

Spatial and Temporal Changes and Influence Mechanisms of Sports Intangible Cultural Heritage in the Yangtze River Delta Region

Li Kunpeng

Department of Physical Education, Zhejiang Yuexiu University, Shaoxing, 312000, China

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Abstract: In order to clarify the internal dynamics of the development of sports intangible cultural heritage in the Yangtze River Delta (YRD) region and help sports culture integrate into the national strategy of YRD integration and development, GIS spatial information technology, metrological geography and human geography analysis methods are used to explore the historical evolution law, spatial distribution characteristics and influencing factors of sports intangible cultural heritage in the YRD region. The results show that: 1) the number of sports intangible cultural heritage in the historical stage is unevenly distributed, the spatial scale shows a significant agglomerative distribution trend, and the evolutionary trajectory shows a pattern of inland extension; 2) the nuclear density of sports intangible cultural heritage shifts from two nuclei and one band to one nucleus and multiple bands, and the high-density zone in the Taihu Lake basin shifts to the coastal area headed by Shanghai; 3) sports intangible cultural heritage have a significant spatial dependence on a municipal scale, and the Socio-economics is the dominant factor influencing the heterogeneity of sports intangible cultural heritage while natural geography is the foundational factor, among which population size and river density have the most obvious influence on the spatial heterogeneity of sports intangible cultural heritage.

Sports intangible cultural heritage is a people-oriented living cultural heritage that embodies the 5,000 years of Chinese history in terms of social practices, ideologies, economic activities, and the people's customs. These elements form the “essence, spirit, and soul” of the Chinese spirit, language, and cultural identity, with strong national and local feathers and their values lie in historical, cultural, and scientific importance. The Chinese cultural symbols of “essence, vitality and spirit”, include the national language, and embody significant historical, cultural, and scientific values. These symbols are of immense national significance and imbued with distinctive regional character. With the national strategy emphasizing “cultural power” and “sports power,” the extensive and diverse history of sports in China is destined to become a significant part of the nation’s cultural heritage and development. This inheritance is inevitable. Since joining the Convention for the Safeguarding of the Intangible Cultural Heritage in 2004, China has raised the curtain on non-legacy protection throughout the country. After over 20 years of rescue and protection efforts, significant results have been achieved in preserving China’s non-legacy sports, which adds a

colorful contribution to the excavation and inheritance of traditional sports culture in the nation. The globalization wave and increasing urban and rural modernization have disrupted the inheritance chain of sports intangible cultural heritage. The updated concept of cultural consumption poses a significant challenge to sports non-heritage, which is deeply entrenched in the countryside. “Vulnerability” characterizes sports non-heritage. [1] Vulnerability is a common feature of non-legacy sports, as the State Council’s “Opinions on Strengthening the Protection of China’s Intangible Cultural Heritage” notes the growing impact faced by intangible cultural heritage. Therefore, it is imperative to reinforce systematic research on China’s sports intangible heritage.[1]

To this end, a series of explorations have been carried out in the academic world at both the theoretical and practical levels, ranging from value system[2-3], inheritance and protection[1,4-5], dilemma breakthrough[6-7] to digital communication[8-9], which have basically constructed a systematic mechanism for the protection of sports non-legacy in China. In recent years, the cross-disciplinary research paradigm has become a hotspot, and the results of using GIS analysis to reveal the spatial characteristics of sports non-legacy are remarkable. At present, GIS is widely used in the study of sports non-legacy in China, and scholars use the nearest neighbor index, kernel density estimation, Gini coefficient and other methods to analyze the spatial characteristics of sports non-legacy from the national scale, provincial scale and regional scale.[10-12] We have done experiments from the provincial scale[13-15], at regional economic zones[16-18], regional economic zones, watersheds and ethnic minority areas, etc.[19-20] Scholars have also explored the spatial distribution of sports non-legacy from the perspectives of national scale, provincial scale, regional economic zone, watershed and minority area.[10] Some scholars have also used geographic probes to argue the influence factors of sports intangible cultural heritage. However, there is currently no research available on sports intangible cultural heritage evolution and development through GIS spatial analysis of historical sequences. Additionally, there are few research paradigms utilizing geographic modeling. This lack of research hinders the comprehensive understanding of the subject.

In 2018, the integrated development of the Yangtze River Delta (hereinafter referred to as the “Yangtze River Delta”) region was upgraded to a national strategy. As a major node of the “Belt and Road” and the Yangtze River Economic Belt, the Yangtze River Delta creates nearly a quarter of the country’s total GDP and is one of the most active regions with the highest degree of openness and the strongest innovation capacity in China’s economic development. The Yangtze River Delta region is close to the coast, with a prosperous economy and deep culture, and its unique geographical location has given it an advantageous cultural gene with Jiangnan characteristics. As a high-density circle in the spatial distribution of sports intangible cultural heritage in China, the Yangtze River Delta region is rich and colorful in sports intangible cultural heritage resources.[11]Currently, there is a dearth of research on the spatial distribution of sports intangible cultural heritage in the Yangtze River Delta region, with an even greater deficit of in-depth exploration of its spatial and temporal sequence. Therefore, the closest neighbor index, kernel density estimation, and standard deviation ellipse are used to reveal the historical and evolutionary characteristics of sports intangible cultural heritage in the YRD region, and the geographically weighted regression (GWR) model is applied to explore the spatial heterogeneity of the variables in terms of physical geography and socio-economics. It seeks to furnish the YRD regional government with a scientifically sound reference point for ascertaining the spatial distribution characteristics and patterns of sports intangible cultural heritage resources. Additionally, it aims to explore a new model of regional economic and cultural integration development.

1. Data and methods

1.1 Data sources and processing

This study is at the level of the national strategy for the integrated development of the Yangtze River Delta (YRD), and the specific study area includes Zhejiang Province, Jiangsu Province, Anhui Province and Shanghai Municipality (three provinces and one city). The raw data of the sports ICH programs involved in this study were obtained from the official website of China Intangible Cultural Heritage and the ICH websites of the three provinces and one city, and they were included in the list of “Traditional Sports, Amusement and Acrobatics”, which includes national, provincial, municipal and extended lists. The data were processed as follows: 1) Examining the sports NH items one by one, recording the origin of the items in terms of dynasties and attributes, and removing the items with obscure sports attributes, such as juggling, circus, magic, etc.; 2) Converting the items at the provincial level to the provincial level.[11] 3) Discounting provincial items[19], duplicate projects are counted once at the highest level; 4) Using the protection unit as the source address and picking up the coordinates using Baidu Map. As of June 2023, the total number of sports NPOs in the Yangtze River Delta region is 196, including 24 in Anhui Province, 76 in Zhejiang Province, 80 in Jiangsu Province, and 16 in Shanghai.

1.2 Research methodology

1.2.1 Nearest neighbor index

The Nearest Neighbor Index is a geographic measure of the proximity of point-like things to each other in geographic space.[21] It reflects the spatial distribution type of point-like elements. The proximity index is used to characterize the spatial distribution of sports intangible cultural heritage in different historical periods in the Yangtze River Delta region, reflecting the spatial distribution characteristics of sports intangible cultural heritage which are divided into three types: aggregated, homogeneous and random. R refers to the nearest neighbor index, is the average distance value between the closest neighboring points, is the theoretical closest neighbor distance, and D denotes the point density. $R = 1$ spatial distribution is random, $R > 1$ spatial distribution is uniform, and $R < 1$ spatial distribution is cohesive.

1.2.2 Kernel density estimation

Kernel Density Estimation (KDE) utilizes the kernel function to compute the center point of every raster through spatial superposition. It then fits this data to a smooth cone-shaped surface, examining the spatial pattern of sports intangible cultural heritage element points. The resulting data reflects the distribution of point data, with higher kernel density indicating greater spatial clustering of the sports intangible cultural heritage in the region, and vice versa[22-23]

1.2.3 Geographically weighted regression (GWR) analysis

Geographically weighted regression explores the degree of spatial variation of the study object at a given scale by establishing a local regression equation at each point in the spatial scale[27]. The Ordinary Least Squares (OLS) model only shows the overall average effect in the study area without referencing the spatial effect, while the GWR model incorporates the spatial attributes of the study elements into the model. And The regression coefficients vary with spatial location, which is more conducive to reflecting the local spatial heterogeneity of the parameter[28-30]. The GWR model is used to analyze the physical geography and socio-economic influences on the sports

intangible cultural heritage in the Yangtze River Delta area, to study its spatial differentiation characteristics and laws, and the relevant model equations are given below.

2. Characteristics of spatial and temporal distribution of sports intangible cultural heritage in the Yangtze River Delta region

2.1 Types of spatial and temporal distribution of sports intangible cultural heritage

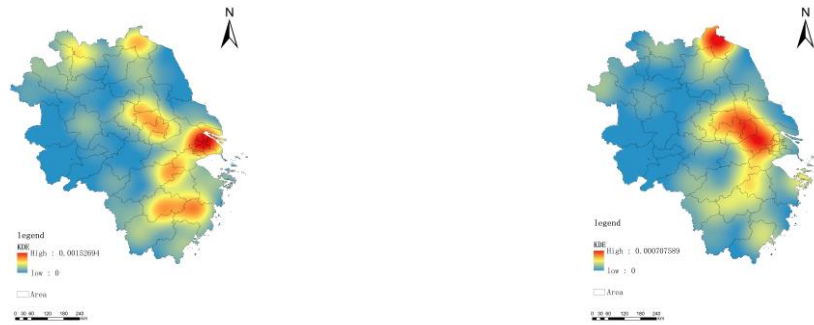
As mentioned in the previous section, a total of 196 items of sports intangible cultural heritage in the Yangtze River Delta region were collated, and 177 items were finalized by eliminating the unattested dynasties of origin with reference to Cui Lequan's[31]. Referring to Cui Lequan's exploration of ancient Chinese sports culture, China is divided into two historical phases for in-depth exploration, namely, the Xia, Shang and Zhou to Sui and Tang periods and the Song, Yuan, Ming and Qing periods. Therefore, the research paradigm of historical orientation and epochal coordinates will be more understandable of the historical history and evolution of the NBLs of sports in the YRD region.

The results of the proximity index show that the nearest-neighbor index R is 0.76 ($p < 0.01$) < 1 and the spatial distribution type is cohesive in the Shang-Zhou-Sui-Tang period; the nearest-neighbor index R is 0.49 ($p < 0.01$) < 1 and the spatial distribution type is cohesive in the Song-Yuan-Ming-Qing period, and the sports intangible cultural heritage of the Yangtze River Delta region of the two historical phases presents a remarkable cohesive distribution state. The spatial distance is of small difference, but there are some differences in the degree of aggregation of sports intangible cultural heritage in different historical stages, indicating that the distribution of sports intangible cultural heritage is not balanced on the municipal scale.

2.2 Differences in the distribution of sports intangible cultural heritage kernel densities

The density of sports intangible cultural heritage in two historical periods is illustrated in Figure 1, which depicts a kernel density that has been mapped and extracted by mask. The density is represented by three main colors that create a red-yellow-blue gradient. Closer proximity to the red color indicates a denser number of sports intangible cultural heritage, while the blue color indicates a more scattered distribution. Technical term abbreviations have been explained upon initial use. Consistent citations and footnotes have been used. Figure 1a illustrates the concentration of “two cores” distribution pattern in the Taihu Lake basin area of Suzhou and Changzhou, as well as in the northeast region of the Yangtze River Delta adjacent to the Yellow Sea. It implies that the water systems, including Hu Po, had a more significant impact on the sports intangible cultural heritage during the Shang period. The Zhou, Sui, and Tang dynasties reveal that sports culture had symbolic importance for those living along rivers and coasts. This is particularly evident in the intangible cultural heritage of sports during the Sui and Tang dynasties. These sports were popular within the region and constitute an essential component of cultural heritage. The formation of cultural origins is a significant aspect, primarily influenced by the Yellow River basin, leading to the creation of a high-value agglomerate in Lianyungang City. As depicted in Figure 1b, a distribution pattern of “a core of multiple points” is evident, centered in the Shanghai City area. The gradual unification of the country after the Song Dynasty, stable political conditions, and the opening of the Maritime Silk Road further solidified the economic status of the Shanghai area, promoting the continuous integration of different nationalities and promoting economic development in the region. The continuous integration of nationalities and the promotion of cultural fusion and mutual understanding led to the formation of a sub-density circle centered around Hangzhou, Nanjing, and Taizhou. The distribution of sports intangible cultural heritage in the Yangtze River Delta region

exhibits a cluster-like pattern, showcasing the impact of natural and humanistic historical factors on the layout of sports intangible cultural heritage.



(a) Shang and Zhou to Sui and Tang dynasties (b) Song, Yuan, Ming and Qing dynasties

Figure 1: Distribution of kernel density of sports intangible cultural heritages

3. Analysis of the Influencing Factors of the sports intangible cultural heritage in the Yangtze River Delta Region

3.1 Selection of Indicators

The formation and development, the spatial distribution of sports intangible cultural heritage are subject to the intertwined effects of two major influences: natural geography and socio-economic factors.[32] This study combines relevant research results and summarizes the influencing factors of the spatial differentiation of sports intangible cultural heritage into two aspects: natural geography and socio-economics, and selects the cross-section data of 2022, with the explanation of the indicators (Table 1) as follows.

Table 1: Selection and meaning of factors influencing the spatial pattern of sports intangible cultural heritage in the Yangtze River Delta region

Variable	Measurement indicators	Data sources	reference point
topography	DEM (meters)	Geospatial Data Cloud	Chang Yuanyuan et al. ^[33]
River density	River length (km)/municipal area (km ²)	OpenStreetMap (OSM)	Yan Shuren et al. ^[34]
Annual precipitation	Total annual precipitation (mm)	Center for Resource and Environmental Sciences	Du Yan and others ^[10]
GDP	GDP (billions of dollars)	Statistical Yearbook	Tian Lei et al. ^[35]
Size of population	Number of resident population at the end of the year (10,000)	Statistical Yearbook	Chang Yuanyuan et al. ^[33]
transport condition	Miles of major roads (km)	Statistical Yearbook	Mushi Lei et al. ^[36]

3.2 Construction of Spatial Regression Models

3.2.1 Constructing OLS models

Firstly, the OLS model was used to test the regression relationship between sports non-heritage and each explanatory variable (Table 2). Known from the whole region, the topography ($t=-0.595$, $p=0.496$), river density ($t=-20.908$, $p=0.162$), and annual rainfall ($t=0.002$, $p=0.149$), the natural geographic factors did not pass the test of significance, which indicates that the natural geography has an influence on sports non-heritage but is not a decisive role; Socio-economic regional economic level ($t=-2.256$, $p=0.023$), population size ($t=3.350$, $p=0.001$), transportation conditions

($t=-2.604$, $p=0.001$) have passed the test of significance, and have a significant impact on sports non-legacy of the Yangtze River Delta, of which the regression coefficients of the economic level and transportation conditions are negative. Conditions' having negative regression coefficients indicates that both have a negative effect on sports intangible cultural heritage. In addition, the values of VIF (Variance Inflation Factor) are all lower than 7.5, indicating that there is no redundancy in this variable.[30]

Table 2: OLS model fitting results

	variant	ratio	std	t-statistic	Stable p-value	VIF
physical geography	constant	2.846 0	4.307 4	0.660 7	0.429 8	-
	DEM	-0.004 0	0.006 7	-0.595 9	0.496 5	1.791 5
	River density	-20.908 9	20.642 6	-1.012 9	0.162 4	1.326 5
	rainfall	0.002 9	0.002 7	1.093 6	0.149 6	2.066 0
Socio - economic	constant	3.575 6	1.519 5	2.353 1	0.002 8	-
	GDP	-0.000 6	0.000 2	-2.256 6	0.023 5*	5.551 4
	population	0.018 1	0.005 4	3.350 8	0.001 3*	6.787 9
	transport	-0.000 3	0.000 1	-2.604 4	0.001 3*	1.988 0

3.2.2 Construction of the GWR model

Table 3: Comparison of OLS and GWR models

	parameters	OLS	GWR
physical geography	R ²	0.096 4	0.330 3
	Calibration R ²	0.023 2	0.152 2
	AICc	246.079 8	244.2643
socio-economic	R ²	0.415 7	0.490 8
	Calibration R ²	0.368 4	0.426 6
	AICc	228.202 2	222.124 3

Since the OLS model does not take the spatial weights into account, it cannot accurately reflect the heterogeneity of the factors. However, the GWR model makes up for this shortcoming. Therefore, in order to further validate the superiority of the model, the GWR model is constructed. The kernel type is selected as Adaptive and the bandwidth method is selected as the AICc method. Besides, the GWR model is constructed under the guidance of the physico-geographical and socio-economic aspects, and is compared with the OLS model. The results show (Table 3) that the R² and the corrected R² of the GWR model for both factors are higher than the OLS model. And the AICc values of the GWR model are all lower than those of the OLS model, which indicates that there is a greater improvement in the goodness of fit of the model and that the model has less error, is more in line with the observed values, and has a better overall performance. Therefore, the regression coefficients of the factors were classified into five categories for visual expression using the natural discontinuity point method (Jenks) (Figures 5-6).

3.3 Spatial dissimilarity analysis of sports intangible cultural heritage based on OLS and GWR models

3.3.1 Physical geography

The formation of regional culture has a close connection with the natural geographic environment in the region because different natural geographic environments form different cultural forms. The spatial distribution of sports intangible cultural heritage is constrained by natural ecosystems, such as topography and geomorphology, hydrological conditions, and rainfall conditions.

1) From the perspective of topography and geomorphology: it's obvious that the Yangtze River Delta region is bounded by the Qinling-Huaihe River. The terrain is low in the north and high in the south, low in the east and high in the west. The northern part is dominated by the plains with open terrain, and the southern part is dominated by the hills with narrow terrain. The terrain varies greatly in the region, as can be seen in Table 2 and Figure 2a. The regression coefficients of the topography and geomorphology are all negative, indicating that topography and geomorphology have a negative impact on the non-heritages in sport, and the impact is the most significant in the region of Zhejiang, as can be seen in Figure 2a. It is weakened from south to north, indicating that the higher terrain area has an unfavorable influence on the sports non-legacy, and the flat terrain area is favorable for the development of the non-legacy.

2) From the river density: as we all know, the south of the Yangtze River is densely populated with Hoops and rivers. The density of rivers in the region is higher than that in the northern Yangtze River Delta, as can be seen in Figure 2b. It can be seen that the greatest impact of river density is in the south-central Yangtze River Delta region, that is, the yellow-orange-red region, located in the south of Jiangsu and Anhui provinces. This region is the core area of the formation of the Wu-Yue culture, the seawater intrusion and flow of the same in the ancient times, the "Boats as vehicles, albums as horses".[37] The hydrological environment promotes the sports non-heritage in the boat boxing, dragon boat racing and lion dance in the generation and development. High river density means that the flat area is reduced. Besides, the sports non-heritage also has a negative impact, especially in the south-central region of Zhejiang Province where the negative impact is the most significant while the northern region of the low density of the river is less impacted. The northern region has been a political center since ancient times, and it is a place of war, with fewer rivers, forming a distribution pattern of sports non-heritages mainly in martial arts, such as Peixian Wushu and Bozhou Xilang Palm.

3) From the rainfall: the difference in precipitation between the north and south of the Yangtze River Delta forms different surface cover, which indirectly affects the distribution of sports intangible cultural heritage. The regression coefficients of Table 2 and Figure 3c are positive, indicating the positive influence of rainfall on sports intangible cultural heritage, while the intensity of the influence in Figure 3c gradually decreases from the north to the south where the influence is more significant, especially in the inland areas of northwestern Jiangsu Province because of the local underdeveloped rivers. The undeveloped rivers in the north, limited drainage, and regular rainfall that floods the land make it difficult to develop sports activities in this area. The distribution of sports has not had a positive impact. However, in the more developed southern region, where there are many rivers including Hu Po, and timely dredging of precipitation occurs, it is easier to develop sports activities. The impact of sports distribution is weaker in this region.

In summary, elevation and river density negatively affect the spatial distribution of sports intangible cultural heritage while precipitation positively affects them, which can be interpreted as low level terrain and sparse river density making it easy for the spatial distribution of sports intangible cultural heritage to take place. The OLS and GWR further verify that the physical geographic factors are the basic factors in the spatial distribution of sports intangible cultural heritages in the Yangtze River Delta, but not the determining factors for the number of sports intangible cultural heritages.

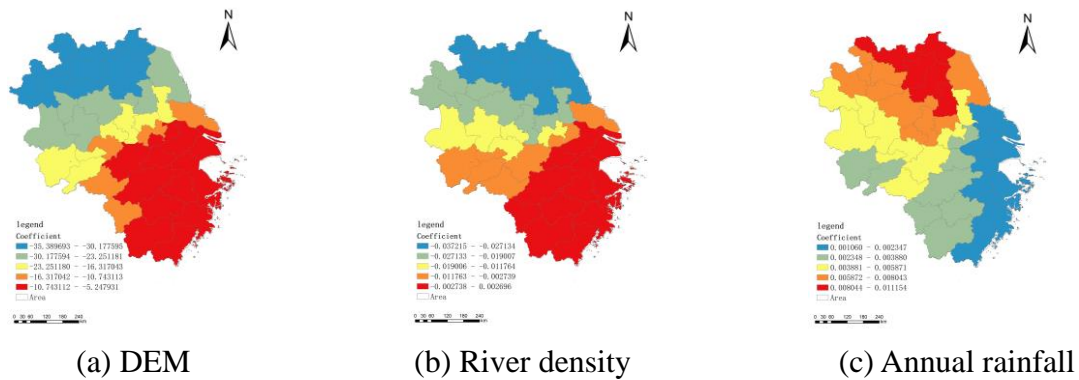


Figure 2: Spatial distribution of regression coefficients of physical geography factors under GWR model

3.3.2 Socio-economic

Non-heritage is the crystallization of human production and life through human activities to show. It is the “living” cultural heritage, and human factors dominate the non-heritage birth, and the distribution of the source of power.[38] The development and protection of sports intangible cultural heritage are affected by regional economic level, population size and transportation conditions.

1) From the level of economic development: sports non-heritage represents an inevitable choice for human inheritance and preservation, as it contributes to both social and economic progress. Table 2 indicates a significant negative value for the level of regional economic development, with spatial attributes taken into account. The regression coefficient for Figure 3a also exhibits a negative value, with the coefficient value reflecting a trend of further increase. Additionally, the trend demonstrates a gradual weakening of impact from west to east. The reason for this is two-fold: Firstly, the western region of Anhui (red area). Currently, there are no sports non-heritages distributed in cities such as Wuhu City and Anqing City. Wuhu City is ranked second in the province’s economic ranking, while Bozhou City is in the top three. However, Bozhou City has a distribution of seven sports non-heritages, exceeding that of the top-ranked Hefei City in both economy and sports non-heritages. Secondly, while Jiangsu Province ranks second in the national economy, it only has two national non-heritage sports, significantly trailing Zhejiang Province, which ranks fourth in the economy (with 12 national non-heritage sports) and has a greater total number of non-heritage sports. The spatial differences can be attributed to the mismatch between the level of economic development and the number of sports that are considered intangible cultural heritage.

2) When considering population size, culture is the outcome of human activities, reflecting both production and lifestyle. Furthermore, sports’ intangible cultural heritage displays a positive correlation with population size. Table 2 and Figure 3b’s regression coefficients are positive, indicating the positive influence of sports’ intangible cultural heritage on population size. Figure 5b illustrates a gradual weakening trend in the intensity of the impact from east to west. The effect is particularly significant in the eastern coastal areas of Jiangsu Province. The total population of eight cities in the eastern region represents 52% of the province, while the sports non-legacy accounts for 61%. It is noticeable that sports non-legacy also exhibits an agglomeration phenomenon with an increase in population size. This pattern corresponds with the spatial autocorrelation analysis of the sports non-legacy conducted previously. Meanwhile, as the population size decreases from east to west, the degree of its impact demonstrates a decreasing trend, reaching a minimum in the western part of Anhui Province. As previously noted, the population in this region is small, and there is no

widespread distribution of sports intangible cultural heritage.

3) From the view of transportation conditions: transportation is an important factor in measuring the advantages and disadvantages of geographic location, but also an important channel for the cross-regional intermingling of sports intangible cultural heritage culture. Table 2 and Fig. 3c show that the traffic conditions present a negative effect on the distribution of sports intangible cultural heritage with a tendency to weaken from southwest to northeast, and the effect is more significant in southern Zhejiang and western Anhui. The southern region of Zhejiang is predominantly hilly with many peaks, which affects the traffic conditions to a certain extent. In addition, the number of sports intangible cultural heritage in the five southern municipalities of Zhejiang accounted for 48% of the whole province, so it's concluded that the locational traffic, to a certain degree, has a negative effect on the number of sports intangible cultural heritage. It has a negative effect, and it moves to the northeast. The flat terrain and well-developed transportation in the eastern part of Jiangsu have minimal impact. Accessible transportation supports the lifestyle needs of the people and promotes the creation and development of intangible cultural heritage related to sports.

To sum up, the level of economic development and transportation conditions have a negative impact on the sports non-heritage, while the population size has a positive effect on it, which can be seen from the factors affecting the distribution of sports non-heritage are more complex. The level of economic development is not the only factor, while the population size is the dominant factor affecting the distribution of sports non-heritage. In addition, the mismatch between the geographical distribution of sports intangible cultural heritage and statistical units is also one of the reasons for the different results of the regression analysis.

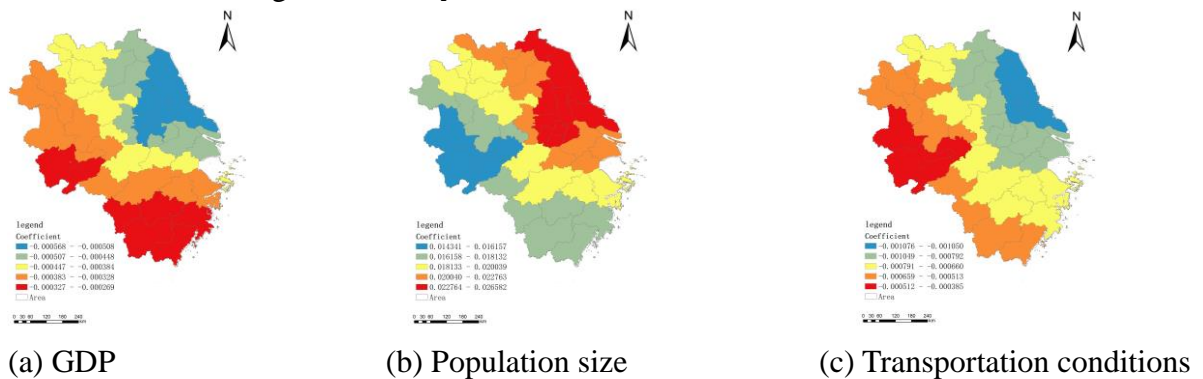


Figure 3: Spatial distribution of regression coefficients of socio-economic factors under the GWR model

4. Conclusion and discussion

4.1 Conclusion

The high-quality development of the Yangtze River Delta region cannot be achieved without the support of cultural soft power. The inheritance and protection of sports non-legacy is an important link between linking and promoting the culture of the Central Plains and the culture of the Jiangnan region, and it is an important approach to boosting cultural coexistence and building a spiritual home together. This study examines the spatial and temporal evolution pattern and heterogeneity of sports NBL in the Yangtze River Delta region under the background of national rejuvenation and culture, and the conclusions are as follows:

(1) The distribution of sports intangible cultural heritage in the Yangtze River Delta region at both historical stages shows a clustered distribution. There is a difference, however, in the nearest neighbor index, and the distribution of sports intangible cultural heritage has a tendency to cluster

with the passage of historical time.

(2) From the spatial density, it can be observed that from the Shang and Zhou to the Sui and Tang dynasties, there was a distribution pattern of non-legacy sports that exhibited “two nuclei”. This pattern was primarily distributed along the Taihu Lake basin and the northeast region of Jiangsu. This pattern continued to exist during the Song, Yuan, Ming, and Qing dynasties. Sports non-legacy presents a “nucleus of the distribution of multiple points” pattern. The “nucleus” is concentrated in the Shanghai area, while “multiple points” are located in the Taihu Lake basin and the northern and central areas of Zhejiang Province. A “core” is also concentrated in the Shanghai area, with “multi-points” in the Taihu Lake Basin and the northern and central areas of Zhejiang Province.

(3) By applying Ordinary OLS and GWR models, the study reveals that natural geographic factors in the north-to-south region of the strip exhibit a significant trend. Moreover, elevation and river density exert a harmful effect on the non-legacy sports. Societal and economic conditions in the east-to-west region of the strip demonstrate a similar trend, with economic level and transportation conditions playing a negative role. Population size is the strongest positive explanatory variable for the factors.

4.2 Discussion

(1) The formation and growth of sports intangible cultural heritage in the Yangtze River Delta is primarily established by historical factors. The sports intangible cultural heritage in the Yangtze River Delta region has undergone five climaxes throughout historical evolution, including the Spring and Autumn and Warring States Periods, the Tang Dynasty, the Song Dynasty, the Ming Dynasty, and the Qing Dynasty. This sequence of growth indicates that the prosperity of each dynasty propelled the development of sports intangible cultural heritage. The formation of this cultural heritage also shows a trend of expansion, corresponding with the relocation of the national regime and the boundaries’ expansion. As the state extends its reach and territory grows, the sphere of sports non-heritage expands, following a predictable trajectory. The government must create tailored policies to unearth the Yangtze River Delta region's profound sports non-heritage, recognize culturally significant folk sports as sports cultural heritage, and optimize distribution patterns.

(2) The number of sports intangible cultural heritage in the Yangtze River Delta is unevenly distributed, and the nuclear density as a whole presents a distribution situation of one nucleus and multiple belts. High-density areas can make use of the siphon effect to shape the brand, improve the visibility, and explore the construction of sports intangible cultural heritage cultural agglomeration and pioneer demonstration zones, whereas the low-density areas should strengthen the protection and inheritance of sports intangible cultural heritage, and at the same time, intensify excavations and declarations of sports intangible cultural heritage in the region, thus promoting the overall optimization of sports culture in the Yangtze River Delta Region.

(3) The non-legacy of sports in the Yangtze River Delta region shows a strong spatial dependence, so in the future, the aim should be based on the spatial union of non-legacy of sports and be guided by the “Eight-Eight Strategy”. In developing local communities, it is important to consider regional advantages and available resources. In the case of western regions, which have less developed natural environments and societies compared to the eastern regions, policies should focus on providing guidance and support, establishing specialized management and protection mechanisms, and promoting self-reliance. This approach will help the region to play a vital role in supporting the overall functioning of the country. The natural environment and social development in the western region are inferior to those in the eastern region. Therefore, the policy needs strengthening and tilting to create a specialized management and protection mechanism to fulfill its vital blood-forming function. The economically developed and conveniently located eastern region

ought to establish a long-term plan for the development of sports non-legacy. This will evade the negative effects of urbanization and over-commercialization on the originality and authenticity of sports non-legacy, hence promoting sustainable development.

(4) Due to the limitation of conditions, the origin of some sports non-legacy programs cannot be verified, which leads to certain errors in the results of the spatial development direction. In the future, more diversified and scientific influencing factors will be further selected for demonstration and exploration.

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