Environmental Science and Pollution Research (2022) 29:23180–23193
https://doi.org/10.1007/s11356-021-17498-z

RESEARCH ARTICLE

Comprehensive partitions and optimisation strategies based on tourism urbanisation and resources environment carrying capacity in the Yellow River Basin, China

Zhaofeng Wang[1] · Qingqing Chen[1]

Received: 24 May 2021 / Accepted: 8 November 2021 / Published online: 20 November 2021

Abstract

A better understanding of the spatial coordination relationship between tourism urbanisation and resources environment carrying capacity (RECC) is vital for the regional selection of key eco-liveable tourist cities in the Yellow River Basin. This study addressed this research issue by evaluating and partitioning tourism urbanisation level and RECC of the Yellow River Basin in 2005, 2011, and 2018 using a geographic information system (GIS) technology, spatial autocorrelation model, and partition method. Empirical results suggest that the tourism urbanisation level of Shaanxi Province maintains its leading position, while Shanxi Province has great development potential. The high-value areas of RECC are concentrated in Gansu, Inner Mongolia, and Shandong provinces. The degree of spatial agglomeration of the tourism urbanisation level and RECC has been improved. The RECC exhibits a greater restrictive effect on the current high-level areas of tourism urbanisation, and the spatial correspondence between them is weak. Based on the findings of this study, a series of optimisation strategies have been proposed to promote the sustainable development of tourism urbanisation in the Yellow River Basin.

Keywords Tourism urbanisation · Resources environment carrying capacity · Partitions · Optimisation strategies · Yellow River Basin

Introduction

Globally, tourism urbanisation is considered an effective means of preventing agricultural decline and promoting the transformation and upgrading of urban industries (Wei and Cui 2015). In China, tourism urbanisation is a key strategy and one of the main targets of new-type urbanisation. It influences and shapes urbanisation development in many aspects (Tao et al. 2017). The ecological protection and high-quality development of the Yellow River Basin became China's major national initiative in 2019 (Xinhua News Agency 2019). For major national strategic regions with geographical features, such as national concentrated contiguous poverty-stricken areas, national ecological function areas and tourism resource-rich areas, the contribution of the tourism sector to urbanisation construction is more critical. However, there have been few in-depth investigations in the relevant literature. Meanwhile, the ecological environment of the Yellow River Basin is relatively fragile, and the RECC is relatively low, which has a strong binding effect on the development of tourism urbanisation. Therefore, accelerating the development of tourism urbanisation in the Yellow River Basin, taking into account the effects of resources and environment and the sustainable development of tourism urbanisation, has become an urgent problem in the area.

Tourism urbanisation and RECC are dynamic development processes. They both have promotion and constrain effects against each other. This is reflected in the nonlinear, complex, and dynamic characteristics of its behaviour (Raza et al. 2021). On the one hand, the orderly development of tourism urbanisation provides financial and technical support for the resources and environment system, which is conducive to the rational development of resources and protection of the environment. However, the disordered development of tourism urbanisation will also destroy ecological resources and overload ecological environment capacity (Xie

Responsible Editor: Eyup Dogan

✉ Qingqing Chen
lightcqq@126.com

[1] College of Tourism, Hunan Normal University, Changsha 410081, Hunan, China

et al. 2013). On the other hand, resources and environmental systems provide resources and environmental support for the development of tourism urbanisation, but they also restrict the development scale of tourism urbanisation (Izquierdo et al. 2018; Nitivattananon and Srinonil 2019).

A number of previous studies have addressed the relationship between tourism urbanisation and the ecological environment in the context of particular countries or regions. The focus of these studies may be classified into three categories, namely the impact of tourism urbanisation on the ecological environment (Xie et al. 2013; Tantatape and Jung 2017; Rai and Goswami 2019), the ecological environment impact of tourism urbanisation (Nitivattananon and Srinonil 2019; Liu et al. 2021), and the interaction between tourism urbanisation and the ecological environment (González et al. 2014; Adedoyin and Bekun 2020; Raza et al. 2021), whereas the research on the coordination relationship between tourism urbanisation and the ecological environment from RECC perspective is limited. It is worth noting that RECC is a crucial index for measuring the relationship between human socioeconomic activities and resource-environment systems (Wang and Xu 2015; Zhang et al. 2019), which provides a scientific basis for realising the balance of population, resources, and environment (Zhou et al. 2021). Furthermore, no existing studies have explored the relationship between the two from the perspective of the watershed. As an open and complex system, the construction of regional units of the watershed system presents dynamic and unbalanced characteristics (Ho 2018). Thus, the sustainable development of tourism urbanisation can be realised only by clarifying the spatial difference and spatial coordination relationship between tourism urbanisation and RECC and achieving a reasonable allocation of resources on time and space scales. However, the existing literature lacks in-depth studies.

To fill this gap, this study employed a geographic information system (GIS) technology, spatial autocorrelation model, and partition method to explore the spatiotemporal pattern and coordination relationship between tourism urbanisation and RECC. The partition method, different from the previous model, clearly reflects the combined state of tourism urbanisation and RECC in light of their independent evaluation value (Hu et al. 2019; Wu et al. 2018; Sun et al. 2020). Furthermore, it helps identify key eco-liveable tourism cities on a large scale. Therefore, partitioning was applied to analyse the spatial coordination relationship between tourism urbanisation and RECC. The main contributions and innovations of this study are identified as follows. This is the first study to investigate the spatial coordination relationship between tourism urbanisation and RECC from the perspective of the watershed. It not only provides a reference for local governments to identify effective tourism urbanisation policy measures to pursue better coordination between tourism urbanisation and RECC but also helps tourism enterprises better fulfil their social responsibility to protect the environment and adopt corresponding innovation strategies (Azizi et al. 2021; Abbas et al. 2021a). Furthermore, this study provides a key model for identifying the coordination relationship between tourism urbanisation and RECC. Although the empirical research is based on a sample of 79 cities in the Yellow River Basin, the methodology is general and may be generalised to other watersheds. Last, this study also responds to the call for more quantitative research on the sustainable development of tourism destinations.

The rest of this paper is structured as follows: the "Literature review" section summarises the findings of previous studies. The "Methodology and data" section describes the methods and data. The "Results" section reports the empirical results. The "Discussion" section presents a discussion of the result, and the "Conclusions and optimisation strategies" section summarises the findings and proposes sustainable development strategies of tourism urbanisation in the Yellow River Basin.

Literature review

The severe acute respiratory syndrome coronavirus 2 is currently spreading around the world, resulting in the coronavirus disease 2019 pandemic (Su et al. 2021). According to the estimation of the UNWTO (2020), international arrivals could fall 60–80% in 2020, translating into a loss of between US$910 billion to 1.2 trillion. Meanwhile, COVID-19 has forced many tourism destinations to cease operations following lockdown measures and travel bans, which results in an immense hit for the local tourism industry (Fotiadis et al. 2021). Therefore, tourism scholars are directing their attention to tourist destinations, especially cities with tourism as the core, looking at their challenges and opportunities and putting forward corresponding tourism development strategies (Li et al. 2021a; Aman et al. 2019). Academic research on tourism urbanisation can be traced back to the 1990s. Mullins (1991) first put forward the concept of tourism urbanisation through an empirical analysis of the two cities of the Gold Coast and Sunshine Coast in Australia. He emphasised the intermediary role of "consumption" and believed that tourists had brought considerable consumption in different places, thus promoting regional urbanisation. Subsequently, many scholars have performed extensive studies on the conceptual connotation (Douglass and Raento 2004), characteristics (Pons and Rullan 2014), categorisation (Tao et al. 2017), development mode (Clavé and Wilson 2017), influencing factors (Kranjčević and Hajdinjak 2019; Hernandez-Rojas et al. 2021), and strategic countermeasures (Wang et al. 2017b) of tourism urbanisation. In terms of research methods, a combination of qualitative and quantitative empirical research was employed. The measurement methods adopted by scholars are different, including the state-space technique (Xiong et al. 2020), regression analysis (Ruan et al. 2019), and evaluation index (Liu et al. 2019). Moreover, some scholars have used measure indexes such as standard deviation, variation coefficient, and static unbalance difference (Wang et al. 2017b), as well as spatial statistical methods such as the standard deviational ellipse model, global autocorrelation Moran's *I*, and cold and hot spot analysis (Liu et al. 2019) to analyse the spatiotemporal differences and evolution mechanisms of tourism urbanisation.

Studies on RECC have become one of the basic topics of sustainable development and national security strategies. Urban RECC evaluation is an important part of the regional resource and environmental development, utilisation, and planning (Zhou et al. 2021). It is also considered one of the standards for measuring the coordination between resources and environmental systems and the development of human society. Therefore, most studies have been performed to establish comprehensive indicator systems for a full-scale reflection of a given city's RECC (Tian and Sun 2018). Different dimensions, such as resources, environment, society, and economy, are involved in most indicator systems (Zhang et al. 2019; Liu et al. 2020). Several methods have been applied in RECC evaluation, such as the technique for order preference by similarity to an ideal solution (TOPSIS) method (Mofidi et al. 2018; Wang et al. 2020a, comprehensive evaluation method (Okey 2018), system dynamics method (Wang et al. 2018), ecological footprint method (Xun and Hu 2019), and catastrophe progression method (Jia et al. 2018). With the development of spatial econometrics, spatial analysis technology has also been applied to the study of RECC, which usually uses Moran's *I* index to analyse the spatial autocorrelation of RECC (Tian and Sun 2018).

In recent years, some scholars have incorporated the ecological environment into the study of tourism urbanisation development as a result of degradation of the ecological environment, endangerment of rare species, and depletion of natural resources. Zhang and Li (2020) detected that the coupling degree of tourism, urbanisation and ecological environment showed a steady increase in Heilongjiang Province from 2003 to 2017, using a coupling coordination degree model. Xiong et al. (2020) examined the spatial–temporal pattern and influencing factors of tourism urbanisation in 17 counties in the Dongting Lake region from 2000 to 2018. The study showed that the spatial pattern of coordination degree and coupling degree was low in the middle and high around. Raza et al. (2021) explored the nonlinear relationship among tourism development, economic growth, urbanisation, and environmental degradation and analysed the threshold level of the contribution of tourism development to the environmental degradation of top tourism destinations. Nevertheless, few studies have been conducted on the coordination relationship between tourism urbanisation and the ecological environment from the RECC perspective.

Through a review of the literature, it can be found that previous studies are concentrated on the measurement of the tourism urbanisation level and the evaluation of RECC, while studies on the relationship between tourism urbanisation and RECC are still in the preliminary exploration stage. Furthermore, no existing studies have examined the significance of the relationship between the two from the perspective of the watershed. Because of the great differences in multiple dimensions among cities in the Yellow River Basin, the coordination performance between tourism urbanisation and RECC varies significantly among cities. Without considering the disparities, policies or management measures may not be suitable for different local practices; therefore, their applications will have limited effectiveness. Wu et al. (2019) show that some policy measures from the central government in China are not implemented effectively at the local level because they are introduced indiscriminately. Thus, there is a gap for this study to conduct an analysis on the coordination relationship between tourism urbanisation and RECC in the Yellow River Basin.

Methodology and data

Measurement of the tourism urbanisation level

Driven by tourism activities, tourism urbanisation contributes to the accumulation and diffusion of productivity factors such as population, capital, and material to tourism-based areas, promoting the orderly expansion of city scale and the continuous improvement of city quality. Quantitative standards on the level of tourism urbanisation remain to be clarified in the literature. Based on recent empirical findings on the development of tourism urbanisation (Wang et al. 2017b; Liu et al. 2019), the two most widely used indicators for comprehensive characteristics (tourism industry and population structures) were selected in this study, and the ratio of these two indicators was adopted to characterise the contribution of tourism in the development of urbanisation. This is calculated as follows:

$$R = \frac{f}{F} / \frac{m}{M} \quad (1)$$

where R indicates the tourism urbanisation level, f is the income of tourism, F is the total value of the industry, m is the number of nonagricultural population, and M is the total population. The ratio of tourism income to the total value of the industry reflects the contribution rate of tourism to the national economy. The urbanisation rate is a comprehensive manifestation of the urban–rural composition of the population and the development of urban spaces. The model uses the ratio of these two measures to indicate the strength of the regional tourism industry's impact on the evolution of urbanisation. Tourism is an important driving force for consumption-driven urbanisation (Liu 2017; Wang et al. 2017b; Xiong et al. 2020). China's tourism industry and urbanisation are both in an important stage of development. They are interdependent and developed together. They gradually form a complex dynamic system that evolves and adapts to each other and shows a coevolutionary structure in a continuous adaptation and feedback process (Huang et al. 2021). The urbanisation process caused by tourism represents a new model of urbanisation in China (Ruan et al. 2019).

Measurement of RECC

Index system construction

The carrying capacity of urban resources and the environment refers to the economic conditions and social activities that can be supported by resources and the environment in the existing conditions (Wang et al. 2017a; Wu et al. 2020). RECC is closely related to the strategic development of villages, cities, and the country, and the openness and pluralism of society have promoted its transition from ecology to sociology. It is generally believed that the stability of the composite ecosystem is based on the balance between resources, environment, society, and economy, with the diverse subsystems being independent and interrelated (Xu et al. 2003; Feng et al. 2018). Among them, the resource system provides various resources necessary for human survival and development, and the resource-carrying capacity is the foundation of environmental carrying capacity. The carrying capacity of the environmental system for waste is limited, constituting a constraint on RECC. In addition, the resource and environment subsystem is under pressure from social and economic activities, although it supports and restricts the development of the socioeconomic subsystem.

This study was conducted based on recent research findings (Fu et al. 2020; Zhang et al. 2019; Liao et al. 2020). We follow the urban complex ecosystem and sustainable development theories, which are combined with the abovementioned conceptual theoretical threshold. Moreover, considering the socioeconomic development characteristics of the Yellow River Basin and the internal and external structures of the ecosystem, an evaluation index system for the RECC of the Yellow River Basin was constructed. The specific indicators are listed in Table 1.

TOPSIS model based on entropy weight

The entropy method determines the weight according to the degree of change in the original index data. As an objective weighting method, it avoids the shortcomings of the index weight tending to the subjective consciousness of the evaluators from weighting methods such as the analytic hierarchy process (AHP) and the Delphi method (Zhao et al. 2020a; Yang et al. 2020). The TOPSIS method was first proposed by Hwang and Yoon (1981). It is a common method to effectively solve multi-objective decision-making problems in an ideal manner (Chen 2019). By combining the entropy weight method with the TOPSIS method, this study overcomes the subjective shortcoming of TOPSIS and objectively and comprehensively reflects the dynamic changes in the RECC of the Yellow River Basin. The specific calculation procedure is as follows (Li, 2021):

(i) Suppose that there are m objects under study and n evaluation indicators for each object under study. Then, the following judgement matrix can be constructed as follows:

$$x\left(x_{ij}\right)_{m\times m}(i = 1, 2, \Lambda, mr, j = 1, 2, \Lambda, n) \tag{2}$$

(ii) The range transformation method was used to standardise the data.

(iii) Computing information entropy:

$$H_j = -k\sum_{i-1}^{m} p_{ij}\, Inp_{ij}, p_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}}, k = \frac{1}{Inm} \tag{3}$$

where $m = 79$.

(iv) Calculating the weight of index j:

$$w_j = \frac{1 - H_j}{\sum_{j=1}^{n}\left(1 - H_j\right)} \tag{4}$$

where $w_j \in [0,1]$

(v) Determining the weighting matrix:

$$R = \left(l_{ij}\right)_{m\times n}, r = w_j \bullet x_{ij}(i = 1,2, \Lambda, m, j = 1,2, \Lambda, n) \tag{5}$$

(vi) Determining the optimal solution S_i^+ and the worst solution S_i^-:

$$S_j^+ = max\left(r_{1j}, r_{2j}, \Lambda, r_{nj}\right), S_j^- = min\left(r_{1j}, r_{2j}, \Lambda, r_{nj}\right) \tag{6}$$

(vii) Calculating the Euclidean distance from each scheme to the positive and negative ideal solutions:

$$S_i^+ = \sqrt{\sum_{j=1}^{n}\left(S_j^+ - r_{ij}\right)^2}, S_j^- = \sqrt{\sum_{j=1}^{n}\left(S_j^- - r_{ij}\right)^2} \tag{7}$$

Table 1 Evaluation index system for RECC

System layer	Index layer (unit)	Attribute	Weight
Economic subsystem	GDP per capita (10,000 yuan)	+	0.0546
	Proportion of secondary industry in GDP (%)	+	0.0137
	Proportion of tertiary industry in GDP (%)	+	0.0266
	Total retail sales of consumer goods (10,000 yuan)	+	0.0755
	Local government general budget expenditure (10,000 yuan)	+	0.0523
	Per capita disposable income of urban residents (yuan)	+	0.0645
	Per capita annual net income of rural households (yuan)	+	0.0620
	Investment in fixed assets (10,000 yuan)	+	0.0737
Social subsystem	Population density (person/km^2)	–	0.0161
	Natural population growth rate (‰)	–	0.0111
	Per capita area of paved roads in cities (m^2)	+	0.0431
	Public library collections per million people (volume)	+	0.0307
	Number of public transportation vehicles per million population (unit)	+	0.0656
	Number of beds in health institutions per million people (bed)	+	0.0332
	Number of students in colleges and universities per 10,000 people (person)	+	0.0872
Resource subsystem	Per capita cultivated land (hm^2)	+	0.0388
	Per capita daily consumption of tap water for residential use (liter)	+	0.0264
	Volume of water supply (10,000 tons)	+	0.0500
	Area of land used for urban construction (km^2)	+	0.0318
Environmental subsystem	Per capita green area (m^2)	+	0.0459
	Green coverage rate of established areas (%)	+	0.0120
	Volume of industrial wastewater discharged (10,000 tons)	–	0.0074
	Volume of sulphur dioxide emission (10,000 tons)	–	0.0115
	Volume of industrial soot (dust) emission (10,000 tons)	–	0.0016
	Ratio of wastewater centralised treated (%)	+	0.0195
	Ratio of consumption wastes treated (%)	+	0.0168
	Ratio of industrial solid wastes comprehensively utilised (%)	+	0.0283

(viii) Calculating the comprehensive evaluation index c_i:

$$C_i = \frac{S_i^-}{S_i^+ + S_i^-} \quad 0 \le C_i \le 1 \tag{8}$$

Spatial autocorrelation analysis

The spatial autocorrelation analysis method was further employed to examine the spatial agglomeration patterns of tourism urbanisation and RECC in the Yellow River Basin. Spatial autocorrelation refers to the potential interdependence of some variables in the same distribution area and effectively measures the degree of spatial agglomeration (Li et al. 2021b). There are two main measures in spatial autocorrelation analysis: global and local measures. Global spatial autocorrelation is used to detect the distribution characteristics in the whole region, and it can be calculated as follows (Cheng et al. 2019; Zhang et al. 2021):

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}\left(x_i - \overline{x}\right)\left(x_j - \overline{x}\right)}{\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}\sum_{i=1}^{n}\left(x_i - \overline{x}\right)^2} \tag{9}$$

where I indicates the global Moran's I index; n is the number of regions; x_i and x_j are the values of the observed variables at sites of i and j space; $\overline{x}$ is the mean value of x_i; and W_{ij} represents the spatial weight matrix. The value of Moran's I generally vary between − 1 and 1. Moran's I value greater than 0 indicates a positive spatial correlation, while Moran's I value less than 0 indicates negative spatial correlation.

Local spatial autocorrelation can identify whether an attribute value of each space has a local spatial correlation. It is calculated as follows (Wang et al. 2020b):

$$I_i = \frac{x_i - \overline{x}}{S_i^2}\sum_{j=1, j\neq i}^{n} w_{ij}\left(x_j - \overline{x}\right) \tag{10}$$

where I_i indicates local Moran's I index; n is the number of regions; x_i and x_j are the index values of the i and j regions, respectively; $\overline{x}$ is the mean value of x_i; and W_{ij} represents the spatial weight matrix.

Data source

In this study, 79 municipal units in the Yellow River Basin are selected as the study area (Zhao et al. 2020b), and the years 2005, 2011, and 2018 are selected as the research time period. The data were collected from the China urban Statistical Yearbook (2006, 2012, 2019), the China Urban Construction Statistical Yearbook (2006, 2012, 2019), the Provincial Statistical Yearbook (2006, 2012, 2019), and the Statistical Bulletin on National Economy and Social Development (SBNESD) of cities in the Yellow River Basin (2005, 2011, 2018). The linear interpolation method was used to preprocess the missing data in the dataset.

Results

Spatial distribution pattern

According to formulas (1)–(8), the evaluation index of tourism urbanisation and RECC of the Yellow River Basin in 2005, 2011, and 2018 was calculated. The index values were divided into five levels using the natural discontinuity method, and the spatial pattern distribution maps are reported in Figs. 1 and 2.

The average values of tourism urbanisation in the Yellow River Basin in 2005, 2011, and 2018 were 0.147, 0.205, and 0.384, respectively, showing a clear upward trend. This finding quantitatively verified that the development of tourism has gradually increased the intensity of its impact on urbanisation. As Fig. 1 shows, the agglomeration phenomenon in the spatial distribution of tourism urbanisation level was prominent. In 2005, the first- and second-level cities of tourism urbanisation were concentrated in Shaanxi Province, the northwestern part of Henan Province, the southern part of Shandong Province, and some cities in Shanxi Province; the fifth-level regions were concentrated in Inner Mongolia, Ningxia, and the southeast of Gansu Province. In 2011, the first- and second-level areas were scattered in Shaanxi Province, Xinzhou City in Shanxi Province, Luoyang City and Kaifeng City in Henan Province, and Tai'an City in Shandong Province, and the fifth-level regions were widely distributed in Inner Mongolia and Ningxia, and a small part was scattered in the northern part of the Hexi Corridor and the Shandong Peninsula. In 2018, the first- and second-level cities were concentrated in Shaanxi, Shanxi, and Gansu provinces; the fifth-level regions were still concentrated in

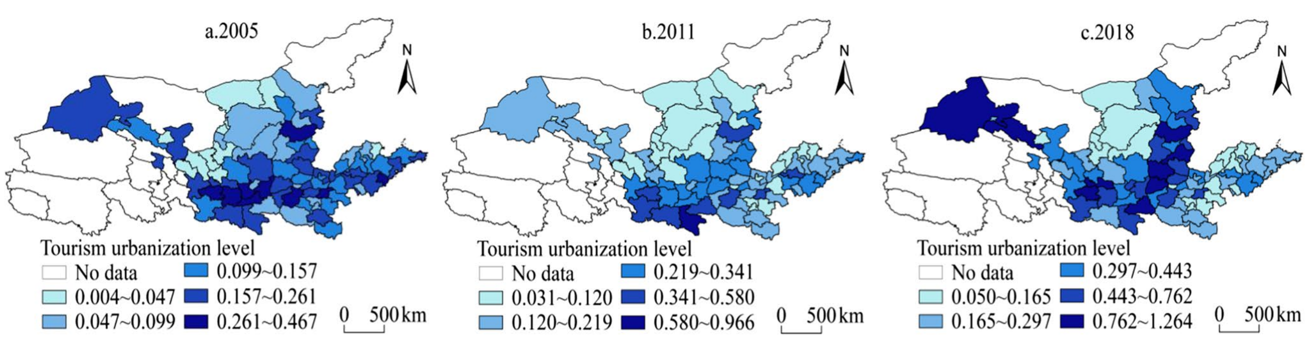

Fig. 1 Spatial patterns of tourism urbanisation level in the Yellow River Basin

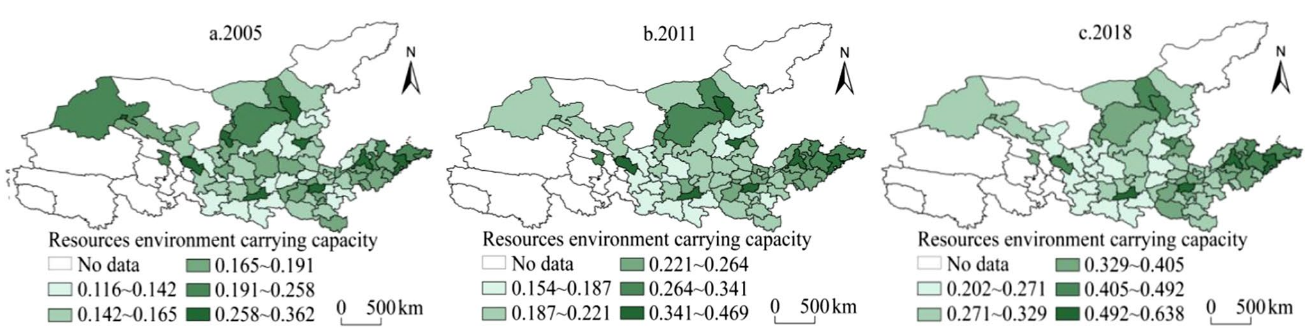

Fig. 2 Spatial patterns of RECC in the Yellow River Basin

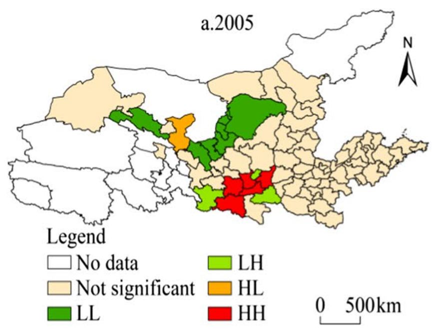

Fig. 3 LISA cluster map of tourism urbanisation level in the Yellow River Basin

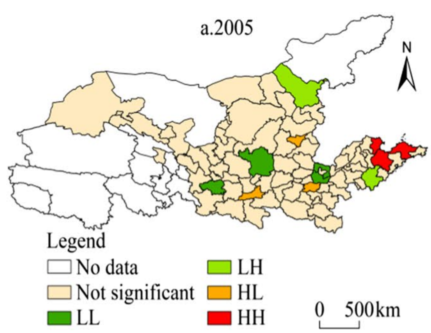

Fig. 4 LISA cluster map of RECC in the Yellow River Basin

Inner Mongolia, Ningxia, and the northern part of Shandong Province.

The average RECC of the Yellow River Basin increased from 0.258 in 2005 to 0.425 in 2018, demonstrating that the RECC of the Yellow River Basin has significantly improved over the past 14 years. From Fig. 2, the spatial distribution of RECC exhibited significant "concentration" characteristics. During the study period, the first- and second-level areas of RECC were concentrated in Gansu, Inner Mongolia, and Shandong provinces and were scattered in the capital cities of Xi'an in Shaanxi Province, Taiyuan in Shanxi Province, and Zhengzhou in Henan Province. The fifth-level cities were concentrated in Shaanxi Province, Shanxi Province, and the southeast of Gansu Province, with expanded spatial clusters.

Spatial autocorrelation analysis

The previous analysis indicated that the types of tourism urbanisation and RECC in the Yellow River Basin had the characteristics of agglomeration distribution in space, implying that there might be a spatial correlation in geographical space. To analyse the spatial heterogeneity and dependence of the Yellow River Basin, GeoDa software was used to calculate the global and local Moran's *I* indices according to formulas (9)–(10). In addition, the local indicators of spatial association (LISA) agglomeration maps in 2005, 2011, and 2018 were drawn using the ArcGIS 10.2 software (Figs. 3 and 4).

Table 2 Global Moran's *I* of tourism urbanisation level in the Yellow River Basin

Year	2005	2011	2018
Moran's *I*	0.104	0.149	0.380
Z (*I*)	2.181	3.170	7.329
P (*I*)	0.029	0.002	0.000

The global Moran's *I* values of tourism urbanisation level in the Yellow River Basin were positive and passed the *Z* test at a significance level of 5%, as shown in Table 2. Moran's *I* indices in 2005, 2011, and 2018 were 0.104, 0.149, and 0.380, respectively. This demonstrates that the tourism urbanisation level in the Yellow River Basin has a positive spatial autocorrelation, and the degree of agglomeration has increased. As illustrated in Fig. 3, the characteristics of local spatial agglomeration of tourism urbanisation in the Yellow River Basin were significant. The proportion of positively correlated cities was higher than that of negatively correlated cities, presenting a positive spatial correlation as a whole. Specifically, the empirical results include the following:

(1) The number of cities in high-high agglomeration areas increased from five to fourteen. The scope of this type of area gradually expanded with a significant increase, and the spatial distribution range gradually shifted from the southern part of Shaanxi Province to Shanxi Province. In recent years, Shanxi Province regards tourism as a sustainable alternative industry, and the policy of building a strong country of tourism economy has achieved initial results. The promoting effect of tourism on urbanisation in this province is gradually highlighted.
(2) The low-low agglomeration areas were mainly distributed in Gansu and Ningxia provinces in 2005 and gradually concentrated in Ningxia and Shandong provinces in 2018, increasing from eight to twenty-six cities. The degree of spatial agglomeration in cities with low levels of tourism urbanisation has increased.
(3) The number of cities in the high-low agglomeration areas accounted for the lowest proportion. The cities located in this area in 2005 and 2018 were Wuwei and Kaifeng, respectively. The high–low agglomeration areas were relatively unstable in terms of spatial changes.
(4) In 2005, there were three low–high agglomeration areas: Longnan, Tongchuan, and Shangluo. In 2011, the low–high agglomeration area occurred only in Tongchuan City. In 2018, Jiayuguan, Hanzhong, and Taiyuan were the main low–high agglomeration areas.

Overall, the spatially positively correlated areas significantly increased, and the proportion of the number of cities increased from 16.46 in 2005 to 50.63% in 2018, presenting a spatial distribution of clusters. The negative spatial correlation area accounted for a relatively low proportion. In 2005, 2011, and 2018, the proportions were 5.06%, 1.27%, and 5.06%, respectively, exhibiting a discrete distribution in space.

The Global Moran's *I* index of the RECC of the Yellow River Basin was positive (Table 3). In 2005, Moran's *I* was close to 0 and failed the significance level test, indicating that the RECC had low spatial autocorrelation and tended to be randomly distributed as a whole. In 2011 and 2018, Moran's *I* was 0.102 and 0.161, respectively; the *Z* values were 1.895 and 2.887, respectively, both greater than 1.96, passing the *Z* test at a significance level of 5%. Therefore, the RECC had a significant spatial positive correlation in spatial distribution, and the positive correlation gradually increased. As illustrated in Fig. 4, the characteristics of the local spatial agglomeration of the RECC of the Yellow River Basin were significant. The agglomeration effect mainly occurred in high-high and low-low agglomeration areas, and the overall spatial correlation was positive. Specifically, the empirical results include the following:

Table 3 Global Moran's *I* of RECC in the Yellow River Basin

Year	2005	2011	2018
Moran's *I*	0.010	0.102	0.161
Z (*I*)	0.430	1.895	2.887
P (*I*)	0.290	0.034	0.003

(1) The high-high agglomeration areas in 2005 were mainly Dongying, Weifang, and Yantai. In 2011, Binzhou, Zibo, Linyi, Qingdao, and Weihai transformed into high-high agglomeration areas. In 2018, Binzhou was withdrawn from the high-high agglomeration type; the types of other cities remained unchanged, and the number of cities increased from four to seven. Consequently, the RECC of the Yellow River Basin was enhanced in the high-high agglomeration areas, which were mainly concentrated in the Shandong Province.
(2) The low-low agglomeration areas in 2005 mainly consisted of four cities: Tianshui, Yan'an, Anyang, and Xinxiang. In 2011, the low-low agglomeration areas included eight cities: Dingxi, Longnan, Tianshui, Pingliang, Qingyang, Guyuan, Yan'an, and Yuncheng. In 2018, Yuncheng was withdrawn from low-low agglomeration areas, and the types of other cities remained unchanged. In terms of spatial change, the low-low agglomeration areas gradually evolved from scattered distribution to agglomeration distribution, mainly concentrated in the Gansu and Shaanxi provinces.
(3) The high-low agglomeration areas were mainly located in Xi'an, Taiyuan, and Zhengzhou in 2005 and 2011, respectively. In 2018, Lanzhou changed to a high-low agglomeration area, while Zhengzhou was withdrawn from the high-low agglomeration area, and the types of other cities remained unchanged. The number of cities in high-low agglomeration areas was relatively low with a scattered distribution, mostly in provincial capital cities.
(4) The low–high agglomeration areas in 2005 were mainly Ulan Qab and Linyi, changed to Ulan Qab, Dezhou, and Rizhao in 2011 and Dezhou, Binzhou, and Rizhao in 2018.

Overall, the positive spatial correlation area increased, with the proportion of the number of cities increasing from 8.86 in 2005 to 17.72% in 2018, presenting an agglomeration distribution in space. There were few negatively correlated cities in space, with the proportion of cities increasing from 6.33 in 2005 to 7.59% in 2018, exhibiting a relatively fragmented distribution in space.

Space type division

The above analysis revealed that the tourism urbanisation level and RECC in the Yellow River Basin were unevenly distributed in space. Therefore, the coordinated spatial characteristics of these two factors need to be explored. In this study, a two-dimensional scatter diagram was employed to classify the spatial combination types, dividing the 79 cities in the Yellow River Basin into five types (Fig. 5). It included a high level of tourism urbanisation—high RECC regions (H–H), high level of tourism urbanisation—low RECC regions (H–L), low level of tourism urbanisation—high RECC regions (L–H), low level of tourism urbanisation—low RECC regions (L-L), and medium-sized tourism urbanisation—medium RECC regions (M-M), corresponding to 5 areas of I, II, III, IV, and V in Fig. 5. Furthermore, with the help of ArcGIS10.2 software, the spatial pattern of the combination types of tourism urbanisation and RECC in 2005, 2011, and 2018 was drawn (Fig. 6). The analysis can be described as follows:

(1) In 2005, there were six H–H cities, accounting for 7.59% of the total. Most of them were regions with prominent economic advantages, including Qingdao, Weihai, Jiuquan, Zhengzhou, Xi'an, and Xining. These cities had a high degree of coordination between the level of tourism urbanisation and the RECC. In 2011 and 2018, the number of H–H cities dropped to zero, indicating a vacant state. Thus, the RECC had a greater restrictive effect on the current high-level areas of tourism urbanisation, and the spatial correspondence between the two was weak.

(2) In 2005, there were 16 H–L cities, accounting for 20.25% of the total, scattered in various provinces, such as Datong, Tianshui, Kaifeng, and Weinan. By 2018, the number of H–L cities increased to 19, accounting for 24.05% of the total, concentrated in Shanxi Prov-

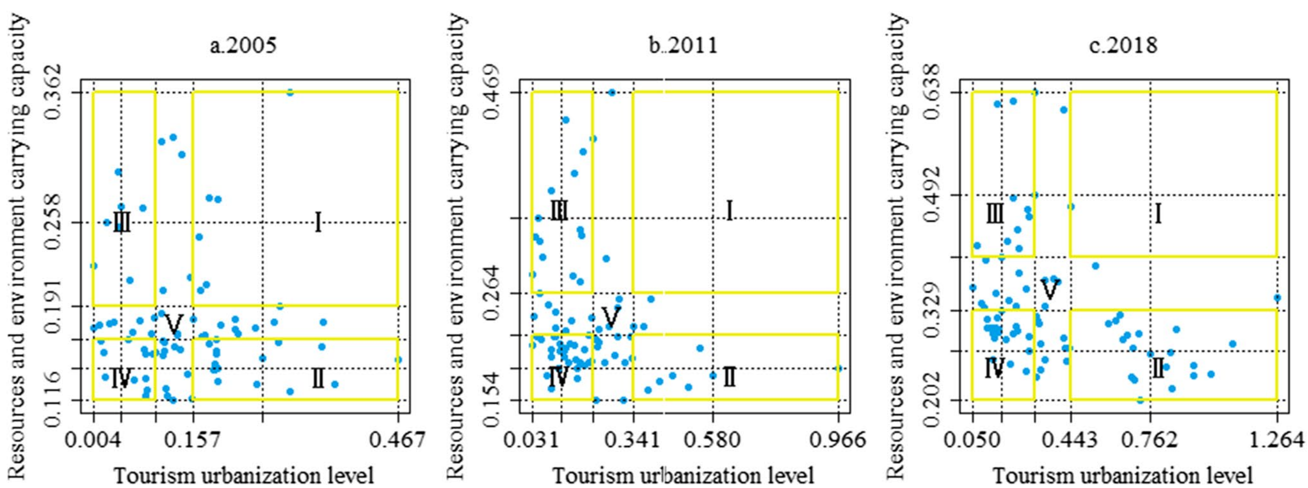

Fig. 5 Combination types of tourism urbanisation and RECC in the Yellow River Basin. Note: X–Y model can be used to represent the combination type of tourism urbanisation and RECC, where *X* represents the tourism urbanisation level and *Y* represents the level of RECC. The classification standard is shown in Figs. 1 and 2

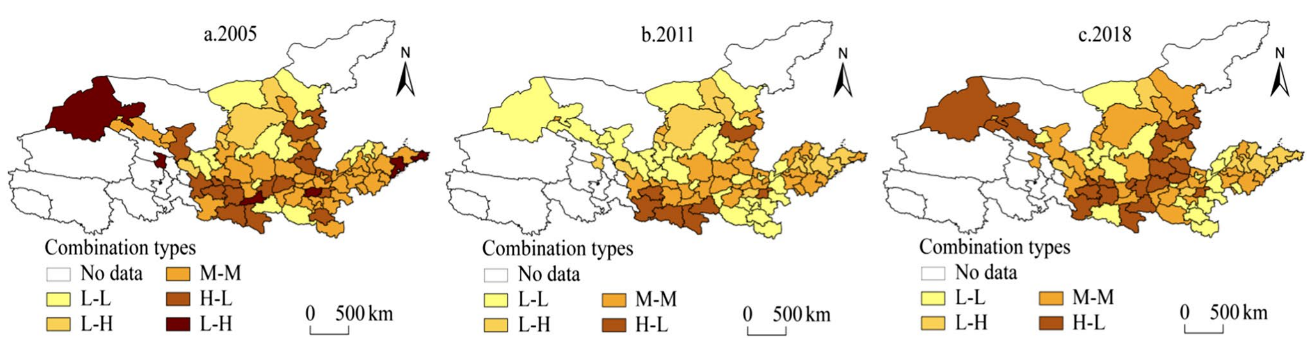

Fig. 6 Spatial pattern of combination types of tourism urbanisation and RECC in the Yellow River Basin

ince, the northwestern part of Gansu Province, and the southern part of Shaanxi Province. Notably, the proportion of H–L cities in Shanxi Province increased from 45.45 in 2005 to 72.73% in 2018, demonstrating that the spatial coordination between tourism urbanisation and RECC in most cities in Shanxi Province was relatively low and needed urgent optimisation.

(3) M-M cities were reduced from 38 in 2005 to 30 in 2018, accounting for more than one-third of the total. They were the most numerous and widely distributed types. Its spatial pattern changed from the original contiguous distribution to the central concentration. These areas had a moderate level of tourism urbanisation or the carrying capacity of resources and environment, and there were certain deficiencies in both the level of tourism urbanisation and the carrying capacity of resources and environment, leaving a large room for improvement.

(4) The number of L–H cities increased from seven to ten, with a relatively small proportion. Its spatial pattern showed a continuous gathering trend in the eastern part of Shandong Province. The resources and environment of such cities were preferable while the contribution of tourism to urbanisation was not highlighted.

(5) The number of L-L cities increased from 12 to 20, accounting for 15.19%, 36.71%, and 25.32% in 2005, 2011, and 2018, respectively. Its spatial pattern changed from dispersion to agglomeration in the border regions of Henan and Shandong. The level of tourism urbanisation in such areas was weak, and the efficiency of resource utilisation was low; therefore, the tourism urbanisation level and RECC were both in a lagging state.

In summary, the number of regions with a benign interaction (H–H) between the level of tourism urbanisation and the RECC gradually decreased, and the number of regions with low-level coordination (L-L) and imbalances (H–L or L–H) increased, further verifying that the high-quality development of tourism urbanisation in the Yellow River Basin had a greater demand for resources and environmental input.

Discussion

According to our findings, the tourism urbanisation level in the Yellow River Basin has increased, but the regional differences are significant. Among them, Shaanxi Province was in a leading position and Shanxi Province had great development potential. However, the characteristics of tourism urbanisation in Inner Mongolia and Ningxia were not significant. Because Shaanxi Province, represented by Xi'an, has high-level tourism resources such as the Silk Road and Qin terracotta warriors and horses, tourism plays a prominent role in the development strategy of these cities (Ruan et al. 2019). Moreover, in recent years, Shanxi Province has taken tourism as a continuous alternative industry, and the policy of building a strong tourism economy province has achieved preliminary results. Therefore, the role of tourism in promoting urbanisation has become increasingly prominent. However, because of the limitations of economy, resources, and geographical location, the tourism industry in Inner Mongolia and Ningxia develops slowly, and the driving effect of tourism on urbanisation is relatively weak. Additionally, the results show that cities with a high level of tourism urbanisation may be divided into two types: cities with rich tourism resources, such as Xi'an in Shanxi, and cities with low urbanisation levels and single industrial structures, which can easily highlight the driving effect of tourism on urbanisation, such as Jinzhong in Shanxi. This conclusion is consistent with that reported by Ruan et al. (2019).

The Moran's I index was positive at a significance level of 5%, which confirmed that there was a significant spatial agglomeration effect on tourism urbanisation levels. That is, areas with high tourism urbanisation levels tended to be close to other areas with high tourism urbanisation levels, and areas with low tourism urbanisation levels tended to be close to other areas with low tourism urbanisation levels. This conclusion corroborates the findings of many previous studies (Liu et al. 2019; Ruan et al. 2019; Xiong et al. 2020). The Moran's I index of the RECC failed the significance level test in 2005, indicating that it was randomly distributed. However, it passed the test in 2011 and 2018, and Moran's I was 0.102 and 0.161, respectively. This shows that the RECC had a significant positive spatial correlation, and the positive correlation gradually increased. This transformation implies that many cities prefer coordinated cooperation to protect the environment. This may be because the Chinese government has attached great importance to the ecological and environmental protection of the Yellow River Basin in recent years and has promulgated a series of measures to promote the integrated protection of ecological space and coordinated environmental governance of the Yellow River Basin.

In 2005, there were six cities with high tourism urbanisation levels and high RECCs, including Qingdao, Weihai, Jiuquan, Zhengzhou, Xi'an, and Xining. These cities initially relied on the dual advantages of politics and the economy to realise the priority development of tourism (Wang et al. 2017b; Xue et al. 2020). The driving effect of tourism on urbanisation began to appear earlier and the eco-environmental capacity of these cities was high. Therefore, the level of tourism urbanisation and RECC was in a leading position in the early stages. However, owing to their early development, large economic volume and diverse industrial types, compared with other cities, tourism, as auxiliary power, makes less contribution to the level of urbanisation (Ruan et al. 2019). With the evolution of time, cities with rich tourism resources or relatively single industrial structures gradually highlight the role of tourism in promoting urbanisation. However, the eco-environmental and resource-carrying capacities of such cities are relatively low. Therefore, in 2011 and 2018, cities with high tourism urbanisation levels and high RECCs decreased to zero. This shows that the RECC had a greater restrictive effect on the current high-level areas of tourism urbanisation, and the spatial correspondence between the two was weak.

This study has made substantial contributions to the development of literature in the discipline of coordination between tourism urbanisation and RECC. This is the first study to examine the coordination relationship between tourism urbanisation development and RECC from the perspective of the watershed. This study highlights the importance of pursuing a win–win situation between tourism urbanisation development and RECC enhancement across cities in the Yellow River Basin. Moreover, the research framework provides an important reference for investigating the sustainable development of tourism urbanisation in other river basins. We suggest that more studies are needed in the future. First, the definition of the connotation of tourism urbanisation and RECC and the construction of index systems remain unclear. How to set a more standardised and effective evaluation mechanism based on the operating characteristics of the two systems still needs to be further discussed in future studies. Second, while this study has explored the coordination relationship between tourism urbanisation and RECC, further study can be extended to examine the factors influencing coordination performance.

Conclusions and optimisation strategies

Conclusions

In this study, using the Yellow River Basin as the research area and 2005, 2011, and 2018 as the research time nodes, a GIS technology, spatial autocorrelation model, and partition method were adopted to model and analyse the spatiotemporal pattern and coordination relationship between tourism urbanisation and RECC. The following three key findings can be drawn.

First, the tourism urbanisation level and RECC in the Yellow River Basin has significantly improved over the past 14 years while there were significant regional differences. Second, the local spatial autocorrelation between tourism urbanisation levels and RECC was significant. Among them, the number of spatially positively correlated cities was more than that of negatively correlated cities; and overall, the cities were spatially positively correlated. The positive and negative correlation areas showed a distinct distribution difference; the former was mostly concentrated, while the latter was mostly scattered. Finally, areas with a positive interaction (H–H) between the tourism urbanisation level and RECC were distributed in the dots. Its number was small and dropped to zero. The number of regions with low-level coordination (L-L) and imbalances (H–L or L–H) increased. The RECC exhibited a greater restrictive effect on the current high-level areas of tourism urbanisation, and the spatial correspondence between the two was weak.

Optimisation strategies

Our study results yielded new insights and could have managerial implications not only for the Yellow River Basin but also for other ecologically vulnerable river basins, particularly in countries or regions focusing on tourism development. The managerial implications inferred from the research results are as follows:

First, the findings from this study show that the characteristics of spatial agglomeration of tourism urbanisation in the Yellow River Basin are significant. Therefore, cross-regional cooperation in tourism urbanisation can be actively promoted (Wang et al. 2017b). High-high agglomeration areas can break the traditional administrative boundary constraints, formulate the direction and goals of the overall tourism urbanisation development, and build a unified system and mechanism. On this basis, the free flow and efficient allocation of various elements of tourism urbanisation are further promoted, forming a new layout for the development of high-quality tourism urbanisation with high-level cluster development and complementary advantages.

Second, the spatial differences of RECC in the Yellow River Basin are significant, among which the high-value areas are concentrated in Shandong Province. Thus, the related departments could fully demonstrate the advanced demonstration role of Shandong Province and other eastern regions, accelerate the optimisation of layout and the deconstruction of functions, and promote cities in the central and western regions where the utilisation of resources and environmental conditions is not reasonable enough and sufficient to upgrade together. Decision-makers could break down the system and mechanism barriers, increase the degree of openness, and attract high-end elements to improve RECC in a more comprehensive and coordinated manner.

Third, the RECC could be considered a rigid constraint for the development of tourism urbanisation in the river basin. This requires the joint efforts of local governments, tourism enterprises, local residents, and social media. Local governments could take advantage of the opportunity of China's ecological civilisation construction and explore a development model compatible with the development and protection of tourism urbanisation (Abbas et al. 2021a; Hussain et al. 2021; Local Burden of Disease HIV Collaborators 2021; Paulson et al. 2021; Wang et al. 2021). Tourism enterprises could actively undertake social responsibility through multiple channels, strengthen their awareness of environmental protection, and improve their internal mechanisms (Abbas et al. 2019a, 2020). Residents' communities could play an important role in formulating innovative sustainable development strategies for tourism to effectively protect the ecological environment of tourism destinations (Mamirkulova et al. 2020). Social media could strengthen publicity and publicise the importance of environmental protection to residents and tourists (Abbas et al. 2019b, 2021b).

Finally, as the empirical results of space type division show, the RECC of the Yellow River Basin has a significant restrictive effect on the current high-level areas of tourism urbanisation, and the spatial correspondence between the two is weak. Therefore, H–L cities could promote the timely and rapid development of tourism urbanisation under the new normal, improve relevant environmental standards, and tighten environmental access systems (Raza et al. 2021). Meanwhile, these cities can optimise the spatial layout of tourism urbanisation according to the environmental carrying capacity and environmental quality and strive to realise the "new normal of tourism urbanisation" to become a typical demonstration area for the construction of eco-tourism liveable cities.

Acknowledgements We sincerely thank the editors and reviewers for their patience and comments.

Author contribution This idea was given by WZF and CQQ. WZF was a major contributor in writing the manuscript. CQQ participated in the review and modification of the manuscript. Both authors read and approved the final manuscript.

Funding This study was supported by the National Natural Science Foundation of China (No. 41771162).

Data availability The datasets used in this research are available on reasonable request.

Declarations

Ethics approval and consent to participate Not applicable.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

References

Abbas J, Raza S, Nurunnabi M, Minai MS, Bano S (2019a) The impact of entrepreneurial business networks on firms' performance through a mediating role of dynamic capabilities. Sustainability 11(11):3006

Abbas J, Aman J, Nurunnabi M, Bano S (2019b) The impact of social media on learning behavior for sustainable education: evidence of students from selected universities in Pakistan. Sustainability 11(6):1683

Abbas J, Zhang Q, Hussain I, Akram S, Afaq A, Shad MA (2020) Sustainable innovation in small medium enterprises: the impact of knowledge management on organizational innovation through a mediation analysis by using SEM approach. Sustainability 12(6):2407

Abbas J, Mubeen R, Iorember PT, Raza S, Mamirkulova G (2021a) Exploring the impact of COVID-19 on tourism: transformational potential and implications for a sustainable recovery of the travel and leisure industry. Current Research in Behavioral Sciences 2:100033

Abbas J, Wang D, Su Z, Ziapour A (2021b) The role of social media in the advent of COVID-19 pandemic: crisis management, mental health challenges and implications. Risk Manag Healthc Policy 14:1917–1932

Adedoyin FF, Bekun FV (2020) Modelling the interaction between tourism, energy consumption, pollutant emissions and urbanization: renewed evidence from panel VAR. Environ Sci Pollut Res 27:38881–38900. https://doi.org/10.1007/s11356-020-09869-9

Aman J, Abbas J, Mahmood S, Nurunnabi M, Bano, S (2019) The influence of Islamic religiosity on the perceived socio-cultural impact of sustainable tourism development in Pakistan: a structural equation modeling approach. Sustainability. https://doi.org/10.3390/su11113039

Azizi MR, Atlasi R, Ziapour, Naemi R (2021) Innovative human resource management strategies during the COVID-19 pandemic: a systematic narrative review approach. Heliyon 7(6)

Chen PY (2019) Effects of normalization on the entropy-based TOPSIS method. Expert Syst Appl 136. https://doi.org/10.1016/j.eswa.2019.06.035

Cheng X, Long R, Chen H, Li QW (2019) Coupling coordination degree and spatial dynamic evolution of a regional green competitiveness system - a case study from China. Ecol Indic 104(SEP):489–500. https://doi.org/10.1016/j.ecolind.2019.04.003

Clavé SA, Wilson J (2017) The evolution of coastal tourism destinations: a path plasticity perspective on tourism urbanisation. J Sustain Tour 25(1–3):96–112

Douglass WA, Raento P (2004) The tradition of invention: conceiving Las Vegas. Ann Tour Res 31(1):7–23. https://doi.org/10.1016/j.annals.2003.05.001

Feng ZM, Sun T, Yang YZ, Yan HM (2018) The progress of resources and environment carrying capacity: from single-factor carrying capacity research to comprehensive research. Journal of Resources and Ecology 9(2):125–134. https://doi.org/10.5814/j.issn.1674-764x.2018.02.002

Fotiadis A, Polyzos S, Huan T-CTC (2021) The good, the bad and the ugly on COVID-19 tourism recovery. Ann Tour Res 87:103117. https://doi.org/10.1016/j.annals.2020.103117

Fu J, Zang C, Zhang J (2020) Economic and resource and environmental carrying capacity trade-off analysis in the Haihe River basin in China. J Clean Prod 270(3):122271. https://doi.org/10.1016/j.jclepro.2020.122271

González SA, Yáñez-Navea K, Muñoz M (2014) Effect of coastal urbanization on sandy beach coleoptera Phaleria maculata (Kulzer, 1959) in northern Chile. Mar Pollut Bull 83(1):265–274. https://doi.org/10.1016/j.marpolbul.2014.03.042

Hernandez-Rojas RD, Folgado-Fernandez JA, Palos-Sanchez PR (2021) Influence of the restaurant brand and gastronomy on tourist loyalty. A study in Córdoba (Spain). Int J Gastron Food Sci 23(100305). https://doi.org/10.1016/j.ijgfs.2021.100305.

Ho P (2018) A theorem on dynamic disequilibrium: debunking path dependence and equilibrium via China's urban property (1949–1998). Land Use Policy 79:863–875. https://doi.org/10.1016/j.landusepol.2016.10.023

Hu MM, Li ZT, Yuan MJ, Fan C, Xia BC (2019) Spatial differentiation of ecological security and differentiated management of ecological conservation in the Pearl River Delta, China. Ecol Indic 104:439–448. https://doi.org/10.1016/j.ecolind.2019.04.081

Huang JF, Yang DC, Cao B (2021) Spatial-temporal process and interaction mechanism of co-evolution between tourism industry and urbanization: a case of the Yangtze River Delta. Econ Geogr 41(6):213–222 (in Chinese)

Hussain T, Abbas J, Wei Z, Ahmad S, Xuehao B, Gaoli Z (2021) Impact of urban village disamenity on neighboring residential properties: empirical evidence from Nanjing through Hedonic pricing model appraisal. J Urban Plan Dev 147(1):04020055

Hwang CL, Yoon K (1981) Methods for multiple attribute decision making. In: Multiple attribute decision making. Springer, Berlin, Heidelberg, pp 58–191

Izquierdo AE, Grau HR, Navarro CJ, Casagranda E, Castilla MC, Grau A (2018) Highlands in transition: urbanization, pastoralism, mining, tourism, and wildlife in the Argentinian Puna. Mt Res Dev 38:390–400

Jia ZM, Cai YP, Chen Y, Zeng WH (2018) Regionalization of water environmental carrying capacity for supporting the sustainable water resources management and development in China. Resour Conserv Recy 134:282–293. https://doi.org/10.1016/j.resconrec.2018.03.030

Kranjčević J, Hajdinjak S (2019) Tourism urbanization in Croatia The Cases of Poreč in Istria and Makarska in Dalmatia. Comparative Southeast European Studies 67(3):393–420

Li X (2021) TOPSIS model with entropy weight for eco geological environmental carrying capacity assessment. Microprocess Microsyst 82:103805. https://doi.org/10.1016/j.micpro.2020.103805

Li J, Wang D, Duan K, Mubeen, R (2021a) Tourists' health risk threats amid COVID-19 era: role of technology innovation, transformation, and recovery implications for sustainable tourism. Front Psychol 12:769175

Li JS, Sun W, Li MY, Meng LL (2021b) Coupling coordination degree of production, living and ecological spaces and its influencing factors in the Yellow River basin. J Clean Prod 298:126803. https://doi.org/10.1016/j.jclepro.2021.126803

Liao SJ, Wu Y, Wong SW, Shen LY (2020) Provincial perspective analysis on the coordination between urbanization growth and resource environment carrying capacity (RECC) in China. Sci Total Environ 730:138964. https://doi.org/10.1016/j.scitotenv.2020.138964Ge

Liu YJ, Tang JX, Ma XF (2019) Spatial and temporal evolution and model of tourism urbanization in concentrated continuous poor areas: taking Wuling Mountainous Area in Hunan as an example. Economic Geography 39(10):214–222+230. (in Chinese)

Liu RJ, PU LJ, Zhu M, Huang SH, Jiang Y (2020) Coastal resource-environmental carrying capacity assessment: a comprehensive and trade-off analysis of the case study in Jiangsu coastal zone, eastern China. Ocean Coast Manage 186:105092. https://doi.org/10.1016/j.ocecoaman.2020.105092

Liu SD, Geng YH, Zhang JJ, Kang XF, Shi XL, Zhang J (2021) Ecological trap in tourism-urbanization: simulating the stagnation and restoration of urbanization from the perspective of government incentives. Ecol Econ 185:107054. https://doi.org/10.1016/j.ecolecon.2021.107054

Local Burden of Disease HIV Collaborators (2021) Mapping subnational HIV mortality in six Latin American countries with incomplete vital registration systems. BMC Med 19(1):4. https://doi.org/10.1186/s12916-020-01876-4

Mamirkulova G, Mi J, Abbas J, Mahmood S, Mubeen R, Ziapour A (2020) 2020/12/01/) New Silk Road infrastructure opportunities in developing tourism environment for residents better quality of life. Glob Ecol Conserv 24:e01194. https://doi.org/10.1016/j.gecco.2020.e01194

Mofidi CM, Alijanpour A, Barani H, Motamedi J, Azadi H, Van Passel S (2018) Economic sustainability assessment in semi-steppe rangelands. Sci Total Environ 637–638:112–119. https://doi.org/10.1016/j.scitotenv.2018.04.428

Mullins P (1991) Tourism urbanization. Int J Urban Reg Res 15(3):326–342

Nitivattananon V, Srinonil S (2019) Enhancing coastal areas governance for sustainable tourism in the context of urbanization and climate change in eastern Thailand. Adv Clim Chang Res 10:47–58. https://doi.org/10.1016/j.accre.2019.03.003

Okey T (2018) Indicators of marine ecosystem integrity for Canada's Pacific: an expert-based hierarchical approach. Sci Total Environ 645:1114–1125. https://doi.org/10.1016/j.scitotenv.2018.07.184

Paulson KR, Kamath AM, Alam T, Bienhoff K, Abady GG, . . . Kassebaum NJ (2021) Global, regional, and national progress towards Sustainable Development Goal 3.2 for neonatal and child health: all-cause and cause-specific mortality findings from the Global Burden of Disease Study 2019. The Lancet 398(10303):870–905. https://doi.org/10.1016/S0140-6736(21)01207-1

Pons A, Rullan O (2014) The expansion of urbanisation in the Balearic Islands (1956–2006). Journal of Marine & Island Cultures 3(2):78–88. https://doi.org/10.1016/j.imic.2014.11.004

Rai B, Goswami S (2019) Urbanization and tourism induced challenges in waste management in hill towns: case of Gangtok. In Waste Management and Resource Efficiency. Springer, Singapore, pp 393–407

Raza SA, Qureshi MA, Ahmed M, Qaiser S, Ali R, Ahmed F (2021) Non-linear relationship between tourism, economic growth, urbanization, and environmental degradation: evidence from smooth transition models. Environ Sci Pollut Res 28:1426–1442. https://doi.org/10.1007/s11356-020-10179-3

Ruan WQ, Li YQ, Zhang SN, Liu CH (2019) Evaluation and drive mechanism of tourism ecological security based on the DPSIR-DEA model. Tourism Manage 75(609–25). https://doi.org/10.1016/j.tourman.2019.06.021

Su ZH, McDonnell D, Wen J, Kozak M, Abbas J, . . . Xiang Y-T (2021) Mental health consequences of COVID-19 media coverage: the need for effective crisis communication practices. Glob Health 17(1):4

Sun MY, Li XH, Yang RJ, Zhang Y, Zhang L, Song ZW et al (2020) Comprehensive partitions and different strategies based on ecological security and economic development in Guizhou Province. China J Clean Prod 274(1):122794. https://doi.org/10.1016/j.jclepro.2020.122794

Tantatape B, Jung WL (2017) Assessing the dynamic impact of tourism, industrialization, urbanization, and globalization on growth and environment in Southeast Asia. Int J Sust Dev World 24(4):362–371. https://doi.org/10.1080/13504509.2016.1238021

Tao H, Liu JM, Deng Y, Ao Du (2017) Tourism sectorization opportunity spectrum model and space partition of tourism urbanization area: a case of the Mayangxi ecotourism area, Fujian province, China. J Mt Sci 14:595–608

Tian Y, Sun CW (2018) A spatial differentiation study on comprehensive carrying capacity of the urban agglomeration in the Yangtze River Economic Belt. Reg Sci Urban Econ 68:11–22. https://doi.org/10.1016/j.regsciurbeco.2017.10.014

UNWTO (2020) International tourist number could fall 60–80% in 2020. Retrieved from https://www.unwto.org/news/covid-19-international-tourist-numbers-could-fall-60-80-in-2020

Wang TX, Xu SG (2015) Dynamic successive assessment method of water environment carrying capacity and its application. Ecol Indic 52:134–146. https://doi.org/10.1016/j.ecolind.2014.12.002
Wang R, Cheng JH, Zhu YL, Lu PX (2017a) Evaluation on the coupling coordination of resources and environment carrying capacity in Chinese mining economic zones. Resour Policy. https://doi.org/10.1016/j.resourpol.2017.05.012
Wang XY, Liu EL, Hou JJ (2017b) Characteristics and types of spatial-temporal differentiation of tourism urbanization response in Shandong province. Scientia Geographica Sinica 37(7):1087–1094 (in Chinese)
Wang D, Nie R, Long RY, Shi R, Zhao YY (2018) Scenario prediction of China's coal production capacity based on system dynamics model. Resour Conserv Recycl 129:432–442. https://doi.org/10.1016/j.resconrec.2016.07.013
Wang DL, Shi YH, Wa KD (2020a) Integrated evaluation of the carrying capacities of mineral resource-based cities considering synergy between subsystems. Ecol Indic 108:13. https://doi.org/10.1016/j.ecolind.2019.105701
Wang KF, Zhao XK, Peng BY, Zeng YM (2020b) Spatio-temporal pattern and driving factors of municipal solid waste generation in China: new evidence from exploratory spatial data analysis and dynamic spatial models. J Clean Prod 270. https://doi.org/10.1016/j.jclepro.2020.121794
Wang C, Wang D, Abbas J, Duan K, Mubeen R (2021) Global financial crisis, smart lockdown strategies, and the COVID-19 spillover impacts: a global perspective implications from Southeast Asia. Front Psychiatry 12:1–14. https://doi.org/10.3389/fpsyt.2021.643783
Wei SC, Cui D (2015) Review and prospects of research on tourism urbanization. In: Proceedings of the 19th International Symposium on Advancement of Construction Management and Real Estate. Springer, Berlin, Heidelberg, pp 79–86
Wu X, Liu SL, Cheng FY, Hou XY, Zhang YQ, Dong SK, Liu GH (2018) A regional strategy for ecological sustainability: a case study in Southwest China. Sci Total Environ 616:1224–1234. https://doi.org/10.1016/j.scitotenv.2017.10.196
Wu Y, Shen L, Zhang Y, Shuai CY, Yan H, Lou Y, Ye G (2019) A new panel for analyzing the impact factors on carbon emission: a regional perspective in China. Ecol Indic 97:260–268
Wu MW, Wu JQ, Zang CF (2020) A comprehensive evaluation of the eco-carrying capacity and green economy in the Guangdong-Hong Kong-Macao Greater Bay Area. China J Clean Prod 281:124945. https://doi.org/10.1016/j.jclepro.2020.124945
Xie PF, Chandra V, Gu K (2013) Morphological changes of coastal tourism: a case study of Denarau Island. Fiji Tour Manag Perspect 5(1):75–83. https://doi.org/10.1016/j.tmp.2012.09.002
Xinhua News Agency (2019) General Secretary Xi Jinping delivered an important speech at the symposium on ecological protection and high-quality development of the Yellow River Basin. Res Soil Water Conserv 1e2. https://doi.org/10.14123/j.cnki.swcc.2019.0226.
Xiong JX, Wang WH, He SH, Yi Y, Tang CF (2020) Spatio-temporal pattern and influencing factor of coupling coordination of tourism urbanization system in the Dongting Lake Region. Scientia Geographica Sinica 40(9):1532–1542 (in Chinese)
Xu LY, Yang ZF, Li W (2003) Review on urban ecosystem carrying capacity. Urban Environment & Urban Ecology 16(6):60–62
Xue MY, Wang CX, Zhao JL, Li MC (2020) Spatial differentiation pattern and influencing factors of tourism economy in the Yellow River Basin. Econ Geogr 40(4):19–27 (in Chinese)
Xun FF, Hu YC (2019) Evaluation of ecological sustainability based on a revised three dimensional ecological footprint model in Shandong Province, China. Sci Total Environ 649:582–591. https://doi.org/10.1016/j.scitotenv.2018.08.116
Yang T, Zhang Q, Wan XH, Li XP, Wang YY, Wang W (2020) Comprehensive ecological risk assessment for semi-arid basin based on conceptual model of risk response and improved TOPSIS model-a case study of Wei River basin, China. Sci Total Environ 719(137502). https://doi.org/10.1016/j.scitotenv.2020.137502
Zhang F, Wang Y, Ma XJ, Wang Y, Yang GC, Zhu L (2019) Evaluation of resources and environmental carrying capacity of 36 large cities in China based on a support-pressure coupling mechanism. Sci Total Environ 688:838–854. https://doi.org/10.1016/j.scitotenv.2019.06.247
Zhang HC, van Berkel D, Howe PD, Miller ZD, Smith JW (2021) Using social media to measure and map visitation to public lands in Utah. Appl Geogr 128:102389. https://doi.org/10.1016/j.apgeog.2021.102389
Zhao LL, Li JY, Shao QL (2020a) Evaluation of urban comprehensive carrying capacity: case study of the Beijing-Tianjin-Hebei urban agglomeration, China. Environ Sci Pollut Res 27:19774–19782
Zhao JJ, Liu Y, Zhu YK, Qin SL, Wang YH, Miao CH (2020b) Spatio-temporal differentiation and influencing factors of the coupling and coordinated development of new urbanization and ecological environment in the Yellow River Basin. Resources Science 42(1):159–171 (in Chinese)
Zhou JY, Chang SS, Ma WQ, Wang DY (2021) An unbalance-based evaluation framework on urban resources and environment carrying capacity. Sustain Cities Soc 72:103019. https://doi.org/10.1016/j.scs.2021.103019