

Article

Tourism Ecological Efficiency and Sustainable Development in the Hanjiang River Basin: A Super-Efficiency Slacks-Based Measure Model Study

Yufeng Cheng ¹, Kai Zhu ^{1,*}, Quan Zhou ¹, Youssef El Archi ², Moaaz Kabil ^{3,4}, Bulcsú Remenyik ⁵ and Lóránt Dénes Dávid ^{6,7,*}

¹ Faculty of Resources and Environmental Science, Hubei University, Wuhan 430062, China; chengyufeng@stu.hubu.edu.cn (Y.C.); zhouquan@stu.hubu.edu.cn (Q.Z.)

² National School of Business and Management of Tangier, Abdelmalek Essaâdi University, Tangier 90000, Morocco; elarchi.youssef@etu.uae.ac.ma

³ Doctoral School of Economic and Regional Sciences, Hungarian University of Agriculture and Life Sciences, 2100 Godollo, Hungary; moaazkabil@cu.edu.eg

⁴ Faculty of Urban and Regional Planning, Cairo University, Giza 12613, Egypt

⁵ Department of Tourism and Hospitality, University of Tokaj-Hegyalja, 3950 Sárospatak, Hungary; remenyik.bulcsu@unihe.hu

⁶ Faculty of Economics and Business, John von Neumann University, 6000 Kecskemet, Hungary

⁷ Institute of Rural Development and Sustainable Economy, Hungarian University of Agriculture and Life Sciences, 2100 Godollo, Hungary

* Correspondence: hizhukai@163.com (K.Z.); david.lorant.denes@uni-neumann.hu (L.D.D.)

Abstract: The Hanjiang River is one of the major tributaries of the Yangtze River, and the Hanjiang River Basin serves as an important link connecting the western and eastern regions of China. As a significant tourist destination, the development of the tourism industry in the Hanjiang River Basin is of great significance for promoting local economic, social, and environmental sustainability. The study of the spatiotemporal evolution of the ecological efficiency of tourism in the Hanjiang River Basin is beneficial for optimizing the investment of tourism resource elements and promoting ecological protection and high-quality development in the area. In this paper, we used the Super-Efficiency Slacks-Based Measure Model to calculate the tourism ecological efficiency of 12 cities in the Hanjiang River Basin from 2010 to 2019 and measured its spatiotemporal evolution and spatial agglomeration using ArcGIS software. The results show that during the study period, the ecological efficiency of tourism in the Hanjiang River Basin presented a phased characteristic of first rising and then falling over time and a heterogeneity characteristic of decreasing in a downward-middle-upward staircase pattern spatially. In addition, the distribution of tourism ecological efficiency exhibited obvious spatial clustering and dependence, with significant low-level homogenization phenomena, which requires strengthening cooperation and coordination among neighboring cities to achieve more efficient resource utilization and higher-quality tourism product development.

Keywords: Hanjiang River Basin; tourism sustainability; tourism ecological efficiency; tourism diversity; spatiotemporal evolution; Super-Efficiency SBM model; spatial clustering



Citation: Cheng, Y.; Zhu, K.; Zhou, Q.; El Archi, Y.; Kabil, M.; Remenyik, B.; Dávid, L.D. Tourism Ecological Efficiency and Sustainable Development in the Hanjiang River Basin: A Super-Efficiency Slacks-Based Measure Model Study. *Sustainability* **2023**, *15*, 6159. <https://doi.org/10.3390/su15076159>

Academic Editor: Tim Gray

Received: 17 March 2023

Revised: 29 March 2023

Accepted: 2 April 2023

Published: 3 April 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Tourism is a vital, comprehensive, and supporting industry that has experienced sustained, high-speed, and stable growth in the global economic system [1,2]. With the deepening of economic globalization, the tourism industry has entered a golden age and has emerged as one of the fastest-growing sectors in the global economy [3]. However, the rapid development of tourism has led to a range of social and environmental problems, including ecological damage and the erosion of cultural heritage [4]. As a result, the

development of sustainable tourism has become a crucial solution to address these issues and has drawn the attention of both the tourism industry and academia [5].

Sustainable tourism is a new approach to tourism development that prioritizes the preservation of the ecological environment, the protection of cultural heritage, the advancement of community economies, and social development [6]. This model requires careful consideration of the impacts on ecology, culture, and society in all aspects of tourism planning, management, and operation to achieve a harmonious balance between tourism development, ecological protection, cultural heritage preservation, and community development [7,8]. Sustainable tourism is not only a growing trend in the tourism industry but also an essential component of global economic sustainability.

Against the backdrop of economic globalization, resource depletion, environmental degradation, and population growth have become increasingly prominent issues, with ecological and environmental challenges posing significant obstacles to sustainable development [9,10]. The Hanjiang River Basin, known for its rich historical heritage and abundant tourism resources, is one of the most important tourist regions in China and a crucial economic support and ecological barrier in the Yangtze River Basin [1]. However, excessive development and unreasonable utilization have led to varying degrees of damage to the tourism ecological environment in the area. According to multiple data sources, China welcomed 6.002 billion domestic tourists and 145.31 million inbound tourists and generated a total tourism revenue of 6.63 trillion yuan in 2019 [1,11]. The intensive human activities associated with tourism inevitably magnify the pressure on the ecological environment of the Hanjiang River Basin [12,13]. As a vital component of the tertiary industry, high-quality tourism development is an imperative requirement. Therefore, balancing the development of the tourism economy and ecological environmental protection has become a pressing issue that must be addressed in the Hanjiang River Basin [14,15].

Ecological efficiency refers to achieving maximum economic output while consuming the least amount of resources and incurring the least environmental cost under certain ecological conditions [16]. This concept evaluates the relationship between economic development and resource utilization, and is commonly used to assess the degree of resource and environmental utilization [17,18]. In the tourism industry, which has both economic and ecological benefits, measuring tourism ecological efficiency is crucial to evaluate the impact on the local ecological environment while promoting economic development [19]. Tourism ecological efficiency can be defined as the relationship between the economic value created by tourism activities and the utilization of ecological resources [20,21]. Optimizing tourism resource allocation, strengthening environmental protection management, and improving technology levels within the tourism industry can improve tourism ecological efficiency [22]. By doing so, the tourism industry can achieve economic benefits while maximizing the protection of the ecological environment, laying a solid foundation for sustainable development [23–25].

It is important to avoid prioritizing economic benefits over ecological environmental protection when improving tourism ecological efficiency [26]. Thus, adhering to the concept of sustainable development, balancing economic development and ecological environment protection, and adopting effective measures to ensure the long-term sustainability of the tourism industry are crucial [27]. By evaluating tourism ecological efficiency and implementing sustainable development practices, we can achieve economic growth while minimizing negative impacts on the environment. This will help ensure the long-term sustainability of the tourism industry and contribute to the protection of the ecological environment.

The development of sustainable tourism plans and policies has become crucial for the tourism industry in the Hanjiang River Basin [28,29]. Such plans and policies should prioritize protecting the ecological environment and promoting the economic and social development of local communities. However, few studies have focused on the tourism ecological efficiency of this important region that connects western and eastern China. To address this gap in the literature, this article explores the spatiotemporal evolution of

tourism ecological efficiency in the Hanjiang River Basin. Our aim is to provide insights into the organic combination of tourism development, ecological protection, cultural heritage preservation, and community development in the region and to expand the application of the Super-Efficiency SBM model. This study provides a reference for promoting sustainable tourism in the area by analyzing the spatiotemporal evolution of tourism development. It also contributes theoretical analysis to the application of the A Super-Efficiency Slacks-Based Measure Model in the field of tourism eco-efficiency, offering valuable insights for policymakers and stakeholders.

2. Theoretical Background

2.1. Sustainable Tourism

The concept of sustainable tourism is derived from the broader theory of sustainable development, which prioritizes long-term, stable, and sustainable development while emphasizing fairness among contemporaries, future generations, countries, and ethnic groups [30]. This theory reflects a growing recognition of the destructive impact of human activities on the ecological environment and underscores the importance of balancing efficiency and fairness goals [31,32].

Sustainable tourism aims to promote the sustainability of the tourism industry by reducing tension and conflict that may arise from the complex interactions between the industry, tourists, the environment, and local communities while maintaining the quality of natural and cultural resources [33,34]. Its central goal is to protect and enhance opportunities for future use while meeting the needs of tourists and local communities, ensuring the preservation of essential ecological processes and biodiversity, and supporting local livelihoods [5,35].

To achieve sustainable tourism development, several requirements must be met, including addressing the needs of local residents, meeting the growing demand for tourism, and protecting the environment [8,36]. Achieving this balance is essential for promoting sustainable tourism development, which can help to preserve natural and cultural resources, support local communities, and promote economic growth in a responsible and sustainable manner [37,38].

2.2. Ecological Efficiency

Ecological efficiency is a critical concept in ecology that measures the efficiency of energy, matter, and information use in an ecosystem [39,40]. It is crucial for the stability and sustainability of an ecosystem and its ability to respond to external disturbances [41]. By understanding ecosystem function and implementing protection and restoration measures, we can strike a balance between environmental protection and healthy economic development [42,43]. This is essential to minimize negative environmental impact during rapid economic growth and to achieve ecological civilization [44,45].

Two key indicators of ecological efficiency are production efficiency and ecological efficacy [46–48]. Production efficiency measures an ecosystem's ability to produce biomass in a given unit of time [49,50], while ecological efficacy measures how well an ecosystem converts solar energy into useful chemical energy [51,52]. Improving ecological efficiency requires enhancing both production efficiency and ecological efficacy, which can be achieved by increasing nutrient input, reducing ecosystem losses, and improving material cycling and energy utilization efficiency [53,54].

Balancing economic development with environmental protection is crucial for achieving ecological efficiency, which can be seen as a means of achieving sustainable development [55,56]. By promoting ecological efficiency, we can support sustainable economic growth while minimizing negative environmental impacts [57]. This requires a comprehensive and integrated approach that takes into account the economic, social, and environmental dimensions of sustainable development.

2.3. Tourism Ecological Efficiency

Tourism ecological efficiency is a critical branch of ecological efficiency research that explores the impact of tourism on the environment [58]. To promote sustainable tourism development, it is essential to consider not only the economic and social benefits but also the environmental impact of tourism [59–61]. The concept of tourism ecological efficiency aims to achieve a sustainable balance between ecology, society, and the economy by considering the development of the tourism industry from the perspective of ecological efficiency [62–64].

Tourism ecological efficiency is based on the core concept of reducing the use of the environment and resources while producing goods and services [65]. Various research methods can measure tourism ecological efficiency, including life cycle costs, life cycle assessment, and input-output analysis [66,67]. The study of tourism ecological efficiency is critical for achieving sustainable development in the tourism industry, protecting the environment and enhancing the economic benefits of tourism [68,69].

The goal of tourism ecological efficiency is to minimize tourism resource input while maximizing tourism economic benefits and minimizing negative impacts on the environment, thus achieving a friendly coexistence between the tourism economy and the ecological environment [70–73]. The evaluation criteria of tourism ecological efficiency can include multiple indicators, such as the efficient utilization of tourism resources, the quality of the ecological environment, and the economic benefits of tourism. By studying and evaluating tourism ecological efficiency, researchers can provide useful references and guidance for the sustainable development of the tourism industry.

3. Study Area Overview

The Hanjiang River Basin is a geographically important area in central China, with a total length of 1577 km and a catchment area of approximately 159,000 square kilometers [74], as shown in Figure 1. The region spans six provinces and municipalities: Hubei, Shaanxi, Henan, Sichuan, Yunnan, and Gansu, covering a total of 20 cities and districts. Its geographic coordinates are $106^{\circ}12'–114^{\circ}35' E$, $30^{\circ}6'–34^{\circ}23' N$. The Hanjiang River Basin crosses the second and third geological structures in China from west to east, resulting in a complex and diverse landscape, including undulating mountainous terrain, gentle plains, and hilly terrain [75].

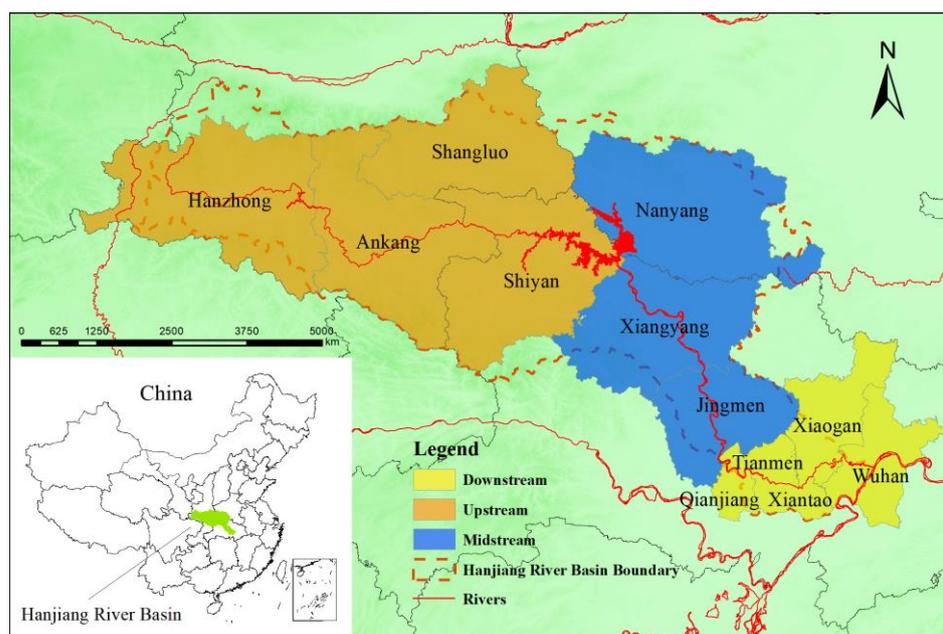


Figure 1. Location of the Hanjiang River Basin.

The Hanjiang River Basin is one of China's important grain-producing regions, with early agricultural development, a good industrial foundation, and abundant mineral resources, including gold, lead, nickel, and copper. In addition, the Danjiangkou Reservoir, which has been incorporated into the South-to-North Water Diversion Project, providing important water transfer and flood control functions and having a high ecological value [76], is important in the Hanjiang River Basin.

However, with rapid economic development and accelerated urbanization, the Hanjiang River Basin is facing environmental pollution and ecological destruction. A large amount of untreated domestic and industrial wastewater is discharged into the Han River, exacerbating the problem of water pollution. Human activities such as sand and gravel mining, shore slope hardening, and overfishing have also had a certain impact on the ecosystem of the Hanjiang River Basin, threatening biodiversity and the sustainable development of the ecological environment.

From a tourism perspective, the Hanjiang River Basin also boasts rich natural landscapes and a historical and humanistic landscape, such as the Three Gorges, Shennongjia, Lushan Mountain, and Emei Mountain. Among them, the Three Gorges is one of China's famous tourist attractions, attracting a large number of tourists with its spectacular natural scenery and unique cultural connotations [1,2]. However, the development of tourism has also brought a series of problems, such as excessive development of scenic areas and insufficient environmental protection awareness among tourists, conditions that need to be addressed.

In conclusion, the Hanjiang River Basin is not only an economically important region in China but also an area rich in ecological environment and tourism resources. It is necessary to strengthen environmental protection and sustainable development to achieve coordinated development of the economy, society, and environment.

4. Data and Methods

4.1. Construction of the Evaluation System

Based on previous literature [77], this study has developed an evaluation index for the ecological efficiency of tourism in the Hanjiang River Basin. The index consists of two levels of indicators, namely input and output indicators, which are presented in Table 1.

Table 1. Evaluation index of tourism ecological efficiency.

Type	Categories	Indicators	Unit	Content
Input Indicators	Resources	A-class scenic spots	Score	Grade 1A: 50; Grade 2A: 60; Grade 3A: 75; Grade 4A: 85; Grade 5A: 90; The sum of these grades is the overall score.
	Services	Star-rated hotels	Number	
	Capital	Tourism industry fixed asset investment	Billions (CNY)	The proportion of tourism in fixed asset investment in the tertiary industry.
	Workforce	Employees in the tourism industry	Number	The proportion of tourism in the number of employees in the tertiary industry.
Output Indicators	Expected output (economic benefits)	Total Tourism Reception	10 ⁴ people	
		Total Tourism Revenue	Million (USD)	
	Nondesired output (ecological impact)	Tourism wastewater discharge	10 ⁴ t	Conversion using the proportion of tourism.
		Tourism sulfur dioxide emissions	t	Conversion using the proportion of tourism.
		Smoke emissions from tourism	10 ⁴ t	Conversion using the proportion of tourism.

Regarding the input indicators, this article addresses the scores of A-level scenic spots, the number of star-rated hotels, fixed asset investment in tourism, and the number of tourism employees as indicators of tourism resources, services, capital, and labor input.

Among them, the study employs the A-level scenic spot score to characterize resource input. Considering that different levels of scenic spots have different impacts, the study adopts a scoring method based on previous research [77,78], using a weighted sum of scores for each level of scenic spots to calculate the A-level scenic spot score. The scoring method used the landscape-quality scoring criteria specified in the “Classification and Evaluation of Tourist Scenic Area Quality Grades”: 1A—50 points; 2A—60 points; 3A—75 points; 4A—85 points; and 5A—90 points. The study takes the lowest score specified for the corresponding level of scenic spots as the value of the tourism resource input for that level. In addition, the study selects the number of star-rated hotels to represent service input and fixed asset investment in tourism to represent capital input. Since the data are not yet available for the city, the study refers to relevant research and converts it by multiplying the fixed asset investment in the tertiary industry by the proportion of tourism. For labor input, the study selects the number of tourism employees, and the calculation method is the same as above.

Regarding the output indicators, this article selects the total tourism revenue and total tourism reception as expected output indicators to measure tourism performance and attractiveness. In selecting ecological environment indicators, tourism carbon emissions are the most commonly used. However, due to the difficulty in obtaining government-protected data on the number of tourists for transportation, accommodation, and other activities, the study selects the discharge of tourism wastewater, sulfur dioxide, and smoke as indicators of unexpected output. Since cities do not separately account for the “three wastes” of the tourism industry, the study refers to previous research and converts it by using the ratio of tourism revenue to GDP [79,80]. The calculation of tourism wastewater discharge is wastewater discharge \times (tourism revenue/GDP). The calculation process for tourism sulfur dioxide emissions and tourism smoke emissions is the same as above.

Based on the natural river basin as the basic support, considering the integrity of the geographical unit and the direct relationship between the regional economy and the Hanjiang River Basin, combined with data availability, the study area selected 12 prefecture-level cities, including the upstream areas of Hanzhong, Ankang, Shangluo, Shiyang, etc., the middle reaches of Nanyang, Xiangyang, Jingmen, etc., and the downstream areas of Qianjiang, Tianmen, Xiantao, Xiaogan, and Wuhan. Data sources include statistical yearbooks, tourism yearbooks, national economic and social development bulletins, and the website of the Ministry of Culture and Tourism from 2010 to 2019.

It should be noted that to eliminate the deviation caused by price fluctuations, this article uses 2010 as the base year to deflate tourism revenue and fixed asset investment. In addition, when a large amount of missing data arises, this article uses interpolation to supplement the data to ensure the evaluation effect.

4.2. Methods

4.2.1. Super-Efficiency SBM Model

The Super-Efficiency SBM (Slacks-Based Measure) model not only addresses the input–output slack and unexpected output problems but also ranks the efficiency values [81–83]. In this study, the Super-Efficiency SBM model was used to measure the ecological efficiency of tourism in the Hanjiang River Basin, and the efficiency levels were divided into five grades based on previous research [83,84]: very high ($TE > 0.8$), high ($0.6 < TE \leq 0.8$), moderate ($0.4 < TE \leq 0.6$), low ($0.2 < TE \leq 0.4$), and very low ($TE \leq 0.2$). The model construction is as follows:

$$\min \rho = \frac{\frac{1}{m} \sum_{i=1}^m \left(\frac{\bar{x}_i}{x_{ik}} \right)}{\frac{1}{r_1+r_2} \left(\sum_{s=1}^{r_1} \frac{\bar{y}^d}{y_{sk}^d} + \sum_{q=1}^{r_2} \frac{\bar{y}^u}{y_{qk}^u} \right)}, \quad \begin{cases} \bar{x} \geq \sum_{j=1, \neq k}^n x_{ij} \lambda_j; \bar{y}^d \leq \sum_{j=1, \neq k}^n y_{sj}^d \lambda_j \\ \bar{y}^d \geq \sum_{j=1, \neq k}^n y_{qj}^d \lambda_j; \bar{x} \geq x_k \\ \bar{y}^d \leq y_k^d; \bar{y}^u \geq y_k^u; \\ \lambda_j \geq 0, i = 1, 2, \dots, m; j = 1, 2, \dots, n; \\ s = 1, 2, \dots, r_1; q = 1, 2, \dots, r_2 \end{cases} \quad (1)$$

where n represents the decision-making unit, and m , r_1 , and r_2 represent input, expected output, and unexpected output, respectively. x , y^d , and y^u represent the elements in the corresponding matrices, and ρ represents tourism ecological efficiency.

4.2.2. Global Spatial Autocorrelation

Global spatial autocorrelation is a commonly used spatial analysis tool that describes spatial correlation from a global perspective [85]. In geographic information systems and spatial statistics, global spatial autocorrelation is typically used to evaluate the degree of spatial clustering and dispersion of spatial data, as well as the strength and direction of spatial correlation [86]. Moran's I index is commonly used to measure global spatial autocorrelation, with the following formula:

$$I = \frac{\sum_{i=1}^n \sum_{j=1}^n W_{ij}(x_i - \bar{x})(x_j - \bar{x})}{S^2 \sum_{i=1}^n \sum_{j=1}^n W_{ij}} \quad (2)$$

where S^2 represents the variance, \bar{x} represents the mean, x_i and x_j represent the tourism ecological efficiency of the i -th and j -th cities, respectively, n represents the total number of city units, and W_{ij} represents the spatial weight matrix. In this study, the researchers chose the geographic proximity weight matrix ($W_{ij} = 1, i \neq j; W_{ij} = 0, i = j$) as the base matrix, and for robustness considerations, the researchers used the geographic distance weight matrix ($W = 1/d_{ij}, i \neq j; W = 0, i = j; d_{ij}$ represents the distance between cities) as a comparative test. Moran's I index is used to measure spatial autocorrelation, with values ranging from -1 to 1 . When Moran's $I > 0$, it indicates that there is spatial positive correlation; when Moran's $I < 0$, it indicates that there is spatial negative correlation; and when Moran's $I = 0$, it indicates that there is no spatial autocorrelation. The calculation of Moran's I can help to reveal the spatial heterogeneity and correlation of tourism ecological efficiency among cities and provide support for the application of GIS and spatial statistics.

4.2.3. Local Spatial Autocorrelation

Local spatial autocorrelation is a spatial analysis tool that measures regional differences and clustering from a local perspective [87]. Unlike global spatial autocorrelation, local spatial autocorrelation evaluates spatial differences and clustering among regions by calculating the spatial correlation between each region and its neighboring regions [88,89]. The specific formula for calculating local spatial autocorrelation is as follows:

$$I_i = \frac{(x_i - \bar{x}) \sum_{j=1}^n W_{ij}(x_j - \bar{x})}{S^2} \quad (3)$$

The variables in the equation have the same meanings as in Equation (2). I_i represents Moran's I index value for each region i , which ranges from -1 to 1 . When $I_i > 0$, it indicates a spatial clustering phenomenon of high-high or low-low similarity attributes between the region and its neighboring regions. When $I_i < 0$, it indicates a spatial clustering phenomenon of high-low or low-high dissimilar attributes between the region and its neighboring regions. When $I_i = 0$, it indicates a random distribution of attributes between the region and its neighboring regions. Calculation of local spatial autocorrelation can help reveal spatial heterogeneity and clustering among regions, providing support for the application of geographic information systems and spatial statistics.

5. Results and Discussion

5.1. Temporal Changes in Tourism Ecological Efficiency

Figure 2 illustrates the temporal changes in tourism ecological efficiency in the Hanjiang River Basin from 2010 to 2019, calculated based on Table 1 and Formula (1). The mean

value of tourism ecological efficiency in the basin was 0.38 in 2010, and the overall trend showed fluctuations, with the highest value of 0.69 recorded in 2016 and the lowest value of 0.63 recorded in 2015. However, there was a significant increase in efficiency in 2019, reaching a peak of 0.73.

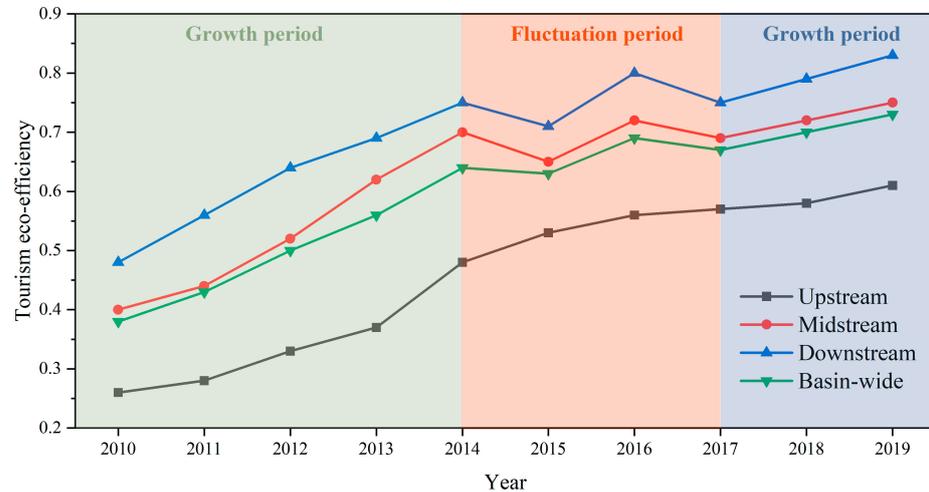


Figure 2. Temporal changes in tourism ecological efficiency in subbasins from 2010 to 2019.

Regional differences in tourism ecological efficiency were observed in the basin. The upstream region consistently exhibited lower efficiency than the basin average throughout the study period but maintained an upward trend. In contrast, the middle and upper reaches of the basin showed a stable increase in efficiency from 2010 to 2014, followed by fluctuations and reversals from 2014 to 2017 and a subsequent upward trend. The efficiency values in the middle and upper reaches of the basin consistently exceeded the basin average, while the downstream region showed a slower rate of increase in efficiency compared to the upstream and middle reaches. The tourism ecological efficiency in the Hanjiang River Basin can be classified into three stages: growth stage (2010–2014), fluctuation stage (2014–2017), and growth stage (2017–2019). This classification reflects a fluctuating trend of first increasing, then decreasing, and then increasing again. Furthermore, the increase in efficiency in the upstream and middle reaches was significantly greater than that in the downstream reaches.

In conclusion, this study offers valuable insights into the temporal changes and regional differences in tourism ecological efficiency in the Hanjiang River Basin. Targeted policy interventions are necessary to improve tourism ecological efficiency in the downstream region while sustaining growth in the upstream and middle reaches. Implementing these measures can promote sustainable tourism development in the basin.

5.2. Spatial Distribution in Tourism Ecological Efficiency

Figure 3 illustrates the regional differences and spatial evolution characteristics of tourism ecological efficiency in the Hanjiang River Basin, which was divided into low, medium, and high levels according to the rule of “0–0.36–0.66–1”. In 2010, only Shiyan City in the upper reaches reached the medium level, while the other cities were at the low level. In contrast, the middle and lower reaches reached the medium level, with some cities even reaching the high level. This indicates that the tourism ecological efficiency in the western upper reaches is significantly lower than that in the eastern middle and lower reaches, with significant spatial differences and a staircase-like decreasing spatial pattern from the downstream to the upstream.

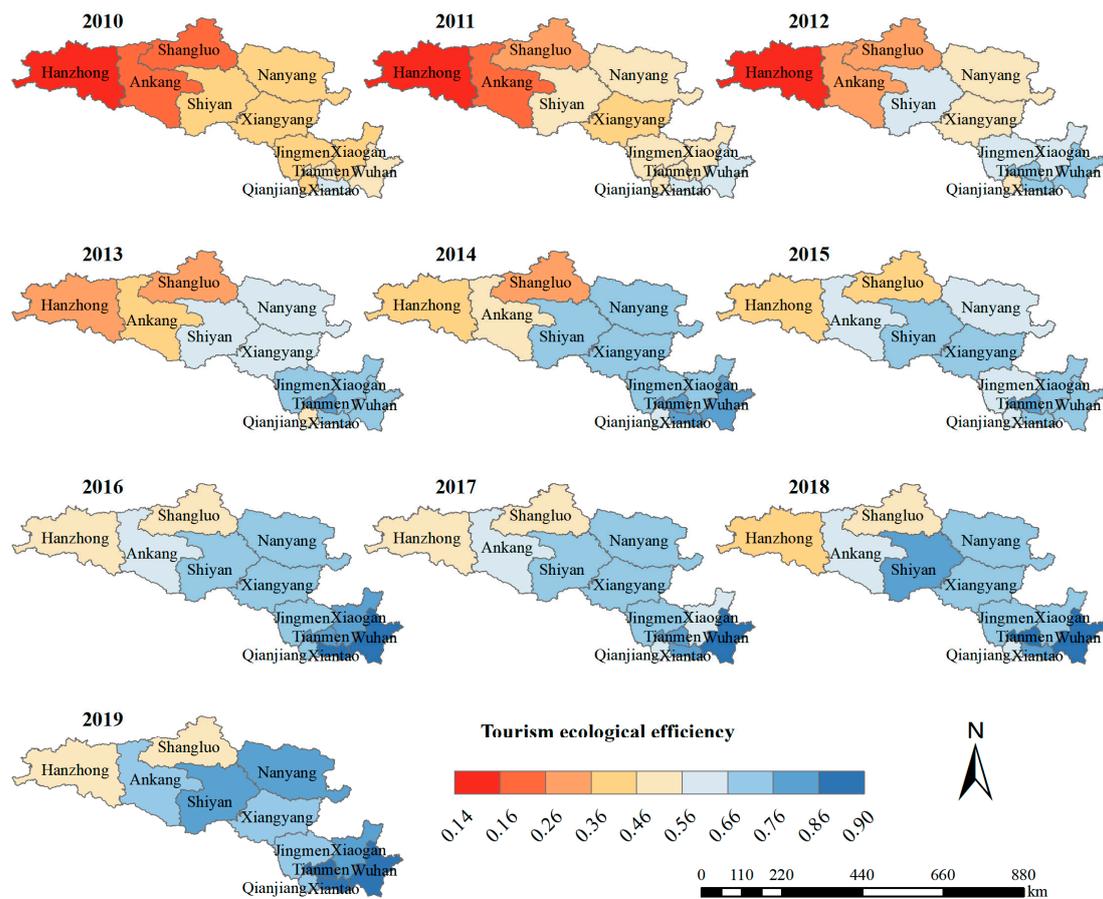


Figure 3. Spatial distribution of tourism ecological efficiency in subbasins from 2010 to 2019.

Over time, the number of low-level areas in the upper reaches decreased, while the number of medium- and high-level areas increased. In 2014, all cities in the upper reaches improved their tourism ecological efficiency to the medium level, and the first high-level area appeared in 2015 in Shiyang City. Ankang City was also upgraded to a high-level area in 2019. The middle reaches had the first high-level area in 2013 in Jingmen City, and all cities in the middle reaches were upgraded to high-level areas in 2016, with Nanyang City having the highest tourism ecological efficiency in 2019. The downstream had the highest average level of tourism ecological efficiency, and in 2013, all cities except Qianjiang City reached the high-level area. These findings indicate that the tourism ecological efficiency of the entire Hanjiang River Basin significantly improved during the study period, and the regional differences gradually narrowed.

The current study conducted a comparative analysis of the spatial distribution of effective decision-making units in the Hanjiang River Basin. Two cities in the upper reaches reached DEA effectiveness, with a mean of 1.074, and Shiyang City had the highest efficiency. Two cities in the middle reaches reached DEA effectiveness, with a mean of 1.232, and Xiangyang City had the highest efficiency. Four cities downstream reached DEA effectiveness, with a mean of 1.317, and Wuhan City had the highest efficiency. In terms of quantity, the downstream had the most cities that reached DEA effectiveness, while the middle and upper reaches had fewer. In terms of efficiency, the cities that reached DEA effectiveness downstream had higher efficiency levels, followed by those in the middle reaches, while the upper reaches had the lowest efficiency levels. Moreover, economically developed cities had higher efficiency levels than other cities, regardless of their position in the basin.

In conclusion, the spatial differences in tourism ecological efficiency in the Hanjiang River Basin are significant, showing a staircase-like decreasing spatial distribution pattern

from downstream to upstream. While regional differences have gradually narrowed, there is still a need to strengthen the coordination and integration of ecological protection and tourism development. Among cities that reach the same effective decision-making unit, those in the downstream reaches show a higher efficiency level than those in the middle and upper reaches. Moreover, economically developed cities exhibit higher efficiency levels than other cities.

5.3. Global Spatial Autocorrelation Analysis

Table 2 shows that the global Moran's I index results for tourism ecological efficiency in the Hanjiang River Basin, considering geographical proximity and the geographical distance weight matrix, indicate significant positive spatial correlation in the region. This means that changes in tourism ecological efficiency in a certain area depend not only on their own intrinsic factors but also on the influence of neighboring areas. This spatial correlation may be related to the geographical environment and population distribution in the basin. For example, upstream areas may face challenges in developing and utilizing tourism resources due to high mountains, dangerous roads, and inconvenient transportation, affecting tourism ecological efficiency. In contrast, downstream areas with flat terrain, convenient transportation, and a large population may have more tourism resources and better tourism services, increasing tourism ecological efficiency [1]. Moreover, the development of tourism may also be influenced by factors such as policies, economy, and culture, which may differ in different regions, further exacerbating the spatial correlation of tourism ecological efficiency in the Hanjiang River Basin.

Table 2. Global Moran's I for the Hanjiang River Basin from 2010 to 2019.

Year	Geographical Proximity Weight Matrix			Geographical Distance Weight Matrix		
	Global Moran's I	Z	p	Global Moran's I	Z	p
2010	0.323	4.061	0.000	0.140	9.692	0.000
2011	0.373	4.501	0.000	0.187	10.013	0.000
2012	0.435	5.331	0.000	0.192	10.055	0.000
2013	0.438	5.442	0.000	0.184	9.680	0.000
2014	0.401	4.846	0.000	0.185	9.551	0.000
2015	0.404	4.891	0.000	0.172	8.719	0.000
2016	0.215	3.895	0.000	0.112	8.790	0.000
2017	0.255	3.971	0.000	0.122	8.231	0.000
2018	0.346	3.599	0.000	0.071	8.475	0.000
2019	0.357	3.536	0.000	0.048	7.679	0.000

Furthermore, the trend analysis indicates that the agglomeration intensity of tourism ecological efficiency in the Hanjiang River Basin shows a "reverse U-shaped" trend, increasing first and then decreasing. This suggests that there is a strong spatial dependence of tourism ecological efficiency in the early stage, where similar tourism ecological efficiency tends to be concentrated in adjacent areas, and this dependence gradually weakens over time. This trend may be related to the development stage of tourism and policy adjustments [90]. In the early stage of tourism, there may be relatively few tourism resources and relatively single tourism products, leading to a more obvious spatial agglomeration of tourism ecological efficiency [91,92]. However, with the rapid development of tourism and continuous policy adjustments, tourism resources and products in different regions are better developed and utilized, and the spatial distribution of tourism ecological efficiency tends to be stable.

In conclusion, tourism ecological efficiency in the Hanjiang River Basin exhibits clear spatial agglomeration and dependence characteristics. Its formation mechanism may be related to various factors, including the geographical environment, population distribution, tourism development stage, and policy adjustments.

5.4. Local Spatial Autocorrelation Analysis

Figure 4 illustrates the local spatial correlation and agglomeration of tourism ecological efficiency in the Hanjiang River Basin, with four time points selected for analysis: 2010, 2013, 2016, and 2019. The number of high-high agglomerations was the highest and mainly distributed downstream of the Hanjiang River, shifting to the middle reaches in 2019. Cities with low-low agglomerations were mainly concentrated upstream of the Hanjiang River.

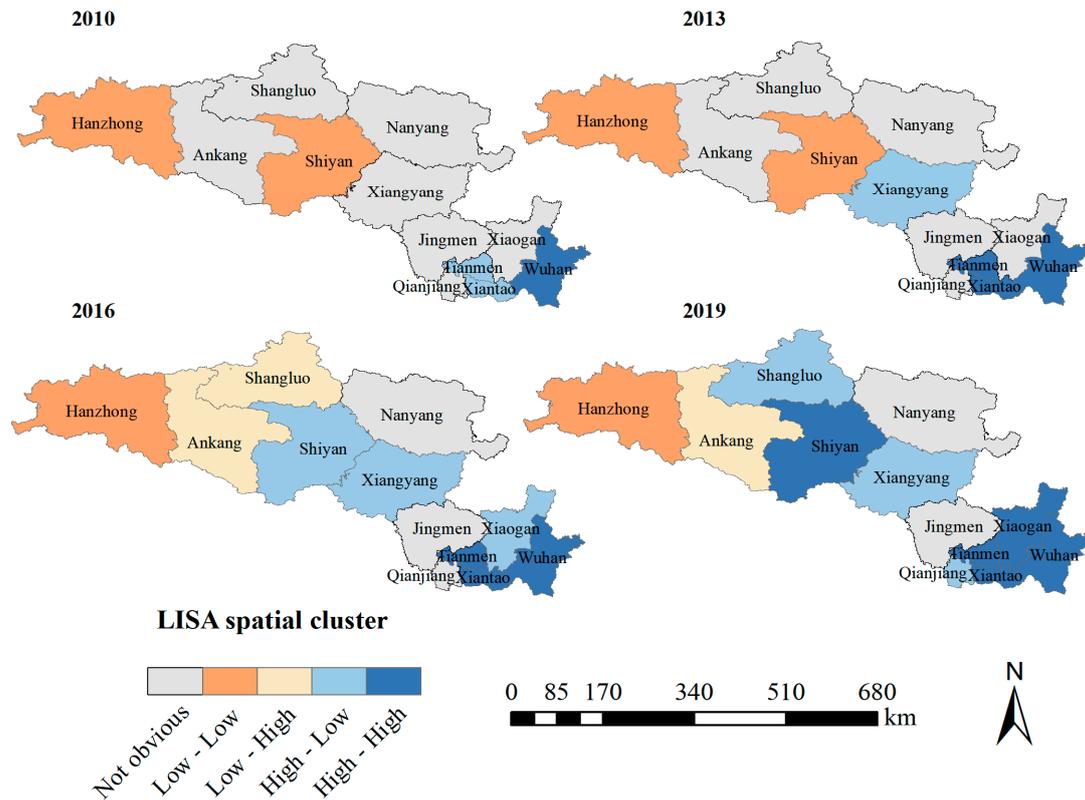


Figure 4. The local indicators of spatial association (LISA) of the Hanjiang River Basin in 2010, 2013, 2016, and 2019.

In terms of distribution patterns, high-high and low-low agglomerations showed a concentrated and contiguous distribution, while low-high and high-low agglomerations displayed a divergent distribution. This spatial agglomeration phenomenon indicates a significant spatial peer effect of tourism ecological efficiency in the Hanjiang River Basin, especially under the low-level homogenized agglomeration state. This may be related to the geographical environment and tourism resource distribution in the basin. For example, the downstream area of the Hanjiang River has abundant tourism resources and a high level of tourism services, leading to a strong correlation between the tourism ecological efficiency of adjacent cities. In contrast, the upstream area has scattered tourism resources and a relatively low level of tourism services, resulting in a weaker correlation with tourism ecological efficiency [1,93,94].

Furthermore, it can be observed that the spatial agglomeration of tourism ecological efficiency in the Hanjiang River Basin presents a local spatial pattern characterized by “the low remain low and the high remain high”, that is, the low-level homogenized agglomeration state is relatively stable, and the high-level homogenized agglomeration state is also relatively stable. This local spatial pattern may be related to the market competition mechanism of the tourism industry. In the fiercely competitive tourism market, excellent tourism enterprises and destinations have strong competitive advantages, further exacerbating the high-level homogenized agglomeration state and making the differences in tourism ecological efficiency more pronounced [95,96].

In conclusion, the significant spatial agglomeration of tourism ecological efficiency in the Hanjiang River Basin holds great significance for sustainable tourism development and regional economic growth.

6. Limitations and Future Work

This study provides a detailed examination of tourism ecological efficiency at the city level, expands the application of the Super-Efficiency SBM model, and focuses on the Hanjiang River Basin, which connects western and eastern China. The findings are significant for the ecological protection and high-quality development of tourism in the basin.

Despite the progress made, we must acknowledge the limitations of this study. One limitation is the use of converted city-level environmental pollution data as a non-desirable output due to data availability issues, which may contain errors. In addition, the latest available data is from 2019, chosen to ensure data consistency and availability, but makes it difficult to fully consider the impact of COVID-19 on the tourism industry in the Hanjiang River Basin.

Future research can address these limitations by conducting field research to obtain tourism-related data for cities in the Hanjiang River Basin and analyzing the spatial differentiation of tourism ecological efficiency and the extent of spatial spillover effects. This will help reveal the driving mechanisms of spatial spillover in different areas of the basin (upstream and downstream). Additionally, data can be collected from multiple sources for the period 2019–2022 (during the COVID-19 pandemic) to study the impact of COVID-19 on tourism ecological efficiency in the Hanjiang River Basin and beyond in China.

We believe that this study's contributions and limitations, along with future research directions, will advance the understanding of tourism ecological efficiency in the Hanjiang River Basin and facilitate sustainable tourism development in the region.

7. Conclusions

This study used panel data from 12 prefecture-level cities in the Hanjiang River Basin to measure tourism ecological efficiency and conducted spatiotemporal evolution and spatial clustering analysis. Through a dynamic perspective analysis, the current situation and trends of tourism ecological protection and high-quality development in the Hanjiang River Basin were revealed. The study found the following:

The tourism ecological efficiency in the Hanjiang River Basin from 2010 to 2019 showed a phased characteristic, with overall significant growth. Specifically, tourism ecological efficiency first rose and then fell. This phased change was due to the Chinese government's issuance of a series of regulations from 2014 to 2017 to promote the improvement of tourism ecological efficiency [13,97,98]. However, with the development of tourism, the accompanying environmental impact became increasingly prominent, and the bottleneck of tourism ecological resources became apparent, resulting in a decrease in efficiency values.

The horizontal comparison of tourism ecological efficiency values of the upstream, middle reaches, and downstream in the Hanjiang River Basin shows that the efficiency value of the upstream has always been below the basin average due to factors such as inconvenient location and transportation, fragile ecological environment, and weak economic foundation for tourism development. However, with the support of national policies, the upstream has accelerated its tourism development pace by taking advantage of its "latecomer advantage" while causing less ecological damage, resulting in a continuous increase in efficiency values [11]. The efficiency values of the middle and downstream have remained stable above the basin average but have been fluctuating since 2014. This indicates that negative impacts accumulated from excessive development of tourism resources in the middle and downstream have become apparent, causing a decline in tourism ecological efficiency due to environmental pollution and ecological imbalance. Therefore, finding new growth points is necessary for high-quality tourism development.

The tourism ecological efficiency in the Hanjiang River Basin exhibits heterogeneity in spatial distribution, with a spatial pattern of decreasing efficiency values from downstream

to upstream in a stepwise manner. Although the spatial differences are significant, they show a trend of narrowing. This spatial difference pattern is closely related to the level of economic development, tourism resource endowment, natural environment, and other factors. The relatively favorable economic foundation of the downstream provides financial support for tourism pollution control, and advanced technology provides technical support for tourism development and protection, leading to a leading level of efficiency. The efficiency value of the middle reaches is average due to the extensive development of resources causing damage to the ecological environment, and the growth of the tourism economy comes with a certain cost in resources and the environment. The efficiency value of the upstream is the lowest due to the relatively weak economic foundation, inconvenient transportation, backward environmental protection technology, and fragile ecological environment under natural constraints, resulting in lower efficiency values than with the middle and downstream.

The overall spatial agglomeration intensity in the Hanjiang River Basin exhibits a “U-shaped” trend of increasing and then decreasing, with spatial dependence also showing a similar trend. This process indicates that the distribution of tourism ecological efficiency in the basin has significant spatial agglomeration and dependence characteristics, with a significant spatial peer effect, especially under the low-level homogenized agglomeration state. Green, high-quality tourism development in the region needs to consider the impact of neighboring cities, and the tourism industry should adopt strategies to strengthen cooperation and coordination between surrounding cities to achieve more efficient resource utilization and better-quality tourism products.

This study analyzed the spatial agglomeration and dependency characteristics of tourism ecological efficiency in the Han River Basin, providing support for sustainable tourism management in the area. To achieve more efficient resource utilization and better tourism product development, regional governments should adopt strategies that strengthen cooperation and coordination among surrounding cities, promoting a fairer and more sustainable tourism industry. Moreover, this study expanded the application scope of the Super-Efficiency SBM model by evaluating tourism ecological efficiency and establishing an evaluation index system for regional tourism efficiency, making significant theoretical contributions to the field.

Overall, the findings of this study offer valuable insights for policymakers and stakeholders in the tourism industry. By highlighting the importance of sustainable tourism development and providing a framework for evaluating tourism ecological efficiency, this research can help guide future efforts to promote sustainable tourism in the Han River Basin and beyond.

Author Contributions: Conceptualization, K.Z.; methodology, K.Z. and Y.C.; software, K.Z. and Y.C.; validation, K.Z., Y.C. and Q.Z.; formal analysis, Y.E.A., M.K., B.R. and L.D.D.; investigation, K.Z., Y.C., Q.Z., Y.E.A., M.K., B.R. and L.D.D.; resources, K.Z.; data curation, K.Z. and Y.C.; writing—original draft preparation, K.Z. and Y.C.; writing—review and editing, K.Z. and Y.C.; visualization, K.Z., Y.C., Q.Z., Y.E.A., M.K., B.R. and L.D.D.; supervision, K.Z.; project administration, K.Z. and L.D.D.; funding acquisition, K.Z. and L.D.D. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data developed in this study will be made available on request to the corresponding authors.

Acknowledgments: Yufeng Cheng would like to express his sincere gratitude to Xinyi Liu for her exceptional patience, care, and support over the past years.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

References

- Zhu, K.; Zhou, Q.; Cheng, Y.; Zhang, Y.; Li, T.; Yan, X.; Alimov, A.; Farmanov, E.; Dávid, L.D. Regional Sustainability: Pressures and Responses of Tourism Economy and Ecological Environment in the Yangtze River Basin, China. *Front. Ecol. Evol.* **2023**, *11*, 168. [\[CrossRef\]](#)
- Zhou, Q.; Zhu, K.; Kang, L.; Dávid, L.D. Tea Culture Tourism Perception: A Study on the Harmony of Importance and Performance. *Sustainability* **2023**, *15*, 2838. [\[CrossRef\]](#)
- Godil, D.I.; Sharif, A.; Rafique, S.; Jermsittiparsert, K. The Asymmetric Effect of Tourism, Financial Development, and Globalization on Ecological Footprint in Turkey. *Environ. Sci. Pollut. Res.* **2020**, *27*, 40109–40120. [\[CrossRef\]](#) [\[PubMed\]](#)
- Han, H. Consumer Behavior and Environmental Sustainability in Tourism and Hospitality: A Review of Theories, Concepts, and Latest Research. *J. Sustain. Tour.* **2021**, *29*, 1021–1042. [\[CrossRef\]](#)
- Guo, Y.; Jiang, J.; Li, S. A Sustainable Tourism Policy Research Review. *Sustainability* **2019**, *11*, 3187. [\[CrossRef\]](#)
- Chang, C.-L.; McAleer, M.; Ramos, V. A Charter for Sustainable Tourism after COVID-19. *Sustainability* **2020**, *12*, 3671. [\[CrossRef\]](#)
- Sheller, M. Reconstructing Tourism in the Caribbean: Connecting Pandemic Recovery, Climate Resilience and Sustainable Tourism through Mobility Justice. *J. Sustain. Tour.* **2021**, *29*, 1436–1449. [\[CrossRef\]](#)
- Kim, S.; Whitford, M.; Arcodia, C. Development of Intangible Cultural Heritage as a Sustainable Tourism Resource: The Intangible Cultural Heritage Practitioners' Perspectives. *J. Herit. Tour.* **2019**, *14*, 422–435. [\[CrossRef\]](#)
- Khalid, S.; Ahmad, M.S.; Ramayah, T.; Hwang, J.; Kim, I. Community Empowerment and Sustainable Tourism Development: The Mediating Role of Community Support for Tourism. *Sustainability* **2019**, *11*, 6248. [\[CrossRef\]](#)
- Serrano, L.; Sianes, A.; Ariza-Montes, A. Using Bibliometric Methods to Shed Light on the Concept of Sustainable Tourism. *Sustainability* **2019**, *11*, 6964. [\[CrossRef\]](#)
- He, L.; Zha, J.; Loo, H.A. How to Improve Tourism Energy Efficiency to Achieve Sustainable Tourism: Evidence from China. *Curr. Issues Tour.* **2020**, *23*, 1–16. [\[CrossRef\]](#)
- Xu, H.; Jiang, F.; Wall, G.; Wang, Y. The Evolving Path of Community Participation in Tourism in China. *J. Sustain. Tour.* **2019**, *27*, 1239–1258. [\[CrossRef\]](#)
- Zhang, J.; Zhang, Y. Tourism, Economic Growth, Energy Consumption, and CO₂ Emissions in China. *Tour. Econ.* **2021**, *27*, 1060–1080. [\[CrossRef\]](#)
- Yang, X.; Jia, Y.; Wang, Q.; Li, C.; Zhang, S. Space–Time Evolution of the Ecological Security of Regional Urban Tourism: The Case of Hubei Province, China. *Environ. Monit Assess* **2021**, *193*, 566. [\[CrossRef\]](#) [\[PubMed\]](#)
- Su, M.M.; Wall, G.; Wang, Y. Integrating Tea and Tourism: A Sustainable Livelihoods Approach. *J. Sustain. Tour.* **2019**, *27*, 1591–1608. [\[CrossRef\]](#)
- Fennell, D.A. Technology and the Sustainable Tourist in the New Age of Disruption. *J. Sustain. Tour.* **2021**, *29*, 767–773. [\[CrossRef\]](#)
- Umar, M.; Ji, X.; Kirikkaleli, D.; Shahbaz, M.; Zhou, X. Environmental Cost of Natural Resources Utilization and Economic Growth: Can China Shift Some Burden through Globalization for Sustainable Development? *Sustain. Dev.* **2020**, *28*, 1678–1688. [\[CrossRef\]](#)
- Han, H.; Guo, L.; Zhang, J.; Zhang, K.; Cui, N. Spatiotemporal Analysis of the Coordination of Economic Development, Resource Utilization, and Environmental Quality in the Beijing–Tianjin–Hebei Urban Agglomeration. *Ecol. Indic.* **2021**, *127*, 107724. [\[CrossRef\]](#)
- Zhang, Y.; Khan, S.U.; Swallow, B.; Liu, W.; Zhao, M. Coupling Coordination Analysis of China's Water Resources Utilization Efficiency and Economic Development Level. *J. Clean. Prod.* **2022**, *373*, 133874. [\[CrossRef\]](#)
- Gössling, S.; Peeters, P.; Ceron, J.-P.; Dubois, G.; Patterson, T.; Richardson, R.B. The Eco-Efficiency of Tourism. *Ecol. Econ.* **2005**, *54*, 417–434. [\[CrossRef\]](#)
- Qiu, X.; Fang, Y.; Yang, X.; Zhu, F. Tourism Eco-Efficiency Measurement, Characteristics, and Its Influence Factors in China. *Sustainability* **2017**, *9*, 1634. [\[CrossRef\]](#)
- Liu, J.; Zhang, J.; Fu, Z. Tourism Eco-Efficiency of Chinese Coastal Cities—Analysis Based on the DEA-Tobit Model. *Ocean Coast. Manag.* **2017**, *148*, 164–170. [\[CrossRef\]](#)
- Wang, R.; Xia, B.; Dong, S.; Li, Y.; Ba, D.; Zhang, W. Research on the Spatial Differentiation and Driving Forces of Eco-Efficiency of Regional Tourism in China. *Sustainability* **2021**, *13*, 280. [\[CrossRef\]](#)
- Peng, H.; Zhang, J.; Lu, L.; Tang, G.; Yan, B.; Xiao, X.; Han, Y. Eco-Efficiency and Its Determinants at a Tourism Destination: A Case Study of Huangshan National Park, China. *Tour. Manag.* **2017**, *60*, 201–211. [\[CrossRef\]](#)
- Guo, L.; Li, P.; Zhang, J.; Xiao, X.; Peng, H. Do Socio-Economic Factors Matter? A Comprehensive Evaluation of Tourism Eco-Efficiency Determinants in China Based on the Geographical Detector Model. *J. Environ. Manag.* **2022**, *320*, 115812. [\[CrossRef\]](#)
- An, C.; Muhtar, P.; Xiao, Z. Spatiotemporal Evolution of Tourism Eco-Efficiency in Major Tourist Cities in China. *Sustainability* **2022**, *14*, 13158. [\[CrossRef\]](#)
- Sun, Y.; Hou, G. Analysis on the Spatial–Temporal Evolution Characteristics and Spatial Network Structure of Tourism Eco-Efficiency in the Yangtze River Delta Urban Agglomeration. *Int. J. Environ. Res. Public Health* **2021**, *18*, 2577. [\[CrossRef\]](#)

28. Sun, Y.; Hou, G.; Huang, Z.; Zhong, Y. Spatial-Temporal Differences and Influencing Factors of Tourism Eco-Efficiency in China's Three Major Urban Agglomerations Based on the Super-EBM Model. *Sustainability* **2020**, *12*, 4156. [[CrossRef](#)]
29. Hao, Z.; Ye, D.; Hui, W.; Zenglin, H.; Hongye, W. An Empirical Analysis of Tourism Eco-Efficiency in Ecological Protection Priority Areas Based on the DPSIR-SBM Model: A Case Study of the Yellow River Basin, China. *Ecol. Inform.* **2022**, *70*, 101720. [[CrossRef](#)]
30. Liu, Z. Sustainable Tourism Development: A Critique. *J. Sustain. Tour.* **2003**, *11*, 459–475. [[CrossRef](#)]
31. Lu, J.; Nepal, S.K. Sustainable Tourism Research: An Analysis of Papers Published in the Journal of Sustainable Tourism. *J. Sustain. Tour.* **2009**, *17*, 5–16. [[CrossRef](#)]
32. Clarke, J. A Framework of Approaches to Sustainable Tourism. *J. Sustain. Tour.* **1997**, *5*, 224–233. [[CrossRef](#)]
33. Rasoolimanesh, S.M.; Ramakrishna, S.; Hall, C.M.; Esfandiar, K.; Seyfi, S. A Systematic Scoping Review of Sustainable Tourism Indicators in Relation to the Sustainable Development Goals. *J. Sustain. Tour.* **2020**, 1–21. [[CrossRef](#)]
34. Streimikiene, D.; Svagzdiene, B.; Jasinskas, E.; Simanavicius, A. Sustainable Tourism Development and Competitiveness: The Systematic Literature Review. *Sustain. Dev.* **2021**, *29*, 259–271. [[CrossRef](#)]
35. Higgins-Desbiolles, F. The “War over Tourism”: Challenges to Sustainable Tourism in the Tourism Academy after COVID-19. *J. Sustain. Tour.* **2021**, *29*, 551–569. [[CrossRef](#)]
36. Guaita Martínez, J.M.; Martín Martín, J.M.; Salinas Fernández, J.A.; Mogorrón-Guerrero, H. An Analysis of the Stability of Rural Tourism as a Desired Condition for Sustainable Tourism. *J. Bus. Res.* **2019**, *100*, 165–174. [[CrossRef](#)]
37. Della Corte, V.; Del Gaudio, G.; Sepe, F.; Sciarelli, F. Sustainable Tourism in the Open Innovation Realm: A Bibliometric Analysis. *Sustainability* **2019**, *11*, 6114. [[CrossRef](#)]
38. Sobaih, A.E.E.; Elshaer, I.; Hasanein, A.M.; Abdelaziz, A.S. Responses to COVID-19: The Role of Performance in the Relationship between Small Hospitality Enterprises' Resilience and Sustainable Tourism Development. *Int. J. Hosp. Manag.* **2021**, *94*, 102824. [[CrossRef](#)]
39. Saling, P.; Kicherer, A.; Dittrich-Krämer, B.; Wittlinger, R.; Zombik, W.; Schmidt, I.; Schrott, W.; Schmidt, S. Eco-Efficiency Analysis by Basf: The Method. *Int. J. LCA* **2002**, *7*, 203–218. [[CrossRef](#)]
40. Archi, Y.E.; Benbba, B.; Nizamatinova, Z.; Issakov, Y.; Vargáné, G.I.; Dávid, L.D. Systematic Literature Review Analysing Smart Tourism Destinations in Context of Sustainable Development: Current Applications and Future Directions. *Sustainability* **2023**, *15*, 5086. [[CrossRef](#)]
41. Caiado, R.G.G.; de Freitas Dias, R.; Mattos, L.V.; Quelhas, O.L.G.; Leal Filho, W. Towards Sustainable Development through the Perspective of Eco-Efficiency—A Systematic Literature Review. *J. Clean. Prod.* **2017**, *165*, 890–904. [[CrossRef](#)]
42. Hickel, J. The Sustainable Development Index: Measuring the Ecological Efficiency of Human Development in the Anthropocene. *Ecol. Econ.* **2020**, *167*, 106331. [[CrossRef](#)]
43. Erdeli, G.; Dinca, A.I. Tourism—A Vulnerable Strength in the Protected Areas of the Romanian Carpathians. *Procedia-Soc. Behav. Sci.* **2011**, *19*, 190–197. [[CrossRef](#)]
44. Huppes, G.; Ishikawa, M. A Framework for Quantified Eco-Efficiency Analysis. *J. Ind. Ecol.* **2005**, *9*, 25–41. [[CrossRef](#)]
45. Huang, J.; Yang, X.; Cheng, G.; Wang, S. A Comprehensive Eco-Efficiency Model and Dynamics of Regional Eco-Efficiency in China. *J. Clean. Prod.* **2014**, *67*, 228–238. [[CrossRef](#)]
46. Font, X.; English, R.; Gkritzali, A.; Tian, W. (Stella) Value Co-Creation in Sustainable Tourism: A Service-Dominant Logic Approach. *Tour. Manag.* **2021**, *82*, 104200. [[CrossRef](#)]
47. Nepal, R.; Indra al Irsyad, M.; Nepal, S.K. Tourist Arrivals, Energy Consumption and Pollutant Emissions in a Developing Economy—Implications for Sustainable Tourism. *Tour. Manag.* **2019**, *72*, 145–154. [[CrossRef](#)]
48. Zhang, T.; Chen, J.; Hu, B. Authenticity, Quality, and Loyalty: Local Food and Sustainable Tourism Experience. *Sustainability* **2019**, *11*, 3437. [[CrossRef](#)]
49. Eslami, S.; Khalifah, Z.; Mardani, A.; Streimikiene, D.; Han, H. Community Attachment, Tourism Impacts, Quality of Life and Residents' Support for Sustainable Tourism Development. *J. Travel Tour. Mark.* **2019**, *36*, 1061–1079. [[CrossRef](#)]
50. Choi, H.-S.C.; Sirakaya, E. Measuring Residents' Attitude toward Sustainable Tourism: Development of Sustainable Tourism Attitude Scale. *J. Travel Res.* **2005**, *43*, 380–394. [[CrossRef](#)]
51. Mickwitz, P.; Melanen, M.; Rosenström, U.; Seppälä, J. Regional Eco-Efficiency Indicators—A Participatory Approach. *J. Clean. Prod.* **2006**, *14*, 1603–1611. [[CrossRef](#)]
52. Bleischwitz, R. Cognitive and Institutional Perspectives of Eco-Efficiency. *Ecol. Econ.* **2003**, *46*, 453–467. [[CrossRef](#)]
53. Coluccia, B.; Valente, D.; Fusco, G.; De Leo, F.; Porrini, D. Assessing Agricultural Eco-Efficiency in Italian Regions. *Ecol. Indic.* **2020**, *116*, 106483. [[CrossRef](#)]
54. York, R.; Rosa, E.A. Key Challenges to Ecological Modernization Theory: Institutional Efficacy, Case Study Evidence, Units of Analysis, and the Pace of Eco-Efficiency. *Organ. Environ.* **2003**, *16*, 273–288. [[CrossRef](#)]
55. Vogtländer, J.G.; Bijma, A.; Brezet, H.C. Communicating the Eco-Efficiency of Products and Services by Means of the Eco-Costs/Value Model. *J. Clean. Prod.* **2002**, *10*, 57–67. [[CrossRef](#)]
56. Ren, S.; Li, X.; Yuan, B.; Li, D.; Chen, X. The Effects of Three Types of Environmental Regulation on Eco-Efficiency: A Cross-Region Analysis in China. *J. Clean. Prod.* **2018**, *173*, 245–255. [[CrossRef](#)]
57. Yin, K.; Wang, R.; An, Q.; Yao, L.; Liang, J. Using Eco-Efficiency as an Indicator for Sustainable Urban Development: A Case Study of Chinese Provincial Capital Cities. *Ecol. Indic.* **2014**, *36*, 665–671. [[CrossRef](#)]

58. Mousazadeh, H.; Ghorbani, A.; Azadi, H.; Almani, F.A.; Zangiabadi, A.; Zhu, K.; Dávid, L.D. Developing Sustainable Behaviors for Underground Heritage Tourism Management: The Case of Persian Qanats, a UNESCO World Heritage Property. *Land* **2023**, *12*, 808. [[CrossRef](#)]
59. Cheung, K.S.; Li, L.-H. Understanding Visitor–Resident Relations in Overtourism: Developing Resilience for Sustainable Tourism. *J. Sustain. Tour.* **2019**, *27*, 1197–1216. [[CrossRef](#)]
60. MacKenzie, N.; Gannon, M.J. Exploring the Antecedents of Sustainable Tourism Development. *Int. J. Contemp. Hosp. Manag.* **2019**, *31*, 2411–2427. [[CrossRef](#)]
61. Roxas, F.M.Y.; Rivera, J.P.R.; Gutierrez, E.L.M. Framework for Creating Sustainable Tourism Using Systems Thinking. *Curr. Issues Tour.* **2020**, *23*, 280–296. [[CrossRef](#)]
62. Haibo, C.; Ke, D.; Fangfang, W.; Ayamba, E.C. The Spatial Effect of Tourism Economic Development on Regional Ecological Efficiency. *Env. Sci Pollut Res* **2020**, *27*, 38241–38258. [[CrossRef](#)] [[PubMed](#)]
63. Castilho, D.; Fuinhas, J.A.; Marques, A.C. The Impacts of the Tourism Sector on the Eco-Efficiency of the Latin American and Caribbean Countries. *Socio-Econ. Plan. Sci.* **2021**, *78*, 101089. [[CrossRef](#)]
64. Choi, Y.E.; Oh, C.-O.; Chon, J. Applying the Resilience Principles for Sustainable Ecotourism Development: A Case Study of the Nakdong Estuary, South Korea. *Tour. Manag.* **2021**, *83*, 104237. [[CrossRef](#)]
65. Zhang, W.; Zhan, Y.; Yin, R.; Yuan, X. The Tourism Eco-Efficiency Measurement and Its Influencing Factors in the Yellow River Basin. *Sustainability* **2022**, *14*, 15654. [[CrossRef](#)]
66. Liu, Q.; Song, J.; Dai, T.; Xu, J.; Li, J.; Wang, E. Spatial Network Structure of China’s Provincial-Scale Tourism Eco-Efficiency: A Social Network Analysis. *Energies* **2022**, *15*, 1324. [[CrossRef](#)]
67. Ogutu, H.; Adol, G.F.C.; Bujdosó, Z.; Andrea, B.; Fekete-Farkas, M.; Dávid, L.D. Theoretical Nexus of Knowledge Management and Tourism Business Enterprise Competitiveness: An Integrated Overview. *Sustainability* **2023**, *15*, 1948. [[CrossRef](#)]
68. Xia, B.; Dong, S.; Li, Z.; Zhao, M.; Sun, D.; Zhang, W.; Li, Y. Eco-Efficiency and Its Drivers in Tourism Sectors with Respect to Carbon Emissions from the Supply Chain: An Integrated EEIO and DEA Approach. *Int. J. Environ. Res. Public Health* **2022**, *19*, 6951. [[CrossRef](#)]
69. Wang, C.; Xu, L.; Huang, M.; Su, X.; Lai, R.; Xu, A. Research on the Evolution of Spatial Network Structure of Tourism Eco-Efficiency and Its Influencing Factors in China’s Provinces Based on Carbon Emission Accounting. *PLoS ONE* **2022**, *17*, e0272667. [[CrossRef](#)]
70. Kelly, J.; Williams, P. Tourism Destination Water Management Strategies: An Eco-efficiency Modelling Approach. *Leis./Loisir* **2007**, *31*, 427–452. [[CrossRef](#)]
71. Han, J. Carrying Capacity of Low Carbon Tourism Environment in Coastal Areas from the Perspective of Ecological Efficiency. *J. Coast. Res.* **2018**, 199–203. [[CrossRef](#)]
72. Li, S.; Ren, T.; Jia, B.; Zhong, Y. The Spatial Pattern and Spillover Effect of the Eco-Efficiency of Regional Tourism from the Perspective of Green Development: An Empirical Study in China. *Forests* **2022**, *13*, 1324. [[CrossRef](#)]
73. Li, D.; Zhai, Y.; Tian, G.; Mendako, R.K. Tourism Eco-Efficiency and Influence Factors of Chinese Forest Parks under Carbon Peaking and Carbon Neutrality Target. *Sustainability* **2022**, *14*, 13979. [[CrossRef](#)]
74. Zhu, K.; Zhang, Y.; Wang, M.; Liu, H. The Ecological Compensation Mechanism in a Cross-Regional Water Diversion Project Using Evolutionary Game Theory: The Case of the Hanjiang River Basin, China. *Water* **2022**, *14*, 1151. [[CrossRef](#)]
75. Zhu, K.; Liu, Q.; Xiong, X.; Zhang, Y.; Wang, M.; Liu, H. Carbon Footprint and Embodied Carbon Emission Transfer Network Obtained Using the Multi-Regional Input–Output Model and Social Network Analysis Method: A Case of the Hanjiang River Basin, China. *Front. Ecol. Evol.* **2022**, *10*, 941520. [[CrossRef](#)]
76. Wang, Y.; Zhu, K.; Xiong, X.; Yin, J.; Yan, H.; Zhang, Y.; Liu, H. Assessment of the Ecological Compensation Standards for Cross-Basin Water Diversion Projects from the Perspective of Main Headwater and Receiver Areas. *Int. J. Environ. Res. Public Health* **2023**, *20*, 717. [[CrossRef](#)]
77. Yang, Y.; Yan, J.; Yang, Y.; Yang, Y. The spatio-temporal evolution and spatial spillover effect of tourism eco-efficiency in the Yellow River Basin: based on data from the 73 cities. *Acta Ecol. Sin.* **2022**, *42*, 8202–8212. [[CrossRef](#)]
78. Qiu, Y.; Yin, J.; Zhang, T.; Du, Y.; Zhang, B. Spatiotemporal Dynamic Analysis of A-Level Scenic Spots in Guizhou Province, China. *ISPRS Int. J. Geo-Inf.* **2021**, *10*, 568. [[CrossRef](#)]
79. Zhong, Y.; Shi, S.; Li, S.; Luo, F.; Luo, W.; Xiao, Q. Empirical Research on Construction of a Measurement Framework for Tourism Carbon Emission in China. *Chin. J. Popul. Resour. Environ.* **2015**, *13*, 240–249. [[CrossRef](#)]
80. Mishra, H.G.; Pandita, S.; Bhat, A.A.; Mishra, R.K.; Sharma, S. Tourism and Carbon Emissions: A Bibliometric Review of the Last Three Decades: 1990–2021. *Tour. Rev.* **2021**, *77*, 636–658. [[CrossRef](#)]
81. Tian, N.; Tang, S.; Che, A.; Wu, P. Measuring Regional Transport Sustainability Using Super-Efficiency SBM-DEA with Weighting Preference. *J. Clean. Prod.* **2020**, *242*, 118474. [[CrossRef](#)]
82. Zhong, K.; Wang, Y.; Pei, J.; Tang, S.; Han, Z. Super Efficiency SBM-DEA and Neural Network for Performance Evaluation. *Inf. Process. Manag.* **2021**, *58*, 102728. [[CrossRef](#)]
83. Huang, Y.; Huang, X.; Xie, M.; Cheng, W.; Shu, Q. A Study on the Effects of Regional Differences on Agricultural Water Resource Utilization Efficiency Using Super-Efficiency SBM Model. *Sci. Rep.* **2021**, *11*, 9953. [[CrossRef](#)] [[PubMed](#)]

84. Khan, S.U.; Cui, Y.; Khan, A.A.; Ali, M.A.S.; Khan, A.; Xia, X.; Liu, G.; Zhao, M. Tracking Sustainable Development Efficiency with Human-Environmental System Relationship: An Application of DPSIR and Super Efficiency SBM Model. *Sci. Total Environ.* **2021**, *783*, 146959. [[CrossRef](#)] [[PubMed](#)]
85. Ord, J.K.; Getis, A. Testing for Local Spatial Autocorrelation in the Presence of Global Autocorrelation. *J. Reg. Sci.* **2001**, *41*, 411–432. [[CrossRef](#)]
86. Koo, H.; Wong, D.W.S.; Chun, Y. Measuring Global Spatial Autocorrelation with Data Reliability Information. *Prof. Geogr.* **2019**, *71*, 551–565. [[CrossRef](#)]
87. Fotheringham, A.S. “The Problem of Spatial Autocorrelation” and Local Spatial Statistics. *Geogr. Anal.* **2009**, *41*, 398–403. [[CrossRef](#)]
88. Sokal, R.R.; Oden, N.L.; Thomson, B.A. Local Spatial Autocorrelation in a Biological Model. *Geogr. Anal.* **1998**, *30*, 331–354. [[CrossRef](#)]
89. Ord, J.K.; Getis, A. Local Spatial Autocorrelation Statistics: Distributional Issues and an Application. *Geogr. Anal.* **1995**, *27*, 286–306. [[CrossRef](#)]
90. Krutwaysho, O.; Bramwell, B. Tourism Policy Implementation and Society. *Ann. Tour. Res.* **2010**, *37*, 670–691. [[CrossRef](#)]
91. Estol, J.; Font, X. European Tourism Policy: Its Evolution and Structure. *Tour. Manag.* **2016**, *52*, 230–241. [[CrossRef](#)]
92. Stevenson, N.; Airey, D.; Miller, G. Tourism Policy Making:: The Policymakers’ Perspectives. *Ann. Tour. Res.* **2008**, *35*, 732–750. [[CrossRef](#)]
93. Wang, P.; Zhang, L.; Li, Y.; Jiao, L.; Wang, H.; Yan, J.; Lü, Y.; Fu, B. Spatio-Temporal Variations of the Flood Mitigation Service of Ecosystem under Different Climate Scenarios in the Upper Reaches of Hanjiang River Basin, China. *J. Geogr. Sci.* **2018**, *28*, 1385–1398. [[CrossRef](#)]
94. Peng, X.Z.; Yu, Q.; Yuan, C. Countermeasure Research of Urban Water Resources Protection and Tourism Development and Utilization of Wuhan. *Appl. Mech. Mater.* **2014**, *675–677*, 892–895. [[CrossRef](#)]
95. Risteska, M.; Kocevskia, J.; Arnaudov, K. Spatial Planning and Sustainable Tourism as Basis for Developing Competitive Tourist Destinations. *Procedia-Soc. Behav. Sci.* **2012**, *44*, 375–386. [[CrossRef](#)]
96. Tfaily, R.A. E-Tourism and the Competitiveness of Tourism Products in the Context of the Global Tourism and Travel Industry Market. *Rev. De Manag. Comp. Int.* **2018**, *19*, 187–195. [[CrossRef](#)]
97. Sharif, A.; Godil, D.I.; Xu, B.; Sinha, A.; Rehman Khan, S.A.; Jermisittiparsert, K. Revisiting the Role of Tourism and Globalization in Environmental Degradation in China: Fresh Insights from the Quantile ARDL Approach. *J. Clean. Prod.* **2020**, *272*, 122906. [[CrossRef](#)]
98. Wang, J.; Huang, X.; Gong, Z.; Cao, K. Dynamic Assessment of Tourism Carrying Capacity and Its Impacts on Tourism Economic Growth in Urban Tourism Destinations in China. *J. Destin. Mark. Manag.* **2020**, *15*, 100383. [[CrossRef](#)]

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.