

Research on the Coordinated Development of Economy Environment Tourism in the Western Region

Xiaomeng Zhou

*School of Finance and Economics, Qinghai University, Xining, Qinghai, 810016, China
392668290@qq.com*

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Abstract: This paper takes 12 provinces and cities in the western region of China as the research objects. Based on the construction of the evaluation index system for the coordinated development of the economic-environment-tourism system in the western region, the entropy method is used to study the comprehensive development evaluation changes of the three major systems in each province and city of the region from a spatiotemporal dimension, as well as the entire system. Finally, the coupling coordination model is used to analysis the spatiotemporal evolution of the coupling coordination relationship of the three major systems in each province and city of the western region, and the Moran'I index is used to measure its spatial correlation. The research found that the economic development and tourism development of each province and city in the west are somewhat correlated, and there is an evident hierarchy in the economic and tourism development of each province and city, with the latter being more pronounced. The overall comprehensive development evaluation and coupling coordination degree of each province and city are showing an upward trend, and exhibit a spatial distribution pattern of higher in the south and lower in the north. There are regional differences and temporal evolution differences in the comprehensive evaluation level and coordination level of each province and city. In 2019 and 2020, the western region as a whole exhibited significant spatial correlation features and strong agglomeration.

1. Introduction

Since the reform and opening up started, with the rapid development of the Chinese economy, the Chinese economy has gradually transformed from "high speed" to "high quality". In the process of economic transformation, the sunrise industry - tourism has become an important force in economic and industrial transformation, and has become a strategic pillar industry of our national economy with strong driving force, serving as an important growth point for high-quality economic development. In 2021, the State Council issued the "14th Five-Year Plan for the Development of the Tourism Industry", mentioning the promotion of effective integration of green ecological resources and tourism, implementing the concept of "clear waters and green mountains are invaluable assets", and following the characteristic tourism path of ecological priority and green development. In 2022, the construction of ecological civilization has taken a new step, and in the

new stage of development, more attention should be paid to ecological civilization construction, emphasizing the orderly promotion of carbon peak and carbon neutrality, accelerating industrial transformation, and developing a green tourism industry where ecological environment and tourism industry promote each other. The 20th CPC National Congress proposed to promote green development, accelerate the green transformation of development modes, encourage coordinated regional development, and focus on boosting high-quality development. Therefore, the study of the coordinated development of the economic-environment-tourism system is of great significance. There exists a certain coordinated and related relationship between the three systems of economy, environment and tourism. Economic growth can support the construction of the tourism industry base and services by providing funds, improve the imbalance in industrial structure, and support environmental protection with technology and funds. The environment, as the foundation, can provide natural resources for the development of the tourism industry, which is the basis and prerequisite for its development, and can also provide a material foundation for economic growth. The development of the tourism industry helps to drive the development of related industries, promote economic development, improve resource utilization, and promote environmental protection, serving as a key link in coordinating economic development and environmental protection.

2. Status Analysis

Research on the relationship between the economy, environment and tourism, both domestically and internationally, is currently mainly divided into studies on the relationship between two systems and studies on the relationship between three systems. In terms of the relationship between the economy and tourism, Balaguer found that the development of the tourism industry in Spain can promote its national economic growth to some extent [1]; Yi Baizhong used coupling theory to study the relationship between China's tourism industry and regional economy and the impact mechanism between the two [2]; Yang Songmao, Li Tian, Wang Lulu, and others separately researched the coupling coordination relationship between the tourism industry and regional economy of Shaanxi Province, Hebei Province, and Zhejiang Province [3]-[5]. In terms of the relationship between the economy and the environment, Najid researched the EKC curve of CO₂ emissions and economic growth in Croatia from 1992 to 2011, showing an inverted "U" shape [6]; Wu Yuming studied the coupling coordination relationship between regional economic growth in China and the environment [7]; Zhang Rongtian, Xue Mingyue, and others separately studied the spatial and temporal distribution patterns of the coupling coordination relationship between economic development and ecological environment in the Yangtze River Delta region and the Yellow River Basin [8]-[9]; Jiang Hongli, Su Shengliang, and others separately researched the coupling coordination relationship between economic development and ecological environment in Jiangsu Province and Ningxia Hui Autonomous Region [10]-[11]. In terms of research on the relationship between tourism and the environment, Colin first proposed the concept of "tourism ecological footprint" and explained how a good ecological environment can promote the sustainable development of the tourism industry [12]; Day, using the United States and China as the research objects, believed that the development of the tourism industry would bring certain pressure to the ecological environment of the region [13]; Wang Zhaofeng researched the spatiotemporal evolution and interactive stress relationship of the tourism development and ecological environment coupling coordination relationship in the Yellow River Basin [14]; Fang Yelin, Geng Ruiqin, and others separately studied the spatiotemporal evolution of the coupling coordination degree between provincial tourism industry and ecological environment from 2001 to 2011 and from 2010 to 2019 in China [15]-[16]. Research on the relationship between the economy, environment and tourism

has gradually increased in recent years. Zhou Cheng, Ge Dongmei, and others separately studied the coupling coordination relationship between the economy, environment, and tourism in 2012 and from 2003 to 2017, as well as the inter-provincial spatial differences [17]-[18]; Zhou Cheng, Wu Qing, and others separately studied the coupling coordination relationship between the economy, environment and tourism in various provinces and cities along the Yangtze River Economic Belt, as well as the spatial distribution differences in Guangdong Province. Zhou Cheng also conducted predictive research on the research area [19]-[20]. Existing literature mainly focuses on the study of the relationship between two systems, with relatively fewer researches on the relationship between three systems, and most studies cover single regions or developed areas, with very few horizontal comparative studies and spatial geographical analyses at the macro level in underdeveloped areas.

This article takes 12 provinces and cities in the western region of China as the research objects. Based on the construction of the evaluation index system for the coordinated development of the economic-environment-tourism in the western region, the entropy method is used to study the comprehensive development evaluation variables of the three major systems and the entire system in this region from a spatiotemporal dimension. In addition, with the help of the coupling coordination model, analysis the spatiotemporal evolution of the coupling coordination relationship of the three major systems in various provinces and cities in the western region, and the Moran'I index is used to measure its spatial correlation. Finally, with the help of the grey GM(1,1) prediction model, the coupling coordination degree of the three major systems in the region for the next five years is predicted, and spatiotemporal evolution analysis is conducted.

3. Indicator System Construction and Data Sources

This article follows the principles of scientificity, practicability, and representativeness, and draws on the establishment of the index system of related research. It combines the actual situation of the economic, environmental and tourism aspects in the western region as well as the availability of data from various provinces and cities in the region. Focusing on the three cores of economy, environment and tourism, it selects detailed indicators from ten dimensions such as the scale of economic development, the level of economic development, economic structure, quality of economic development, environmental status, environmental pollution, environmental governance, tourism market size, tourism element structure and tourism human resources, totaling 49 indicators (including positive and negative indicators). This effectively constructs a comprehensive evaluation index system for the coordinated development of economic-environment-tourism in the western region (Table 1). In the economic subsystem, there are 4 primary indicators and 19 secondary indicators to measure the comprehensive development level of the economic subsystem. In the environmental subsystem, there are 3 primary indicators and 19 secondary indicators to measure the comprehensive development level of the environmental subsystem. In the tourism subsystem, there are 3 primary indicators and 11 secondary indicators to measure the comprehensive development level of the environmental subsystem.

The data for the various indicators in this article mainly come from the local statistical yearbooks of the provinces and cities in the western region from 2011 to 2021, as well as the "China City Statistical Yearbook," "China Tourism Statistical Yearbook," and "China Statistical Yearbook." Additionally, it includes local environmental bulletins and local tourism bulletins from 2010 to 2020. For the few data points that could not be obtained, the smoothing index method was applied to supplement them.

Table 1: Evaluation indicators for coordinated development of economic-environment-tourism in the western region.

Target level	Primary indicator	Secondary indicator	Indicator attribute
Economic System	Economic Development Scale	Regional GDP	+
		General public budget revenue	+
		Total retail sales of social consumer goods	+
		Total import and export volume	+
		Fixed Asset Investment Growth Rate year	+
	Economic Development Level	Per Capita GDP	+
		Per Capita Disposable Income of Urban Residents	+
		Local Financial Education Expenditure	+
		Local Financial Medical Care Expenditure	+
		Local Financial Social Security and Employment Expenditure	+
	Economic Structure	Primary Industry Output Proportion	+
		Secondary Industry Output Proportion	+
		Tertiary Industry Output Proportion	+
		Urban Unemployment Rate	-
	Economic Development Quality	Rural Per Capita Disposable Income	+
		Urban and Rural Residents' Disposable Income Ratio	-
Consumption Expenditure as a Proportion of Disposable Income		+	
Total Social R&D Expenditure as a Proportion of GDP		+	
Engel Coefficient of Urban Residents		-	
Environmental System	Environmental Status	Per Capita Water Resources	+
		Total Water Usage	-
		Forest Coverage Rate	+
		Built-up Area Greening Coverage Rate	+
		Per Capita Park Green Area	+
	Environmental Pollution	COD Emissions in Wastewater	-
		Ammonia Nitrogen Emissions in Wastewater	-
		Sulfur Dioxide Emissions	-
		Nitrogen Oxide Emissions	-
		General Industrial Solid Waste Generation	-
		Rural Fertilizer Application	-
		Agricultural Plastic Film Usage	-
		Pesticide Usage	-
	Environmental Governance	Total Afforested Area	+
		Industrial Pollution Control Investment Completion Amount (yuan(B32) Positive)	+
		City sewage treatment volume	+
		Urban sewage treatment rate	+
		General industrial solid waste utilization	+
Tourism System	Tourism market scale	Harmless treatment rate of domestic waste	+
		Total tourism revenue	+
		Inbound tourist arrivals	+
		Foreign exchange income from tourism	+
		Domestic tourist arrivals	+
		Domestic tourism revenue	+
	Tourism element structure	Tourism revenue as a percentage of GDP	+
		Number of star-rated hotels in the region	+
		Percentage of five-star hotels	+
		Total number of travel agencies	+
	Tourism human resources	Number of employees in large-scale tourism hotels at the end of the year	+

4. Empirical Analysis

4.1. Temporal Evolution Analysis

4.1.1. Temporal analysis of coupled coordinated development of Economy-Environment-Tourism in western regions

This paper utilizes the entropy method to calculate the weights of various indicators in each subsystem, and uses a comprehensive evaluation model to calculate the economic development evaluation, environmental development evaluation, tourism development evaluation, comprehensive development evaluation, and coupling coordination degree of the western region from 2010 to 2020. The comprehensive development evaluation of the western region generally shows an upward trend, and according to the development trend, it can be divided into two stages: from 2010 to 2019, the comprehensive development evaluation of the western region increased linearly, with a large increase; in 2020, the comprehensive development evaluation of the western region showed a slight decline. In 2020, due to the impact of the COVID-19 epidemic, various epidemic response measures have affected various industries, thereby affecting the comprehensive development of the western region to a corresponding degree, hence the comprehensive development evaluation displayed a slight decrease.

From 2010 to 2019, the coupled coordination degree of the economic-environment-tourism in the western region showed a linear upward trend, indicating that during this period, the degree of coordinated development of the economy, environment and tourism in the western region gradually improved; in 2020, the system's coupling coordination degree showed a certain degree of decline, indicating a certain degree of decline in the coordinated development of the economy, environment, and tourism in the western region during this period. According to the coupling coordination determination criteria, the coordination level of the Economy-Environment-Tourism system in the western region from 2010 to 2020 can be divided into three stages. The first stage in 2010 is close to the level of imbalance and recession, and from 2011 to 2017, the coordination level is categorized as a barely coordinated development class, while from 2018 to 2020, the coordination level is categorized as a primary coordinated development class.

4.1.2. Analysis of the temporal coordination of economy-environment-tourism development in western provinces and cities

The comprehensive evaluation model was used to respectively calculate the economic development evaluation, environmental development evaluation, tourism development evaluation, comprehensive development evaluation, and coupling degree and coupling coordination degree of the western provinces and cities from 2010 to 2020. The economic and tourism subsystems in the western region have strong similarities in development. The economic development evaluation of the western provinces and cities showed a linear upward trend during the period from 2010 to 2020, and the tourism development evaluation of the western provinces and cities also showed a linear upward trend during the period from 2010 to 2019; however, the growth rate of most provinces and cities' tourism development evaluation was slightly slower than their economic development evaluation, indicating a certain correlation between the economic and tourism development of the western provinces and cities, with tourism development being a part of economic development and the latter supporting the former.

Looking at the differences in economic and tourism development evaluation of the western provinces and cities, there are obvious differences in economic development and tourism development among each province and city, and there is a certain level of hierarchy, with the

hierarchy of the latter being more obvious, indicating that the macroeconomic differences among the western provinces and cities will persist in the long term and cannot be effectively improved in the short term. Additionally, due to the dependence of the tourism industry on environmental and resource endowments, its development has strong flexibility under the support of favorable national policies and improved supporting services, which is of great significance for narrowing the economic and tourism development gaps among the western provinces and cities, improving the development differences among the provinces and cities, and promoting the coordinated development of the entire western region.

The environmental subsystem changes and characteristics in the provinces and cities of the western region show certain differences with the economic subsystem and the tourism subsystem. The environmental development evaluation of Xizang has been ranked first from 2010 to 2020, while XJ and Gansu have remained relatively low during this period. This indicates that there is no significant correlation between the environment and the economy or tourism, further suggesting that there is no conflict between economic development and environmental protection. While promoting economic and tourism development in the provinces and cities of the western region, priority can be given to environmental protection, promoting green and circular economy, and advancing high-quality development to create a high-quality life and promote the optimization of the ecological environment. The evaluation values of environmental development in most provinces and cities in the western region have remained relatively stable, indicating that these provinces and cities also attach equal importance to the protection of the ecological environment while developing the economy and tourism. The environmental development evaluation values in Sichuan and Guizhou have gradually increased, indicating that these two provinces have gradually strengthened their efforts in environmental protection while developing the economy and tourism, and even exceeded the efforts in economic and tourism development. However, the environmental development evaluation value of Guizhou suddenly dropped sharply in 2020, indicating serious errors in environmental protection during that year, with issues such as illicit occupation of forest land by liquor companies and some enterprises discharging phosphorus-containing wastewater into the river basin. Xizang and Inner Mongolia have shown a continuous trend of decline followed by an increase in the evaluation value of environmental development, conforming to the inverted "U" shape of the environmental Kuznets curve. This indicates that the ecological environment and economic growth are negatively and positively correlated, alternating with each other, which is related to the annual environmental protection measures.

Utilizing the evaluation of the development of various subsystems, and calculating the comprehensive development evaluation value of the economic-environment-tourism system in each province and city in the western region according to the comprehensive evaluation model. The overall trend of the comprehensive development evaluation value of the economic-environment-tourism system in the western provinces and cities from 2010 to 2019 is linearly rising, indicating that the comprehensive development level of the provinces and cities in the west is improving year by year. However, in 2020, the comprehensive development evaluation value of most provinces and cities in the western region experienced a significant decline, due to the impact of the COVID-19 pandemic, resulting in a considerable impact on the comprehensive development of each province and city. Qinghai and Ningxia experienced a smaller impact from the COVID-19 pandemic, leading to a smaller decline in their comprehensive development evaluation value, and a smaller overall impact on their comprehensive development. Between 2010 and 2020, Sichuan, Shaanxi, and Chongqing's comprehensive development evaluation values were basically among the top three in the western region, while Ningxia, Qinghai, and Gansu's comprehensive development evaluation values were basically among the last three in the western region, indicating that Sichuan, Shaanxi, and Chongqing have a higher level of comprehensive development and are relatively developed

provinces and cities in the west, while Ningxia, Qinghai, and Gansu have a lower level of comprehensive development and are relatively underdeveloped provinces in the western region.

With the coupling coordination model, combined with the evaluation data of the economic, environmental, and tourism subsystems of each province and city in the western region, the coupling coordination degree of the economic-environment-tourism system in each province and city in the western region can be obtained (Table 2). Over time, from 2010 to 2019, the overall change in the coupling coordination degree of the economic-environment-tourism system in each province and city in the western region showed a linearly rising trend and tended to develop towards a benign coordination direction. In 2020, the impact of the COVID-19 pandemic led to a declining trend in the coupling coordination degrees of the three major systems of the provinces and cities in the western region. Between 2010 and 2020, Sichuan and Shaanxi's coupling coordination degrees of the three major systems were among the top two in the provinces and cities in the western region, while Ningxia and Qinghai's coupling coordination degrees of the three major systems were among the last two in the provinces and cities in the western region, indicating that the economic, environmental, and tourism coupling and coordination development of Sichuan and Shaanxi are relatively high among the provinces and cities in the west, while Ningxia and Qinghai are relatively low, showing certain regional differences.

Table 2: The temporal evolution of the coordinated development of the western provincial Economy-Environment-Tourism system.

Province	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Sichuan	0.53	0.55	0.57	0.59	0.61	0.64	0.67	0.70	0.73	0.75	0.71
Chongqing	0.48	0.52	0.54	0.56	0.58	0.59	0.61	0.63	0.66	0.68	0.65
Yunnan	0.50	0.53	0.55	0.57	0.58	0.59	0.61	0.62	0.66	0.67	0.64
Guizhou	0.39	0.44	0.46	0.49	0.51	0.53	0.56	0.60	0.63	0.65	0.60
Guangxi	0.49	0.51	0.53	0.55	0.57	0.59	0.61	0.64	0.66	0.69	0.63
Xizang	0.44	0.41	0.43	0.43	0.45	0.47	0.48	0.49	0.51	0.52	0.49
Shanxi	0.54	0.55	0.57	0.59	0.60	0.62	0.63	0.66	0.68	0.70	0.62
Qinghai	0.39	0.39	0.41	0.41	0.42	0.44	0.46	0.46	0.47	0.48	0.47
Gansu	0.43	0.41	0.43	0.44	0.45	0.46	0.48	0.49	0.51	0.53	0.50
Ningxia	0.36	0.34	0.35	0.36	0.36	0.36	0.38	0.39	0.39	0.40	0.38
XJ	0.47	0.47	0.48	0.49	0.49	0.50	0.52	0.53	0.55	0.56	0.50
Inner Mongolia	0.47	0.49	0.50	0.53	0.54	0.54	0.56	0.57	0.58	0.60	0.55

4.2. Analysis of Spatiotemporal Evolution

4.2.1. Spatial and Temporal Evolution of Comprehensive Evaluation of Western Provinces and Cities

Using the optimal natural breakpoint method of the ArcGIS map analysis software, the comprehensive development evaluation of 12 provinces and municipalities in the western region from low to high in 2010 and 2020 was divided into four types, namely low-level, low-medium level, medium-high level, and high-level. In terms of spatial distribution in 2010, Gansu, Ningxia, and Guizhou were classified as low-level regions, Chongqing, Qinghai, XJ, Guangxi, and Inner Mongolia were classified as low-medium level regions, Sichuan, Yunnan, and Shaanxi were classified as medium-high level regions, and Xizang was classified as high-level. In 2020, Sichuan replaced Xizang as the high-level region, while Xizang became the low-medium level region; Yunnan and Shaanxi remained as medium-high level regions, Guangxi and Chongqing transitioned

from low-medium level regions to medium-high level regions; Inner Mongolia was classified as low-medium level, Guizhou transitioned from a low-level region to a low-medium level region; Gansu and Ningxia remained as low-level regions, and XJ and Qinghai were downgraded from low-medium level regions to low-level regions. From a spatial structural perspective, the overall performance showed a transition from low-medium level type regions to medium-high level type regions, indicating a certain degree of spatial dependence in the comprehensive development evaluation of provinces and municipalities in the western region.

4.2.2. Spatial and Temporal Evolution of Coordination Levels of Western Provinces and Cities

In terms of spatial distribution, the coordination level in the western region has gradually diversified and the level of coupled coordination development in the economic, environmental, and tourism sectors has been improved. From 2010 to 2020, Sichuan changed from barely coordinated development to moderately coordinated development, becoming the province with the highest level of coupled coordination development in the western region; Shaanxi and Yunnan progressed from barely coordinated development to primary coordinated development, Chongqing and Guangxi progressed from being on the verge of imbalance and decline to primary coordinated development; XJ, Gansu, and Inner Mongolia all progressed from being on the verge of imbalance and decline to barely coordinated development, Guizhou progressed from slightly unbalanced and declining to barely coordinated development; Qinghai progressed from slightly unbalanced and declining to being on the verge of imbalance and decline, while Xizang continued to be on the verge of imbalance and decline, and Ningxia has consistently maintained a state of slight unbalance and decline.

From a spatial structural perspective, the degree of economic, environmental, and tourism system coupled coordination in provinces and municipalities in the western region basically showed a continuous development centered on high values in both periods, but in 2010 it was centered on Sichuan, Yunnan, and Shaanxi, while in 2020 it was centered on Sichuan alone; the overall coordination level of provinces and municipalities in the western region showed a transition from barely coordinated development and being on the verge of imbalance and decline to primary coordinated development. Areas with high values of economic, environmental, and tourism coupled coordination are mostly in economically developed or tourism-developed provinces and municipalities, as these areas have recently increased their efforts in environmental protection and have made great efforts to control environmental pollution. In particular, in recent years, a good ecological environment has become a hotspot for creating tourist attractions, and the development of the environment and tourism mutually promote each other, leading to coordinated development.

4.3. Spatial correlation analysis of economy-environment-tourism coupling coordination in western provinces and cities

The regional differences in the coupling coordination of the economy, environment, and tourism in the western provinces and cities have been continuously narrowing over time, which can only reflect their spatial heterogeneity and cannot reflect their spatial interaction characteristics. Therefore, the spatial autocorrelation model can be used to analyse the global Moran's I index and local spatial autocorrelation to reveal the spatial correlation characteristics of the economy, environment, and tourism coupling coordination in the western provinces and cities (Table 3).

Table 3: Global Moran's I index of economic, environmental, and tourism coupling coordination in western regions from 2010 to 2020.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Moran'I	-0.271	-0.54	-0.014	0.042	0.067	0.081	0.092	0.15	0.177	0.195	0.221
Z-Value	-1.264	0.258	0.538	0.931	1.11	1.216	1.294	1.701	1.89	2.012	2.21
P-Value	0.206	0.796	0.59	0.352	0.267	0.226	0.195	0.089	0.059	0.044	0.027

From 2010 to 2012, the global Moran's I index was less than 0 and could not pass the significance test, indicating that the regional coupling coordination generally showed negative spatial correlation and dispersed distribution. From 2012 to 2018, the global Moran's I index was greater than 0, but could not pass the significance test, indicating that the western region's coupling coordination generally showed dispersed distribution. In 2019-2020, the global Moran's I index was greater than 0, passed the 5% significance level test, and increased from 0.195 in 2019 to 0.221 in 2020, indicating that the western region generally has significant spatial correlation characteristics and enhanced agglomeration.

The analysis identifies the spatial correlation type of the economy, environment, and tourism coupling coordination among the provinces and cities in the western region (Figure 1). In 2020, there were still significant differences in the coupling coordination among the provinces and cities in the western region, with the system coupling coordination of Ningxia, Gansu, Inner Mongolia, and XJ in the northwest region being relatively low. Chongqing and Guizhou belong to the high-high agglomeration type, while other provinces and cities in the western region are not significant.

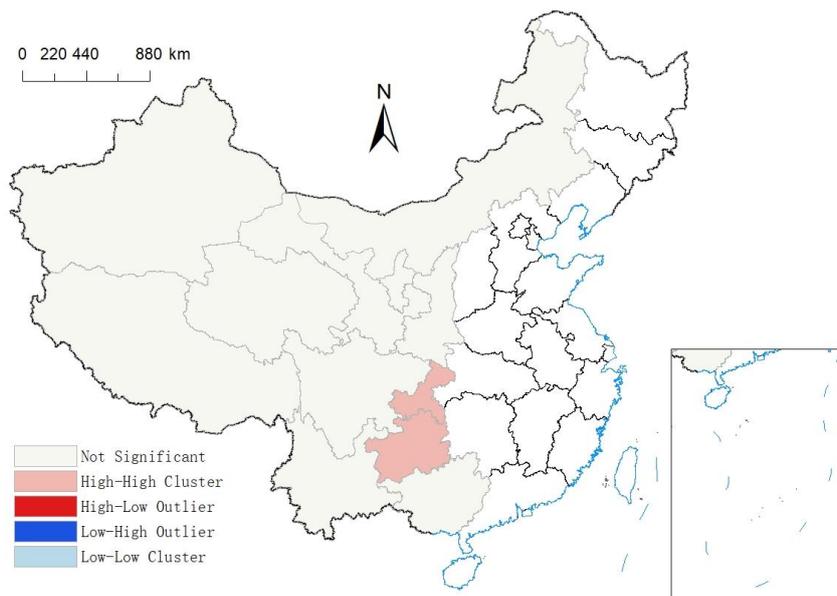


Figure 1: LISA map of the economic, environmental, and tourism coupling coordination in the western region in 2020.

5. Conclusion and Discussion

First, the comprehensive development level of the western region gradually increased during the period of 2010-2019, with a slight decrease in 2020 due to the outbreak of the pandemic. The economic-environmental-tourism coupling coordination degree in the western region showed a linear upward trend from 2010 to 2019, but experienced a certain degree of decline in 2020 due to the impact of the pandemic. Ultimately, the overall coordination level of the western region's three systems reached the category of primary coordinated development.

Second, the economic development and tourism development of various provinces and cities in the western region are moderately correlated, while there is not a significant correlation between the environment and economy or tourism. There are obvious differences in the economic and tourism development of each province and city, and there is a certain level of ranking with the latter being more prominent.

Third, from 2010 to 2019, the overall change in the coordination degree of the economic-environmental-tourism coupling in various provinces and cities in the western region showed a linear upward trend, gradually developing towards a benign coordination direction, and its comprehensive development level increased year by year.

Fourth, as time passed, the comprehensive evaluation levels of economic-environmental-tourism systems of the provinces and cities in the western region underwent different changes, showing certain regional differences in the comprehensive development evaluation levels, with a spatial distribution pattern of higher levels in the south and lower levels in the north.

Fifth, in 2010, the coordination levels of the economic-environmental-tourism coupling in various provinces and cities in the western region were relatively low. However, with the passage of time, the coordination levels became richer, with the addition of two higher-level coordination levels in 2020. The coordination development level of the economic-environmental-tourism coupling in the provinces and cities was enhanced, but there are certain regional differences in the coordination levels.

Sixth, from a spatial structure perspective, the economic, environmental, and tourism system coupling coordination degree of various provinces and cities in the western region basically showed a characteristic of clustered development centred on high values in two periods. However, in 2010, it was centred on Sichuan, Yunnan, and Shaanxi, while in 2020, it was centred solely on Sichuan. The overall coordination levels of the provinces and cities in the western region reflect a transition from barely coordinated development and being on the brink of uncoordinated decline to primary coordinated development.

Seventh, the global Moran's I index of the western region changed from negative to positive, and the index in 2019 and 2020 could only pass the 5% significance test, indicating significant spatial correlation and strong aggregation in the overall western region for these two years. Chongqing and Guizhou belong to the high-high cluster, while other provinces and cities in the west are not significant.

Based on the results of the above analysis, the level of economic-environmental-tourism coupling coordination development of various provinces and cities and the overall western region has been increasing year by year. However, there are significant regional differences and the overall level of coordinated development in the western region is not very high. Therefore, it is necessary to enhance the coordination development level of the three systems in the western region and address the regional differences in the coordination levels of the provinces and cities. To address these issues, it is necessary to strengthen the economic, environmental and tourism exchanges and integrated development among the provinces and cities in the west, advocate for prioritizing environmental protection, utilize the advantages of the ecological environment to develop the tourism industry, promote the healthy development of the economy, and then utilize the healthy economic development to further advance environmental and tourism development, ultimately achieving a harmonious and coordinated development of the economic-environmental-tourism of the western region and its provinces and cities. Additionally, it is crucial to establish a sound support system for the coordinated development of the economy, environment and tourism in the western region and its provinces and cities, such as strengthening organizational support, improving spatial governance support, optimizing relevant policy support and optimizing relevant institutional support.

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