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Research on Spatial Distribution Characteristics and Correlation Degree of the Historical and Cultural Towns (Villages) in China

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Abstract: Historical and Cultural Towns (Villages) (HCTVs) are the important parts in the recordation of the traditional culture, folk customs and architectural art in China. However, with the rapid development of the economy and rural urbanization, these towns and villages are faced with a series of problems, such as traditional features lost, traditional architecture destroyed and the lack of a long-term comprehensive and effective plan for scientific conservation measures. As a result, these historic heritages and their surroundings are in a serious crisis and will be destroyed to a certain extent. This paper chose 799 HCTVs as objects of this study, which were published by the Department of Housing Construction. The distribution features and mechanism have been analyzed with thesupport of GIS technology. In addition, the spatial correlation between elevation, stream, transportation, traditional culture and language was also explained through spatial overlay analysis. Through the statistical comparison and cluster analysis, it explored natural and human factors with the influence of HCTV distribution. The purpose is to help us make selection more reasonable and offer a reference of development of regional tourism for the future. The results showed that: (1) The spatial distribution of HCTVs clearly varies among different regions of China, and four concentrated typical areas are found in the Shanxi-Hebei-Henan border area, southeast coastal zone, Sichuan-Chongqing-Guizhou border area and Hunan-Guangxi border area. (2) The distribution characteristics have a peculiar style in the countryside and have a trend of cluster around a geographic line (e.g., a traffic line, a river) and a small town. (3) The HCTV has different characteristics in spatial form, river system distribution, regional culture and transportation system. The majority of them are distributed along the river and are cultural centers, traffic hubs and birthplace of civilizations in history. (4) Natural geographical environment, current population distribution patterns, level of regional economic development, accumulation of historic and cultural heritages, as well as rules and standards in the definition of HCTV, are the main factors affecting the spatial distribution. The purpose of this paper is to help us select more reasonable criteria and rules in the process of HCTV selection.

Keywords: historical and cultural towns (villages); spatial distribution; spatial relationship; GIS; China

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1. Introduction

In order to develop traditional national culture, protect the traditional pattern and historical appearance of towns and villages, and promote the inheritance and continuity of excellent traditional architectural art, the Chinese Ministry of Housing and Construction and the Bureau of Cultural Heritage have jointly promulgated the Selection Measures for Historical and Cultural Towns (Villages) (HCTV) since 2003 and have selected seven batches of famous Chinese HCTV, including 312 famous cultural towns and 487 famous historical and cultural villages as of June 2021 [1,2]. An HCTV is a town or village with regional cultural characteristics that are particularly rich in preserved cultural relics, have significant

historical value or commemorative significance and can reflect the traditional appearance and local ethnic characteristics of some historical periods [3]. HCTVs can reflect the traditional culture and national customs formed in different regions, different ethnic groups and different historical periods and are an important means to inherit excellent traditional culture and promote regional national spirit, as well as an important way to develop cultural tourism in towns and cities and to promote green economic development [4,5]. Therefore, it is of great significance to study the distribution pattern and regional ethnic characteristics of famous HCTVs in China and their spatial correlation.

Seen from the current research on HCTV field, many studies have their own characteristics such as historical perspective [6,7], geographical perspective [8,9], economic perspective [1,10] and cultural perspective [11]. Abroad, an HCTV is called a small historic town, old village or hamlet [12–14], and the research mainly focuses on the distribution of villages and the town's spatial structure [15,16], heritage value [17], landscape pattern [4,18,19], and influence factors [7,20,21]. Especially since entering the 21st century, in some places such as Europe and the United States, the scholars have focused on the ancient buildings, ancient villages and historical towns. In recent years, Geographic Information System (GIS) spatial analysis methods are used for historical, cultural and tourism geography research. It has become a new trend in the development of related social science research, such as historical, cultural and tourism geography. For example, Derek et al. [13] studied the land use value of the cultural town and forest tourism by using geospatial data, which has the function of temporal and spatial visualization and has strong practicality. Hadjimitsis et al. [22] used remote sensing data to explore natural culture through the spatial overlay analysis method to find out the natural and man-made risks arising from the exploitation and utilization of heritage. Michael et al. [23] analyzed the application of GIS in tourism geography and concluded that spatial visualization of GIS has unique advantages in its result displays. Sun et al. [16] analyzed the application of GIS technology in the development of cultural heritage digital resources and believed that its combination with survey data can comprehensively develop and utilize ancient cultural resources. It can be seen that research studies in ancient towns, ancient villages and cultural heritage have the characteristics of depth, practicality, and frontier and can introduce the latest technologies and ideas into the theoretical research [14,24].

In China, the research on HCTVs began in the 1990s, and some criteria was proposed by Liu Peilin [25]. He was the first to propose selection conditions that took into account the historical environment, special historical commemorative value, commemorative symbols and special residential characteristics, which laid the foundation for the selection criteria for later Chinese historical and cultural villages. In the 21st century, a large number of domestic scholars have made a lot of achievements in the field of HCTV in China. As seen from the research content, the research on HCTVs in China mainly focuses on the evaluation system [2], protection and utilization [3,26], cultural value excavation [27], spatial structure [28,29], tourists' perceptions [12,28], environmental impact [7,30] and tourism development [15,31,32]. Research on the spatial pattern of famous historical and cultural villages and towns was divided into two stages Before 2010, the research method was mainly mathematical and statistical, and after 2010, the spatial analysis function of GIS was mostly used. However, there are several shortcomings in the research in the HCTV field on a different scale: (1) Existing studies have focused more on individual villages, and fewer studies have comprehensively studied the spatial distribution characteristics of famous HCTV on a larger scale; also, fewer studies have been conducted on the causes of the spatial distribution of famous HCTVs. (2) Seen from the study areas, most research on HCTVs mainly focus on province, watershed and cultural concentration area, but fewer studies refer to a national scale or intercontinental area. Generally, the research about HCTVs, at present, is still concentrated in the spatial form level based on the disciplines of geography and landscape architecture, which is needed to further enhance the comprehensive study with the perspectives of anthropology, sociology, economics and culture and management [25].

With the development of rural transformation, the protection and utilization of cultural features of HCTVs are facing multiple pressures, such as cultural protection and economic development. The spatial layout and evolution mechanism of HCTVs have quickly become a research hotspot. With the deep integration of cultural geography, tourism geography and big data in the future, spatial analysis and spatial visualization tools will play an important role in distribution characteristics and influence factors [33,34]. This kind of leading and advanced perspective should be deeply and widely applied to improve the ability of sustainable use of the advanced culture. The spatial statistical method integrated GIS technology proposed in this article can explore the spatial evolution rule of HCTVs from the perspective of spatial visualization and can find the influencing factors, so as to improve the understanding and experience of the management and better promote the protection and utilization of the HCTV landscape.

The scientific objectives of this study are: (1) to explore the spatial distribution characteristics of HCTV; (2) understand the relationship between distribution pattern and natural or socio-economic factors and which main factors have affected the distribution pattern at present; (3) how to efficiently and sustainably protect and utilize HCTVs in the future.

2. Data Sources and Processing

The National Tourism Administration and the Ministry of Housing and Urban-Rural Development have announced 799 Chinese HCTVs since 2022, of which 312 are famous historical and cultural towns and 487 are famous historical and cultural villages. To keep up with the latest data, the traffic, water system and GDP data used in this article have been updated to 2022. Some of the traffic and water system data were updated with the help of Google Earth and GF images, which were obtained from the geographic data spatial cloud (http://www.gscloud.cn/) (accessed on 21 June 2022). The data processing is as follows: firstly, the names and locations of HCTVs were collected and the geographical coordinates of each place with the help of Google Earth were obtained. Secondly, HCTVs and information tables were imported into ArcGIS10.4 to establish a basic database. Thirdly, their spatial characteristics and the influence factors were analyzed by means of spatial superposition and kernel density based on establishing a grid (Table 1).

Table 1. Data sources and methodology.

	Data	Data Sources	Analysis Methods	Analysis Tools
Spatial distribution	Map of Chinese famous towns & villages in history & culture Spatial Boundary Vectors	The National Tourism Administration The Ministry of Housing and Urban-Rural Development Google Earth National Earth System Science Data Center	Nearest Point Index Analysis Kernel Density Thiessen Polygon Analysis of the Evolution of Concentration Trends Mesh Fractal Dimension	ArcGIS10.4 Google Earth Excel2016 Origin8
Physical geographical elements	Topographical Map of China Map of China's Rivers and Lakes	Physical Geographical Atlas of China Map of China Physical Geography of China National Earth System Science Data Center	Overlay Analysis Buffer Analysis Quantitative Statistical Analysis	ArcGIS10.4
Human geographic elements	Map of Prefecture-level Cities Road and Rail Traffic Data County-level Population Data County-level Economic Data	Map of China Google Earth China Economic Statistics Yearbook	Euclidean Distance Overlay Analysis Buffer Analysis Quantitative Statistical Analysis	ArcGIS10.4 Excel2016 Origin8
Traditional culture	Cultural and Geographical Map of China	Chinese Language Atlas Chinese Cultural Geography	Overlay Analysis Quantitative Statistical Analysis	ArcGIS10.4

The distribution of HCTVs is strongly linked to the areas where people live, their language and their culture. There are different local cultures and living conditions with different languages, historical cultures and living areas. The books of "The Atlas of Chinese Languages" and "The Cultural Geography of China" were used to classify HCTVs into different types based on regional languages, living areas, history and culture (Table 2). The

Thiessen polygons were also created and then clipped and dissolved through geoprocessing tools under ArcGIS 10.4 analysis tools. The attribute area maps were obtained according to the Thiessen polygons results (Figure 1).

Table 2. The HCTV classify result of China.

	Classification Basis	Classification Results
Chinese famous HCTV	Regional languages (LD)	1 Northeast Mandarin 2 Beijing Mandarin 3 Jilu Mandarin 4 Jiaodong Mandarin 5 Central Plains Mandarin 6 Jianghuai Mandarin 7 Lanyin Mandarin 8 Southwest Mandarin 9 Jin Dialect 10 Hakka 11 Cantonese 12 Wu Dialect 13 Hokkien 14 Gan Dialect 15 Immigration Mandarin 16 Hmong Dialect 17 Xiang Dialect 18 Hui Dialect 19 Military Dialect 20 Tibetan 21 Qiang Dialect 23 Salar Dialect 30 Uyghur Dialect
	Living areas (LA)	1 Xinjiang Desert-Oasis 2 Tibetan Plateau 3 Inner Mongolia grassland 4 Loess Plateau 5 Sichuan Basin 6 Yunnan-Guizhou Plateau 7 Black soil living area in northeast China 8 North China Plain 9 Jiangnan water town 10 Mazu cultural in south China
	History & Culture (HC)	1 Qilu Culture 2 Yanzhao Culture 3 Sanqin Culture 4 Sanjin Culture 5 Chu Culture 6 Wuyue Culture 7 Bashu Culture 8 Guandong Culture 9 Hui Culture 10 Lingnan Culture 11 Frontier Ethnic Culture

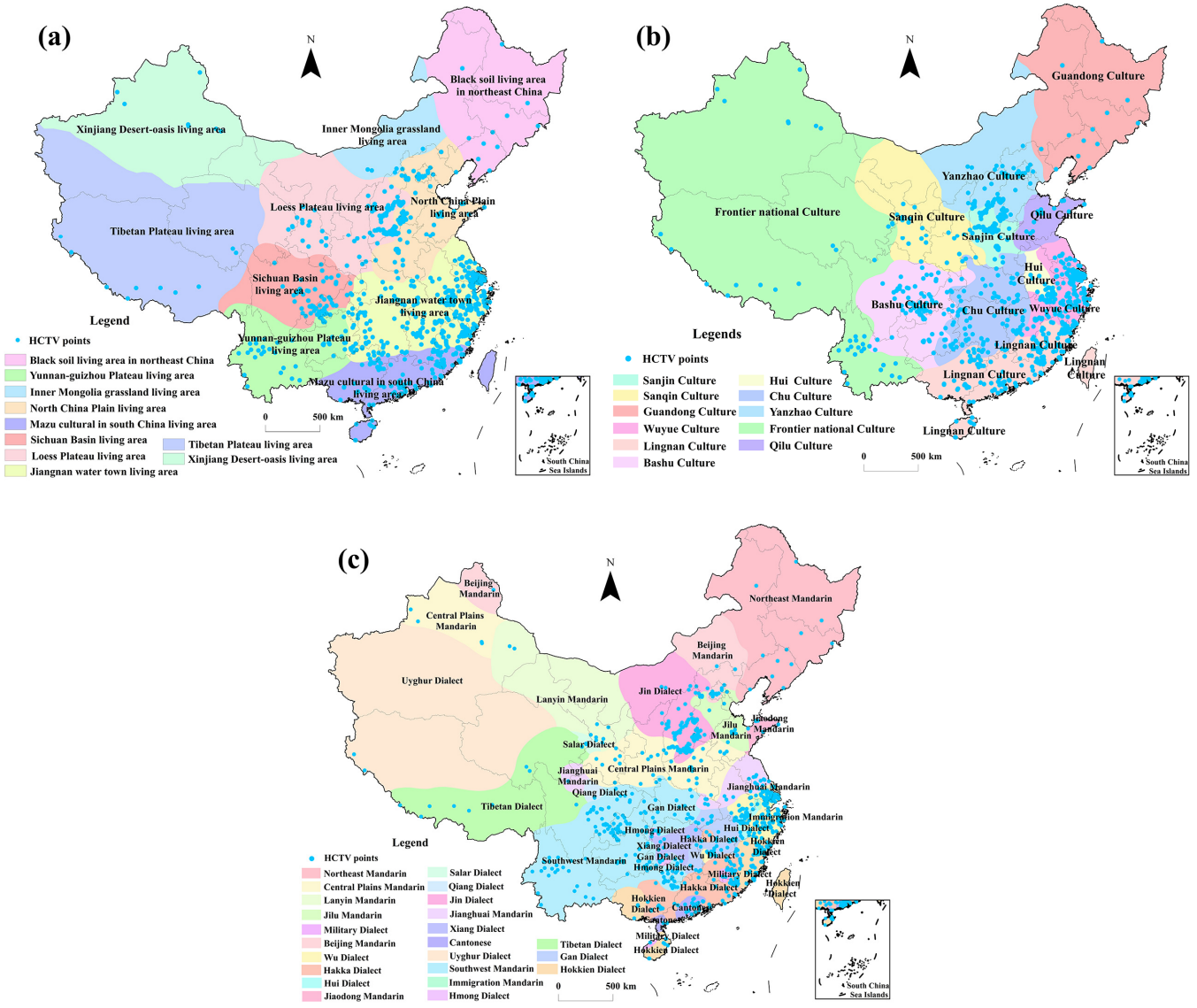

Figure 1. Living areas (**a**), History & culture (**b**) and Regional language (**c**) in China.

3. Methodology

3.1. Nearest Neighbor

In order to understand the distribution characteristics, Nearest Neighbor Index (NNI) was used to calculate the aggregation. The NNI was commonly used to determine the type of spatial distribution of tourism elements [35]. It is the ratio of the actual nearest distance between points to the theoretical nearest distance, and the nearest distance r_E is the average distance between each point and its nearest point distance r_1 [21], and the formula is as follows:

$$r_E = \frac{1}{2\sqrt{n/A}} = \frac{1}{2\sqrt{D}} \tag{1}$$

$$R = \frac{\overline{r1}}{r_E} = 2\sqrt{Dr_1} \tag{2}$$

where n is the number of points, A is the area of the region, D is the density of points, r_E is the average distance of the nearest neighbor points in the random distribution model, $\overline{r_1}$ is the average of the distance r_1 between the nearest neighbour points, and R is the nearest neighbor index. When $R = 1$, $r_1 = r_E$, it means that the point element is randomly distributed; when $R > 1$, $r_1 > r_E$, it means that the point element is uniformly distributed, and when $R < 1$, $r_1 < r_E$, it means that the point element is agglomerated.

3.2. Kernel Density

Kernel density can reflect the spatial dispersion and agglomeration characteristics of geographical elements [27]. The numbers and location of HCTV distribution can be judged according to the results of kernel density. The results can be displayed by a spatial map using ArcGIS software, which can directly express the geographical distribution characteristics. Its formula is:

$$f_n(x) = \frac{1}{nh^d}\sum_{i=1}^{n} k(\frac{x - X_i}{h}) \tag{3}$$

where n is the number of points, h is the bandwidth, d is the dimensionality of the data, $k()$ is the kernel function, x and X_i are the spatial sample points and $(x - X_i)$ is the distance from the estimated point to the actual point.

3.3. Grid Dimension Analysis

In order to analyze the spatial distribution of HCTVs more clearly and display the results in detail and visually, the grid-based analysis was used to calculate the even or centralized or random distribution. The number of grids $N(r)$ occupied will vary with the grid size r [36]. By calculating the grid with row number i and column number j, each type of the number N_{ij}, and the total number of the whole area N, the probability P_{ij} can be defined as $P_{ij} = N_{ij}/N$. According to this principle, the amount of information can be calculated as follows:

$$I(r) = -\sum_{i}^{k}\sum_{j}^{k} P_{ij}(r) \ln P_{ij}(r) \tag{4}$$

where $k = 1/r$, k is the number of segments of the region; $P_{ij} = N_{ij}/N$, and r is the size of grid. If it is fractal, the amount of information should be:

$$I(r) = I_0 - D_1 \ln r \tag{5}$$

where I_0 is a constant and D_1 is the information dimension. D_1 is measured by grid analysis. Under normal circumstances, the information dimension D_1 is between 0 and 2, which reflects the equilibrium of attractions in the region. When $D_1 = 0$, it means that all attractions are concentrated in one point. Otherwise, when $D_1 = 2$, it means that the attractions in the region are evenly distributed. The larger D_1 means that the spatial distribution of the

elements in the attraction system is more balanced, and, on the contrary, more concentrated. When D_1 is near to 1, it means that the attraction system has the tendency to concentrate on a certain geographical line (e.g., railway, road, river, etc.) [37].

3.4. Evolution Trends Analyze

The standard deviation ellipse can be used to describe the spatial variation of geographical phenomena such as the evolution trend [38]. It is the equilibrium polygon where geographical elements remain evenly distributed and is an important indicator for describing the spatial distribution of geographical phenomena. The standard deviation ellipse reflects the central, discrete and directional trends of geographic elements [23] and is calculated as:

$$SDE_x = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \overline{X})^2}{n}} \tag{6}$$

$$SDE_y = \sqrt{\frac{\sum_{i=1}^{n} (y_i - \overline{y})^2}{n}} \tag{7}$$

where x_i and y_i are the coordinates of element i, $\{\overline{X}, \overline{Y}\}$ denotes the mean centre of the element and n is the total number of elements. The angle of rotation is calculated as follows:

$$\tan\theta = \frac{A + B}{C} \tag{8}$$

$$A = \left(\sum_{i=1}^{n} \widetilde{x_i}^2 - \sum_{i=1}^{n} \widetilde{y_i}^2\right) \tag{9}$$

$$B = \sqrt{\left(\sum_{i=1}^{n} \widetilde{x_i}^2 - \sum_{i=1}^{n} \widetilde{y_i}^2\right)^2 + 4\left(\sum_{i=1}^{n} \widetilde{x_i}\widetilde{y_i}\right)^2} \tag{10}$$

$$C = 2\sum_{i=1}^{n} \widetilde{x_i}\widetilde{y_i} \tag{11}$$

where $\widetilde{x_i}$ and $\widetilde{y_i}$ are the deviations of the coordinates from the mean centre.

The standard deviations of the x and y axes are:

$$\sigma_x = \sqrt{\frac{\sum_{i=1}^{n} (\widetilde{x_i}cos\theta - \widetilde{y_i}sin\theta)^2}{n}} \quad \sigma_y = \sqrt{\frac{\sum_{i=1}^{n} (\widetilde{x_i}sin\theta - \widetilde{y_i}cos\theta)^2}{n}} \tag{12}$$

4. Results and Discussion

4.1. Spatial Distribution Characteristics of HCTV

Based on the spatial distribution of HCTV, the actual observed mean distance and the expected mean distance between HCTV were calculated using the average nearest neighbor distance tool of ArcGIS 10.4, which were 40,202.7431 m and 82,190.4560 m, respectively. The nearest neighbor ratio index R was 0.4891, and the z-score was -22.4568 with a significance level of $p < 0.01$, which indicated that HCTVs displayed a typical clustering distribution pattern. The overlay of HCTVs and the boundaries of the four geographic regions (Figure 2a) showed that HCTVs in China were concentrated in the southern and northern regions with the numbers of 400 and 100, respectively, while the northwestern region (the number was 15) and the Qinghai-Tibet Plateau region (the number was 13) were sparsely distributed, only accounting for only 5% of the total. According to the density distribution map (Figure 2b), it can be seen that the distribution of HCTVs in China showed four concentrated distribution areas including North China, Southwest China, junction areas between the South and Central China, and East China. The distribution of HCTVs in China presented two characteristics: (1) The regional distribution was obviously uneven, with the number in the eastern region accounting for more than 80% of the national total, while the number of northwestern region and the Qinghai-Tibet Plateau region was less

than 10%. (2) It presented a cluster distribution forming four major agglomerations: Hebei-Shanxi-Henan gathering area, Jiangsu-Zhejiang-Anhui-Jiangxi-Fujian-Shanghai gathering area, Sichuan-Chongqing-Guizhou gathering area and Hunan-Guangxi gathering area.

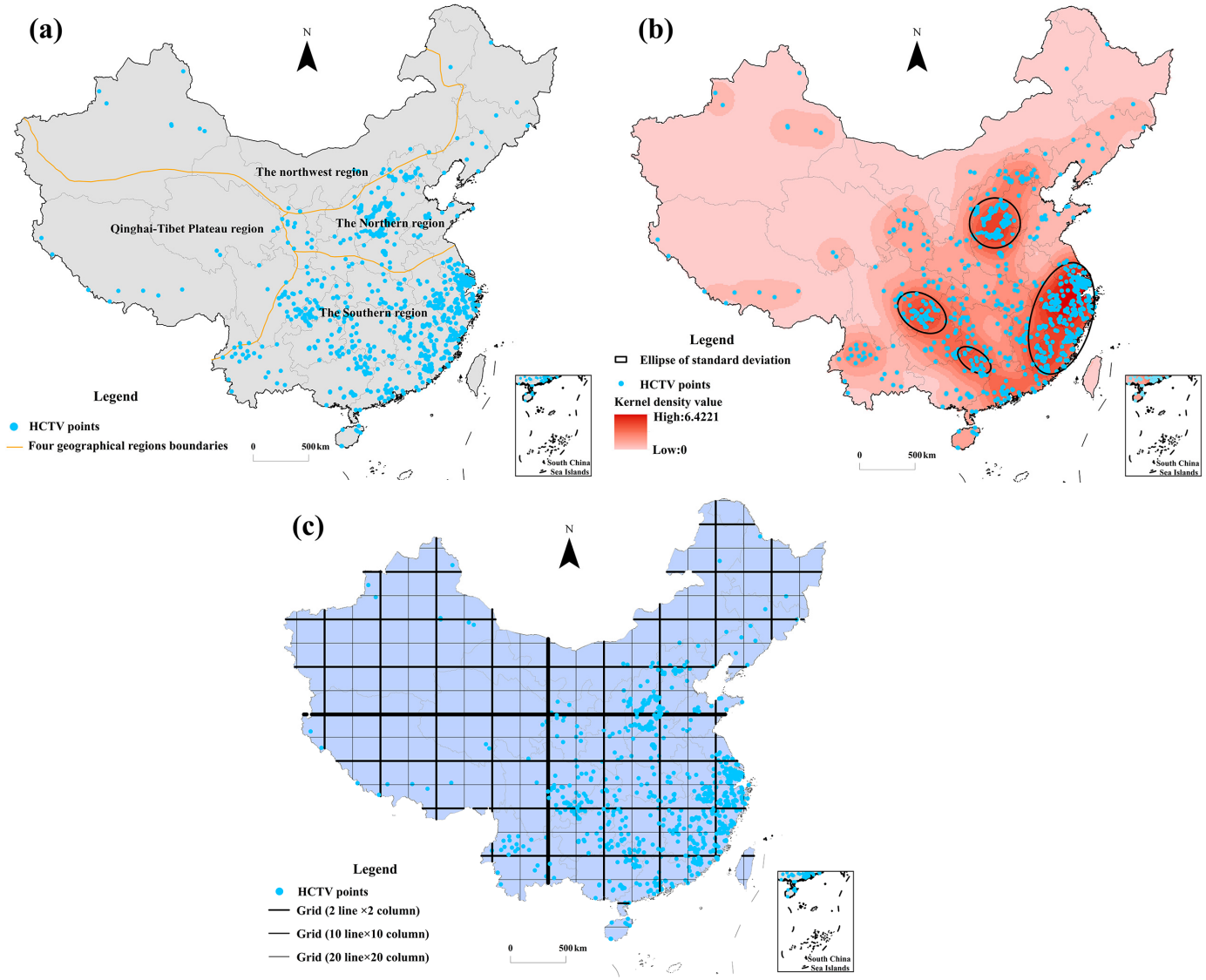

Figure 2. Spatial distribution (**a**), kernel density map (**b**) and grid partition (**c**) of HCTVs in China.

In addition, the spatial equilibrium of HCTVs is studied by using the grid dimension model and grid classification method (Figure 2c). The results were showed (Figure 3) that the spatial structure of HCTVs in China has obvious fractal characteristics (the measurement coefficient is 0.992), and the capacity dimension D_0 is 1.297, indicating that the HCTV distribution is relatively concentrated and tends to concentrate on a certain geographical line (water system and traffic). According to the calculation results, D_1 (0.642) is much smaller than D_0, and D_1 is less than 1, which indicates that the spatial fractal structure of HCTVs is relatively complex; and it also reflects that the fractal body (HCTV) in the study area is partially clustered around a certain center in the process of system self-organization evolution (Table 3). Combined with the distribution map of prefecture-level cities in China and the spatial distribution map of HCTVs in China, it can be seen that HCTVs tend to cluster in places with a good natural environment and social and economic conditions, and factors such as topography, water system, transportation, and surrounding towns are more influential.

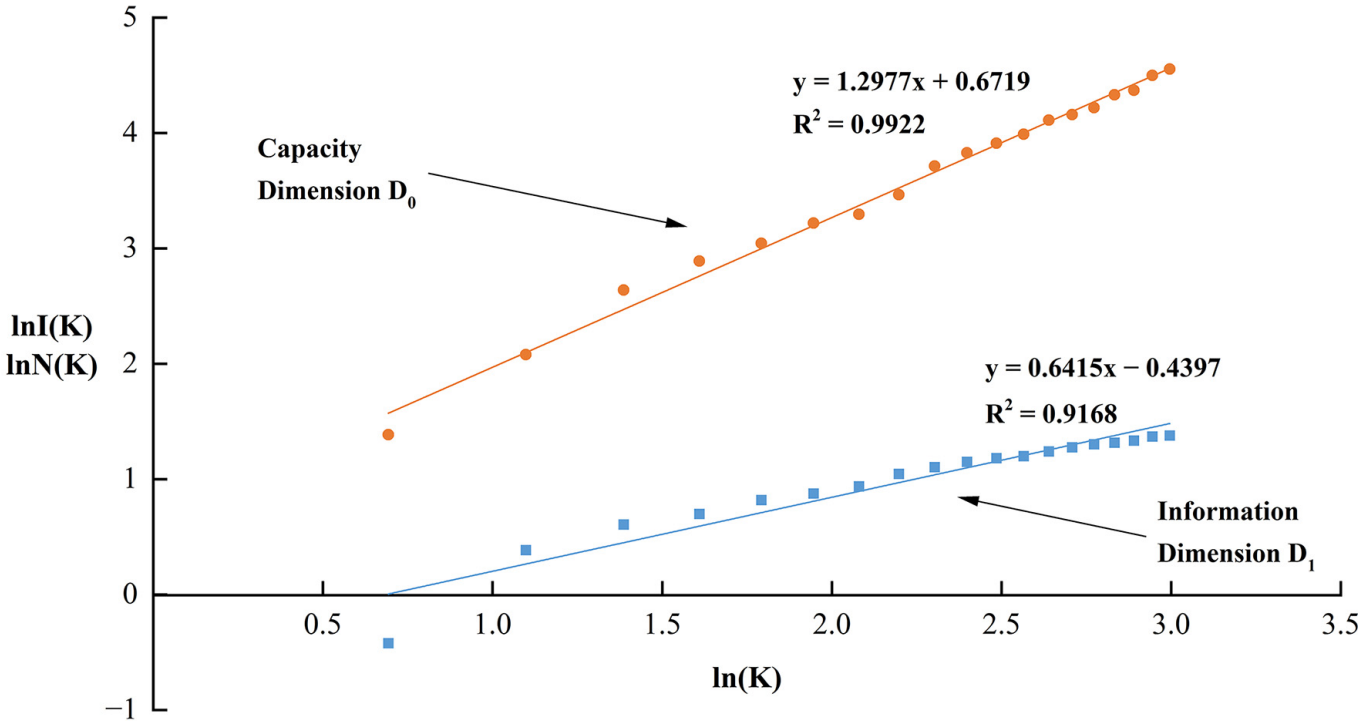

Figure 3. The ln-ln plot for grid dimension of HCTV in China. *K* is the number of segments on each side of the region; *I* is the fractal dimension of the network; *N* is the total number of points in the whole region.

Table 3. The calculated result of grid dimension of HCTVs.

K	2	3	4	5	6	7	8	9	10
N(r)	4	8	14	18	21	25	27	32	41
I(r)	0.6568	1.4711	1.8341	2.0109	2.2711	2.4028	2.5539	2.8442	3.0198
K	11	12	13	14	15	16	17	18	20
N(r)	56	50	54	61	64	68	76	79	95
I(r)	3.1589	3.2599	3.3174	3.4566	3.5832	3.6804	3.7318	3.8015	3.9667

4.2. Spatial Correlation Analysis

4.2.1. Spatial Correlation between HCTV and Natural Environment

Topography restricts the distribution of water and heat, soil fertility status, and traffic accessibility, which are important factors for population concentration, village formation, and historical and cultural development, and thus becomes an important reason for the spatial distribution of HCTVs. The spatial relationships between topography, climatic region and HCTV distribution (Figure 4a) were analyzed. The geographical distribution of HCTVs has significant variability, and they are mainly distributed in the third and second terraces and their junctions, with the third terrace, particularly being the most numerous and densely distributed. From the perspective of the altitude of distribution, it is mainly distributed in flat terrain below 500 m. From the perspective of quantity distribution, there are 573 places in the area of 0–500 m, 129 places in the range of 500–1000 m, 70 places in the range of 1000–2000 m, 17 places in the range of 2000–3000 m, and only 10 places in the range of more than 3000 m.

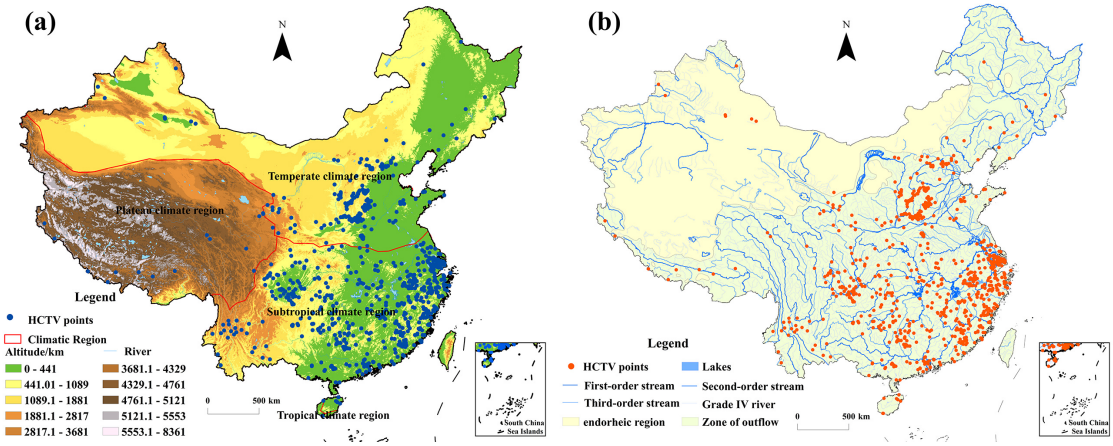

Figure 4. Relationship between natural topography (**a**), river (**b**) and HCTV in China.

From the distribution of climate regions, HCTVs are mainly distributed in subtropical climate regions and temperate climate regions; the number of HCTVs is 542 and 236, respectively. They account for about 97.37% of the total number of HCTVs. It was found that the distribution of HCTVs is directly affected by different climate region. Especially in the subtropical climate region, it is the most important concentrated region of HCTVs because of the suitable air temperature, humid climate, flat terrain and comfortable environment. Generations of people have lived here for a long time, gradually forming the distinctive language, architecture, history and culture of the landscape, which synthetically constitute the key reason of the concentrated distribution of HCTVs.

In addition, the water system is also the basis and guarantee of human survival and development and an important place for human activities. There is a longer history of human development, more tourism resources, and more historical and cultural relics along the water system. The distribution of water resources affects the patterns of traditional culture and historical architecture (Figure 4b). To specifically analyze the relationship between different levels of rivers and HCTVs, buffer zones with bandwidths of 5 km and 10 km were established on both sides of rivers of different levels using the buffer analysis of ArcGIS10.4 to extract and count the number of HCTVs in different buffer zones (Table 4). It can be seen that the distribution of HCTVs in China is obviously hydrophilic with the densest distribution along the rivers. Seen from the stream distribution, about 760 were distributed in the outflow area, and most of them were located along the third and fourth level rivers (562).

Table 4. The distribution number of HCTVs along different river classes.

River Band Width	Level 1	Level 2	Level 3	Level 4	Total
5 km	41	85	70	218	414
10 km	22	57	47	227	353
Total	63	142	117	445	767

4.2.2. The Spatial Correlation between HCTVs and Social Development

In order to analyze the spatial correlation between HCTVs and the local towns and cities distribution, the distance analysis tool in ArcGIS10.4 was used to reflect the spatial distance relationship between famous HCTVs and towns and cities. The result was reclassified into four grades with an interval of 20 km, and the number of HCTVs in different distances was computed (Figure 5). It was found that HCTVs were mainly distributed in areas within 40 km (98%), while more than half (66%) were distributed in areas within 20 km, which indicates that there are many HCTVs distributed close to the towns because of the architecture, folk customs and cultures with a long history. It reflects that the better

the development of the town, the better the protection of the traditional culture of the town, the greater the HCTV quantity distribution.

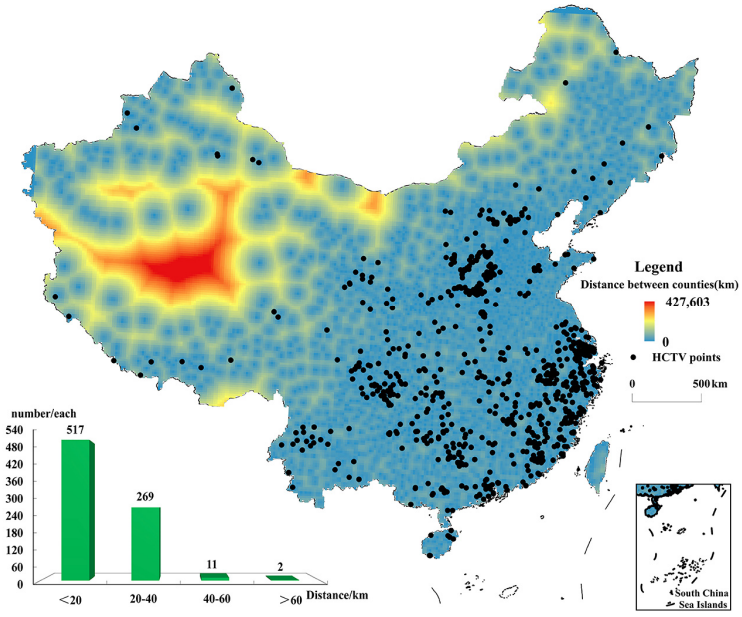

Figure 5. The Spatial distance relationship between small cities and the HCTV in China.

Transportation is also an important link between tourism destination and tourist source, which directly affects the tourist flow and the protection and development degree of tourism destination. Therefore, in this study the influence buffer of 100 km and 50 km were established, respectively, for railway, national highway and provincial highway, and the spatial association between HCTVs and traffic lines was compared and analyzed by counting the number of HCTVs (Figure 6, Table 5). The results show that HCTVs are mostly distributed along traffic lines, and the concentrated distribution area of HCTVs are also the dense distribution areas of most traffic trunk lines. In the 50 km impact buffer zone, the coverage of HCTVs is up to more than 60%, especially in the 50 km range of highways where the distribution of HCTVs is up to 92%, indicating that the traffic network in these HCTV distribution areas is connected in all directions.

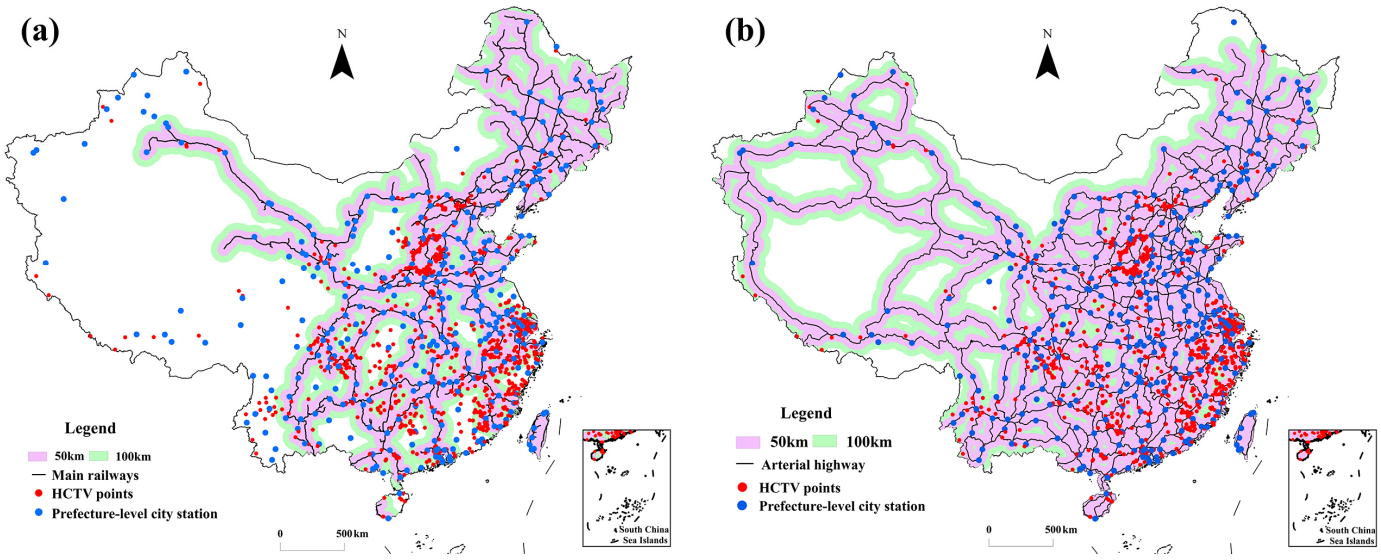

Figure 6. Relationship between railway (**a**), highway (**b**) and the HCTV in China.

Table 5. The number of historical and cultural towns (villages) about traffic line.

Traffic Buffer Distance (Kilometer)	Railway Number	Highway Number
50	485	741
100	144	58
Total	629	799

In order to explain the correlation between cities, traffic distance and HCTVs from a statistical point, simple correlation analysis was used to analyze the distribution density of HCTVs and the distance between cities and roads. The results are shown in Figure 7. The correlation between HCTV density and distance is a nonlinear relationship, and with the increase of the distance between cities and roads, the density of HCTVs decreases sharply to zero. It indicates that there is a negative effect between HCTVs and distances. This result also reflects that HCTVs are mainly distributed in areas close to towns and cities and with relatively convenient transportation, while there is almost no HCTV distribution in marginal mountains and areas with harsh environments, which is consistent with the relationship between HCTVs and natural environment.

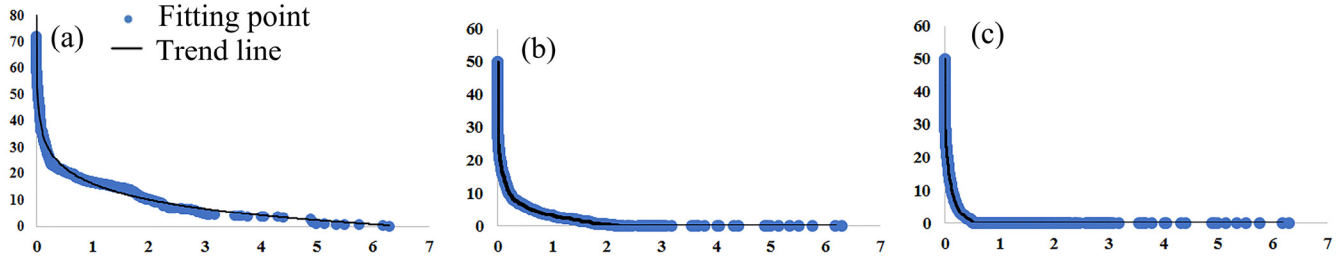

Figure 7. Statistical relationship between cities distance (**a**), railway distance (**b**), highway distance (**c**) and the HCTV density in China. The *X*-axis is the density of HCTV, and the *Y*-axis is the spatial distance of cities, railway and highway, respectively.

We found that the level of population and economic development is an important driving force for the migration of cultural centers, the protection and development of historical culture, and the development and construction of tourist areas [39]. Therefore, the annual GDP and population were selected as economically level for analysis of the spatial correlation (Figure 8). The results show that HCTVs are mostly concentrated in the developed areas in the east and middle, and most of the famous HCTVs are concentrated in the east of the population density, which accounts for more than 94.8% of the total number of HCTVs, while the number of them in the west is only 39.

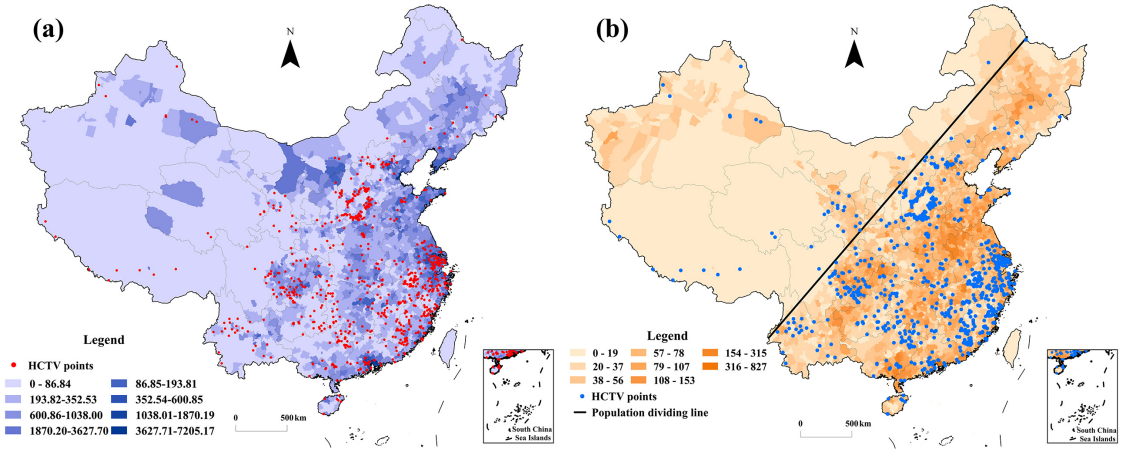

Figure 8. Relationship between GDP (**a**), population (**b**), and HCTV in China.

4.3. Spatial Correlation between HCTVs and Traditional Culture

Using the intersect function of ArcGIS10.4 to calculate the regional language and regional living area where HCTV are located and referring to the Chinese Language Atlas and the Chinese Cultural Geography Atlas, the area of the region where HCTVs are located was classified (Figure 9a–c). The results show that there are differences in the spatial correlation between HCTV and regional language and regional living areas in China. The northeastern region has the highest correlation between HCTVs and the language and living area. The living area in the south of the Yangtze River gathers the largest number of HCTVs, and a variety of different language cultures appear in the living area, while the living area and regional language of the inland region in the northwest are more homogeneous, and their distribution of HCTVs is the least. The intermingling of different languages and cultures has formed distinctive and long-established traditional cultures, as well as more well-preserved historical and cultural settlements, which is one of the important reasons for the formation of HCTVs. However, the minority regions with relatively underdeveloped living conditions (Qinghai-Tibet Plateau region and Xinjiang desert region) have formed few distributions due to their nomadic livelihood.

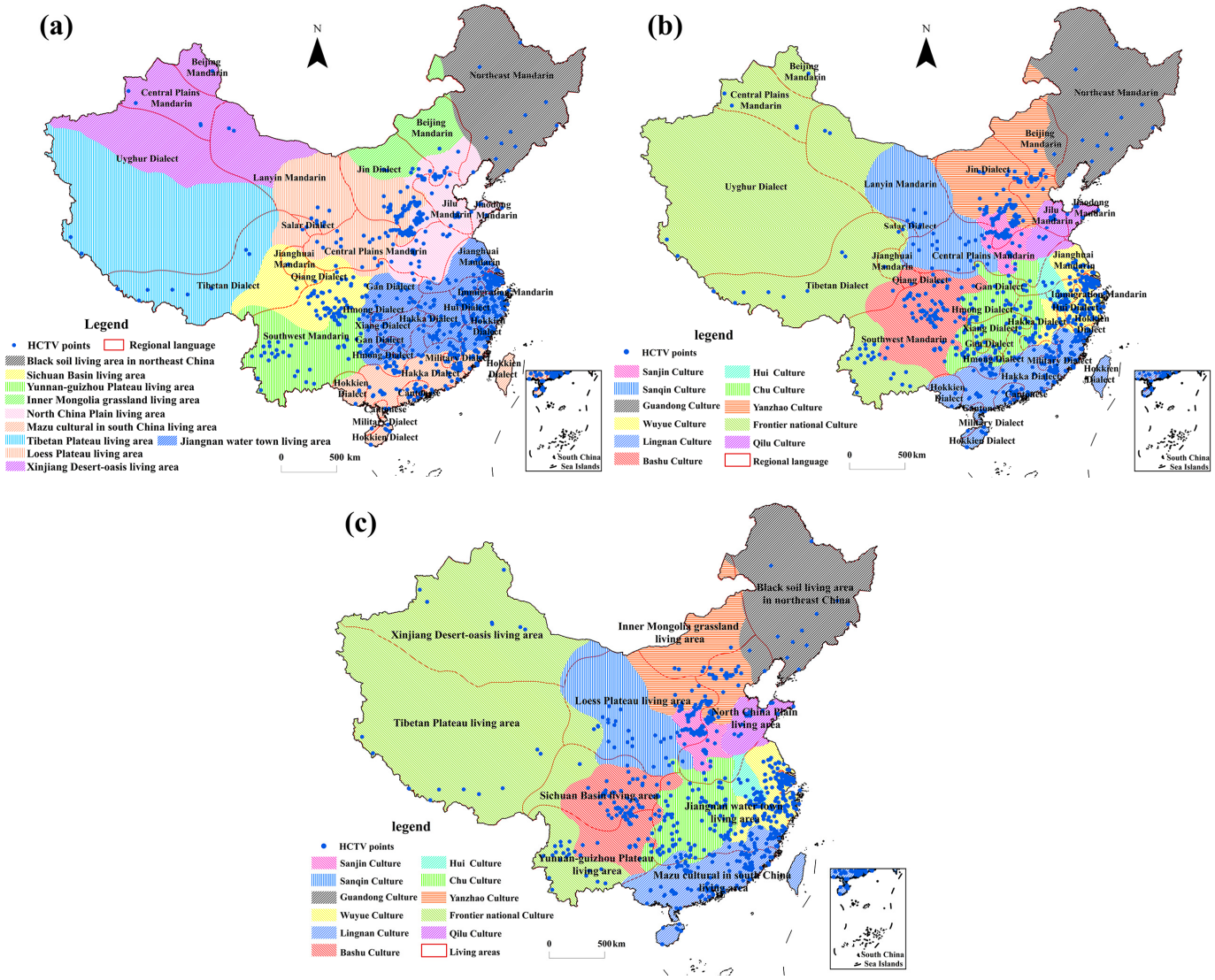

Figure 9. The regional relationship between living areas, history & culture and regional language and the HCTV in China. (**a**). Living areas and regional language (**b**). History & culture and regional language (**c**). Living areas and history & culture).

Based on the comprehensive statistical results of the geographical distribution and numbers of HCTVs in the three historical traditional cultures, including historical culture, regional language and living area, it can be seen that the spatial correlation degree between historical culture and HCTV is the highest, and there is an obvious spatial difference. Wuyue culture and Lingnan culture areas have the greatest number of HCTVs, followed by living areas, which indicate that history and culture determines the regional characteristics and unique traditional culture of the HCTV. However, in the regional language distribution areas, there are more historical and cultural towns and villages in the southwest Mandarin and Wu dialect areas, and the number of HCTVs is 150 and 129, respectively. In other regional language areas, the number of HCTV distribution is relatively not obvious, except the immigrant mandarin, Qiang dialect, Military dialect and Uyghur dialect, which have the characteristics of migration and nomadic minorities.

According to the spatial relationship between the cultural geography of China and the HCTV, the spatial correlation degree was analyzed and studied (Figure 9b), and the results show that in the northeastern region, the main culture is Guandong, and the language is Northeastern Mandarin; the region has a humid and semi-humid climate separated by the Daxinganling Mountains, the Qilaotu Mountains, and the Nurulhu Mountains, therefore forming a relatively independent linguistic and cultural interaction zone with the Yan and Zhao cultures. In the vast frontier ethnic culture region, the language is mainly Uyghur and Tibetan, and the name of the HCTVs is highly consistent with the language and culture of the region. The existence of Chinese and Beijing official dialects in the border ethnic cultural region is related to the construction of Xinjiang by the Corps after liberation and also to the arrival of people from the Central Plains in Xinjiang to escape war and take root during the war period. In the Lingnan and WuYue culture regions, the HCTVs are more concentrated, and there is a wide variety of languages; various languages have merged with each other, producing many language subspecies and language islands. The Sanqin and Bashu cultures, which have a larger area, are relatively homogeneous in language, and their HCTV distribution is also significantly different from that of Jiangsu, Zhejiang and Fujian and Guangdong.

A comparative analysis of HCTVs with historical culture and regional living areas revealed (Figure 9c) that HCTVs are mainly distributed in the WuYue culture, Lingnan culture, BaShu culture and San-Jin culture areas, which have distinctive regional characteristics. From the spatial relationship between HCTVs and living areas, 309 HCTVs are distributed in the Jiangnan water village living area, 117 are distributed in Matsu living area, which indicates that HCTV has a regional correlation in living area and historical and cultural relevance, and the difference of regional distribution is very obvious.

In order to further analyze the spatial relationship between three traditional cultures such as regional languages (LD), living areas (LA) and history & culture (HC), and the regional preferences of HCTV distribution, we selected smoothing spline method to fit each HCTV point and obtained the fitting curves of LD, HC, LA and HCTV. The Frechet distance model was used to obtain the similarity between each curve and HCTV curve and can be quantitatively evaluated for the preference of HCTV. The calculated curve results are shown in Figure 10. The results show that HCTV has the highest similarity degree with LA, and the Frechet value is 16.96, which shows that HCTV has regional preference for living areas. Different nationalities, buildings in different villages and towns and regional cultural characteristics constitute the elements of living areas of HCTVs and also determine the spatial distribution characteristics and influencing factors of HCTVs. In addition, HCTV is also highly similar to LD, with a Frechet value of 18.21, indicating that regional language is also an important factor in determining the spatial distribution of HCTV.

Figure 10 also showed that the regional distribution of HCTV in China overlaps with LA, LD and HC, indicating that the integration of different languages and cultures has formed traditional culture with a long history and a distinctive characteristic, as well as many well-preserved historical and cultural settlements, which is one of the important reasons for the distribution of HCTVs. In the Lingnan culture and Wuyue culture areas,

there are a wide variety of languages, and various languages merged with each other and formed many language subspecies and language islands. The Sanqin culture and Bashu culture have a relatively single language, and their HCTV distribution is obviously different from that of Jiangsu and Zhejiang, Fujian and Guangdong province. In addition, the high density of HCTVs are mainly distributed in Wuyue culture, Lingnan culture, Bashu culture and Sanjin culture areas, which have distinct regional characteristics. From the spatial relationship between HCTV and LA, about 309 HCTVs are distributed in south of China, and 117 HCTVs are distributed in the Matsu living area, while only 5 HCTVs live in the Inner Mongolia grassland. It can be seen that HCTVs have regional correlation in the degree of living area and history and culture.

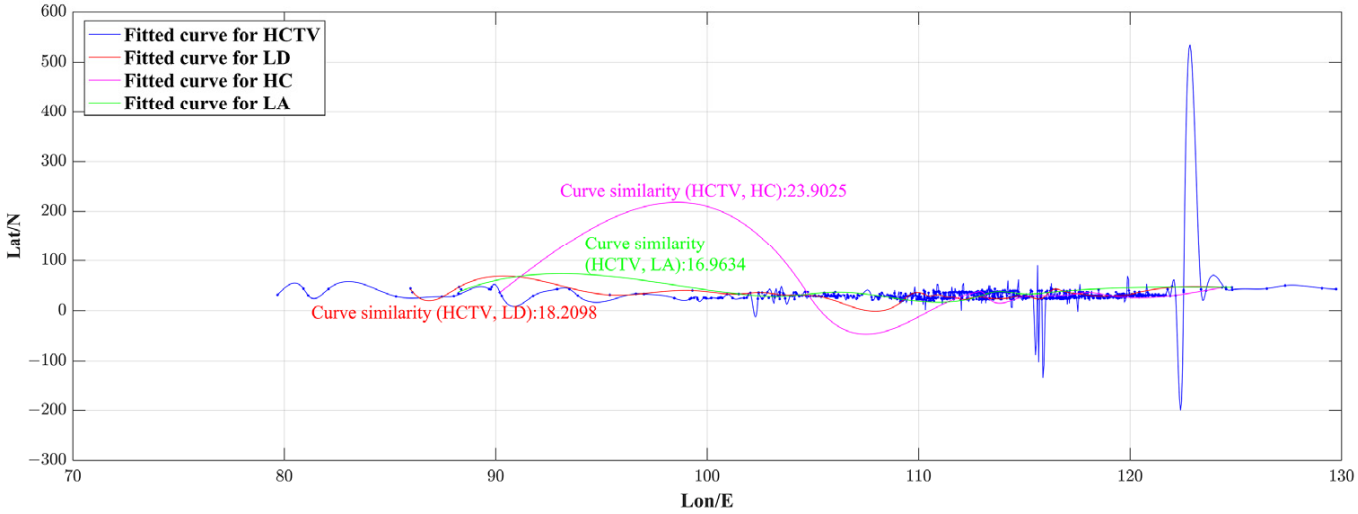

Figure 10. Fitting relationship between LA, LD, HC and HCTV.

The research results show that the northeast region, which is mainly distributed with historical and cultural famous towns, is dominated by the Guandong culture and the language is Northeast Mandarin. This region has a humid and semi-humid climate and is separated by the Great Khingan Mountains and other natural geographical barriers, so it is relatively independent geographically and forms a relatively independent language and cultural interaction zone with the Yanzhao culture. The existence of Central Plains Mandarin and Beijing Mandarin in the border ethnic cultural areas is related to the construction of Xinjiang by the Corps after liberation and also to the fact that the people of Central Plains came to Xinjiang to take root in order to escape the war. China's HCTVs are independent in space, and many HCTV landscape features have low similarity. Therefore, it is necessary to further strengthen the existing spatial corridors of famous towns and villages with the help of regional transportation lines and urban information and cultural exchange channels and eventually develop into the dominant form of spatial structure of famous towns and villages in China. In the future, we should continue to revise and improve the policies and measures in the verification and announcement of famous towns and villages, planning formulation, evaluation and inspection, protection and development, and strengthen the differentiated management of HCTVs. By promoting the protection of famous towns and villages, we can better achieve comprehensive sustainable development.

4.4. Sustainable Protection Strategies for HCTV in China

4.4.1. Improving the Standards for Selecting and Protecting HCTVs, Combining Protected Planning and Ecological Conservation Planning

The results showed that the number of HCTVs in the central and eastern regions is growing faster than that in the western minority regions. There are few HCTVs in the vast western region such as Xinjiang, Qinghai, Gansu, Tibet, and Inner Mongolia, which indicates that as a region with a concentrated distribution of ethnic minorities in China,

the protection and development of ancient villages are seriously lagging behind. However, the western region contains a lot of ethnic minorities and regional cultures, which should be protected and developed as a key area. Western provinces should fully understand the importance of protecting and using famous HCTVs. They should take the opportunity of selecting HCTVs to accelerate the protection and inheritance of historical and cultural heritage, promote industrial transformation and economic development in traditional ethnic areas, and rationally link development and protection to better help local people with their sustainable development.

At present, the protection of HCTVs is relatively weak compared to famous historical and cultural cities; the protection of intangible culture is relatively weaker than that of material culture, and the protection of historical environment is relatively weaker than that of historical buildings. These are the weaknesses of heritage protection in China and the gap between China and other developed countries in the protection of traditional historical culture. Therefore, how to select, protect and use the famous HCTVs in different regions of China in a scientific and reasonable way is a popular topic and worthy of valuable consideration by the government, scholars, and developers.

4.4.2. Strengthening the Infrastructure Renovation and Environmental Improvement of HCTVs

The research results show that the roads, bridges, river renovation, water supply, drainage and other infrastructure of HCTVs in many places have experienced long periods of wind and rain erosion and are somewhat tattered. Therefore, it is necessary to carry out infrastructure reconstruction in the future and combine it in the national planning of village and town construction. In addition, service centers, parking lots, public rest places, museums, cultural performance centers, intangible cultural heritage and ethnic culture should be built to meet the needs of landscape protection, public life services and cultural exhibition space.

4.4.3. Increasing Funding for the Protection of HCTVs

To protect the core area of housing repair, we should expand the scope of financial support. At the same time, we will appropriately raise the subsidy standards according to the market conditions and reasonably calculate and increase the subsidy standards for the renovation projects with cultural and traditional characteristics based on the current subsidy standards in light of the actual situation. For cultural relics that are immovable, funds for their protection shall be subsidized. On the basis of the current fiscal policy, the central and local governments will allocate 1:1 funds.

4.4.4. Strengthening Strategic Research on the Protection and Development of HCTVs

It is necessary to break through the traditional thinking of village protection from the political, economic, social, historical, geographical, cultural, artistic, legal, administrative and other multi-dimensional perspectives to explore the inherent attributes, cultural characteristics, historical value or commemorative significance of famous towns and villages to make comprehensive competitive factors, integrate utilization of resources and effect building, protection and development strategy, and implementation strategy. In addition, project planning is needed to carry out comprehensive and systematic research. Only when the local government reaches a consensus on the scientific and reasonable overall plan and strategic conception and sees the bright prospect of the protection of HCTVs and the economic and social development complementing each other, can the local government really improve its understanding, enhance its confidence, grasp the direction, and guide the smooth preparation and effective implementation of the protection plan.

5. Conclusions

HCTVs are a medium of inheriting and carrying forward the Chinese nation's traditional culture and history. The spatial distribution characteristics and regional spatial

correlation comprehensively reflect the different characteristics of regional culture and its level of protection and management. Therefore, analysis of the distribution characteristics is of great significance for the management, development and utilization of traditional historical and cultural settlements in China, and it can also provide a decision-making reference for the selection and management of HCTVs in the future. In this paper, density analysis and spatial statistical analysis of ArcGIS are used to analyze the spatial distribution characteristics and spatial correlation degree. The results showed that the spatial distribution of HCTVs is different in different regions because of the comprehensive influence factors such as local cultural, languages, natural conditions and social economy. The spatial distribution of HCTVs has obvious fractal characters. The good natural conditions, more suitable living environment, more population distribution, more road networks and better economy have precipitated more HCTVs. Traditional historical culture is one of the reasons affecting their origin and is the core element affecting their spatial distribution, which also indicates that the selection, protection and management of HCTVs in China follow the general principles of originality, scale and characteristics.

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References

1. Wu, B.H.; Xiao, J.Y. Research on Spatial Distribution and Correlation of the Historical and Cultural Towns (Villages) in China. *Econ. Geogr.* **2012**, *32*, 7–11. [CrossRef]
2. Zhang, Y.L.; Xiao, D.W. Objective Evaluation System of Historic Cultural Villages and Towns. *Huazhong Archit.* **2010**, *28*, 161–163.
3. Zhao, J.Y. Protection and Development Strategy of Historical and Cultural Towns-A Case Study of Fenghuang Ancient Town in Zhashui County. *Archit. Cult.* **2020**, *1*, 84–86.
4. Shi, Y.L.; Huang, Y.; Huang, H. Study on Cultural Landscape Protection and Changes in Historical Villages and Towns. *Chin. Gard.* **2018**, *34*, 124–128.
5. Tang, B.; Chen, Z.H. Investigation and Thoughts on the Construction of Historical and Cultural Towns in Pingba Town of Jingshan City under the Vision of Rural Revitalization. *Anhui Agric. Sci.* **2020**, *48*, 267–271. [CrossRef]
6. Dai, Y.; Dai, L.L.; Huang, J.J. Research Summary of the Historic Village and Town Preservation in China. *Urban Plan. J.* **2019**, *2*, 68–74.
7. Hu, S.W.; Chen, J.H. Research on Spatial Differentiation and Influence Factors of the Historic Cultural Towns and Villages in China. *Dev. Small Cities Towns* **2016**, *7*, 62–67. [CrossRef]
8. Kang, J.Y.; Zhang, J.H.; Hu, H. Analysis on the spatial distribution characteristics of Chinese traditional villages. *Prog. Geogr.* **2013**, *32*, 1477–1485. [CrossRef]
9. Li, Y.J.; Chen, T.; Wang, J. Temporal-spatial distribution and formation of historic and cultural villages in China. *Geogr. Res.* **2013**, *32*, 1477–1485. [CrossRef]
10. Lenar, S.; Nailya, B.; Nai, S. Historical and cultural heritage and region's economic: Case Study central and eastern Russia. *Procedia-Soc. Behav. Sci.* **2015**, *3*, 151–156.
11. Shajjad, H.; Filipe, T.B. Interpretative mapping in cultural heritage context: Looking at the historic settlement of Khan Jahan in Bangladesh. *J. Cult. Herit.* **2019**, *39*, 297–304. [CrossRef]
12. Anne, H.J.; Geoffrey, W.; Jason, F. Creative food clusters and rural development through place branding: Culinary tourism initiatives in Stratford and Muskoka, Ontario, Canada. *J. Rural Stud.* **2015**, *39*, 133–144. [CrossRef]
13. Derek, B.; Darla, K.M.; Caleb, G. Spatial analysis of land suitability, hot-tub cabins and forest tourism in Appalachian Ohio. *Appl. Geogr.* **2014**, *54*, 139–148. [CrossRef]
14. Stefanis, M.; Gian, M.U. New Opportunities for Cruise Tourism: The Case of Italian Historic Towns. *Sustainability* **2020**, *12*, 4616. [CrossRef]

15. Sun, F.; Wang, D.G. The Spatial Distribution and Development Pattern of Tourism Towns and Villages with Characteristic Landscape. *Tour. Trib.* **2017**, *32*, 80–93. [CrossRef]
16. Sun, S.J.; Wang, X.J.; Hu, M.X. Spatial distribution of Airbnb and its influencing factors: A case study of Suzhou, China. *Appl. Geogr.* **2022**, *139*, 102641. [CrossRef]
17. Xavier, R.; Chiara, B. Risk protection for cultural heritage and historic centres: Current knowledge and further research needs. *Int. J. Disaster Risk Reduct.* **2022**, *67*, 102652. [CrossRef]
18. Chen, B.X.; Nakama, Y. A Study on Village Forest Landscape in Small Island Topography in Okinawa, Japan. *Urban For. Urban Green.* **2010**, *9*, 139–148. [CrossRef]
19. Yang, X.; Fang, C.; Wang, Y. Construction of gene information chain and automatic identification model of traditional village landscape: Taking shaanxi province as an example. *Geogr. Res.* **2019**, *38*, 1378–1388. [CrossRef]
20. Li, Q.; Ye, C.S.; Lai, Z.M. Spatial Distribution Patterns and Influencing Factors of Top Towns and Villages of History and Culture in Jiangxi Province. *Jiangxi Sci.* **2016**, *34*, 628–634. [CrossRef]
21. Wang, H.Q.; Yuan, J.D.; Meng, X.J. Spatial Distribution and Its Influencing Factors of Level-A Scenic Spots in Northeast China. *Sci. Geogr. Sin.* **2017**, *37*, 895–903. [CrossRef]
22. Hadjimitsis, D.; Agapiou, A.; Alexakis, D.; Sarris, A. Exploring natural and anthropogenic risk for cultural heritage in Cyprus using remote sensing and GIS. *Int. J. Digit. Earth* **2013**, *6*, 115–142. [CrossRef]
23. Michael, J.; Smith, D.; Michael, F.; Goodchild, P.A. *Geospatial Analysis: A Comprehensive Guide to Principle Techniques and Software Tools*, 2nd ed.; Publishing House of Electronics Industry: Beijing, China, 2005; pp. 58–65.
24. Liu, J.; Jin, X.; Fan, Y.; Xiang, X.; Ran, N.; Zhou, Y. Rural residential land consolidation strategy from a perspective synthesizing towns, villages and land parcels: A case study in xinyi city, jiangsu province. *Geogr. Res.* **2018**, *37*, 678–694. [CrossRef]
25. Liu, P.L. The recent development of cultural geography in china. *Prog. Geogr.* **1998**, *17*, 90–96.
26. Zhao, L. New Thinking on the Transformation and Development of Historical Cultural Villages and Villages Based on "Cultural Protection": Taking Shipai Ancient Town, a Famous Historical and Cultural Town of the Country as an Example. *Dev. Small Cities Towns* **2018**, *36*, 57–62.
27. Li, Y.; Yang, D.Y.; Yu, M.D. The Conservation and Renovation of the Historical and Cultural Villages in Yunnan Province from the Perspective of Ecological Cultural Resources Theory. *J. Kunming Univ. Sci. Technol.* **2018**, *18*, 92–101. [CrossRef]
28. Ma, M.C.; Weng, J.; Yu, L. Market size, scale economies, and tourism market structure: A case of historic water town tourism in China. *Tour. Manag.* **2015**, *49*, 119–137. [CrossRef]
29. Wei, W.; Shi, P.J.; Xie, B.B. The evolution of urban spatial structure in Shiyang river basin—A case study on the Gulang county. *J. Shangqiu Norm. Univ.* **2013**, *29*, 93–107.
30. Barbara, O.; Magdalena, W.; Barbara, P.; Katarzyna, H.; Robert, D. Application of the building cohesion method in spatial planning to shape patterns of the development in a suburban historical landscape of a 'village within Kraków'. *Land Use Policy* **2022**, *114*, 105997. [CrossRef]
31. Wang, M.D.; Liu, J.M.; Zhang, S.Y.; Xin, H.Z. Spatial pattern and micro-location rules of tourism businesses in historic towns: A case study of Pingyao, China. *J. Destin. Mark. Manag.* **2022**, *25*, 100721. [CrossRef]
32. Zhang, Z.A.; Liang, Z.X.; Bao, J.G. From theme park to cultural tourism town: Disneyization turning of tourism space in China. *Reg. Sustain.* **2021**, *2*, 156–163. [CrossRef]
33. Huang, W. What Were GIScience Scholars Interested in During the Past Decades? *J. Geovis. Spat. Anal.* **2022**, *6*, 7. [CrossRef]
34. Nikhil, S.; Danumah, J.H.; Saha, S.; Prasad, M.K.; Rajaneesh, A.; Mammen, P.C.; Ajin, R.S.; Kuriakose, S.L. Application of GIS and AHP Method in Forest Fire Risk Zone Mapping: A Study of the Parambikulam Tiger Reserve, Kerala, India. *J. Geovis. Spat. Anal.* **2021**, *5*, 14. [CrossRef]
35. Zhang, C.; Yang, B.G. *Basis of Quantitative Geography*; Higher Education Press: Beijing, China, 1985.
36. Wu, Q.; Li, X.G.; Wu, L.; Chen, S. Distribution Pattern and Spatial Correlation of A-Grade Tourist Attractions in Hunan Province. *Econ. Geogr.* **2017**, *37*, 193–200. [CrossRef]
37. Yu, Y. Landscape Transition of Historic Villages in Southwest China. *Front. Archit. Res.* **2013**, *2*, 234–242. [CrossRef]
38. Liao, P.; Gu, N.; Yu, R.R.; Chris, B.B. Exploring the spatial pattern of historic Chinese towns and cities: A syntactical approach. *Front. Archit. Res.* **2021**, *10*, 598–613. [CrossRef]
39. Zhao, Y.; Zhang, J.; Zhang, J.H. Research on the Content and Method of the Conservation of the Historic Cultural Towns & Villages in China. *Hum. Geogr.* **2005**, *20*, 68–74. [CrossRef]