaptation enhances environmental resilience by reducing vulnerability, strengthening preparedness, and supporting ecosystem conservation.¹² Adaptive measures such as resilient infrastructure, environmental monitoring, disaster preparedness, and ecosystem recovery are increasingly recognized as essential components of sustainable tourism development.

The second element is technological innovation, especially the application of smart tourism technology. Smart tourism systems contribute to digital adaptive capacity by improving destination management, visitor services, sustainability monitoring, and information exchange among stakeholders. The growing importance of digital transformation after the COVID-19 pandemic has increased emphasis on the role of technology in strengthening tourism resilience.¹³⁻¹⁵

The third element is community well-being. Sustainable tourism research consistently emphasizes that community participation, social inclusion, cultural preservation, and equitable benefit-sharing are critical determinants of long-term tourism destination sustainability.^{16,17} Communities contribute local knowledge, support conservation efforts, and enhance destination legitimacy through active participation in tourism planning and governance.¹⁸

The main theoretical contribution of the proposed adaptive sustainability framework lies in broadening resilience-based tourism research beyond environmental adaptation alone. While previous studies have frequently

examined climate adaptation, smart tourism, or community participation independently, the proposed framework conceptualizes these dimensions as interconnected components of a broader socio-ecological system. Through this integration, the study advances a more comprehensive understanding of how tourism destinations adapt to climate change, technological transformation, and stakeholder expectations.

Accordingly, this framework provides the conceptual foundation for examining stakeholders' perspectives on sustainable tourism development within the Brahmaputra River Basin and exploring pathways toward a more resilient and sustainable river tourism system.

3. Literature review and research gap

3.1. Sustainable river tourism and destination sustainability

River tourism has received increasing attention in sustainable tourism research as rivers represent a multifaceted resource that supports ecological conservation, cultural heritage, recreation, transportation, and local livelihoods. Unlike traditional tourist destinations centered on urban centers or coastal areas, river tourism destinations are closely linked to dynamic ecosystems and resource-dependent communities. As a result, the sustainability of river tourism depends not only on economic performance but also on environmental integrity, social inclusion, and effective governance.¹⁹

Sustainable tourism emphasizes the balanced integration of environmental, economic, and social objectives to ensure that tourism development meets present needs without compromising the ability of future generations to benefit from natural and cultural resources.²⁰ While sustainable tourism provides the overarching framework for river tourism development, riverine tourism possesses distinctive characteristics that differentiate it from other forms of nature-based tourism. River systems function simultaneously as ecological corridors, cultural landscapes, transport routes, and livelihood resources, requiring governance approaches that balance tourism development with ecosystem conservation and water resource management. Research on inland waterways and river cruise tourism has demonstrated that sustainable river destinations depend on integrated planning, stakeholder collaboration, and adaptive governance to address competing environmental, economic, and social demands. These studies further suggest that river tourism sustainability is shaped not only by visitor management but also by river basin governance, environmental resilience, and community participation.^{21,22} Although such perspectives have been explored in river systems

like the Danube, Rhine, Yangtze, and Ganges, comparable research on the Brahmaputra River Basin remains limited, highlighting the need for context-specific investigation.

3.2. Climate adaptation and tourism resilience

Climate change has emerged as one of the most significant challenges threatening tourism destinations worldwide. Rising temperatures, extreme weather events, changing precipitation patterns, flooding, droughts, and ecosystem degradation increasingly affect tourism resources, infrastructure, visitor experiences, and destination competitiveness.^{12,23} As a result, climate adaptation has become a central component of tourism sustainability and resilience research. Climate adaptation refers to the processes through which tourism destinations adapt to actual or anticipated environmental changes to reduce vulnerability and enhance adaptive capacity. Within tourism contexts, adaptation strategies may include climate-resilient infrastructure, disaster preparedness programs, environmental monitoring systems, ecosystem restoration initiatives, and risk management frameworks. These measures help tourism destinations anticipate environmental disturbances while maintaining operational continuity and long-term sustainability.

Although resilience has become a prominent concept in tourism research, it has also attracted critical attention. Some scholars argue that resilience is often defined too broadly and is difficult to operationalize; others caution that an overemphasis on resilience may unintentionally maintain existing systems without addressing underlying structural vulnerabilities or promoting transformative change. These critiques have encouraged researchers to distinguish between adaptation and transformation, and to examine resilience within broader governance and sustainability transition perspectives. Recognizing these debates, the present study adopts resilience as a framework for understanding adaptive capacity while emphasizing institutional learning, stakeholder collaboration, and governance transformation within the socio-ecological context of the Brahmaputra River Basin.

3.3. Smart tourism and technological innovation

Technological innovation has transformed tourism systems by reshaping how tourism destinations are managed, marketed, and experienced. Advances in information and communication technologies, digital platforms, mobile applications, artificial intelligence, geographic information systems, and data analytics have contributed to the emergence of smart tourism. Smart tourism refers to the application of technology to enhance visitor experiences, improve operational efficiency, support sustainability objectives, and strengthen destination management.^{13,24}

Smart tourism technologies offer important opportunities for sustainable destination development by improving the collection, integration, and use of tourism-related information. Real-time information systems can support visitor management and destination management, while digital platforms can facilitate destination marketing, information sharing, and communication among tourism stakeholders. Smart technologies can also provide information that supports more informed decision-making and improves destination competitiveness. Furthermore, integrating digital technologies into tourism planning can lead to more adaptive approaches in destination management by enhancing information flows and coordination among stakeholders.^{13,24}

The COVID-19 pandemic has accelerated digital transformation across the tourism sector. Contactless services, virtual experiences, online reservation systems, and digital communication platforms became essential tools for maintaining tourism operations during disruptive periods.²⁴ Contemporary tourism resilience literature increasingly recognizes digital adaptive capacity as an important component of destination sustainability.²⁵

Despite the growing importance of smart tourism, technological innovation alone cannot guarantee sustainable outcomes. The effectiveness of digital solutions depends on governance capacity, stakeholder engagement, infrastructure availability, and alignment with local development priorities. Therefore, understanding how technological innovation interacts with environmental and social dimensions of sustainability remains an important area of inquiry.

3.4. Community well-being and participatory governance

Community well-being has become a central concept in sustainable tourism research because local communities play a critical role in shaping tourism experiences, protecting environmental resources, and supporting destination development. Sustainable tourism initiatives are more likely to succeed when local populations perceive tourism as beneficial and participate actively in planning and decision-making processes.^{16,26} Community well-being extends beyond economic benefits and includes social inclusion, cultural preservation, quality of life, access to opportunities, and equitable distribution of tourism-related benefits. Research consistently demonstrates that tourism development generates more sustainable outcomes when local stakeholders are empowered to influence decisions affecting their communities.¹⁷

Participatory governance has emerged as a key mechanism for promoting community-centered tourism

development. Participatory approaches encourage collaboration among government agencies, tourism businesses, civil society organizations, and residents. Such governance arrangements improve transparency, strengthen social trust, and enhance the legitimacy of tourism policies.¹¹ Moreover, participatory governance can contribute to resilience by facilitating collective action and adaptive learning in response to environmental and social challenges.^{9,18,27}

Recent adaptive governance scholarship argues that sustainability challenges in complex SES require flexible, collaborative, and learning-oriented governance arrangements capable of responding to environmental uncertainty.^{28,29} Adaptive governance emphasizes cross-sectoral collaboration, knowledge sharing, institutional flexibility, and participation across multiple levels of decision-making.²⁹⁻³¹ These principles are particularly relevant for river tourism destinations, where environmental change, tourism development, and community livelihoods are closely interconnected. Consequently, adaptive governance provides an important conceptual bridge linking climate adaptation, community participation, and sustainable destination management.²⁸⁻³⁰

In river tourism destinations, community participation is particularly important because local populations often possess valuable knowledge regarding environmental conditions, cultural heritage, and resource management practices. Integrating community perspectives into tourism planning can therefore enhance both sustainability and destination resilience.

3.5. Regenerative tourism, post-growth perspectives, and sustainable transitions

Recent tourism scholarship has extended beyond traditional sustainability approaches to include regenerative tourism and post-growth perspectives. These emerging frameworks challenge tourism development models that prioritize continuous growth and instead emphasize ecological restoration, community well-being, and long-term resilience.^{31,32}

Regenerative tourism advocates practices that seek to contribute positively to environmental and social well-being rather than merely minimizing negative impacts.³² Similarly, degrowth perspectives encourage policymakers and destination managers to reconsider growth-oriented approaches in tourism and focus instead on sustainability, equity, and quality-of-life outcomes.³³

These perspectives have gained increased relevance following the COVID-19 pandemic, which exposed vulnerabilities associated with tourism dependence and growth-oriented development models.^{14,32} Scholars

increasingly argue that tourism futures should prioritize resilience, inclusivity, adaptive governance, and environmental stewardship rather than solely economic performance.^{34,35} Although regenerative and post-growth approaches remain relatively underexplored in river tourism contexts, they provide valuable insights for understanding sustainable tourism transitions in environmentally sensitive destinations such as the Brahmaputra River Basin.

Beyond regenerative tourism, sustainability transition research argues that long-term transformation requires coordinated changes in governance systems, technological innovation, institutional arrangements, and stakeholder behavior. Transition perspectives emphasize that sustainability is achieved through gradual systemic change rather than isolated interventions. Although these approaches have been applied mainly in energy and urban sustainability research, they provide a useful lens for understanding how climate adaptation, smart tourism, community participation, and governance can collectively support the long-term transition of river tourism destinations toward greater resilience and sustainability.³⁶

3.6. Research gap

The literature reveals that climate adaptation, technological innovation, community well-being, and governance are all important dimensions of sustainable tourism development. However, existing studies frequently examine these factors independently, resulting in fragmented understandings of tourism sustainability. Limited research has explored how environmental resilience, digital adaptive capacity, and community participation interact within a unified socio-ecological framework.³⁷

Furthermore, river tourism in Northeast India, particularly along the Brahmaputra River, remains comparatively underexplored in relation to integrated sustainability and governance. Existing studies have examined tourist perceptions and the socio-cultural and environmental dimensions of Brahmaputra River tourism; broader research has highlighted the importance of adaptive governance and sustainability in complex river systems.³⁸⁻⁴⁰ However, the integration of climate adaptation, smart tourism, adaptive governance, and community well-being within a comprehensive river tourism framework remains insufficiently addressed.

To address these gaps, the present study adopts a socio-ecological perspective to examine how climate adaptation, technological innovation, community well-being, and adaptive governance interact to influence sustainable river tourism futures. Rather than examining these dimensions independently, the study explores their interrelationships

within a single analytical framework grounded in stakeholder perspectives from the Brahmaputra River Basin. In doing so, it extends existing discussions of tourism resilience by proposing an adaptive sustainability framework that illustrates how environmental resilience, digital adaptive capacity, community legitimacy, and adaptive governance can collectively support long-term sustainability transitions in environmentally vulnerable river destinations.

4. Methodology

4.1. Research design

This study adopted a qualitative exploratory case study approach to investigate stakeholder perspectives on sustainable river tourism development within the Brahmaputra River Basin, Assam. A qualitative design was considered appropriate because the research sought to explore complex interactions among climate adaptation, technological innovation, governance processes, and community well-being within a specific socio-ecological context. Qualitative methods are particularly valuable for examining stakeholder experiences, perceptions, and interpretations of complex social phenomena that cannot be captured adequately through quantitative indicators alone.^{41,42} Thematic analysis was subsequently used to identify and interpret recurring patterns and themes within the qualitative data.⁴³

The study was informed by resilience theory and SES theory, which conceptualize tourism destinations as dynamic systems characterized by continuous interactions among environmental, social, institutional, and technological components. The qualitative case study approach enabled an in-depth examination of these interactions within the context of river tourism development in the Brahmaputra River Basin.

4.2. Study area

The research was conducted in selected tourism destinations within the Brahmaputra River Basin in Assam, India. The Brahmaputra River is one of Asia's largest river systems and serves as an important ecological, cultural, and economic resource for the region. The basin supports diverse tourism activities, including river cruises, eco-tourism, cultural tourism, religious tourism, recreational tourism, and wildlife-based tourism.

The study sites were selected purposively because they represent diverse forms of river tourism within the Brahmaputra River Basin. Guwahati serves as the principal tourism gateway, with river cruises, religious tourism, and recreational activities; North Guwahati reflects community-based and cultural tourism associated with riverside settlements; while Chandrapur represents an emerging tourism area facing significant environmental challenges, including flooding and riverbank erosion. Collectively, these locations provide a representative understanding of the socio-ecological characteristics of river tourism within the study area.

4.3. Participant selection and data collection

Purposive sampling was employed to identify interviewees with direct knowledge and experience related to tourism development, environmental management, and community engagement within the Brahmaputra River Basin (Table 1). Purposive sampling is widely used in qualitative research because it selects information-rich participants who can provide detailed insights into the research topic.

A total of 24 semi-structured interviews were conducted between February and November 2025. The interview participants represented diverse stakeholder groups, including local community leaders, tourism entrepreneurs, tourism service providers, government officials, environmental practitioners, and tourism

Table 1. Profile of interview participants

Stakeholder category	Number of participants	Selection criteria
Community leaders	5	Direct involvement in local tourism and community activities
Tourism entrepreneurs	5	Owners/operators of tourism-related businesses
Tourism service providers	4	Individuals providing transportation, guiding, or hospitality services
Government officials	4	Officials involved in tourism, environment, or local administration
Environmental practitioners	3	Professionals engaged in conservation and environmental management
Tourism researchers	3	Researchers with expertise in tourism and river studies
Total	24	

researchers. Participants were selected through purposive sampling based on their direct knowledge, professional involvement, or lived experience related to river tourism development within the Brahmaputra River Basin. The selection sought to ensure representation from multiple stakeholder groups to capture diverse perspectives on tourism sustainability, climate adaptation, governance, and community well-being.

The interviews were conducted either face-to-face or through online communication platforms, depending on participant availability and accessibility. Each interview lasted approximately 30–50 minutes. An interview guide was developed to ensure consistency across interviews while allowing flexibility for participants to discuss issues they considered important.

The interview questions focused on four broad themes:

- (i) Climate-related challenges affecting tourism development;
- (ii) Technological innovation and smart tourism practices;
- (iii) Community participation and local well-being;
- (iv) Governance mechanisms and sustainable tourism futures.

All interviews were conducted in the preferred language of the participants and were recorded with informed consent. Interview recordings were subsequently transcribed for analysis.

Data collection continued until thematic saturation was achieved, whereby no substantially new concepts or perspectives emerged from successive interviews. The recurrence of similar issues across stakeholder groups indicated that sufficient depth had been obtained to address the research objectives.

4.4. Data analysis

The study employed thematic analysis to identify patterns, relationships, and recurring themes within the interview data. Thematic analysis is widely recognized as a flexible and systematic method for analyzing qualitative data and generating meaningful interpretations of participant experiences.⁴³ Data analysis followed a three-stage coding process:

(i) Open coding

During the first stage, interview transcripts were read repeatedly to identify meaningful units of text related to the research objectives. Initial codes were assigned to segments reflecting participants' experiences, perceptions, and views on a sustainable river tourism system.

(ii) Axial coding

In the second stage, conceptually similar codes were grouped into broader categories to identify recurring patterns and relationships across stakeholder groups.

(iii) Selective coding

Finally, categories were reviewed and synthesized into four overarching themes that captured the principal dimensions of a sustainable river tourism system identified across the dataset.

The thematic analysis followed the six-phase approach proposed by Braun and Clarke⁴³, including familiarization with the data, generation of initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report. Manual coding was considered appropriate because the dataset consisted of 24 semi-structured interviews, enabling close engagement with the transcripts while maintaining analytical rigor.⁴¹ The coding process is shown in [Table 2](#).

4.5. Research quality and validity

Several strategies were employed to enhance the validity of the findings. Following established qualitative research guidelines, validity was strengthened through triangulation of stakeholder perspectives across multiple participant groups. The inclusion of government officials, tourism entrepreneurs, community representatives, and tourism experts enabled the comparison and verification of findings across different sources.

Member checking was conducted by sharing summaries of key findings with selected participants to confirm the accuracy of interpretations. Transferability was enhanced through detailed descriptions of the study context, participant characteristics, and research procedures. Dependability was supported through systematic documentation of the data collection and analysis

Table 2. Example of coding process

Interview excerpt	Initial code	Category	Final theme
Flooding damages tourism facilities every year	Flood impacts	Climate risks	Climate resilience and adaptive planning
Digital platforms attract more visitors	Digital marketing	Smart tourism	Smart tourism and digital governance
Local people should participate in planning	Community participation	Social inclusion	Community participation and social inclusion
Government departments should work together	Institutional coordination	Governance	Integrated governance

processes. Collectively, these measures contributed to the trustworthiness of the study findings.

To enhance analytical credibility, coding decisions were reviewed repeatedly throughout the analytical process to ensure consistency between codes, categories, and themes. Interpretations were continuously compared across stakeholder groups to minimize researcher bias and strengthen the validity of the findings.

4.6. Ethical considerations

The study adhered to established ethical principles for social science research. Participation was voluntary and informed consent was obtained from all participants prior to data collection. Participants were informed about the research objectives, the voluntary nature of their involvement, and their right to withdraw at any stage of the study. Confidentiality and anonymity were maintained throughout the research process by removing personally identifiable information from transcripts and research records.

5. Findings

5.1. Climate resilience and adaptive planning

Participants consistently identified climate-related challenges as one of the most significant threats to the long-term sustainability of tourism development in the Brahmaputra River Basin. Recurring floods, riverbank erosion, unpredictable weather patterns, and environmental degradation were frequently cited as factors affecting tourism infrastructure, visitor safety, and destination attractiveness.

Several stakeholders emphasized that seasonal flooding disrupts transportation networks, damages tourism facilities, and limits access to river-based attractions. Community representatives noted that extreme weather events increasingly influence tourism demand and operational planning. One participant observed: "Flooding has always been part of life along the Brahmaputra, but its intensity and unpredictability are creating greater challenges for tourism businesses and local communities."

While community leaders primarily emphasized the immediate impacts of flooding on livelihoods and access to tourism sites, government officials placed greater emphasis on strengthening disaster preparedness, infrastructure resilience, and long-term planning. Tourism entrepreneurs were particularly concerned about disruptions to visitor arrivals and business continuity, indicating that although all stakeholder groups recognized climate risks, they perceived priorities through different institutional and livelihood perspectives.

Similarly, tourism entrepreneurs highlighted concerns regarding infrastructure vulnerability. Many argued that sustainable tourism development requires investments in climate-resilient infrastructure capable of withstanding environmental disturbances while minimizing disruptions to tourism activities. An environmental practitioner observed: "Protecting the river ecosystem is equally important as developing tourism because environmental degradation ultimately affects both local communities and visitor experiences." Participants also emphasized the importance of environmental conservation initiatives. Ecosystem protection, riverbank stabilization, biodiversity conservation, and sustainable resource management were viewed as essential components of long-term tourism sustainability.

The present study shows that climate adaptation plays a foundational role in shaping sustainable river tourism futures. Consistent with resilience theory, stakeholders emphasized preparedness, adaptive capacity, and environmental stewardship as critical determinants of destination sustainability.

5.2. Smart tourism and digital governance

The second major theme focused on the growing role of technological innovation and smart tourism practices in supporting sustainable tourism development.

Participants reported increasing use of digital platforms for destination promotion, visitor engagement, online booking services, and tourism information dissemination. Tourism operators emphasized that digital technologies have improved market visibility and expanded opportunities to reach domestic and international visitors. One tourism entrepreneur explained: "Digital platforms allow smaller tourism businesses to compete more effectively by improving visibility and communication with potential visitors."

Government officials generally viewed digital technologies as tools for improving destination management and policy implementation, whereas tourism entrepreneurs emphasized their value for marketing, visitor communication, and business competitiveness. A government official commented: "Digital information systems can help manage tourism more efficiently, but they should complement rather than replace local knowledge and community participation." Community representatives supported greater use of technology but highlighted the need for digital literacy and improved internet connectivity to ensure that residents could participate effectively in smart tourism initiatives.

Government representatives highlighted the potential of technology to strengthen destination management

through data collection, visitor monitoring, and improved service delivery. Several participants suggested that digital tools could help address environmental challenges by supporting real-time monitoring of tourism activities and environmental conditions.

Stakeholders also noted that technological innovation became particularly important during and after the COVID-19 pandemic. Digital communication platforms, online marketing strategies, and contactless services enabled many tourism businesses to maintain operations during periods of disruption.

However, participants also identified challenges associated with technological adoption. Limited digital infrastructure, unequal access to technology, and insufficient technical skills were perceived as barriers to implementing smart tourism initiatives across some areas of the Brahmaputra River Basin. A community leader stated: “Technology offers many opportunities, but benefits will remain uneven unless local communities receive training and support.”

The analysis indicates that smart tourism contributes to the digital adaptive capacity conceptualized in this study. Digital technology not only enhances visitor experiences but also supports adaptive governance and destination resilience by improving communication, coordination, and information sharing among stakeholders.

5.3. Community participation and social inclusion

Community well-being was perceived as a central determinant of sustainable tourism development. Across stakeholder groups, participants observed that tourism sustainability depends upon meaningful community involvement, equitable benefit-sharing, and protection of cultural heritage.

Local community representatives expressed strong support for tourism development when it generates employment opportunities, supports local businesses, and contributes to community development. However, interviewees also stressed that local populations should play an active role in planning and decision-making processes. One participant commented: “Tourism cannot be sustainable if local people are only observers. Communities must be involved in decisions that affect their livelihoods and cultural resources.”

Stakeholders identified cultural heritage preservation as an important component of community well-being. Traditional knowledge, local customs, religious practices, and cultural landscapes were viewed as valuable tourism assets that require protection and promotion. Interviewees further emphasized the importance of inclusive governance

arrangements that allow diverse stakeholder groups to participate in tourism planning. Community involvement was frequently associated with stronger social trust, greater local support for tourism initiatives, and improved sustainability outcomes.

Several respondents also expressed concerns regarding unequal distribution of tourism benefits. While tourism can create economic opportunities, respondents argued that policies should ensure that these benefits reach local communities rather than disproportionately benefiting a small number of stakeholders.

Although participants broadly supported community participation, differences emerged regarding the extent of local involvement in tourism planning. Community representatives expressed a stronger desire for direct participation in decision-making, whereas some government officials acknowledged community participation primarily through consultation mechanisms. These differing perspectives highlight that improving institutional collaboration remains an important challenge for sustainable river tourism governance. A community representative remarked: “We understand the river better because we live with it every day, so our experience should be considered when tourism plans are prepared.”

Existing tourism literature reviewed in **Section 3** emphasizes community legitimacy and social inclusion as essential foundations of sustainable destination development. Community participation enhances resilience by strengthening local ownership, fostering collective action, and supporting adaptive responses to environmental and social change.

5.4. Integrated governance for sustainable tourism futures

The final theme of concern was governance and stakeholder collaboration. Several participants consistently considered that sustainable tourism development requires coordinated action among government agencies, tourism businesses, community organizations, and environmental stakeholders.

Government officials acknowledged that tourism sustainability involves multiple policy domains, including environmental management, infrastructure development, disaster preparedness, and community development. Consequently, integrated governance approaches were considered necessary for addressing complex sustainability challenges. One policymaker stated: “Tourism planning should not occur in isolation. Environmental management, community development, and tourism policies must work together.”

Tourism entrepreneurs expressed the need for simplified administrative procedures and stronger institutional coordination, whereas government officials emphasized policy integration and environmental regulation. Despite these differing priorities, stakeholders consistently recognized that a sustainable river tourism system requires cross-sectoral collaboration rather than isolated interventions. A tourism entrepreneur stated: “When different departments work independently, tourism development becomes slower and less effective. Better coordination would benefit both businesses and local communities.” Participants consistently pointed out the need for stronger collaboration among stakeholders. Improved communication, information sharing, and joint decision-making were viewed as mechanisms to enhance policy effectiveness and reduce conflicts among competing interests.

Stakeholders also perceived adaptive governance as an important requirement for responding to changing environmental and socio-economic conditions. Flexible governance arrangements that can learn from experience and adjust to new challenges were considered essential for sustaining tourism development in the long term. Many respondents noted that governance should facilitate coordination among climate adaptation initiatives, technological innovation strategies, and community development programs. Rather than pursuing isolated interventions, interviewees suggested integrated approaches capable of addressing environmental, technological, and social dimensions simultaneously.

These results suggest that governance functions as a connecting mechanism linking climate resilience, smart tourism, and community well-being. Effective governance enables resource mobilization, stakeholder coordination, and the implementation of adaptive strategies that support sustainable tourism futures in destinations.

6. Discussion

6.1. Sustainable river tourism as a socio-ecological system

The study demonstrates that sustainable tourism development within the Brahmaputra River Basin cannot be understood solely through environmental, economic, or technological perspectives. Rather, tourism sustainability emerges through dynamic interactions among ecological conditions, technological capabilities, governance structures, and community participation. This observation supports the central assumptions of SES theory, which conceptualizes sustainability as an outcome of interconnected relationships between human and environmental systems.^{5,10}

The study reveals that environmental vulnerability, technological transformation, and community well-being are not independent dimensions of tourism development. Instead, they function as mutually reinforcing components of a broader socio-ecological system. Climate-related disturbances affect tourism infrastructure and visitor experiences; technological innovations influence governance capacity and destination management; community participation shapes the legitimacy and effectiveness of sustainability initiatives. These interactions highlight the need for integrated approaches capable of addressing multiple dimensions of sustainability simultaneously.

The findings therefore reinforce previous research suggesting that tourism destinations should be viewed as adaptive systems rather than static entities.^{22,37} Within the Brahmaputra River Basin, tourism development is embedded within complex ecological and social processes that require continuous adaptation, collaboration, and learning.^{29,30} Consequently, sustainable tourism futures depend on stakeholders’ ability to manage environmental uncertainty while promoting social inclusion and institutional flexibility.^{30,31}

The present study highlights the inseparable relationship between environmental vulnerability, community livelihoods, and governance within the Brahmaputra River Basin. The analysis therefore suggests that river tourism sustainability in this context is influenced not only by tourism development but also by recurrent flooding, riverbank erosion, cultural heritage, and local communities’ dependence on river resources. This socio-ecological context distinguishes the Brahmaputra River Basin from many previously studied river tourism destinations.

6.2. Climate adaptation and destination resilience

The study highlights climate adaptation as a foundational element of sustainable river tourism development. Participants consistently identified flooding, erosion, and environmental degradation as significant challenges affecting tourism activities throughout the basin. These observations align with existing research emphasizing that climate-related risks increasingly threaten destination sustainability and competitiveness.^{7,12}

From a resilience perspective, the study suggests that adaptive capacity is more important than simple recovery from environmental disturbances. Stakeholders described preparedness, environmental stewardship, ecosystem conservation, and long-term planning as critical components of tourism sustainability. Such perspectives are consistent with resilience scholarship, which views adaptation as an ongoing process through which systems

learn, reorganize, and strengthen their ability to cope with uncertainty.^{2,3} The study also highlights the importance of integrating climate adaptation into tourism planning rather than treating environmental management as a separate policy domain. Interviewees emphasized that resilient tourism infrastructure, ecosystem conservation, and disaster preparedness should form integral components of destination development strategies. This finding supports calls for greater integration between tourism planning and climate adaptation policy within vulnerable destinations.⁷

For the Brahmaputra River Basin, where environmental disturbances represent recurring realities rather than isolated events, resilience-based planning appears particularly important. Strengthening adaptive capacities may reduce the vulnerability of tourism destinations while enhancing long-term sustainability.

6.3. Technological innovation and digital adaptive capacity

The study further suggests that technological innovation plays an increasingly important role in sustainable tourism development. Participants viewed digital platforms, online communication systems, and smart tourism technologies as mechanisms for improving destination management, visitor experiences, and stakeholder coordination.

Existing smart tourism literature primarily focuses on technological efficiency, service enhancement, and destination competitiveness.^{13,25} However, the present analysis suggests that technology also contributes to resilience by enhancing what this study conceptualizes as digital adaptive capacity. Digital adaptive capacity refers to the ability of destinations to use technological resources to respond effectively to environmental, social, and operational challenges.

The importance of digital adaptive capacity became particularly evident following the COVID-19 pandemic, which accelerated the adoption of digital technologies throughout the tourism sector.¹⁵ Participants noted that digital technology supported communication, marketing, information sharing, and service continuity during periods of disruption. These observations support recent arguments that digital transformation should be viewed as a core component of tourism resilience rather than merely a tool for operational efficiency.^{13,14}

Nevertheless, the findings also indicate that technological innovation alone cannot guarantee sustainable outcomes. Participants highlighted concerns regarding digital inequalities, infrastructure limitations, and unequal access to technological resources. These challenges suggest that the effectiveness of smart tourism initiatives depends upon broader governance and

community contexts. Consequently, digital technology should be understood as an enabling mechanism that supports sustainability when combined with inclusive governance and stakeholder participation.

6.4. Community well-being and participatory governance

Community well-being was perceived as a critical determinant of sustainable tourism futures. Participants consistently emphasized that tourism development must generate meaningful benefits for local communities while protecting cultural heritage and supporting social inclusion.

These results align with longstanding tourism scholarship emphasizing the importance of community participation in destination development.^{16,27} Local communities contribute knowledge, cultural resources, environmental stewardship, and social legitimacy essential for sustainable tourism initiatives. When communities are excluded from decision-making processes, tourism development may generate conflict, resistance, and inequitable outcomes.

The present study further highlights the significance of participatory governance. Stakeholders argued that tourism planning should involve collaboration among government agencies, tourism businesses, civil society organizations, and residents. Such collaborative approaches enhance transparency, strengthen trust, and improve policy legitimacy. From a resilience perspective, community participation can contribute to adaptive capacity by facilitating collective action and social learning. Communities that actively engage in tourism governance are better positioned to respond to environmental and socio-economic challenges while supporting sustainability objectives. This observation is consistent with existing research emphasizing community resilience as a key component of sustainable development.¹⁸

The study therefore reinforces the argument that tourism sustainability depends not only on environmental management and technological innovation but also on social legitimacy and inclusive governance arrangements.

6.5. Theoretical contributions: The adaptive sustainability framework

The principal theoretical contribution of this study lies not in proposing entirely new theoretical constructs but in demonstrating how climate adaptation, smart tourism, community well-being, and adaptive governance operate as interdependent components of sustainable river tourism within a socio-ecological system. Existing tourism studies have frequently examined these dimensions

separately. By integrating them within a single analytical framework grounded in stakeholder perspectives from the Brahmaputra River Basin, the proposed adaptive sustainability framework provides a context-specific explanation of how these interactions collectively support sustainable tourism transitions in environmentally vulnerable river destinations (Figure 1).

The present study advances the literature by demonstrating that these dimensions are interconnected components of a broader socio-ecological system. The proposed framework integrates:

- (i) Environmental resilience through climate adaptation;
- (ii) Digital adaptive capacity through technological innovation and smart tourism;
- (iii) Community legitimacy through participation, inclusion, and well-being;
- (iv) Adaptive governance as the coordinating mechanism linking these dimensions.

This framework extends resilience-based tourism research in two important ways. First, it broadens the concept of resilience beyond environmental adaptation by incorporating technological and social dimensions. Second, it positions governance as a central mechanism through which sustainability transitions occur within tourism destinations.

Accordingly, the study contributes to emerging debates on sustainable tourism transitions, adaptive governance,

and socio-ecological resilience by providing a more comprehensive explanation of how tourism destinations respond to environmental change, technological transformation, and evolving stakeholder expectations.

7. Policy implications

The evidence from the interviews provides several practical implications for policymakers, tourism planners, destination managers, and local stakeholders seeking to promote sustainable river tourism development in the Brahmaputra River Basin and other environmentally vulnerable river destinations.

First, climate adaptation should be integrated into tourism planning and destination management strategies. The recurring challenges of flooding, riverbank erosion, and environmental degradation highlighted by participants indicate the need for climate-resilient tourism infrastructure, ecosystem restoration programs, and disaster preparedness initiatives. Policymakers should prioritize investments in sustainable infrastructure capable of withstanding environmental disturbances while minimizing impacts on tourism activities and local communities. Additionally, environmental monitoring systems should be strengthened to support proactive decision-making and risk management.

Second, stakeholder perspectives reveal the importance of technological innovation in supporting sustainable

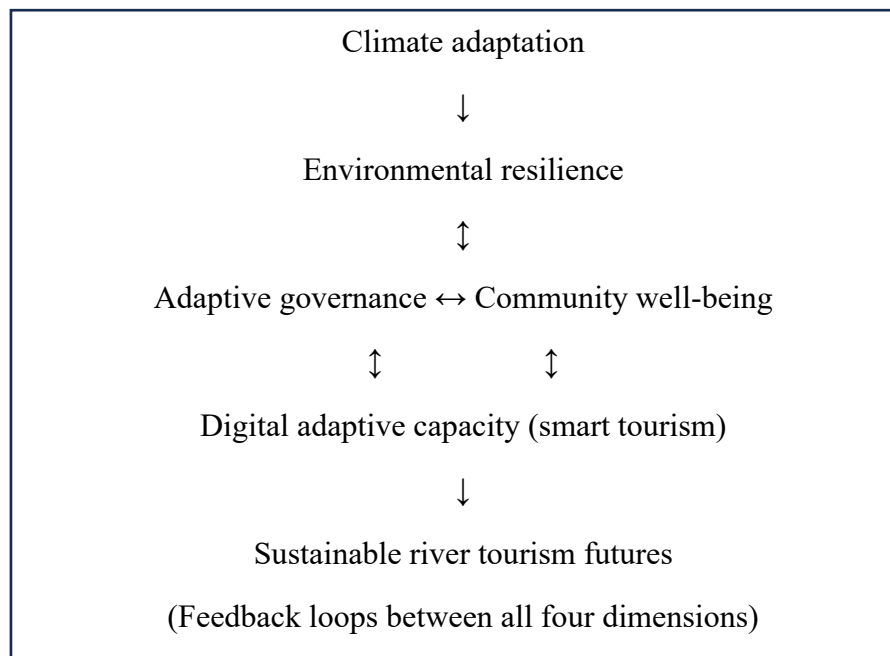


Figure 1. Adaptive sustainability framework

tourism development. Government agencies and tourism organizations should encourage the adoption of smart tourism technologies that enhance visitor experiences, improve destination management, and facilitate sustainability monitoring. Digital platforms can improve communication among stakeholders, increase destination visibility, and support data-driven decision-making. However, efforts to promote technological innovation must also address digital inequalities through training programs, infrastructure development, and capacity-building initiatives for local communities and tourism operators.

Third, community participation should be recognized as a central component of tourism governance. Policies should promote inclusive decision-making processes that enable local communities to participate actively in tourism planning and management. Community engagement not only improves the legitimacy of tourism initiatives but also strengthens social cohesion and local support for sustainability goals. Mechanisms for equitable benefit-sharing should be developed to ensure that tourism-generated economic opportunities contribute to community well-being.

Finally, integrated governance approaches are necessary to address the complex and interconnected challenges facing river tourism destinations. Collaboration among government agencies, tourism businesses, environmental organizations, and community groups can improve policy coordination, reduce institutional fragmentation, and enhance adaptive capacity. The findings suggest that sustainable tourism futures are more likely to emerge when environmental management, technological innovation, and community development strategies are pursued through coordinated and participatory governance frameworks.

8. Limitations and future research

Several limitations should be acknowledged when interpreting the findings of this study. First, the research employed a qualitative case study approach focused on selected destinations within the Brahmaputra River Basin. While this approach provided rich contextual insights, the findings may not be directly generalizable to other river tourism destinations with different environmental, socio-economic, or governance characteristics.

Second, the study relied on stakeholder perceptions and experiences collected through semi-structured interviews. Although multiple stakeholder groups were included to enhance credibility and triangulation, the findings remain subject to the perspectives and interpretations of participants.

Future research could expand upon this study by conducting comparative analyses across multiple river tourism destinations in India and other regions. Quantitative investigations may also examine the relationships among climate adaptation, technological innovation, community well-being, and tourism sustainability using larger datasets. Additionally, future studies could explore the effectiveness of specific governance mechanisms and smart tourism initiatives in strengthening destination resilience under changing environmental conditions.

9. Conclusion

This study examined sustainable river tourism futures in the Brahmaputra River Basin through the lenses of resilience theory and SES theory. By exploring stakeholder perspectives on climate adaptation, technological innovation, and community well-being, the research sought to understand how these dimensions collectively influence sustainable tourism development in an environmentally vulnerable riverine destination.

The findings identified four interconnected themes shaping tourism sustainability: climate resilience and adaptive planning, smart tourism and digital governance, community participation and social inclusion, and integrated governance for sustainable tourism futures. Together, these themes illustrate that sustainable tourism development depends upon interactions among environmental resilience, digital adaptive capacity, community legitimacy, and adaptive governance.

The study contributes to the tourism sustainability literature by proposing an adaptive sustainability framework that integrates environmental, technological, and social dimensions within a socio-ecological perspective. Unlike previous studies that frequently examine these dimensions separately, the framework highlights their interdependence and their collective influence on destination resilience and sustainability transitions.

From a practical perspective, the findings underscore the importance of climate-resilient infrastructure, smart tourism technologies, participatory governance, and community-centered development strategies. Sustainable tourism futures within the Brahmaputra River Basin will depend upon the stakeholders' ability to balance environmental protection, technological innovation, and social well-being through adaptive and collaborative governance arrangements.

As tourism destinations worldwide face increasing environmental uncertainty and technological transformation, the insights generated by this study provide a useful foundation for understanding how river

tourism systems can transition toward more resilient, inclusive, and sustainable futures.

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Conflict of interest

The author declares no competing interests.

Author contributions

This is a single-authored article.

Ethics approval and consent to participate

This study did not undergo formal review by an institutional ethics committee or review board, as ethics approval was not required under the applicable institutional policies. Informed consent was obtained verbally from all participants prior to their participation in the study. Participants were informed about the purpose of the study and their voluntary participation and confidentiality were ensured.

Consent for publication

Informed consent for publication was obtained verbally from all participants prior to their participation in the study.

Availability of data

The data used in this study are available from the corresponding author upon reasonable request.

References

- Holling CS. Resilience and stability of ecological systems. *Annu Rev Ecol Syst.* 1973;4:1-23.
doi: 10.1146/annurev.es.04.110173.000245
- Walker B, Holling CS, Carpenter SR, Kinzig A. Resilience, adaptability and transformability in social-ecological systems. *Ecol Soc.* 2004;9(2):5.
doi: 10.5751/ES-00650-090205
- Folke C. Resilience: The emergence of a perspective for social-ecological systems analyses. *Glob Environ Change.* 2006;16(3):253-267.
doi: 10.1016/j.gloenvcha.2006.04.002
- Biggs R, Schlüter M, Schoon ML, eds. *Principles for Building Resilience: Sustaining Ecosystem Services in Social-Ecological Systems.* Cambridge University Press; 2015.
doi: 10.1017/CBO9781316014240
- Berkes F, Colding J, Folke C, eds. *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change.* Cambridge University Press; 2009.
doi: 10.1017/CBO9780511541957
- Amore A, Hall CM, Prayag G. *Tourism and Resilience: Individual, Organisational and Destination Perspectives.* Bristol, UK: Channel View Publications; 2018.
doi: 10.21832/9781845416317.
- Dogru T, Marchio EA, Bulut U, Suess C. Climate change: Vulnerability and resilience of tourism and the entire economy. *Tour Manag.* 2019;72:292-305.
doi: 10.1016/j.tourman.2018.12.010
- Prayag G. Time for reset? COVID-19 and tourism resilience. *Tour Rev Int.* 2020;24(2-3):179-184.
doi: 10.3727/154427220X15926147793595
- Folke C, Carpenter SR, Walker B, Scheffer M, Chapin T, Rockström J. Resilience thinking: Integrating resilience, adaptability and transformability. *Ecol Soc.* 2010;15(4):20.
doi: 10.5751/ES-03610-150420
- Ostrom E. A general framework for analyzing sustainability of social-ecological systems. *Science.* 2009;325(5939):419-422.
doi: 10.1126/science.1172133
- Bramwell B, Lane B. Critical research on the governance of tourism and sustainability. *J Sustain Tour.* 2011;19(4-5):411-421.
doi: 10.1080/09669582.2011.580586
- Becken S. Developing a framework for assessing resilience of tourism sub-systems to climatic factors. *Ann Tour Res.* 2013;43:506-528.
doi: 10.1016/j.annals.2013.06.002
- Li Y, Hu C, Huang C, Duan L. The concept of smart tourism in the context of tourism information services. *Tour Manag.* 2017;58:293-300.
doi: 10.1016/j.tourman.2016.03.014
- Sigala M. Tourism and COVID-19: Impacts and implications for advancing and resetting industry and research. *J Bus Res.* 2020;117:312-321.
doi: 10.1016/j.jbusres.2020.06.015
- Koo C, Shin S, Gretzel U, Hunter WC, Chung N. Conceptualization of smart tourism destination competitiveness. *Asia Pac J Inf Syst.* 2016;26(4):561-576.
doi: 10.14329/apjis.2016.26.4.561
- Murphy PE. *Tourism: A Community Approach.* Routledge; 1985.

17. Nunkoo R, Ramkissoon H. Developing a community support model for tourism. *Ann Tour Res.* 2011;38(3):964-988.
doi: 10.1016/j.annals.2011.01.017
18. Berkes F, Ross H. Community resilience: Toward an integrated approach. *Soc Nat Resour.* 2013;26(1):5-20.
doi: 10.1080/08941920.2012.736605
19. Hall CM. Constructing sustainable tourism development: The 2030 agenda and the managerial ecology of sustainable tourism. *J Sustain Tour.* 2019;27(7):1044-1060.
doi: 10.1080/09669582.2018.1560456
20. World Tourism Organization, United Nations Development Programme. *Tourism and the Sustainable Development Goals–Journey to 2030.* World Tourism Organization; 2017.
doi: 10.18111/9789284419401
21. Bhuiyan MA, Zhang Q, Xuan W, Rahman MK, Khare V. Does good governance promote sustainable tourism? A systematic review of PESTEL analysis. *SN Bus Econ.* 2023;3(1):33.
doi: 10.1007/s43546-022-00408-x
22. Paauw M, Scown M, Triyanti A, Du H, Garmestani A. Adaptive governance of river deltas under accelerating environmental change. *Utrecht Law Rev.* 2022;18(2):30-50.
doi: 10.36633/ulr.803
23. Scott D, Hall CM, Gössling S. Global tourism vulnerability to climate change. *Ann Tour Res.* 2019;77:49-61. doi: org/10.1016/j.annals.2019.05.007
24. Gretzel U, Sigala M, Xiang Z, Koo C. Smart tourism: Foundations and developments. *Electron Mark.* 2015;25(3):179-188.
doi: 10.1007/s12525-015-0196-8
25. Buhalis D, Moldavska I. Voice assistants in hospitality: Using artificial intelligence for customer service. *J Hosp Tour Technol.* 2022;13(3):386-403.
doi: 10.1108/JHTT-03-2021-0104
26. Tosun C. Limits to community participation in the tourism development process in developing countries. *Tour Manag.* 2000;21(6):613-633.
doi: 10.1016/S0261-5177(00)00009-1
27. Dredge D, Jamal T. Progress in tourism planning and policy: A post-structural perspective on knowledge production. *Tour Manag.* 2015;51:285-297.
doi: 10.1016/j.tourman.2015.06.002
28. Armitage D, Berkes F, Doubleday N, eds. *Adaptive Co-Management: Collaboration, Learning, and Multi-Level Governance.* University of British Columbia Press; 2008.
doi: 10.59962/9780774855457
29. Chaffin BC, Gosnell H, Cosens BA. A decade of adaptive governance scholarship: Synthesis and future directions. *Ecol Soc.* 2014;19(3):56.
doi: 10.5751/ES-06824-190356
30. Lockwood M, Davidson J, Curtis A, Stratford E, Griffith R. Governance principles for natural resource management. *Soc Nat Resour.* 2010;23(10):986-1001.
doi: 10.1080/08941920802178214
31. Bellato L, Frantzeskaki N, Nygaard CA. Regenerative tourism: A conceptual framework leveraging theory and practice. *Tour Geogr.* 2023;25(4):1026-1046.
doi: 10.1080/14616688.2022.2044376
32. Higgins-Desbiolles F. The “war over tourism”: Challenges to sustainable tourism in the tourism academy after COVID-19. *J Sustain Tour.* 2021;29(4):551-569.
doi: 10.1080/09669582.2020.1803334
33. Fletcher R, Murray Mas I, Blanco-Romero A, Blázquez-Salom M. Tourism and degrowth: An emerging agenda for research and praxis. *J Sustain Tour.* 2019;27(12):1745-1763.
doi: 10.1080/09669582.2019.1679822
34. Cave J, Dredge D. Regenerative tourism needs diverse economic practices. *Tour Geogr.* 2020;22(3):503-513. doi: org/10.1080/14616688.2020.1768434
35. Sheldon PJ. Designing tourism experiences for inner transformation. *Ann Tour Res.* 2020;83:102935.
doi: 10.1016/j.annals.2020.102935
36. Geels FW. The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environ Innov Soc Transit.* 2011;1(1):24-40.
doi: 10.1016/j.eist.2011.02.002
37. Prayag G, Spector S, Orchiston C, Chowdhury M. Psychological resilience, organizational resilience and life satisfaction in tourism firms: Insights from the Canterbury earthquakes. *Curr Issues Tour.* 2020;23(10):1216-1233.
doi: 10.1080/13683500.2019.1607832
38. Mahanta B, Khawzawl TL. Factors influencing tourist perceptions of river tourism destinations: A case study of the Brahmaputra River in Guwahati, Assam, India. *Afr J Biomed Res.* 2025;28(2S):774-778.
doi: 10.53555/AJBR.v28i2S.6947
39. Mahanta B. Riverine eco-tourism and sustainable development in Assam, India: Transforming the Brahmaputra corridor. *Eco-Tour Sustain Dev.* 2026;2(1):119-130.
doi: 10.63385/etsd.v2i1.462
40. Mili M, Saha S. Prospects and challenges of river tourism in Assam, India: A SWOT analysis. *South Asian J Soc Stud Econ.* 2025;22(12):130-142.

doi: 10.9734/sajsse/2025/v22i121225

41. Strauss A, Corbin J. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. 2nd ed. Sage Publications; 1998.
42. Yin RK. *Case Study Research and Applications: Design and Methods*. 6th ed. Sage Publications; 2018.
43. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol*. 2006;3(2):77-101.
doi: 10.1191/1478088706qp063oa