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Relationships between Tourism, Urbanization and Ecosystem Service Value in the Cities of Xinjiang in Northwest China

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Abstract: The relationships between urbanization and tourism have been explored in many studies. However, there is a lack of research on the relationships between urbanization, tourism development and ecosystem services in the cities of Xinjiang. To investigate these relationships, this research takes 2000–2020 as the research period, considers 14 major cities in Xinjiang, and applies the entropy approach to build assessment indicator systems of tourism and urbanization development. The service value of the ecosystem (ESV) is calculated using the improved equivalent factor. The changing attributions of tourism, urbanization development, and the ESV are discussed. The coupling coordination degree (CCD) approach is employed to analyze the connected collaboration of tourism, urbanization, and the ESV. The results show that the tourism and urbanization level of cities in Xinjiang has increased rapidly from 2000 to 2020. The total ESV has increased with a small rate. The CCD among tourism, urbanization, and ESV in Xinjiang has been relatively low, and it is in a state of moderate disorder, but it exhibits a trend of coordinated development. The CCD of ESV and tourism are lower than those of urbanization and ESV. Economic urbanization and tourism are highly coupled. From the perspective of the development trend, the level of economic urbanization is improving, and its CCD with the tourism subsystem is increasing. At the same time, the CCD between tourism and ESV is also on the rise. The tourism development level, urbanization level, and ESV, as well as the CCD among these indicators, show spatial differences.

Keywords: tourism; urbanization; ESV; coupling coordination; Xinjiang

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Citation: Muyibul, Z.; Tan, X.; Tuniyazi, J.; Du, R. Relationships between Tourism, Urbanization and Ecosystem Service Value in the Cities of Xinjiang in Northwest China. *Sustainability* **2023**, *15*, 4190. https://doi.org/10.3390/su15054190

Academic Editor: J.B. Ruhl

Received: 6 January 2023
Revised: 16 February 2023
Accepted: 22 February 2023
Published: 25 February 2023

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1. Introduction

Tourism and urbanization are closely related [1–3]. The interaction between them during the process of development has been confirmed in many studies. Urbanization provides a good economic basis for the development of tourism. As a resource-saving and environmentally friendly industry, tourism plays an important role in the optimization of the urban industrial structure, expansion of employment scale, and the improvement of urban comprehensive strength and cultural heritage, and it has become the leading industry in the development of many cities, which works to their advantage [1–3]. However, excessive human activities also exert negative impacts on the ecosystem. During the process of urbanization, a large amount of ecological space can be transformed into urban living and production space to meet the demands of the growing population, which negatively impacts the ecological environment [4,5]. Similarly, human activities in the process of tourism development have a certain impact on the water resources and land resources of the tourist destinations, leading to the decline in ecosystem functions [6]. Therefore, exploring the interactions between urbanization, tourism development and ecosystems is necessary for the sustainable development of cities.

At present, many studies have analyzed the interaction between tourism development and urbanization, the impact of tourism development on ESV and the impact of urbanization on ESV. The role of tourism in promoting the social economy and urban development

has long been a consensus and a research hotspot, and consensus has been reached. Mullin (1991) [7] proposed the tourism urbanization concept, believing that tourism has become the main propelling force elevating the transformation of the urban and regional economies, society, and culture. Tourism is closely related to many industries. It is also of great importance in preserving, displaying, and disseminating regional culture and has played a significant role in the modern economic development and urbanization in China [2]. Tourism and urbanization are symbiotic in many aspects, such as their development goals and development methods. The development of cities promotes economic development, and good economic conditions provide the basis for tourism development. In some regions with rich tourism resources and a low level of urbanization development, tourism has received more attention than industrial production due to advantages such as low energy consumption and strong industrial driving effects, and it has played a significant role in driving urban development. However, both tourism and urbanization are in the process of development, and the excessive development of tourism resources and low efficiency of urban planning has led to confusion and a loss of control concerning land use [8–10]. The overexploitation of resources and disorderly expansion of land further expand the imbalance of ecosystem services and ultimately threaten the habitats in which humans live and the sustainable development of regions [11–13]. Studies have demonstrated that alternating patterns in land utilization during tourism development leads to issues such as polluted water resources and soil loss, which have a great impact on ecosystem functions [14,15]. Relevant studies have examined the value-added effect of tourism development on ecosystem services [16], the effect of land utilization change in typical tourism development areas on ESV [15,17], the coordination between the improvement of tourism resources and the ecological environment [18,19], the CCD between the tourism economy and the ecological environment [20], and tourism ecological security [21,22]. In contrast, there are many studies on the effect of urbanization on ecosystem services. Although the development of cities has greatly benefited the improvement of both the economy and the standard of living, the degradation of ecosystem services caused by rapid urbanization cannot be ignored. Since the effect of human activities on the ecosystem can be reflected by changes in the ESV, the ESV is used to explore the changes in human activities within the urban ecological environment [23,24]. Regarding those areas for which the relevant statistical data of the ecological environment are difficult to obtain, ESV is one of the best indicators to use in ecosystem research. Scholars have performed several studies concerning the correlation between urbanization and ESV [15,25–29]. On the one hand, urbanization impacts inflowing factors such as materials, energy, and information by changing the utilization and coverage of land and altering the regional services provided for residents; alternatively, when urbanization is ongoing, the fact that both energy and resources are excessively consumed and urban waste is massively produced can cause several problems in terms of both ecology and the environment. Researchers have studied the CCD of tourism, urbanization, and the ecological environment by building a tourism–urbanization–ecological environment assessment indicator methodology and exploring the coordination between the ecological environment of the urban and tourism economy [30–32]. In summary, there are many studies on the relationship between urbanization and tourism development, urbanization and ESV, and tourism development and ESV, while the relationships among the three subsystems are less investigated across multiple dimensions. The development of tourism in the context of urbanization can improve ecological benefits, but the overdevelopment of tourism causes adverse consequences for the ecosystem. The relationships between tourism development, urbanization and ESV may not be simple linear relationships, and may involve dynamic nonlinear interactions.

Xinjiang is located in northwestern China, far away from the sea (Figure 1). Its special landform and multiethnic gathering features make it rich in natural and cultural tourism resources. It is one of the provinces in China with complete tourism resources, the largest number of high-quality tourism resources, and the largest potential for tourism resource development. Since the "13th Five Year Plan," Xinjiang's tourism market has grown rapidly,

the tourism destination system has improved, investment in tourism infrastructure has increased, the tourism-related industrial system has been developed, and the leading role of development for both the economy and society has been highlighted. According to the relevant research, Xinjiang has developed rapidly since the implementation of the Western Development Strategy in 2001. Although its comprehensive urbanization index is low, its growth rate is large, increasing from 0.06 in 1990 to 0.16 in 2018 [25]. Due to its distance from the sea and specific regional topography involving three mountains and two basins, most areas in Xinjiang are seriously short on water, making the ecosystem fragile, and this has become the main factor constraining the development of the region by affecting the function of the ecosystem [33]. The development goals of new urbanization and ecological construction advance new requirements for the high-quality development of Xinjiang's cities from the past development direction characterized by the pursuit of economic and social benefits to the new direction, which aims for the maximization of economic, social and ecological benefits. The realization of sustainable development should include the concepts of being "people-oriented" and providing access to "green water and green mountains" as its theoretical and policy basis. For Xinjiang, which has rich tourism resources, rapid urbanization and a fragile ecological environment, it is necessary to explore a coordinated development path between the economy, society and ecology. This is required for the healthy development of tourism, the orderly promotion of urbanization and the sustainable development of the ecological environment in Xinjiang. In this case, after developing a detailed understanding of data access as related to Xinjiang's tourism and urbanization development, this study selected 14 major cities in Xinjiang as the research area for empirical analysis, accounted for the availability and operability of the data, and chose operable and representative indicators obtainable from the official authorities to establish the relevant evaluation system. The relationships between the tourism, urbanization and ESV were analyzed based on the CCD model. The research results provide a scientific basis for the high-quality development of Xinjiang cities.

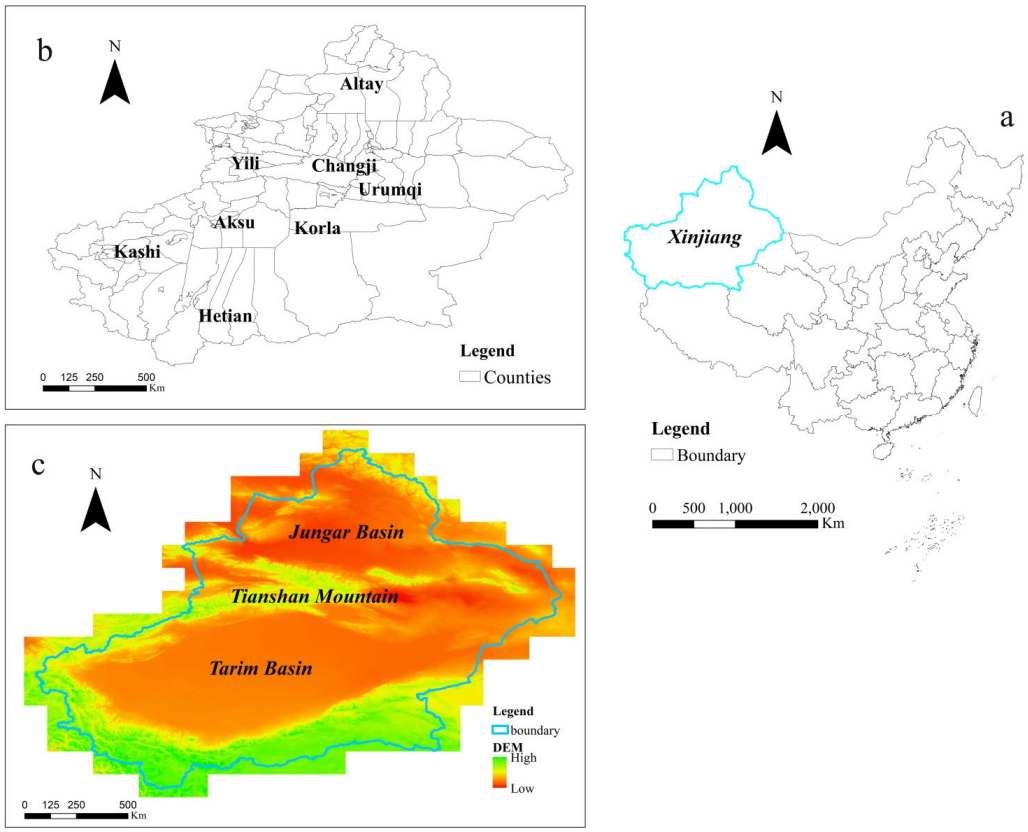

Figure 1. Map of the research region. (**a**) Map of China; (**b**) Districts of study area; (**c**) Elevation.

2. Materials and Methods

2.1. Materials

The data related to tourism and urbanization in this study come from the Statistical Yearbook of Xinjiang (xinjiang.gov.cn) (accessed on 10 August 2022) for the period between 2000 and 2020, as well as the statistical yearbooks and the social and economic bulletins of various prefectures and cities. The missing data for a few cities in a few years are supplemented using the interpolation method. The ESV is calculated with the utilization of land/cover (LULC) data, which come from the geographic monitoring cloud platform (www.dsac.cn) (accessed on 10 August 2022). LULC data products take Landsat TM/OLI remote sensing images as the primal data repository. After the images were processed and interpreted, Xinjiang's LULC types were divided into 6 primary categories and 25 secondary categories.

2.2. Methods

The study begins with the constituent elements of tourism and urbanization, as based on the economic and social benefits generated by their development; follows the principles of certainty, representativeness, applicability, data availability and the variability of indicators; establishes an evaluation index system for tourism and urbanization construction through the existing analysis and research of scholars, and selects more representative and up-to-date sources of information.

2.2.1. Construction of a Tourism Development Assessment Index System

Considering that tourism development contributions are mainly reflected in the regional economy, social employment, industrial scale, and their industrial effect, the tourism system is subdivided into the following four aspects: tourism economic income, tourism employment effect, tourism industry size, and tourism industry effect. Tourism economic income includes earnings from international and domestic tourism. Tourism employment effects relate to both direct tourism practitioners and indirect tourism practitioners. The size of the tourism industry is calculated from the number of travel agencies, hotel rooms, and scenic places. The tourism industry effect includes the number of international and domestic tourists (Table 1).

Table 1. Evaluation index system of tourism in Xinjiang.

Primary Index	Secondary Index	Weight
Economic effects of tourism	Earnings from international tourism (CNY)	0.1248
	Earnings from domestic tourism (CNY)	0.1051
Employment effects of tourism	Direct tourism practitioners	0.1396
	Indirect tourism practitioners	0.0999
Size of the tourism industry	Total number of travel agents	0.0883
	Total number of a hotel rooms	0.0715
	Total number of scenic places	0.0879
Industry effects of tourism	Total number of inbound international tourists (people)	0.153
	Total number of domestic tourists (people)	0.1299

The calculation formula for comprehensive tourism development evaluation is as follows:

$$Tx = \sum_{j=1}^{n} v_j x_j \quad (1)$$

where T(x) denotes the comprehensive tourism progression index, j represents the number of indicators in the tourism system and v_j is the weight of the corresponding index. x_j is the standardized score of the corresponding index. The higher the T(x) score is, the better the tourism progression is; otherwise, the worse it is.

2.2.2. Construction of an Assessment Index System for Urbanization Development

Urbanization is a comprehensive and complex process involving population, land space, society, and the economy. Previous studies [25] divide urbanization into four subsystems: population, land, economic, and social urbanization. Considering the data availability, 12 indicators for urbanization are selected as follows. For the urbanization of the population, indicators such as population density, the proportion of the nonagricultural population, and urban population density are selected. Land urbanization includes two indicators, namely the area of roads per capita and the area of construction land. For economic urbanization, indicators such as gross regional product, the contribution of the secondary and tertiary industries to the GDP, local financial revenue, and the total fixed asset investment are selected. Social urbanization includes indicators such as the total retail sales of consumer goods, number of college students, and number of hospital beds per 10,000 people (Table 2).

Table 2. Assessment index system of urbanization in Xinjiang.

Primary Index	Secondary Index	Weight
Population urbanization	Population density (people/km^2)	0.09
	The proportion of the urban population (%)	0.2025
	Urban population density (people/ km^2)	0.1575
Land urbanization	Area of developed districts (km^2)	0.12
	Per capita area of paved roads (km^2/people)	0.08
Economic urbanization	GDP (CNY/people)	0.06
	Contributions of the secondary and tertiary industry to GDP (%)	0.075
	Local financial revenue (CNY/people)	0.0475
	Total fixed asset investment (CNY/people)	0.0675
Social urbanization	Total retail sales of consumer goods (CNY/people)	0.06
	Number of students in colleges and universities (persons)	0.025
	Number of hospital beds per 10,000 people (bed)	0.015

The calculation formula for comprehensive urbanization development evaluation is as follows:

$$U(y) = \sum_{j=1}^{n} v_j y_j \quad (2)$$

where j denotes the indicator numbers in the urbanization construction system, v_j represents the weight of the corresponding index, and y_j is the standardized score of the corresponding index. The higher the U(y) score is, the larger the urbanization development level would be, and vice versa.

2.2.3. Calculation of the ESV

Following the methods of previous studies [33–35], this paper uses the equivalent factor approach to calculate the ESV of urban areas in Xinjiang. The steps of this computation are presented below.

(1) Determination of the ESV equivalence factor of one standard unit

The score of one standard unit ESV equivalent factor unit equals 1 over 7 of the mean economic score of the grain units in Xinjiang for the year.

The calculation formula is:

$$C = \frac{1}{7} \times P \times Q \quad (3)$$

where C represents the score of one standard unit ESV equivalent factor unit (CNY/hm^2), P is the mean price of grain in Xinjiang (CNY/kg), and Q is the grain output per unit area in Xinjiang (CNY/hm^2). According to the Xinjiang Statistical Yearbook (2000–2021), the average unit yield of wheat and corn is 6954.683 kg/hm^2, and the average price of crops is 2.579 CNY/kg. The calculated score of one standard unit ESV equivalent factor unit in Xinjiang from 2000 to 2020 is 2562.31 CNY/ hm^2.

(2) Correction of the equivalent weight factor table for ESV

According to the actual characteristics of land-use types in Xinjiang, the ESV per unit area of dissimilar land utilization types in Xinjiang was modified according to the equivalent weight factor table of ecosystem services of the terrestrial ecosystems in China (Table 3).

Table 3. ESV coefficients of LULC in Xinjiang (CNY hm^2/a).

First-Class Utilization	Second-Class Utilization	Forestland	Grassland	Cultivated Land	Water Area	Unused Land
Provision services	Food production	845.56	1101.79	2562.31	1153.04	51.25
	Raw materials production	7635.68	922.43	999.30	768.69	102.49
Regulation services	Gas regulation	11,069.18	3843.47	1844.86	3740.97	153.74
	Climate regulation	10,428.60	3997.20	2485.44	20,011.64	333.10
	Hydrological regulation	10,479.85	3894.71	1972.98	41,278.81	179.36
	Waste disposal	4407.17	3382.25	3561.61	37,486.60	666.20
Supporting Services	Soil conservation	10,297.38	5737.84	3765.44	1050.22	435.46
	Biodiversity maintenance	11,552.54	4790.08	2612.76	8786.06	1024.60
Cultural services	Recreation services	7635.68	2229.21	435.59	11,709.76	614.95

The calculation formula is:

$$C_k = D \times C,\ k = 1, 2, \ldots, 6 \quad (4)$$

where C_k is the ESV of unit area land utilization type k (CNY/hm^2); C denotes the score of one standard unit ESV equivalent unit (CNY/hm^2); D represents the equivalent data referring to the research results table of Xie et al. [34]; and k refers to land utilization type, namely cultivated, forest, unused, construction, grasslands, and water regions.

(3) Calculation of ESV

The calculation formula is:

$$ESV = \sum_{k=1}^{6} A_k \times C_k \quad k = 1,\ 2, \ldots,\ 6 \quad (5)$$

where the ESV is the entire score of the ES in Xinjiang (CNY); A_k denotes the area of land utilization of type k (hm^2); C_k denotes the ESV per unit area of land utilization of type k (CNY/hm^2); and k denotes the type of land use.

2.2.4. Determination of Index Weight

(1) Data standardization

Each of the above indicators uses different units that cannot be compared or calculated directly. Therefore, the range standardization method is used to standardize all indicators [25]. This computation is as follows:

$$y_{ij} = \frac{x_{ij} - x_{imin}}{x_{imax} - x_{imin}} \ (i = 1,\ 2, \ldots,\ n;\ j = 1,\ 2, \ldots,\ p) \quad (6)$$

where y_{ij} is the standardized data, x_{ij} is the index prior to standardization, x_{imax} denotes the highest score of the corresponding indicator item prior to standardization, x_{imin} denotes the smallest value of the corresponding indicator item prior to standardization, n represents the indicator numbers and P represents the number of years.

(2) Determination of index weight

The entropy weighting approach is utilized to find the weight of the index. Based on the objective actual data, we set x_{it} as the actual score of the t-th index of sample i (i = 1, 2..., n; t = 1, 2..., p), where n represents the sample numbers and p represents the index numbers. The steps of the computation are defined by the following equations:

The change in index proportion:

$$k_{it} = \frac{x_{it}}{\sum_{i=1}^{n} x_{it}} \tag{7}$$

The calculation of entropy:

$$l_t = -\frac{1}{\ln n} \sum_{i=1}^{n} k_{it} \ln k_{it} \tag{8}$$

The standardization of entropy:

$$s_t = \max l_t / l_t \tag{9}$$

It can be determined from the formula (10) that $s_t \geq 1$

The weight of indicators:

$$v_j = \frac{s_t}{\sum_{t=1}^{p} s_t} \tag{10}$$

It can also be seen from Formula (10) that the greater the value of s_t is, the greater the value of v_j.

2.2.5. The Model Based on Coupling Coordination

(1) The degree of coupling

The calculation formula to determine the degree of coupling is as follows:

$$C = 3 \times \left\{ \frac{T \times U \times E}{[T + U + E]^3} \right\}^{\frac{1}{3}} \tag{11}$$

where T denotes the comprehensive index of tourism development, U represents the comprehensive index of urbanization development, and E is the ESV. C denotes the coupling index, $C \in [0, 1]$. Based on previous research [26], the degree of coupling is divided into the following four stages: low coupling ($0 < C \leq 0.3$), the antagonistic stage ($0.3 < C \leq 0.5$), the running-in stage ($0.5 < C \leq 0.8$), and high coupling ($0.8 < C \leq 1$).

(2) The index of coordination

Equations (12) and (13) are as follows:

$$D = \sqrt{C \times G} \tag{12}$$

$$G = \alpha T + \beta U + \partial E \tag{13}$$

where D represents the CCD index; C denotes the degree of coupling; and G denotes the comprehensive development level function of tourism, urbanization, and the ecological environment; and α, β and ∂ denote undetermined coefficients. Assuming that tourism development, urbanization and ESV are equally important to the urban system, the values of α, β and ∂ are taken as 1/3 (Table 4).

Table 4. Classification outcomes of the degrees of coupling coordination.

Category	Coupling Coordination Degree	Subclass
Disorder	$0 < D \leq 0.1$	Extremely disordered
	$0.1 < D \leq 0.2$	Seriously disordered
	$0.2 < D \leq 0.3$	Moderately disordered
	$0.3 < D \leq 0.4$	Lightly disordered
Transition	$0.4 < D \leq 0.5$	Nearly disordered
	$0.5 < D \leq 0.6$	Poorly coordination
	$0.6 < D \leq 0.7$	Primary coordination
Coordination	$0.7 < D \leq 0.8$	Medium coordination
	$0.8 < D \leq 0.9$	Good coordination
	$0.9 < D \leq 1.0$	High coordination

3. Results

3.1. Comprehensive Progression Levels of Tourism, Urbanization and ESV

(1) Tourism

The comprehensive tourism progression index of metropolitan areas in Xinjiang increased by 19.72% from 2000 to 2020. In the tourism dimension, tourism economic income, the industry size of the tourism, and the industry effects of tourism increased by 97.63%, 36%, and 28.26%, respectively, while the tourism employment effect decreased by 40.32% (Figure 2).

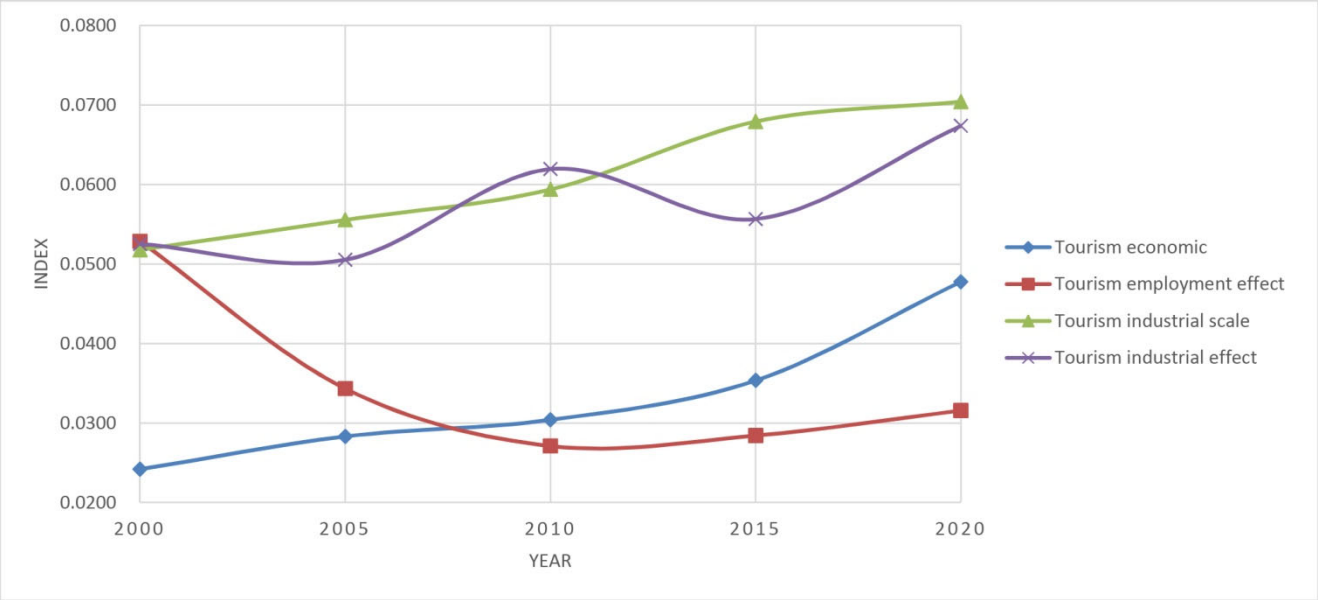

Figure 2. Tourism development trends in cities in Xinjiang.

Spatially, cities with high comprehensive tourism development levels are mainly distributed in Urumqi, Yining, Changji, and Altay in the north and Kashi in the south (Figure 3). The tourism income in Urumqi was in first place between 2000 and 2015, while Yining's tourism economic income was higher than Urumqi's in 2020. The tourism economic income of Altay and Changji began to increase significantly in 2015. It is worth noting that the tourism economic income of Gaochang declined after 2015. From the perspective of the tourism employment effect, Urumqi has always been the leader. The tourism employment effects in Kashi, Aksu, and Korla in southern Xinjiang are relatively high. In terms of the industry size of tourism, Urumqi, Yining, Tacheng, and Kashi have the largest tourism industry sizes, followed by Changji and Aksu. Concerning the industry effect of the tourism, Urumqi and Yining have always been the leaders, followed by Changji,

Kashi, Gaochang, Korla, and Aksu. It is worth noting that the tourism industry effect in Gaochang began to decline in 2010. By analyzing the relevant data regarding the industry effects of tourism in Gaochang, it is found that since 2015, the total number of international tourists has declined significantly, with a change rate of −19.77%/year, which is the main reason behind the decline in the industry effects of tourism.

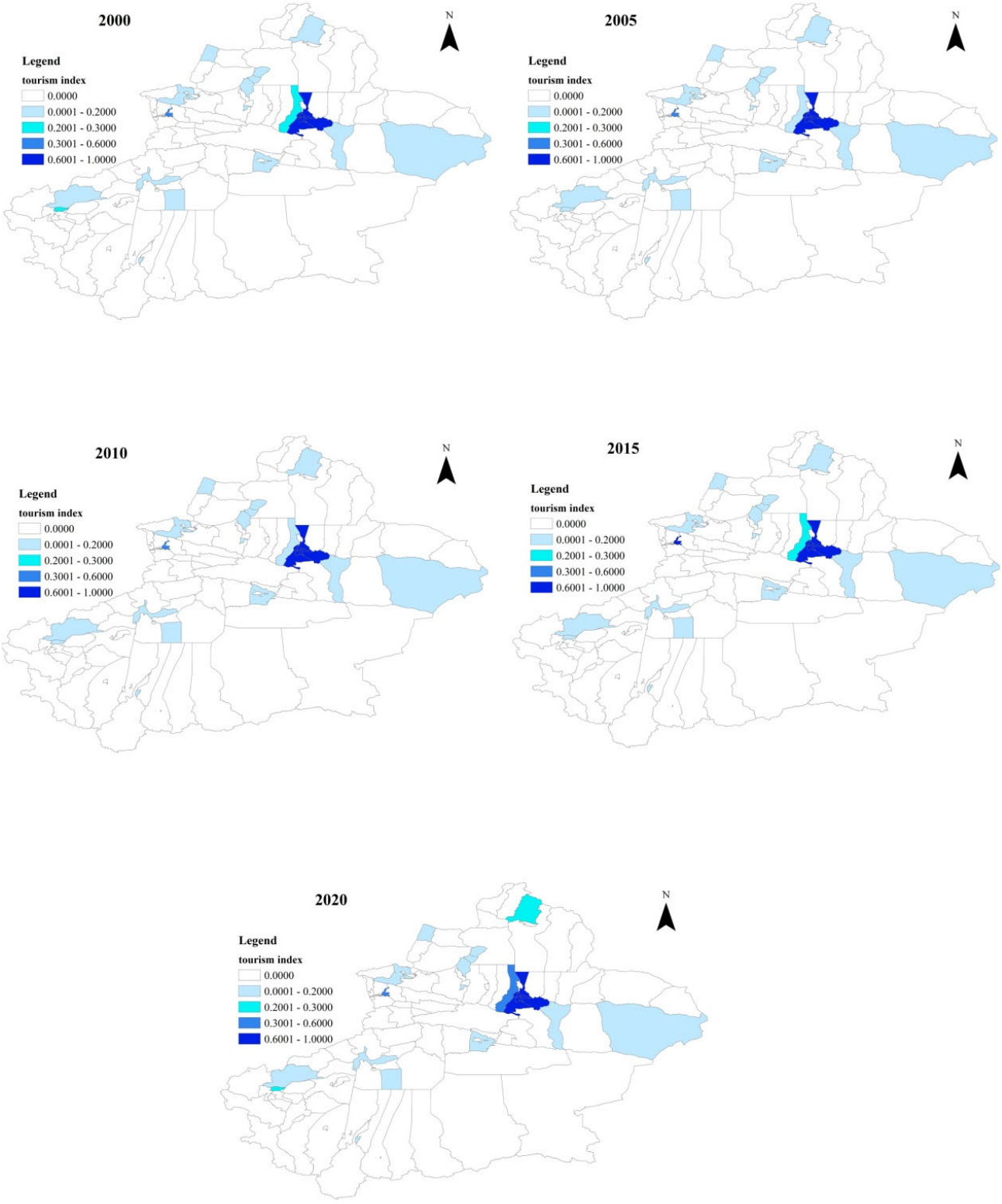

Figure 3. Spatial distribution of tourism development in the cities of Xinjiang.

(2) Urbanization

The urbanization degree of major cities in Xinjiang increased by 46.3% from 2000 to 2020. Among the indicators, the levels of population, economic, social, and land urbanization increased by 17.29%, 48.3%, 32.63%, and 109.92%, respectively (Figure 4).

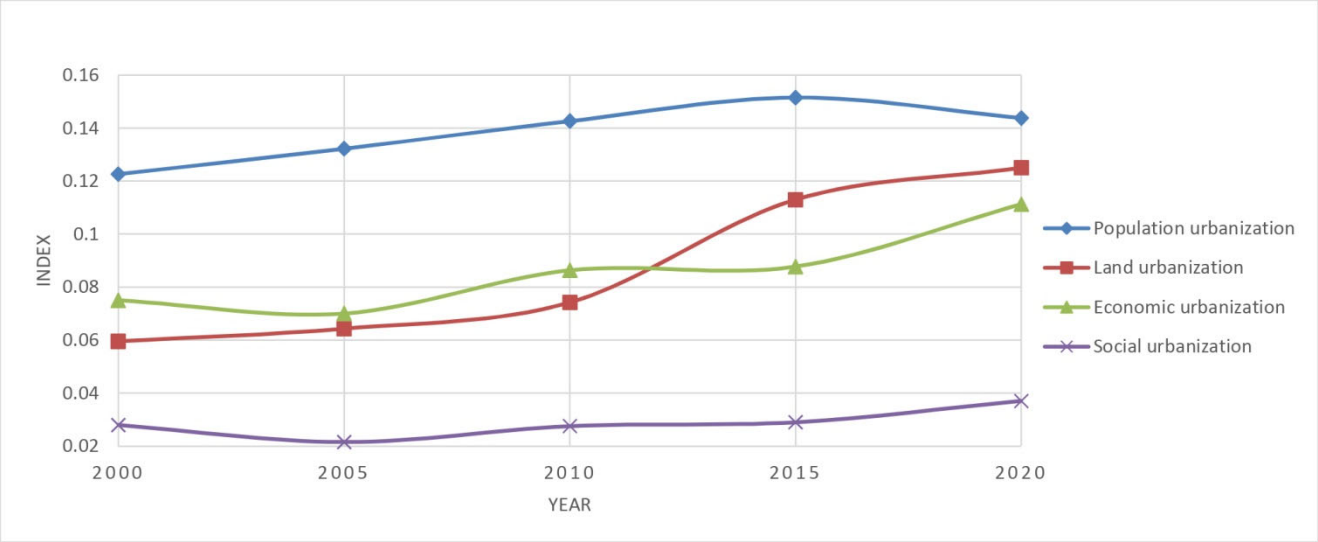

Figure 4. Urbanization development trends in Xinjiang.

Spatially, Urumqi and Karamay have the highest comprehensive development indexes of urbanization, with values above 0.55, followed by Korla in southern Xinjiang, which has a value higher than 0.4 (Figure 5). The urbanization levels in Changji and Aksu have increased since 2015. From the perspective of the economic urbanization level, Karamay, Urumqi, Korla, and Yizhou have the highest economic urbanization development level, while Tacheng and Altay have the lowest economic urbanization development levels, with values of less than 0.03. From the perspective of the development level of social urbanization, Urumqi has always held first place. As the capital of Xinjiang, Urumqi has advantages in market scale, education, and medical care, and its social urbanization level is substantially higher than that of other cities. It is worth noting that the social urbanization levels of Aksu and Kashgar grew rapidly from 2015 to 2020, with increases of 143.96% and 138.53%, respectively. From the perspective of the population urbanization development level, Urumqi, Karamay, Yining and Kashi have a development index higher than 0.2, while Gaochang and Atushi have a development index lower than 0.1. The cities with higher land urbanization levels include Karamay and Gaochang in the north and Korla and Aksu in the south.

(3) ESV

According to the calculation results of ESV, the total value of urban ecosystem services in Xinjiang increased from 229.93 $\times$ 10^9 CNY in 2000 to 237.54 $\times$ 10^9 CNY in 2020, with a small alteration ratio of 3.31%. Among the indicators, the scores for provision services, regulation services, and support services increased by 8.97%, 4.07%, and 1.88%, respectively, while the value of cultural services decreased by 0.06% (Figure 6).

Spatially, the regions with high ESV are distributed in Urumqi, Yizhou, Altay, and Bole in northern Xinjiang and Aksu and Atushi in southern Xinjiang (Figure 7). From 2000 to 2020, the cities with decreased ESV were mainly distributed in northern Xinjiang, including Urumqi (4.68%), Yizhou (0.35%), Changji (4.86%), Yining (17.94%) and Tacheng (0.69%). The total ESV of other cities increased. The values of providing services in Yining, Hotan, and Urumqi decreased by 29.5%, 9.21%, and 5.65%, respectively, while those in other cities increased. The values of regulation and supporting services decreased in Yining, Urumqi,

Changji, Tacheng, and Yizhou and it increased in other cities. The cities with reduced cultural services are mostly distributed in northern Xinjiang.

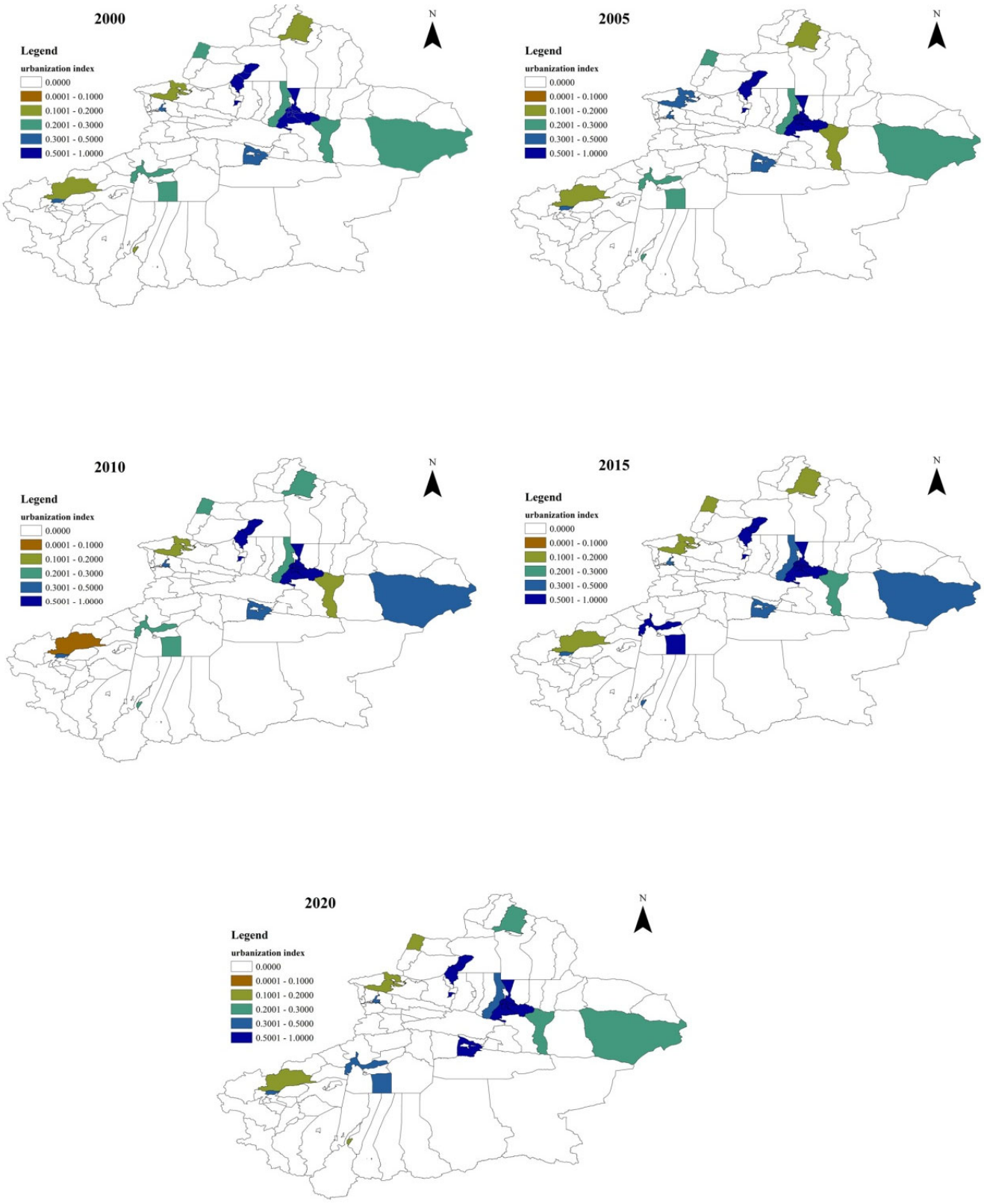

Figure 5. Spatial distribution of urbanization levels throughout Xinjiang.

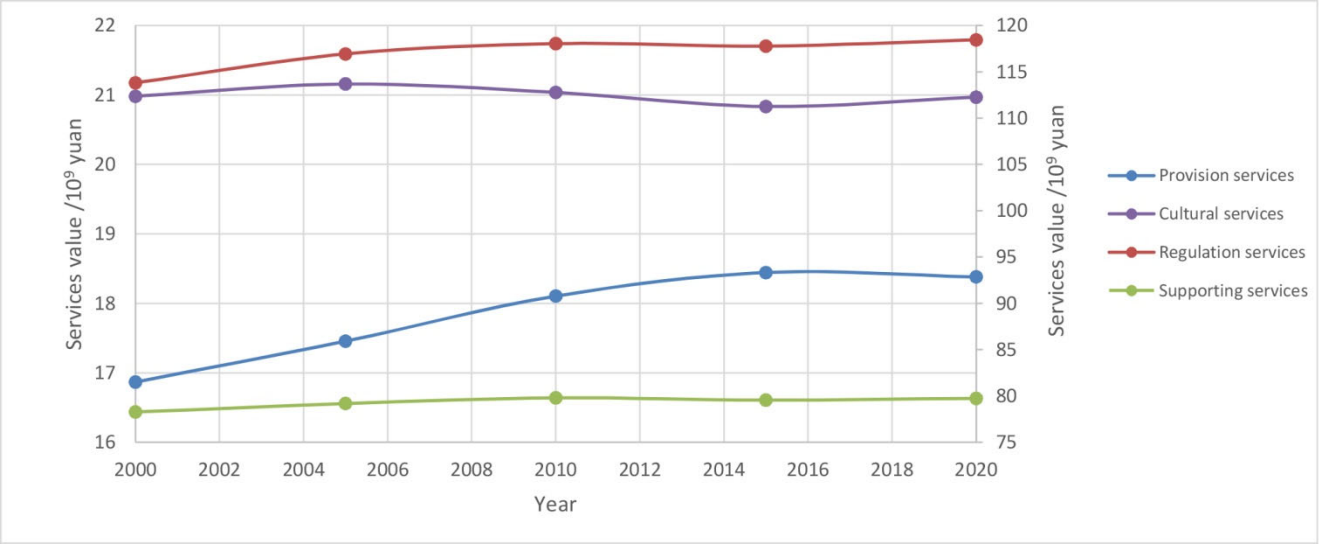

Figure 6. ESV trends in the cities of Xinjiang.

3.2. Analysis of the Coupling and Coordination of Tourism, Urbanization, and ESV

3.2.1. The Overall Relationships between the Three Systems

(1) Coupling analysis

The results of the coupling degree analysis represent the level of correlation between systems. The coupling level among tourism, urbanization, and ESV in the major cities of Xinjiang is low, and the overall distribution is between 0.23 and 0.25. Spatially, cities with high coupling degrees are distributed in northern Xinjiang, including Urumqi, Gaochang, Changji, and Tacheng, where the coupling degree is greater than 0.3 over the course of the research. The coupling level between tourism and urbanization is 0.4–0.45. The coupling degree between tourism and ESV is 0.33–0.38. The coupling degree between urbanization and ESV is 0.39–0.41. Throughout the course of the research, the coupling degree between systems presented an upward trend. Spatially, the degree of coupling between tourism and urbanization was higher in Urumqi, Gaochang, Changji, Yining, Tacheng, Altay, and Kashi and it was greater than 0.45 throughout the study period. The cities with a lower degree of coupling between tourism and urbanization were Karamay, Yizhou, and Atushi. The cities with a higher coupling degree between tourism and ESV are distributed in Urumqi, Karamay, Gaochang, Changji, Tacheng, Bole, and Korla, with a coupling degree index that was greater than 0.4 during the study period. The coupling degree between urbanization and ESV was lower in Yining, Kashi, and Hotan, and it was greater than 0.35 in other cities.

(2) Coupling coordination analysis

The coordination degree can better reflect the comprehensive benefits of tourism, urbanization, and ecology. The average value for the degree of coordination between tourism, urbanization development, and ESV was within the range of 0.2–0.3 during the period of 2000 to 2020, which indicates moderate disorder and a slow growth trend. Spatially, the CCD of tourism, urbanization, and ESV was the highest in Urumqi, being in the nearly disordered stage, followed by Changji, which was in the slightly disordered stage. The CCDs of Karamay, Gaochang, Bole, Korla, and Kashi were between 0.2 and 0.3, indicating moderate disorder. Tacheng, Altay, and Aksu experienced a change from moderate disorder to slight disorder. Yizhou experienced a fluctuating state between moderate slight and moderate disorder. Yining presented a stage of serious disorder before 2015 and moderate disorder after. Both Atushi and Hotan presented stages of serious disorder over the course of the research (Figure 8).

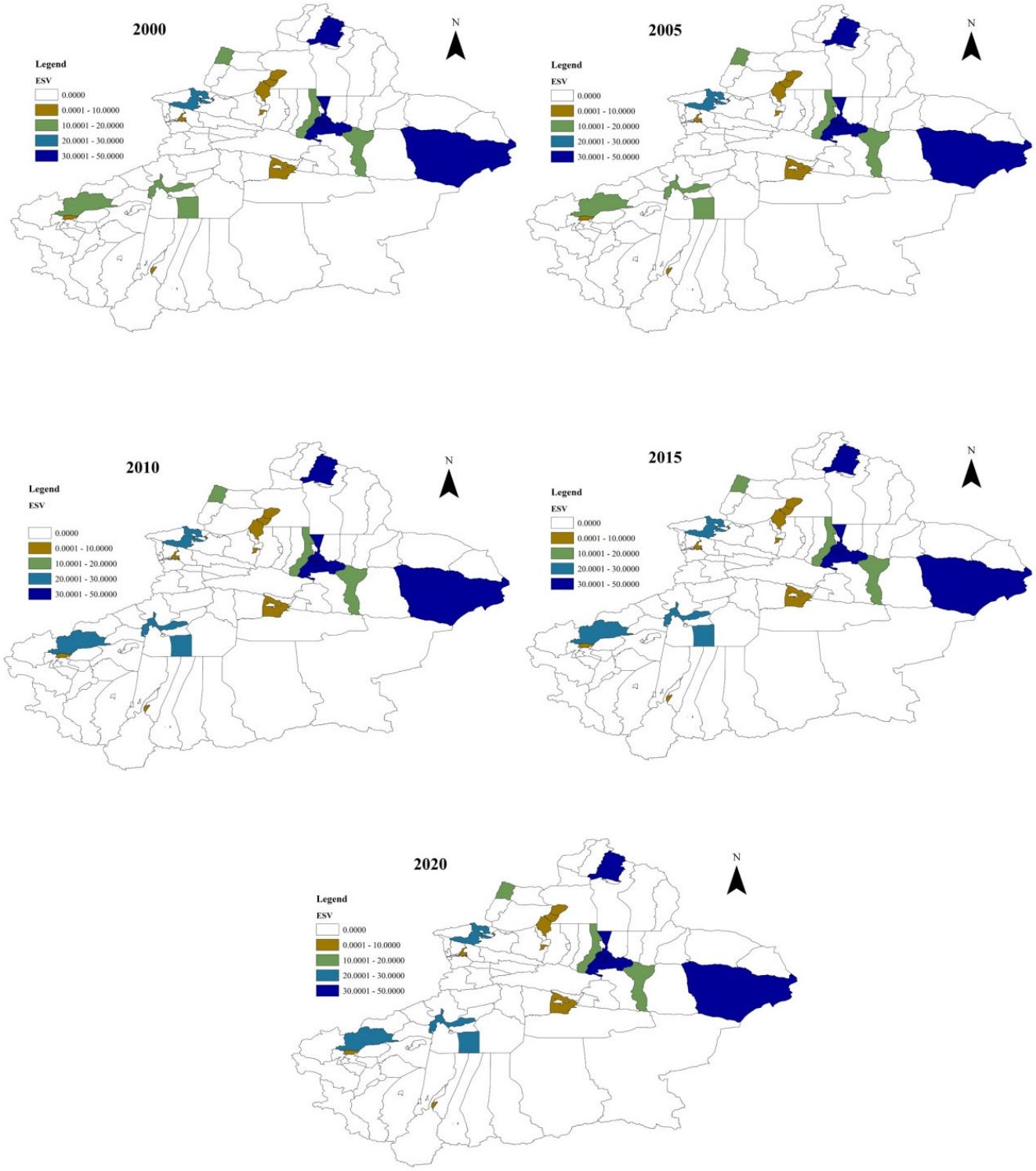

Figure 7. Spatial distribution of ESV in Xinjiang.

Analysis of the CCD among tourism, urbanization, and ESV indicated that the CCD between tourism and urbanization and that between urbanization and ESV ranged from 0.3–0.4, indicating a state of slight disorder. The CCD between tourism and ESV experienced a fluctuating state between slight and moderate states of disorder. Spatially, Urumqi had the highest level of CCD between tourism and urbanization, presenting a mainly coordinated state, followed by Yining, with a CCD of 0.4–0.5 and presenting a nearly disordered stage. The state of the CCD of tourism and urbanization in Changji, Korla, Aksu, and Kashi was

moderately disordered. The state of the CCD of tourism and urbanization in Karamay and Altay changed from moderate disorder to slight disorder, Atushi presented a state of serious disorder, and other cities presented states of moderate disorder. From 2000 to 2020, the CCD of tourism and ESV was in the primary coordination state in Urumqi. Changji and Altay presented changes from states of slight disorder to those of near disorder. Yizhou and Aksu experienced states of slight disorder, Bole changed from a state of moderate disorder to that of slight disorder, Yining presented a state of serious disorder, Hotan presented a state of extreme disorder, and other cities shifted from levels of serious disorder to moderate disorder. During the period of the research, the urbanization and the ESV in Urumqi and Yizhou were poorly coordinated. Altay and Aksu were nearly disordered. Karamay, Changji, Bole, and Korla experienced a change from states of slight disorder to near disorder. Gaochang, Tacheng, and Atushi were mildly disordered. Kashi presented a state of moderate disorder, and Yining and Hotan presented states of serious disorder.

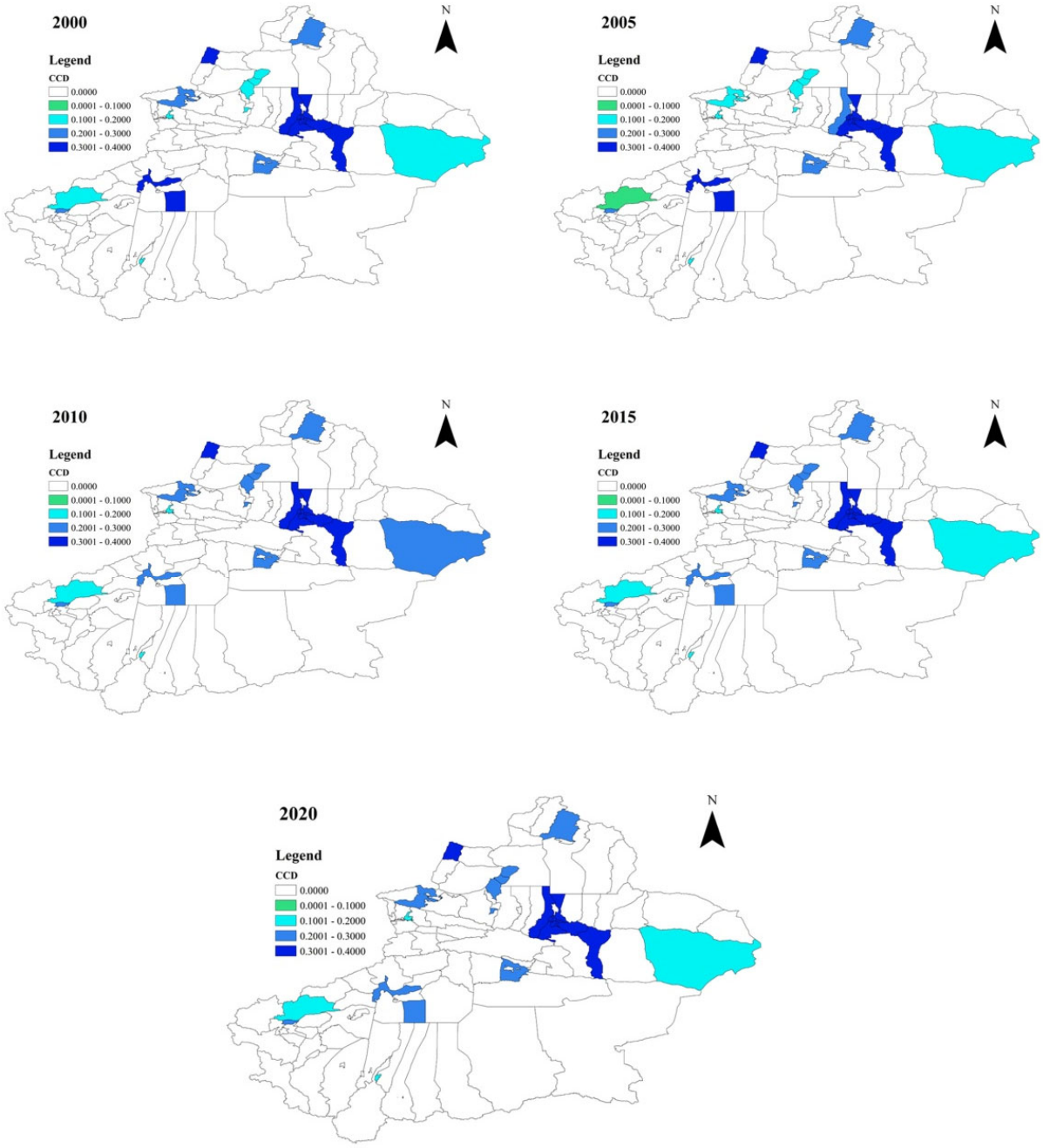

Figure 8. Coupling coordination level of tourism, urbanization, and ESV in Xinjiang.

3.2.2. Coupling and Coordination Relationships among Subsystems

The CCD between urbanization, ESV and the industry size of tourism is higher than among the other tourism subsystems, followed by the CCD of the industry effects of tourism, while the CCD between urbanization, ESV and the economic effects of tourism is low. Spatially, the CCD between the urbanization, ESV and tourism subsystems in Urumqi is higher than that in other cities. The CCD of the industry size of tourism, urbanization and ESV in Gaochang, Changji, Altay, Korla and Aksu is higher than that in the other cities. The CCD of the industry effects of tourism, urbanization and ESV in Gaochang, Changji, Korla are at the second highest level. In 2000, the CCD of urbanization, ESV and the employment effects of tourism in Urumqi, Changji and Aksu were higher than those in the other cities.

The CCD of tourism, ESV and population urbanization is higher than that of the other urbanization subsystems. The CCD of tourism, ESV and population and land urbanization was highest in 2010. The CCD of tourism, ESV and economic urbanization was highest in 2020. Spatially, the CCDs of tourism, ESV and population urbanization in Urumqi, Changji, Yining and Kashi were higher than those in the other cities. The CCD of tourism, ESV and land urbanization in Urumqi and Aksu was higher than that in the other cities. The CCD of tourism, ESV and economic urbanization, social urbanization was the highest in Urumqi.

The CCD of tourism, urbanization and subsystems of ESV are higher than those of the subsystems of tourism and urbanization. Spatially, the CCD of tourism, urbanization and the subsystems of ESV in Urumqi is higher than that in the other cities. The CCDs of tourism, urbanization and the provision service, regulation service, supporting service in Changji, Korla and Aksu are the second highest. The CCD of tourism, urbanization and cultural services in Aksu was the highest in 2015.

4. Discussion

From 2000 to 2020, Xinjiang's tourism industry developed rapidly. In the tourism subsystem, the industry size of tourism across all years makes the largest contribution to the comprehensive index of tourism development, followed by the industry effects of tourism. The contribution of the economic effects of tourism to the comprehensive index of tourism development is the smallest, but its contribution rate has continued to increase during the research period. Contrary to the economic effects of tourism, the contribution rate of the employment effects of tourism to the comprehensive index of tourism development showed a decreasing trend. Although the tourism industry is large in scale, the economic benefits of tourism are at a relatively low level. This result shows that the development of Xinjiang's tourism efficiency is low. Other studies on tourism industry development in other cities in China also showed the same results [36]. From the perspective of the comprehensive index of tourism development and the change trend of tourism subsystems across different cities, the industry size of tourism in Aksu, Kashgar and Hotan in southern of Xinjiang makes an important contribution to the comprehensive index of tourism development. The industry effects of tourism in Urumqi, Changji, and Yining in the northern Xinjiang and in Gaochang and Yizhou in the eastern Xinjiang greatly contributed to the comprehensive index of tourism development. This shows that there are spatial differences in the contribution rate of the tourism development subsystem to the comprehensive index of tourism development across cities. By analyzing the CCD between the comprehensive index of tourism development and the urbanization subsystem, it is found that the CCD between urbanization, the industry size of tourism and the industry effects of tourism is relatively high. Among them, the industry size of tourism is highly coupled with economic urbanization and land urbanization and relatively highly coordinated with population urbanization. The industry effects of tourism are highly coupled with economic urbanization and land urbanization, but the coordination level is generally low. This shows that there is a robust correlation between Xinjiang's economic urbanization, land urbanization, the industry size of tourism and the industry effects of tourism, but at present, the coordination between the various subsystems of cities is low, and the role of urbanization in driving the tourism industry is not prominent.

From 2000 to 2020, the urbanization level, especially economic urbanization, of major cities in Xinjiang has improved, and the land urbanization index has increased rapidly. The western development strategy proposed in 2000 and the new urbanization construction policies implemented since 2013 are the main driving forces promoting urbanization development in Xinjiang, playing a key role in urban progression in the last 20 years. In the urbanization subsystem, population urbanization contributed the most to the urbanization comprehensive index between 2000 and 2015, and land urbanization has developed rapidly since 2010. These characteristics are similar to those of the initial development of urbanization in other cities in China [26,36–38]. In 2020, economic urbanization and population urbanization made the same contribution to the comprehensive index of urbanization. The social urbanization index makes the smallest contribution to the comprehensive urbanization index. The contribution of each subsystem of different cities to the comprehensive urbanization index differs. The land urbanization of Gaochang and Aksu makes a great contribution to the comprehensive index of urbanization. Due to the influence of geographical conditions, the spatial distribution of natural resources in Xinjiang is uneven, which, to some extent, leads to the difference in urban development levels at the spatial scale. It can be seen that over the past 20 years of urban development, the level of population urbanization and land urbanization in Xinjiang has been relatively high, the level of economic urbanization is gradually improving, and the level of social urbanization development needs further consideration.

The process of urbanization has an impact on the ecosystem, and the relationship between urbanization and ESV has been evaluated from multiple perspectives. In our research, the total ESV of cities in Xinjiang shows an increasing trend. When the spatial distribution and the ESVs' changing trend are a concern, the changing trend of ESV in northern Xinjiang is compatible with the outcomes of Shi et al. [25]. The value of food production and soil conservation both increased, which is also compatible with the research outcomes of Shi et al. [25]. From the perspective of the CCD between ESV and the urbanization subsystem, the coupling degree between ESV and population and between ESV and land urbanization is relatively high, but the CCD has been in a state of moderate disorder. Spatially, Urumqi, Karamay, Changji, Tacheng and Korla have a high degree of coupling between ESV and population urbanization. The cities with a high degree of coupling between ESV and land urbanization include Karamay City, Gaochang District, Korla City, Aksu City and Kashgar City. Karamay and Korla also present a high degree of coupling between ESV and economic urbanization. The coupling degree between ESV and the social urbanization index is higher in Kashgar and Hotan than it is in other cities. The CCD of population urbanization and economic urbanization in Urumqi are in the nearly ordered state, and the CCDs of the ESV and urbanization subsystems in other cities are low. The CCD model can only reflect the coupling degree and coordination between systems. To determine the positive correlation or negative correlation between systems, correlation analysis should be conducted on the basis of multiple years of data. Although urbanization lags behind ESV, the coupling index can reflect the relationship between the urbanization subsystem and ESV to some extent. Xinjiang's cities still need development; however, that development should not only focus on population and land urbanization, but should also consider economic urbanization and social urbanization. At present, the coupling degree among population and land urbanization and ESV has reached a high level in some cities. The proper control of both population and land urbanization over the course of development of these cities is conducive to the sustainable development of the urban system. As an arid area with a fragile ecological environment, Xinjiang's urbanization needs to be focused on the quality of urban development rather than on its speed. In many previous studies on urbanization and ESV, scholars have noted that the extensive development of population, land and economic urbanization has negative impacts on ESV [26,39–41]. At the initial stage of urban development, on the one hand, the consumption of resources and energy increases, and the emissions of pollutants increase, which puts varying degrees of pollution into the atmosphere, water, and soil; alternatively,

when urbanization is in process, a substantial amount of land is transformed into urban construction land, which leads to great changes in the urban landscape pattern, thus affecting the ESV [25,29]. Compared with urbanization, the CCDs of the ESV and tourism subsystems are relatively low. However, the CCD between ESV and the tourism subsystems in Urumqi is relatively high and close to the transition stage. The coupling degree between ESV and the employment effects of tourism, the industry size of tourism and the industry effects of tourism is relatively high in Kashgar, and the coupling index is above 0.45, while its coordination is low. Over the course of the research, the CCD between tourism and the ESV was in a moderately disordered state since the total ESV of each city was higher than the comprehensive tourism development index. Although the CCD between the two shows an increasing trend, due to the difference between indexes, it also shows a lower level of coordination than the comprehensive index of urbanization development. The CCD between tourism and ESV is increasing, which indicates that tourism development can promote the improvement in ESV in urban development. However, the negative impact of tourism development on ESV cannot be easily ignored. In the process of tourism development, related industries need to consume resources and energy to produce tourism products. During this time, the land structure of tourism destinations changes, pollutant emissions increase, and the ecosystem service functioning becomes damaged [15,17,19]. In addition, the various negative behaviors of tourists are detrimental at erratic levels to the structure and function of the ecosystem in tourism destinations. Therefore, in the process of urban development, attention should be paid to the protection of ecosystems, and various functional areas should be rationally planned.

5. Conclusions

In this study, an indicator system is constructed based on the benefits of urbanization and tourism, the urbanization development level, tourism development level and ESV change characteristics of 14 cities in Xinjiang, which are evaluated, and the relationship between the three systems are analyzed based on the CCD model. At present, the level of urban ESV of Xinjiang is high, but its levels of urbanization and tourism development are low. In the urbanization subsystem, the development of land urbanization happens quickly, and the coupling degree with ESV is high, but it is not coordinated with the development of ESV. The development of tourism lags behind the development of urbanization. Economic urbanization and tourism are highly coupled. However, due to the low economic urbanization efficiency prior to 2015, the driving effect of urbanization on tourism development is not significant. In the development of the tourism industry, the industry size of tourism has continued to improve, but the industry effects of tourism have fluctuated, showing a relatively minor increasing trend. The industry size of tourism and the industry effects of tourism are highly coupled with economic urbanization, but their development is not coordinated. The level of urbanization, especially the level of economic urbanization, has restricted the effect on the tourism industry. Due to the low level of urbanization and the lagging development of tourism, the CCD and ESV of tourism are lower than those of urbanization and ESV. From the perspective of the development trend, the level of economic urbanization is improving, and its CCD with the tourism subsystem is also increasing. At the same time, the CCD between tourism and ESV is also on the rise. At present, the characteristics of urbanization development in Xinjiang are similar to those of many cities in China at the early stage of urbanization development, and they are characterized by population and land urbanization. However, the excessive development of population urbanization and land urbanization may exert negative impacts on ecosystems to a certain extent. Therefore, it is beneficial to the sustainable development of cities to properly control the speed with which population and land urbanization develop and consider the quality of development rather than simply the speed. This is an effective way to improve the coordinated development of urbanization, tourism and the ecosystem by improving the level of economic urbanization and social urbanization in an effort to drive the development of the tourism industry and alleviate the pressure on the ecological environment that is

caused by the rapid development of population and land urbanization. Since the CCD of urbanization, tourism and ecosystems is a complex process, the current methodologies cannot fully reveal the mechanism behind the three systems. In follow-up research, we will continue to pay attention to the coupling and coordination mechanism of the systems, and determine the coordinated development mechanism of urbanization, tourism and ecosystems in the urban development of Xinjiang based on multidisciplinary knowledge to provide a scientific basis for the high-quality development of Xinjiang's cities.

Author Contributions: Z.M.: conceptualization, supervision, writing—original draft, writing—review and editing; X.T.: resources, methodology; writing—review and editing; J.T.: investigation, data curation. R.D.: methodology, data curation. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Foundation of Xinjiang University [No. 22CPY152], the Ph.D. Programs Foundation of Xinjiang University [No. BS202105] and Tianchi PH.D Programs Foundation of Xinjiang [No. TCBS202030].

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Acknowledgments: The authors appreciate the anonymous reviewers for their constructive comments and suggestions that have significantly improved the content and quality of this manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

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