The Spatial Distribution Pattern and Influencing Factors of Rural Governance Demonstration Villages and Towns in China

Authors: Jishu, Wang, Guolei, Chen, Jisha, Zhang, and Lianlian, Li

Source: Journal of Resources and Ecology, 14(5) : 1061-1074

Published By: Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences

URL: https://doi.org/10.5814/j.issn.1674-764x.2023.05.017

J. Resour. Ecol. 2023 14(5): 1061-1074
DOI: 10.5814/j.issn.1674-764x.2023.05.017
www.jorae.cn

The Spatial Distribution Pattern and Influencing Factors of Rural Governance Demonstration Villages and Towns in China

WANG Jishu, CHEN Guolei*, ZHANG Jisha, LI Lianlian

School of Geography and Environmental Sciences, Guizhou Normal University, Guiyang 550025, China

Abstract: Rural governance is the basic requirement for promoting the modernization of the national governance system and governance capacity, so it is closely related to the implementation of the national rural revitalization strategy and the realization of the modernization goal of national governance. Taking 2189 rural governance demonstration villages and towns in China as the research object, the spatial distribution structure and influencing factors of rural governance demonstration villages and towns were explored in this study by using the nearest neighbor index method, the kernel density estimation method, the grid dimension analysis method and the spatial autocorrelation analysis method. The results show that the spatial distribution of rural governance demonstration villages and towns in China tends to be clustered, and the spatial differentiation is obvious. The analysis of kernel density in the rural governance demonstration villages and towns presents a number of kernel centers in space, and the distribution pattern of secondary centers is in the form of a belt distribution, which is formed by decreasing and spreading around the surrounding kernel centers. The rural governance demonstration village and town system features obvious scale-free areas and fractal characteristics. The spatial distribution of the rural governance demonstration villages and towns is mainly influenced by natural and cultural factors, among which, the topography and lake water systems are the main influencing factors. Among the humanistic factors, the social economy, transportation and national culture are the main influencing factors, while the influence of population distribution is not significant.

Key words: demonstration villages and towns; rural governance; spatial distribution pattern; influencing factors

1 Introduction

Taking villager autonomy as the core goal, rural governance is guided by the government, with multi-governance subjects coordinating and participating together to promote the harmonious and stable development of rural society (He, 2005). To realize the overall rural revitalization and meet the needs of a better life for the farmers, efforts must be made to solve the existing problems in rural social governance (Qiu, 2020). In order to implement the decision-making and deployment of the central government for promoting the modernization of the rural governance system and governance capacity, and give full play to the exemplary and leading role of typical experiences, the Ministry of Agriculture and Rural Affairs announced two batches of rural governance demonstration villages and towns successively, and in June 2019 it issued the *Notice on Launching the Pilot Demonstration Work of Rural Governance System Construction* and the *Notice on Launching the Creation of Rural Governance Demonstration Villages and Towns*. National rural governance demonstration villages and towns are required to be the leading force of rural governance, and different models should be available for effective rural gov-

Received: 2022-12-25 **Accepted:** 2023-03-30
Foundation: The Guizhou Science and Technology Foundation (ZK[2021] General 186); The Guizhou Provincial Department of Education Natural Science Research Fund (Guizhou Jiaohe KY Zi [2022] No.156); The Guizhou Normal University Doctoral Research Project (GZNUD [2019] No.5).
First author: WANG Jishu, E-mail: 2813255134@qq.com
***Corresponding author:** CHEN Guolei, E-mail: 201907008@gznu.edu.cn

Citation: WANG Jishu, CHEN Guolei, ZHANG Jisha, et al. 2023. The Spatial Distribution Pattern and Influencing Factors of Rural Governance Demonstration Villages and Towns in China. *Journal of Resources and Ecology*, 14(5): 1061–1074.

ernance, in order to give full play to the demonstration villages and towns. Furthermore, to make new contributions to rural revitalization, studies on the national rural governance demonstration villages and towns (hereafter referred to as governance villages and towns) are of great significance.

As for the research on the villages and towns, domestic and foreign scholars have focused on their spatial distribution and influencing factors (Tchetchik et al., 2008; Chen et al., 2019; Yan et al., 2019), the development mode and path (Buark et al., 2004; Huang et al., 2019; Chen et al., 2022), the evolution process and mechanism (Liu and Wu, 2011; Greta et al., 2019; Li, 2019), rural development and protection (Yang, 2017; Brown, 2021; Yan, 2021), as well as rural transformation and revitalization (Chiodo, 2019; Wang and Li, 2022; Zhang and Zhang, 2022). In terms of the research object, the foreign academic focus has been on rural tourism (Maja et al., 2022), smart villages (Król and Hernik, 2022), digital villages (Gao et al., 2022), and related topics. However, China has a long history and a prosperous culture; so compared with foreign countries, the research object in China is wider and covers ethnic minority characteristic villages, traditional villages, ancient villages, ancient towns, historical and cultural towns, leisure villages and key rural tourism villages (Chen, 2019; Wang and Liu, 2020; Xu et al., 2020). In terms of research methods, the domestic and foreign methods are similar, combining qualitative and quantitative analysis (Guan et al., 2017; Benni et al., 2019) with the case analysis method (Almohamad, 2021; Wu et al., 2022b). The nearest neighbor index, buffer analysis, spatial autocorrelation, spatial autocorrelation and other methods in the ArcGIS geospatial system software (Cao and Wang, 2022; Wu et al., 2022a) are mainly adopted by the commonly used geospatial analysis methods in China to process and analyze the data. China's research scale covers various levels, such as the whole country, provinces, cities and watersheds (Wang et al., 2020; Huang et al., 2021; Wang and Zeng, 2021; Zhu et al., 2022), while the foreign research scale is mainly based on nationwide exploration and analysis (Rojas, 2020; Ricardo et al., 2022). Research on the influencing factors covers topography, geomorphology, rivers, water systems, transportation, policies and other aspects (Wang and Liu, 2019; Rytkönen and Tunón, 2020). Generally speaking, it mainly includes physical geography and human geography (Sanagustin-Fons et al., 2018; Zhang and Ma, 2021).

In summary, a great deal of theoretical and practical research and exploration of villages and towns has been carried out by domestic and foreign scholars, and the research has gradually deepened, with rich research contents and remarkable research results. However, while rural governance is an important part of the rural revitalization and modernization of state governance, there are few systematic studies on the spatial structure of rural governance and the factors influencing it on a national scale from the geographical point of view. To this end, ArcGIS spatial analysis technology is used in this study to explore the spatial differentiation characteristics and laws of rural governance in China, with the aim of providing a reference for the development and protection of rural governance and the realization of rural revitalization and modernization.

2 Data and methods

2.1 Data sources

A total of 2189 national rural governance demonstration villages and towns published by the Ministry of Agriculture and Rural Affairs (http://www.moa.gov.cn/) in 2020 were selected as the research samples. The location coordinates of the 2189 national rural governance demonstration villages and towns were obtained with the help of the Baidu coordinate pickup system and imported into ArcGIS 10.2 software. The coordinate data were registered and projected, and the distribution space and attribute database of the governance villages and towns were established. The 50 m resolution DEM was obtained from the Data Center of Resources and Environmental Sciences of China Academy of Sciences (http://www.resdc.cn), while the data of population, regional GDP, etc. came from the statistical yearbooks and statistical bulletins of the prefecture-level cities.

2.2 Research methods

2.2.1 Nearest neighbor index method

The nearest point index indicates the spatial distribution type and mutual proximity index of point-like elements (Shen et al., 2013), which mainly involve three distribution types (Li et al., 2015), i.e., uniform, random and clustered distributions. The nearest point index can accurately reflect the spatial distribution characteristics of point elements. The calculation is the ratio of the actual nearest distance to the theoretical nearest distance (i.e., the theoretical value when randomly distributed), and its formula is:

$$R = \frac{\overline{r_1}}{r_E} = 2\sqrt{D} \tag{1}$$

where, R denotes the nearest neighbor index; $\overline{r_1}$ represents the actual nearest distance; $\overline{r_E}$ refers to the theoretical nearest distance; and D is the dot density. A value of R=1 means that the points are randomly distributed; when R>1, the distribution of points tends to be uniform; and when R<1, the points tend to be clustered.

2.2.2 Kernel density estimation method

The kernel density estimation method is a nonparametric method for estimating the probability density function of point sets in different geographical locations. The density of points is related to the probability of events, with a denser point set indicating a higher probability of events and vice versa. When the distance between the point set and the center reaches a certain threshold, the range density value is 0 (Wang, 2011), and the formula is:

$$\overset{\Lambda}{f}(x)=\frac{1}{nh^{d}}\sum_{i=1}^{n}K\left(\frac{x-x_i}{h}\right) \quad (2)$$

where, $\overset{\Lambda}{f}(x)$ is the kernel density function value; x_i is the coordinate position of the point to be calculated; h is the threshold distance of the search bandwidth; n is the number of points within the threshold range; and d is the dimension value for the number of points.

2.2.3 Grid dimension analysis method

Grid dimension analysis can be used to divide the whole research area grid, count the different numbers of points in each area grid, judge the multi-level spatial distribution structure of the point set, and reflect the complexity and degree of balance in the point set distribution (Chen et al., 2018). While gridding the point set space, the grid dimension $N(r)$ changes with a change in the network scale X (Wu et al., 2017). When the spatial distribution of rural governance demonstration villages and towns in China is scale-free, the relationship is:

$$N(r)\propto r^{-T} \quad (3)$$

In the formula (3), $T=D_0$ is the capacity dimension. Assuming that the statistical number of grid points is N_{ij}, the number of points in the whole area is N, and its probability can be generally defined as $P_{ij}=N_{ij}/N$. Then, the information dimension formula is based on probability and can be broadly defined as:

$$I(r)=-\sum_{i=1}^{k}\sum_{j=1}^{k}P_{ij}(r)\ln P_{ij}(r) \quad (4)$$

where $k=1/X$ is the number of segments on each side of the region, and if the point set is fractal, then:

$$I(r)=I_0-D_1 r \quad (5)$$

In the formula, D_1 is the information dimension and I_0 is a constant which reflects the balance of the spatial distribution of point sets. Usually, the grid dimension D value is between (0–2), and when D=2, it indicates that the regional points are evenly distributed; when the value of D approaches 1, the points are concentrated in a geographical zone (geographical line); and when $D_1=D_0$, the point set is a simple fractal.

2.2.4 Spatial autocorrelation analysis method

Spatial autocorrelation analysis is an analytical method for measuring whether the attribute values of point-like features are dependent or correlated with the values of adjacent point features (Sridharan et al., 2007). Moran was selected, and the Moran's I index is between (–1, 1). The spatial distribution is significantly concentrated in the case of a positive index, while it is significantly different for a negative index, and a value of 0 indicates that the spatial distribution is irrelevant. *Getis-Ord* G_i^* measures the local spatial autocorrelation characteristics, and the normalized formula is:

$$Z\left(G_i^*\right)=G_i^*-\frac{E\left(G_i^*\right)}{\sqrt{Var\left(G_i^*\right)}} \quad (6)$$

where $E(G_i^*)$ and $Var(G_i^*)$ are the G_i^* mathematical expectation and coefficient of variation, respectively. A positive and significant value of $Z(G_i^*)$ indicates the existence of many points around the geographic unit of location i, which represents a "hot spot" and presents a high-value spatial agglomeration situation in space. If $Z(G_i^*)$ is negative and significant, the number of points at position i is lower than the average, so it represents a "cold spot area" and a low-value spatial agglomeration.

3 Results and analysis

3.1 Spatial distribution characteristics

3.1.1 Spatial distribution type

The average observation distance of governing villages and towns was calculated to be 23.53 km using the spatial statistical tools of ArcGIS 10.2, while the expected average distance is 43.95 km, the average nearest R =0.535 <1, and the Z value is –41.59. The 99% confidence test showed that the spatial distribution of governance villages and towns is characterized by agglomeration (Table 1).

Table 1 Index of the nearest point of governance villages (towns)

Batch	Total number	$\bar{r_1}$ (km)	$\bar{r_E}$ (km)	R	Z	P
First batch	1097	34.01	61.21	0.556	–28.15	0.00027
Second batch	1092	37.18	62.04	0.599	–25.33	0.00039
Total	2189	23.53	43.95	0.535	–41.59	0.00056

3.1.2 Spatial regional characteristics

Below the national level, the villages and towns are mainly governed in Shanxi, Hubei, Chongqing, Shandong, Henan, Anhui, Jiangxi, Jiangsu, Zhejiang, Fujian and Guangdong provinces, accounting for 48.7% of the total number of villages and towns governed in China. Among them, there are 140 villages and towns in Hebei Province, and ranking second there are 133 in Jiangsu Province. Six other provinces have less than 133 but more than 100, including Shandong Province (113), Anhui Province (107), Guangdong Province (106), Hunan Province (109), Sichuan Province (131), and Zhejiang Province (132). These top provinces account for 31.7% of the villages and towns in the country, while Shanghai (21), Tibet Autonomous Region (22), Qinghai Province (17), Ningxia Hui Autonomous Region (20), Beijing (24), Tianjin (21) and Hainan Province (22) have the lowest numbers of villages and towns, together accounting for 6.72% of the national villages and towns.

Taking Qinling Mountains and Huaihe River as the boundary, since they form the natural boundary between the north and south of China, the distribution of governance villages and towns is characterized by more in the south and less in the north. The northern region includes Heilongjiang, Jilin, Liaoning, Beijing, Tianjin, Hebei, Shandong, Shanxi, Henan, Shaanxi and other provinces and cities, and governs 730 villages and towns, accounting for 33.35% of the total. Meanwhile, the southern region includes Sichuan, Chongqing, Hubei, Anhui, Jiangsu, Shanghai, Zhejiang, Hunan, Jiangxi, Fujian, Guizhou, Yunnan, Guangxi, Guangdong, Hainan and other provinces and cities, and governs 1224 villages and towns, accounting for 56.83% of the total. Northwest China and Qinghai-Tibet have the lowest distributions, accounting for 7.9% and 1.78%, respectively.

According to the principle of combining the level of economic and technological development with geographical location, China is divided into three economic zones. From the perspective of the three major economies, the eastern part is the greatest, followed by the central part, and the western part is the least. The eastern region includes 11 provinces and cities, including Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Guangxi, and governs 908 villages and towns, accounting for 41.48% of the total. The central economic belt includes Heilongjiang, Jilin, Shanxi, Anhui, Jiangxi, Henan, Hubei, Hunan, Shaanxi, Inner Mongolia and other provinces and cities, and governs 801 villages and towns, accounting for 36.59% of the total. Xinjiang, Tibet and Qinghai are in the west, and there are 455 villages and towns in Hainan, Yunnan, Guizhou, Ningxia, Gansu, Chongqing, Sichuan and other provinces and cities, accounting for 20.79% of the total. Obviously, the villages and towns in the eastern region are more densely distributed than those in the central and western regions. The economy, transportation, education, health care and other conditions in the eastern region are better than those in the central and western regions, and the higher level of social and economic development can provide a strong foundation for the construction of villages and towns. Limited by the relatively weak economic foundation and the lack of talents and technology, the villages and towns in the central and western regions are less densely distributed than those in the eastern region.

Based on scientific considerations, integrating various dimensions such as history and nationality, and following the relevant zoning principles, China can be divided into seven physical geographical divisions. Judging from the seven geographical divisions (Table 2), the governance villages and towns are the most densely distributed in East China, making up the highest proportion, followed by the distributions in North China, Central China and Southwest China, while the least are in Northeast China, South China and Northwest China, Shanghai, Jiangsu, Zhejiang, Shandong and Fujian in East China are coastal cities with developed economies, convenient transportation, high population densities and high-quality talents; while Shanghai, Jiangsu, Zhejiang and Anhui belong to the Yangtze River Delta region, which has a high degree of opening to the outside world and is equipped with well-developed science and technology. Although the area is small, the regional GDP accounts for one-fourth of the national total, and this area plays a pivotal role in the modernization drive of China. Therefore, these regions are conducive to the governance of villages and towns. North China has prominent industries and rapid development of scientific and technological innovation. For example, Shanxi is an important energy supply base in China. Inner Mongolia is rich in agricultural and animal husbandry resources, with high-quality agricultural and livestock products sold all over the country, effectively driving the development of the local economy, and providing valuable mineral resources, natural resources and tourism resources. The Beijing-Tianjin-Hebei region has a cluster of high-tech industries and scientific and technological talents. It also has beautiful natural scenery, numerous historical resources, and profound cultural heritage, forging a solid foundation for the establishment of governance villages and towns. There are many ethnic minorities in Central China and Southwest China, where there are unique minority cultures, rich tourism resources and landform resources, but the economy is relatively underdeveloped, and governance villages and towns are thus less densely distributed. The early development of heavy industry in Northeast China brought serious environmental pollution. Nowadays, the traditional industries are declining but the emerging industries are underdeveloped, so it is urgently necessary to adjust the industries and rehabilitate the environment. Northwest China is characterized by a fragile environment, arid climate, sparse population, inconvenient transportation, serious land desertification, an underdeveloped economy, and sparse distribution of governance villages and towns.

3.2 Spatial density characteristics

The kernel density analysis chart (Fig. 1) shows that Beijing, southern Hebei, central Henan, southern Jiangsu, Shanghai, northern Zhejiang and southern Guangdong are the regions featuring the highest kernel density, while southwestern Jilin, northwestern Liaoning, central Hebei, central and southwestern Shandong, Hubei, central Hunan, central Jiangxi, central Fujian, central Guizhou and eastern Sichuan have the highest kernel density, and Heilongjiang, Shanxi, Ningxia, Chongqing, Yunnan and Guangxi have the lowest kernel density. Generally speaking, the distribution characteristics of the first and second batches are basically consistent with the kernel density analysis of all governance villages and towns, so considering the two batches separately exerts no significant impact on the overall distribution situation, but the difference lies in the quantity. On the whole, the distribution

Table 2 Governance villages (towns) in seven geographical divisions of China

Region	Province (city)	Number of villages and towns	Proportion (%)	Number in first batch	Proportion (%)	Number in second batch	Proportion (%)
Northeast	Heilongjiang Province	64	8.90	32	8.84	32	8.90
	Jilin Province	66		33		33	
	Liaoning Province	65		32		33	
North China	Shanxi Province	36	13.11	3	13.03	33	13.18
	Inner Mongolia Autonomous Region	66		33		33	
	Beijing	24		12		12	
	Tianjin	21		10		11	
	Hebei Province	140		85		55	
East China	Shanghai	21	30.19	11	30.44	10	29.94
	Jiangsu Province	133		67		66	
	Zhejiang Province	132		67		65	
	Jiangxi Province	64		33		31	
	Shandong Province	113		57		56	
	Anhui Province	107		55		52	
	Fujian Province	91		44		47	
Central China	Hunan Province	109	15.07	54	15.13	55	15.02
	Hubei Province	90		46		44	
	Henan Province	131		66		65	
South China	Guangdong Province	106	8.81	52	8.75	54	8.88
	Guangxi Zhuang Autonomous Region	65		33		32	
	Hainan Province	22		11		11	
Southwest	Sichuan Province	131	15.07	66	15.22	65	14.92
	Guizhou Province	67		35		32	
	Yunnan Province	66		33		33	
	Chongqing	44		22		22	
	Tibet Autonomous Region	22		11		11	
Northwest	Shaanxi Province	69	8.81	34	8.56	35	9.06
	Gansu Province	44		22		22	
	Qinghai Province	17		6		11	
	Ningxia Hui Autonomous Region	20		10		10	
	Xinjiang Uygur Autonomous Region	43		22		21	

density characteristics of governance villages and towns in China are rather obvious, as they are mainly distributed in the southeast of China, but only rarely in the northwest and Qinghai-Tibet regions.

Shanghai, Zhejiang, Jiangsu, Anhui and some other provinces and cities belong to the Yangtze River Delta urban agglomeration, which is the region with the most active economic development, the highest degree of openness, the highest degree of urban agglomeration and the strongest innovation ability in China. It is also the economic center with the greatest comprehensive strength in China, as positioned by the central government. The Beijing-Tianjin- Hebei urban agglomeration, which connects the northeast and east China, is not only the political and cultural center of China, but also an important hub for the economic development of northern China. It is one of the first regions in China to form metropolitan circles and urban agglomerations. Guangdong is the distribution area of the Pearl River Delta urban agglomeration, which has a superior geographical position. In addition, coastal areas have close contacts with foreign countries, and are more exposed to western advanced culture and some new ideas than the inland provinces, thus affecting the theory and methods of rural governance in coastal areas to a certain extent. In summary, the maps in Fig. 1 show that the regions with the highest distributions of kernel density are developed provinces and cities in China, which have highly concentrated talents and good advantages in terms of resources, transportation and location, and these factors are conducive to the cultivation and creation of governance villages and towns.

3.3 Spatial equilibrium characteristics

The spatial complexity of governing villages and towns was calculated and counted according to the grid dimension analysis method. Firstly, rectangular boxes that could fully-cover the study area on the vector map of the spatial distri-

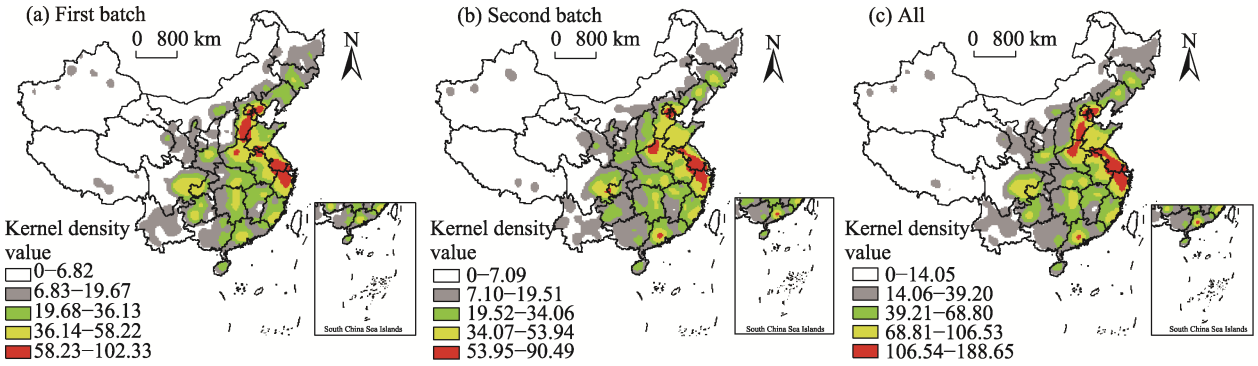

Fig. 1 The kernel densities of villages (towns) in China

bution of "governing villages and towns" were selected and made with the help of ArcGIS software, and a fixed scale was set for the superposition operation. The grid K is an equilateral rectangular grid with a value between 2 and 10, and the total number of grids in the research area is K^2. Secondly, the number $N(r)$ of grids in the area covered by "governing villages and towns" and the number N_{ij} of point sets in each grid were counted according to the number of sides of the rectangle. Then, the probability P_{ij} of "governing villages and towns" and the information value $I(r)$ under different grid numbers were calculated. Finally, the ($N(r)$, K) and ($I(r)$, K) were calculated (Table 3). The logarithmic scatter plot was drawn numerically, and the capacity dimension and information dimension of "governing villages and towns" were obtained by fitting and regression.

As shown in Fig. 2, the total capacity value of all villages and towns under governance is 1.4544 (with a judgment coefficient of 0.9848), and the capacity value is close to 1 according to the judgment range (0, 2) of grid dimension D, indicating that the points of "villages and towns under governance" present unbalanced characteristics in the system spatial distribution. However, the information dimension value of 0.7245 (with a decision coefficient of 0.9543) is smaller than the capacity dimension of 1.4544, and the two values are quite different. This indicates a situation of unequal probability of the spatial distribution of villages and towns under governance, and the fractal structure of the system is complex, with significant differences in grid dimensions and strong differences among the fractal grids. Besides, Figs. 3 and 4 show that the capacity values of the first and batches of villages and towns to be treated are 1.3896 and 1.4179, respectively, and the values are within the judgment range (0, 2). The information dimension value is obviously smaller than the capacity dimension value. Therefore, the results of the two batches of villages and towns to be treated are the same as those of all villages and towns to be treated. Combined with the distribution characteristics of villages and towns to be treated, this analysis may indicate that the distribution of villages and towns to be treated is affected by the landforms and landscapes.

3.4 Spatial correlation

The data in Table 4 show that the estimated value of Moran's I of the spatial distribution of all villages and towns in governance is 0.1042>0. The estimated values of Moran's I of the first and second batches are 0.0544 and 0.1426, respectively, both of which are larger than the expected index of –0.0333, indicating the significant positive spatial correlation of the spatial distribution of villages and towns in governance. Furthermore, all villages and towns in governance are in a spatial agglomeration situation in areas with similar numbers and scales. From the hot spot analysis in

Table 3 Measurement data of the grid dimensions of villages (towns) governed by the state

Batch	K	2	3	4	5	6	7	8	9	10
First batch	$N(r)$	4	9	14	17	23	25	31	37	42
	$I(r)$	0.9338	1.6157	1.8644	1.9817	2.3786	2.6234	2.7991	2.9698	3.1510
Second batch	$N(r)$	4	9	15	17	23	28	32	39	43
	$I(r)$	0.9300	1.5802	1.8852	2.0302	2.3849	2.6369	2.8555	3.0203	3.2142
All	$N(r)$	4	9	15	20	24	29	33	40	47
	$I(r)$	0.8914	1.6127	1.8833	2.0676	2.3561	2.6529	2.8145	3.0035	3.1759

Note: The rectangle covering the study area on the vector map of the distribution of demonstration villages and towns was selected, and a rectangular grid with an equal unit level was made. The side length of the rectangular grid was set to 1 unit length and divided into K equal parts, and K^2 small areas were obtained. The number of grids covered by demonstration villages and towns $N(r)$ was counted, then the number of demonstration villages and towns N_{ij} in each grid was counted and the probability $P_{ij}(r)$ of demonstration villages and towns was calculated, and finally the corresponding $N(r)$ and $I(r)$ were calculated.

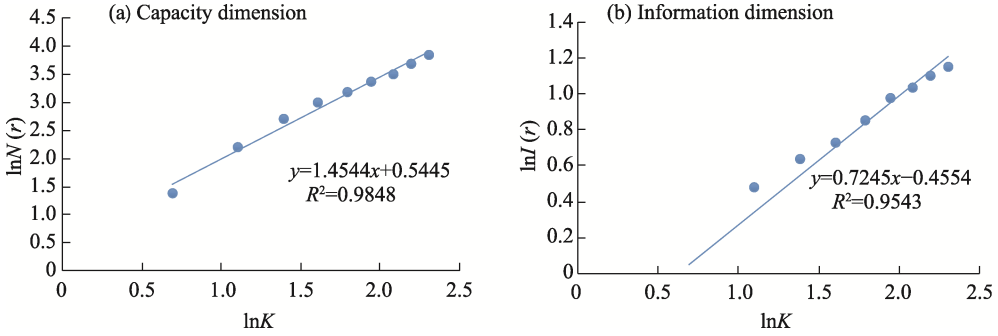

Fig. 2 Double logarithmic scatter diagram of the grid dimensions of villages (towns) in China

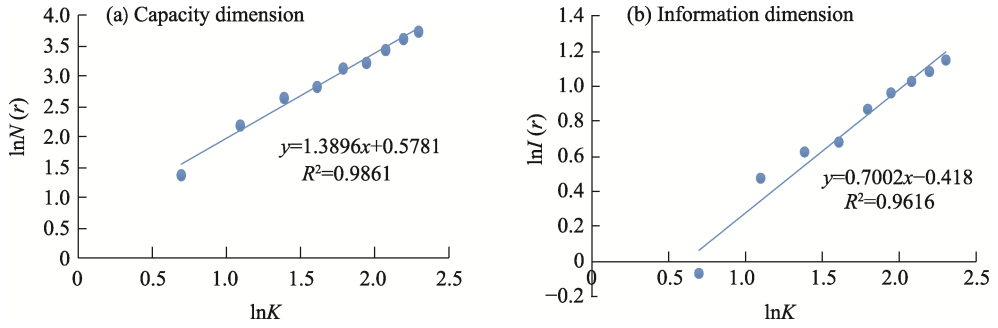

Fig. 3 Double logarithmic scatter plots of the grid dimensions of the first batch of governance villages (towns)

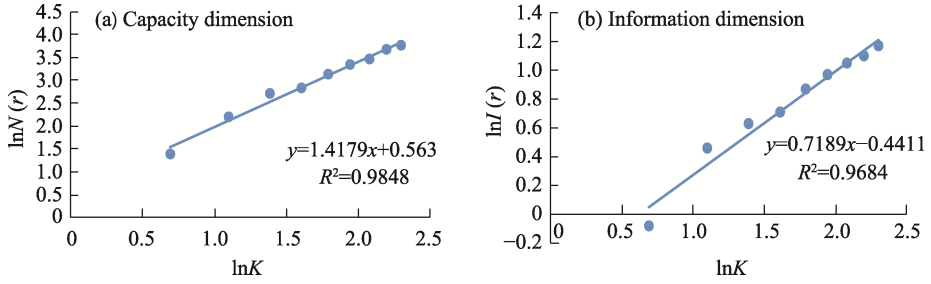

Fig. 4 Double logarithmic scatter diagrams of the grid dimensions of the second batch of governance villages (towns)

ArcGIS, a hot spot map (Fig. 5) for managing the spatial pattern of villages and towns was drawn, and it generally shows the distribution patterns of hot spots, sub-hot spots, sub-cold spots and cold spots from west to east. Below the national level, the hot spots and sub-hot spots are mainly distributed in Shanxi, Hubei, Chongqing, Shandong, Henan, Anhui, Jiangxi, Jiangsu, Zhejiang, Fujian, Guangdong and other provinces and cities, accounting for 48.7% of the total number of villages and towns in the country. The secondary cold spots are mainly distributed in Liaoning, Hebei, Hunan, Guizhou, Guangxi and other provinces and cities, occupying 20.33% of the national total. The cold spots are mainly distributed in Inner Mongolia, Heilongjiang, Jilin, Shaanxi, Yunnan and other provinces and cities, representing 15.12% of the national total. In general, the governance villages and towns are mainly distributed in the south and southeast, with fewer in the north and northeast, and basically none in the northwest. In addition, the distributions of the first and second batches are basically the same.

Table 4 Moran's *I* index of the overall situation of national governance villages (towns)

Value	All	First batch	Second batch
Global Moran's *I* index	0.1042	0.0544	0.1426
Expected index	–0.0333	–0.0333	–0.0333
Variance	0.0122	0.0122	0.0122
Z value	1.2455	0.7994	1.5935
P value	0.2129	0.4241	0.1111

3.5 Factors influencing the spatial distribution of villages and towns

An extensive and in-depth literature review showed that previous studies mostly analyzed the governance of villages and towns from the perspective of natural geographical factors and human geographical factors. Therefore, in order to fully understand the spatial distribution law of the relevant villages and towns, the influences of topography, economy, traffic and other factors on the spatial distribution of

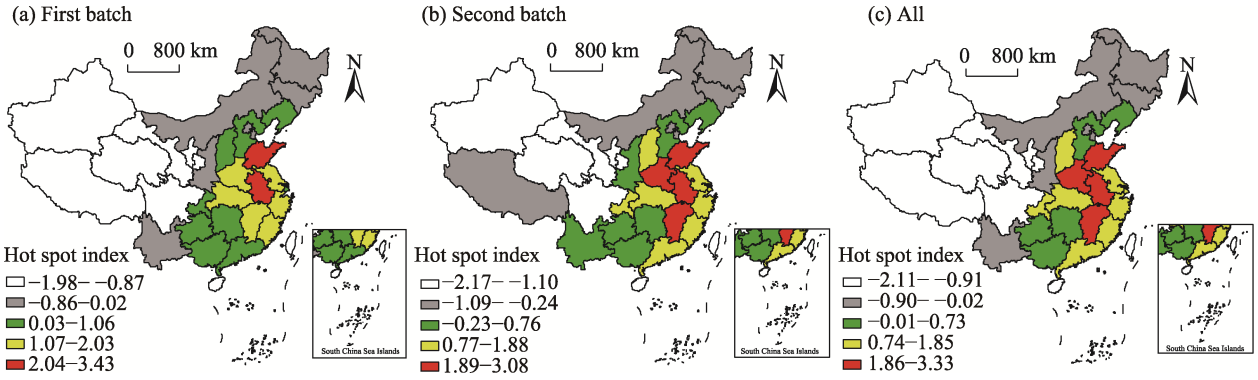

Fig. 5 Governance hot spots in villages (towns) across China

governance villages and towns in China were further explored.

3.5.1 Physical and geographical factors

(1) Relationship with topography. The terrain in China is complex and diverse, and the terrain types mainly include plains, plateaus, mountains, hills, and basins. By studying the altitudes and landform types of governance villages and towns using ArcGIS software, the landform types and proportions of forest villages and towns were obtained. As shown in Table 5, the topographical and geomorphological distributions of the first and second batches of villages and towns are consistent with those of all villages and towns, and the villages and towns are mainly distributed in low-altitude plains and hilly areas, as well as low and medium-altitude platform areas. The plains, with a low altitude, vast area, open and flat terrain, are conducive to the development of transportation, and areas where there is fertile soil and a humid climate are easy to cultivate and suitable for living. The hilly landforms, with a low altitude and abundant precipitation, are suitable for the growth of trees and fruit trees, and they are conducive to the development of a diversified economy. The terrace, as a flat terrain, is conducive to the development of agriculture and animal husbandry. Overall, the low altitude areas have a small slope and a small relative height difference, which is suitable for human production and living. To some extent, the plain and hilly terrains provide good natural and geographical conditions for the effective governance of villages and towns.

Table 5 Main geomorphological types and their proportions of governance villages (towns) (Unit: %)

Batch	Low altitude mountain area	Low altitude plain	Low altitude hills	Low altitude platform	Mid-altitude mountain
First batch (1097)	20.42	30.99	11.21	9.21	8.66
Second batch (1092)	19.58	28.56	10.78	9.43	10.52
All (2189)	20.77	30.88	11.27	9.45	9.73

Relationship with elevation. In order to reveal the relationship between the spatial layout of villages and towns and elevation, the elevation points were extracted from the DEM by ArcGIS, and the results show an average elevation of less than 500 m. The villages and towns are mainly distributed in areas with an elevation of 500 m and below, with some more at elevations between 500 m and 1000 m, but with few above 1000 m (Table 6). Further, superimposing the governance villages and towns with the national DEM in ArcGIS (Fig. 6) indicates that about 80% of the governance villages and towns are distributed in areas with a flat terrain and a low elevation value suitable for living. To further refine the analysis, the elevation values were then divided into five areas by using the classification method of natural discontinuity points, and the villages and towns under their jurisdiction are mainly distributed in low altitude areas from 161 m below sea level to 718 m above sea level. Some villages and towns with little governance are distributed in the high altitude areas from 719 to 1707 m, but the high altitude areas above 4310 to 8377 m are rare, suggesting a positive correlation between the distribution of governance villages and towns and the elevation.

(3) Relationship with the lake water system. Water is the source of life, an irreplaceably important resource for human survival as well as economic and social development, and an indispensable guarantee system for the improvement of the urban ecological environment. There are seven major water systems in China, from north to south: Songhua River, Liaohe River, Haihe River, Huanghe River, Huaihe River, The Yangtze River and Pearl River. In order to be clearer and more intuitive, the 5-km buffer zone of the seven major water systems was analyzed, and the overlapping analysis was carried out with the governance villages and towns (Fig. 7). This analysis showed that there is a more dense distribution in the middle part of Heilongjiang in the lower reaches of Heilongjiang water system, but almost none in other areas. Some governance villages and towns are distributed in the lower reaches of the Yellow River system,

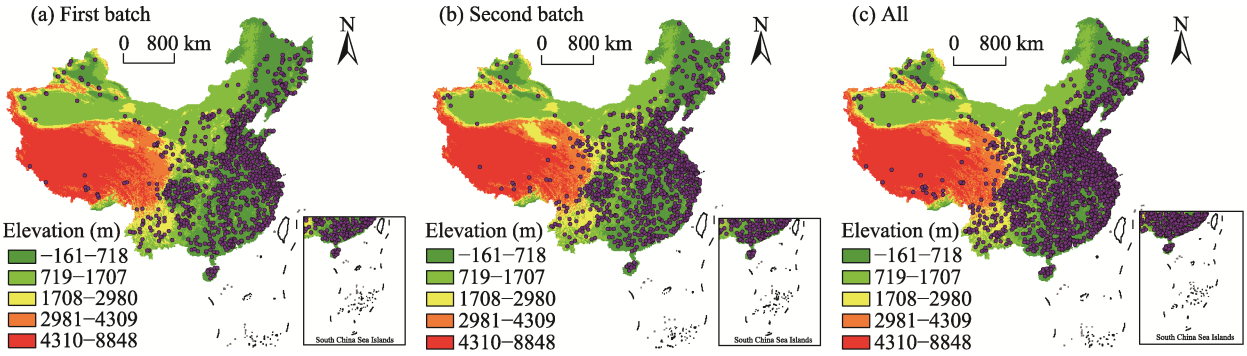

Fig. 6 Relationship between distribution and the elevation of villages (towns) in China

Table 6 Relationship between governance villages (towns) and elevation

Elevation (m)	First batch (1097)	Proportion (%)	Second batch (1092)	Proportion (%)	All (2189)	Proportion (%)
$h \leqslant 500$	802	73.11	758	69.41	1564	71.48
$500 < h \leqslant 1000$	130	11.85	142	13.00	279	12.75
$1000 < h \leqslant 1500$	94	8.57	106	9.71	191	8.73
$1500 < h \leqslant 2000$	32	2.92	40	3.66	69	3.15
$h > 2000$	39	3.56	46	4.21	86	3.93

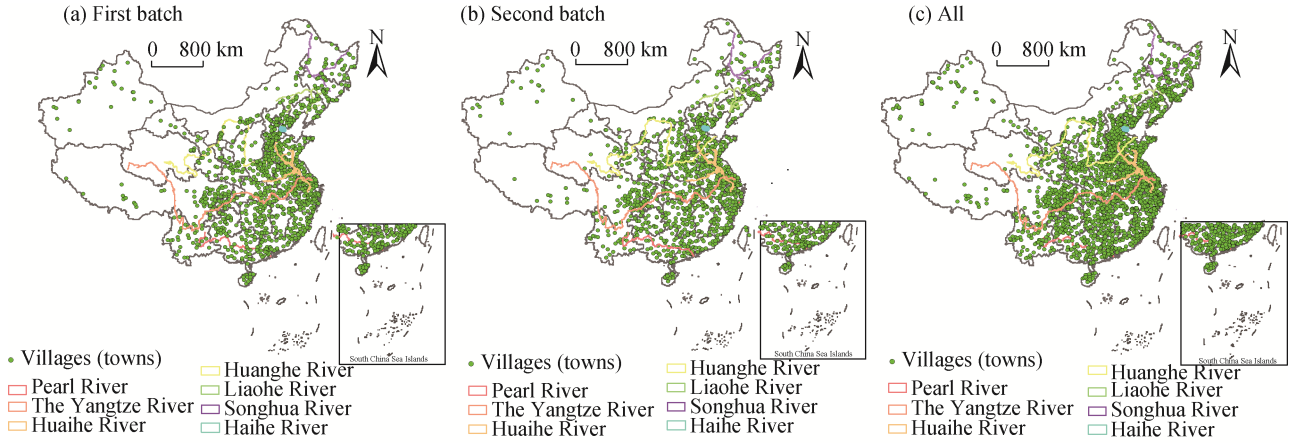

Fig. 7 Relationship between the distribution of governance villages (towns) and the major water systems

mainly in Shaanxi, Henan and Shandong, but less in the upstream cities. Chongqing, Hubei, Hunan, Anhui, Jiangsu and Shanghai in the middle and lower reaches of the Yangtze River show wide distributions, but there are few cities in the upper reaches. Besides, there are many governance villages and towns distributed around Henan, Anhui and Jiangsu provinces of the Huaihe River system and Liaoning of the Liaohe River system. Yunnan, Guizhou, Guangdong, Hunan, Guangxi, Jiangxi and other provinces and cities through which the Pearl River system flows, have more governance villages and towns, but there are few villages and towns in the upper reaches of Lancang River, Nujiang River, Songhua River and other rivers. Villages and towns are only scarcely distributed in Tarim River and Yarlung Zangbo River. This analysis shows that the governance of villages and towns is closely related to the river systems, which is the main reason that affects their distribution, but the upstream portions of the water systems are at higher altitudes, thereby leading to the sparse distribution of governance villages and towns in the upstream areas.

3.5.2 Human and geographical factors

(1) Relationship with social economy. Economic factors are an important measure of the development of a region. The tertiary industry, as the fastest-growing industry in the industrial structure of China, has increased employment opportunities, enriched people's lives and played a positive role in the economies of the cities (Lei, 2021). Income is the embodiment of people's quality of life, so gross national product, added value of tertiary industry and population income were selected as the indicators for this study. Statistics on the gross national product (GDP) of 341 prefecture-level cities (states) in 34 provinces (cities) in China in 2021, and the number of villages and towns governed by these 341 prefecture-level cities (states) were compiled.

Through the correlation analysis of SPSS22.0, the Pearson coefficients of the GDP of all villages and towns, the first batch of villages and towns, and the second batch of villages and towns and cities (states) in China are 0.596, 0.548, and 0.134, respectively; and the *P* values are less than 0.05. The Pearson coefficients of the added value of the tertiary industry in all the villages and towns in China, the first batch of villages and towns, the second batch of villages and towns, and all prefecture-level cities (states) are 0.135, 0.164, and 0.089, respectively, with *P* values of 0.013, 0.002, and 0.099. The Pearson coefficients of population income of all villages and towns in China, the first batch of villages and towns, the second batch of villages and towns and cities (states) are 0.235, 0.235, and 0.208, respectively, and the *P* values are all 0 (i.e., less than 0.05), indicating that there is a correlation between them. Among these economic factors, the gross national product (GNP) has a significant impact on the spatial distribution of all the villages and towns to be governed and the first batch of villages and towns to be governed, but it has little impact on the second batch of villages and towns to be governed. Overall, the degree of influence of the three indicators above follows the order of gross national product > population income > added value of the tertiary industry. Since the reform and opening up, the economy of China has developed rapidly, and China now has the second largest economy worldwide, making the country more prosperous and powerful. The education, medical care, transportation and infrastructure have been improved in every city; the catering, accommodation, finance, entertainment and other industries have continued to grow rapidly; and people's living standards have improved significantly. Similarly, the emergence and development of rural governance cannot be separated from the leading role of the economy. The increase in gross national product makes it possible for the government to provide more financial investments to village and town governance, and offers a more direct and effective means of village and town governance from the top-level system design of the government. With the increases in the added value of the tertiary industry and the income of the population, micro-individuals are more willing to participate in the relevant work of villages and towns, thus providing the enthusiasm and innovation of society and inspiring individuals to get involved in village governance.

(2) Relationship with population distribution. Statistics on the populations of 341 prefecture-level cities (states) in 34 provinces (cities) in China in 2021 and the number of villages and towns governed by these 341 prefecture-level cities (states) were compiled, and a correlation analysis was carried out by SPSS22. The Pearson's coefficients of the populations of all villages and towns in China, the first batch of villages and towns and the second batch of villages and towns, and those of prefecture-level cities (states) are 0.169, 0.189, and 0.132, respectively. The *P* values are 0.002, 0, and 0.015, respectively, which are all less than 0.05, reflecting the low correlation between the degree of population concentration and the spatial distribution of villages and towns. Thus, the population is not a factor that affects the distribution of villages and towns. The establishment of village and town governance is an overall survey of the strong leadership of the party organizations in those villages and towns, the moral standards of villager behavior, the development of the villages and towns, and the stability of rural society. The fact that a village or township can meet the national standards and be selected as a governance village is closely related to the population quality of the village or town, and indicates the high-quality talents and good human resource advantages of the region. The villages and towns are thus well managed by the high-quality managers and laborers, so that the industries in those villages and towns are promoted and developed, the living environment is improved, and the economic benefits are improved. In short, the quality of the population, i.e., the quality of workers, is more important than the number of people, suggesting that it is necessary to improve the population quality in order to cultivate and create more governance villages and towns in some areas that now have fewer of them.

(3) Relationship with traffic conditions. Human production and life cannot be separated from traffic. The overlapping analysis of national highways and villages and towns (Fig. 8) shows that villages and towns are closely related to highways, and are mainly distributed near highways. The buffer analysis tool of ArcGIS 10.7 software was then used to analyze the buffer zones of 10 km, 15 km and 20 km around the national highways and railways. By counting the number of villages and towns in the buffer zone, the proportion was calculated, and the relationship between the distribution of villages and towns and traffic conditions was analyzed (Tables 7 and 8). The results show that traffic conditions affect the spatial distribution of governance villages and towns. There are more governance villages and towns closer to traffic, and fewer governance villages and towns farther away from traffic, indicating that traffic conditions are an important factor affecting the distribution of villages and towns.

Transportation infrastructure is the material basis of economic and social development, and the basic condition for allowing all kinds of transportation tools to operate and realize transportation organization activities. It has a decisive influence on the flow of traffic production factors and the development of urban systems. The establishment and improvement of the transportation system is conducive to the development of the city, the promotion of cultural exchanges, the common prosperity of society and the realization of the strategic goal of rural revitalization. In summary, without a good and efficient traffic system and convenient traffic conditions, the urban economy cannot be well developed

Table 7 Analysis and proportions of the highway buffer zones

Buffer zone	10 km buffer ratio (%)	15 km buffer ratio (%)	20 km buffer ratio (%)
First batch (1097)	24.43	34.18	41.83
Second batch (1092)	23.90	33.79	40.84
All (2189)	24.76	34.63	41.66

Note: The buffer analysis tool of ArcGIS 10.7 software was used to analyze the buffer zones of 10 km, 15 km and 20 km around the national highways. By counting the number of villages and towns in a buffer zone, the proportion was calculated, and the relationship between the distribution of villages and towns and traffic conditions was analyzed.

Table 8 Analysis and proportions of railway buffer zones

Buffer zone	10 km buffer ratio (%)	15 km buffer ratio (%)	20 km buffer ratio (%)
First batch (1097)	42.48	54.51	67.09
Second batch (1092)	41.94	54.76	65.02
All (2189)	41.25	55.46	66.28

Note: The buffer analysis tool of ArcGIS 10.7 software was used to analyze the buffer zones of 10 km, 15 km and 20 km around the national railway system. By counting the number of villages and towns in each buffer zone, the proportion was calculated, and the relationship between the distribution of villages and towns and railway conditions was analyzed.

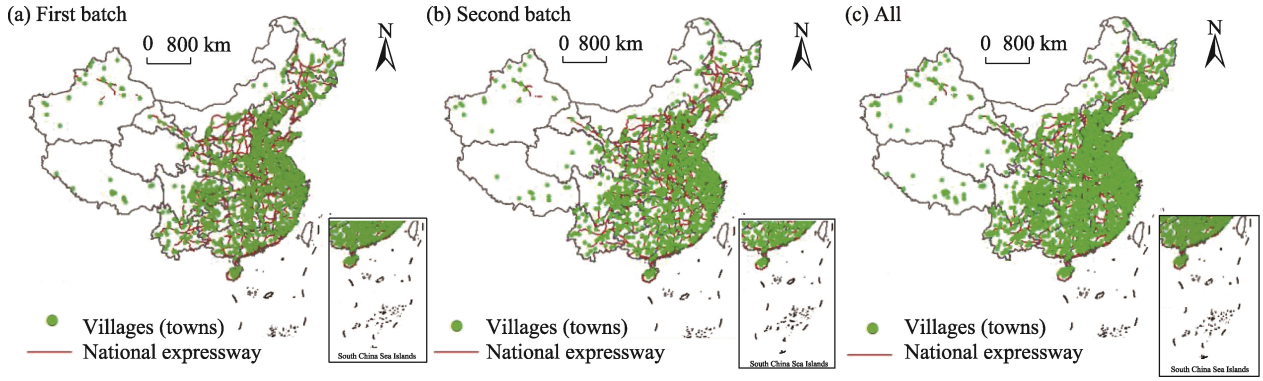

Fig. 8 Relationship between the distribution of governance villages (towns) and high speed transportation systems

and the people's living standard cannot be improved. Therefore, it is necessary to improve the construction of the infrastructure in the western region, the Qinghai-Tibet region, such as an expressway network and trunk lines of public railways, and promote the high-quality development of transportation.

(4) Relationship with national culture. Culture injects spiritual energy into the governance of villages and towns, and profound cultural details provide the possibility for the creation of the governance of villages and towns. The above kernel density analysis chart, hot spot analysis chart and relevant statistical tables show that the cultural areas such as Yanzhao, Wuyue, Central Plains, Qilu, Jingchu, Hakka culture, Yunnan, Guizhou and other places where human activities are frequent, and the economy and culture are developed, are areas which also feature densely-distributed villages and towns. Culture is the embodiment of the cultural environment, history and cultures of different regions, and it has obvious local characteristics. It is easier for a region with a strong cultural atmosphere to establish a national identity and strengthen national cohesion. The unique national culture of each region can more easily form a typical village with a certain scale, and there is a special governance system, which is conducive to the selection and cultivation of governance villages and towns.

4 Discussion and conclusions

4.1 Discussion

Based on our analysis of the spatial distribution pattern and related problems of villages and towns in China, steps in the developmental path of villages and towns are put forward here to provide some theoretical guidance for their better development.

(1) To enhance cultural self-confidence, actively explore regional cultural resources, and attach importance to cultural protection and inheritance. This study shows that there are more cultural areas in Yanzhao, Wuyue, Central Plains, Qilu, Jingchu, Hakka culture, Yunnan, Guizhou and other places with frequent human activities and developed economy and culture to govern the villages and towns. Chinese culture has a long history. In managing villages and towns, attention should be paid to the cultivation of characteristic rural culture, protecting national culture, keeping good folk customs, giving full play to the unique advantages of rural culture, and building villages and towns into a beautiful homeland with a clear cultural context, profound historical memory, rich ethnic customs and distinctive regional characteristics, in order to promote the revitalization of rural culture in the new era (Liu et al., 2019).

(2) To pay attention to the construction of rural talents, strengthen the support of rural revitalization talents, and increase the total amount of talents for managing villages and towns. The southeastern coastal areas of China are economically developed and gather talented people, while the northwestern frontier areas are sparsely staffed, so there are obvious differences in talent distribution between east and west (Liu and Hu, 2019). According to the above analysis, governance villages and towns are concentrated in the southeastern coastal areas of China and economically developed inland provinces and cities, but sparsely distributed

in the northwestern and Qinghai-Tibet areas, which is basically consistent with the talent distribution pattern in China. The excessive concentration of talents in developed areas of China, as well as the shortage of talents in underdeveloped areas, has become the distribution trend of talents in China. Rural governance needs a strong team of talents who are not only equipped with solid professional theoretical knowledge but also good psychological qualities and rich experience (Peng, 2022). Therefore, one suggestion is to raise the salaries of posts in villages and towns in underdeveloped areas, and appropriately introduce talents into the villages and towns, in order to further promote the development of talents in the villages and towns, improve the talent revitalization system, and boost the revitalization of rural talents.

(3) To strengthen regional cooperation, narrow regional differences and promote regional sustainable development. According to the research results, the distribution of governance villages and towns is less dense in the southwestern region with limited economic development, while the coastal cities and Beijing-Tianjin-Hebei region with better economic development are the core hotspots, presenting obvious differences in distribution. With the continuous deepening of economic globalization and the gradual transformation of the domestic economy into a high-quality development stage, the regional spatial pattern and structure of the economic development of China are also undergoing profound changes, and the development mode of "single-handedness" in an individual city is unsustainable (Zhang and Hong, 2022). Therefore, for the sake of the overall development pattern of the country, all regions should strengthen their exchanges and cooperation, complement each other's advantages, achieve mutual benefits and win-win scenarios, and strengthen radiation to drive benefit, while the developed regions should help drive the underdeveloped regions to enhance the overall economic strength of the entire region.

（4) To implement the system guarantee, establish a long-term tracking management mechanism, and strengthen the assessment and supervision of the governance villages and towns. To manage villages and towns, one piece of advice is not only to pursue an increase in their quantity, but also to pay attention to the improvement of their quality. The establishment and selection of villages and towns should be strictly implemented according to national standards, and at the same time, the scientifically valid and reasonable evaluation index system should be improved. For villages and towns governed by selection, the government should strengthen their construction quality, and should not neglect their management and allow their development. A comprehensive and long-term assessment and supervision system should be established, the infrastructure and economic development of villages and towns governed by selection should be regularly inspected, and measures for improvement should be put forward according to the actual situation. One additional requirement is to criticize villages and towns governed by failure during the assessment, and order them to make corrections.

4.2 Conclusions

The spatial distribution pattern and influencing factors of villages and towns governed by the state are studied and explored herein. This analysis led to three basic conclusions.

(1) Governance villages and towns are mainly distributed in the southeast of China, but less so in the north and west. From the perspective of north-south distribution, the distribution of governance villages and towns is characterized by more in the south and less in the north, with the least dense distribution in the northwest and Qinghai-Tibet regions. From the perspective of the three major economies, the eastern part is the largest, followed by the central part, and the western part is the least. Judging from the seven geographical divisions, governance villages and towns are most densely distributed in East China, accounting for the highest proportion, followed by North China, Central China and Southwest China. The distribution densities in Northeast China, South China and Northwest China are the lowest. The analysis of the kernel density of villages and towns shows a number of kernel centers in space, and the distribution pattern of sub-centers shows a zonal distribution formed by the decreasing and spreading of the kernel centers around the center. Moreover, the distribution density of governance villages and towns is gradually increasing from west to east.

(2) Governance villages and towns are mainly distributed in hot spots, i.e., more in the south and southeast of China, but less in the north and northeast of China. This pattern presents the spatial correlation of governance villages and towns, with obvious spatial differences between hot spots and cold spots, prominent polarization, and obvious "cluster" and "ribbon" distribution characteristics as a whole. The analysis of grid dimensions shows that the village and town system has an obvious scale-free area, a complex fractal structure and obvious fractal characteristics.

(3) The spatial distribution of governance villages and towns is mainly influenced by terrain, elevation, rivers, economy, traffic conditions, national culture and other factors. The gentle terrain, developed economy and convenient transportation provide good natural and geographical conditions and superior humanistic conditions for the cultivation and development of villages and towns, while the river systems provide the power source for the maintenance and management of the villages and towns. The regions with profound national cultural heritage provide the direction for the country to choose and manage villages and towns, and the gathering of talent in coastal areas provides the necessary talent support for the management of villages and towns.

References

Almohamad A. 2021. The destruction and looting of cultural heritage sites by ISIS in Syria: The case of Manbij and its countryside. *International Journal of Cultural Property*, 28(2): 221–260.

Benni S, Carfagna E, Torreggiani D, et al. 2019. Multidimensional measurement of the level of consistency of farm buildings with rural heritage: A methodology tested on an Italian case study. *Sustainability*, 11(15): 1–23.

Brown D. 2021. Towards a comparative research agenda on in situ urbanisation and rural governance transformation. *International Development Planning Review*, 43(3): 289–320. (in Chinese)

Buark S, Dogan E, Gazioglu C. 2004. Impact of utbanization and tourism on coasta environment. *Ocean & Coastal Management*, 47(9–10): 515–527.

Cao K J, Wang M M. 2022. Evolution of spatial pattern in beautiful countryside, China and its influencing factors. *Economic Geography*, 42(8): 1446–1454. (in Chinese)

Chen G L, Zhang C Y, Luo J, et al. 2018. Spatial distribution pattern of classic red tourism scenic spots in China. *Resources and Environment in Arid Areas*, 32(9): 196–202. (in Chinese)

Chen G L, Zhang C Y, Zeng J X, et al. 2019. Study on the spatial differentiation pattern of "one village, one product" in China. *Economic Geography*, 39(6): 163–171. (in Chinese)

Chen L Y, Hu H, He X, et al. 2022. The development path and data mining mode of rural tourism under the background of big data. *Wireless Communications and Mobile Computing*, (2022): 1–13. DOI: 10.1155/2022/3031169.

Chen Y Q. 2019. Study on the spatial distribution characteristics and influencing factors of famous historical and cultural villages and towns in Fujian Province. *Urban Development Research*, 26(12): 12–18. (in Chinese)

Chiodo E. 2019. Collaborative processes and collective impact in tourist rural villages—Insights from a comparative analysis between Argentinian and Italian case. *Sustainability*, 11(2): 432. DOI: 10.3390/su11020432.

Gao W J, Xiao D W, Zhuo X L. 2022. Distribution characteristics and influencing factors of ethnic villages in Yunnan. *Economic Geography*, 42(9): 228–238. (in Chinese)

Greta T, Emily Y Y C, Sida L. 2019. Planning of a healthemergency disaster risk management programme for a Chinese ethnic minority community. *International Journal of Environmental Research and Public Heath*, 16(6): 1–12.

Guan Z M, Wang T W, Zhi X X. 2017. The spatial and temporal pattern of the distribution of traditional villages in Central Plains Economic Zone and its causes. *Economic Geography*, 37(9): 225–232. (in Chinese)

He X F. 2005. Three major themes of rural governance research. *Social Science Front*, (1): 219–224. (in Chinese)

Huang D K, Sun W, Chen W, et al. 2021. Study on the evolution and mechanism of rural settlement pattern based on multi-temporal remote sensing data—Taking Jiangsu Province as an example. *Resources and Environment of the Yangtze River Basin*, 30(10): 2407–2416. (in Chinese)

Huang X, Zou T Q, Chu D P. 2019. Study on the evolution mechanism and model of tourism rural governance longitudinal case study of Yuanjiacun, Shaanxi from 1949 to 2019. *Human Geography*, 35(3): 93–103.(in Chinese)

Król K, Hernik J. 2022. Digital folklore of rural tourism in Poland. *Sustainability*, 14(3): 1–11.

Lei M M. 2021. An empirical analysis of the relationship between China's tertiary industry development and economic growth based on VAR model. *Economic Vision*, (6): 162–165. (in Chinese)

Li B H, Yin S, Liu P L, et al. 2015. Analysis of spatial distribution characteristics and influencing factors of traditional villages in Hunan Province. *Economic Geography*, 35(2): 189–194. (in Chinese)

Li Z M. 2019. Temporal and spatial evolution and formation mechanism of ancient villages in Fenhe River Basin. *Economic Geography*, 39(2): 207–214. (in Chinese)

Liu H, Hu S L. 2019. Spatial agglomeration pattern and temporal and spatial evolution of talents in China. *Economic Survey*, 36(5): 1–8. (in Chinese)

Liu L, Wu B H. 2011. Double-driven rural development of "urban scenic spot": Path selection and its dynamic evolution process. *Scientia Geographica Sinica*, 41(1): 1898–1906. (in Chinese)

Liu T Q, Liu P L, Wang L J. 2019. The path choice of ancient villages and towns protection and tourism development under the background of new urbanization—Taking Xuanzhou ancient town as an example. *Geography Research*, 38(1): 134–145. (in Chinese)

Maja P W J, Meyer S, Von S. 2022. Smart rural village's healthcare and energy indicators—Twin enablers to smart rural life. *Sustainability*, 14(19). DOI: 10.3390/SU141912466.

Peng X X. 2022. Analysis of the path of cultivating agricultural legal talents in China's agricultural and forestry universities under the rural revitalization strategy. *Journal of Inner Mongolia Agricultural University* (*Social Science Edition*), 24(3): 41–45. (in Chinese)

Qiu C L. 2020. Modernization of rural governance with China characteristics and its basic experience. *Hunan Social Sciences*, (2): 73–80. (in Chinese)

Ricardo B, Carlos P M, Alexandre G. 2022. Rural tourism in Portugal: Moving to the countryside. *Journal of Maps*, 18(1): 79–88.

Rojas F. 2020. Assembling Petra's rural landscapes. *Antiquity*, 94(376): 1–8.

Rytkönen P, Tunón H. 2020. Summer Farmers, diversification and rural tourism—Challenges and opportunities in the wake of the entrepreneurial turn in Swedish policies (1991–2019). *Sustainability*, 12(12). DOI: 10.3390/su12125217.

Sanagustin-Fons V T, Lafita-Cortés J, Moseñe. 2018. Social perception of rural tourism impact: A case study. *Sustainability*, 10(2): 339. DOI: 10.3390/su10020339.

Shen H F, Zheng J G, Tang F P, et al. 2013. Analysis of spatial distribution characteristics of A-level tourist attractions in Henan Province. *Economic Geography*, 33(2): 179–183. (in Chinese)

Sridharan S, Tunstall H, Lawder R, et al. 2007. An exploratory spatial data analysis approcach to understanding the relationship between deprivation and mortality in Scotland. *Social Science & Medicine*, 65(9): 1942–1952.

Tchetchik A, Fleischer A, Finkelshtain I. 2008. Differentiation andsynergies in rural tourism: Estimation and simulation of the Israeli Market. *America Journal of Agricultural Economics*, 90(2): 553–570.

Wang F H. 2011. Quantitative method and application based on GIS. Beijing, China: Commercial Press. (in Chinese)

Wang L, Li X F. 2022. The temporal and spatial evolution of rural revitalization development level and the influence of multi-dimensional environmental regulation. *Statistics and Decision*, 38(20): 63–66. (in Chinese)

Wang L, Zeng J. 2021. The spatial differentiation characteristics and types of rural settlements in southwest Shandong—Taking Heze as an example. *Geography Research*, 41(8): 2235–2251. (in Chinese)

Wang Z F, Liu Q F. 2019. Spatial heterogeneity characteristics and influencing factors of minority villages in China. *Economic Geography*, 39(11): 150–158. (in Chinese)

Wang Z F, Liu Q F. 2020. Spatial distribution and influencing factors of

national characteristic towns in China. *Economic Geography*, 40(3): 419–427. (in Chinese)

Wang Z W, Ma L G, Wang H W. 2020. Analysis of spatial pattern and influencing factors of oasis rural settlements in arid inland areas—Taking Tarim River Basin as an example. *Resources and Environment of Yangtze River Basin*, 29(12): 2637–2646. (in Chinese)

Wu D D, Wu Y, Ma R F, et al. 2022a. Research on spatial pattern and sustainable development model of beautiful countryside, Zhejiang. *World Geography Research*, 31(2): 363–375. (in Chinese)

Wu K S, Kong D Y, Wang Y, et al. 2022b. Spatial differentiation of influencing factors and effects of rural transformation and development—Taking Shaanxi Province as an example. *Journal of Natural Resources*, 37(8): 2033–2050. (in Chinese)

Wu Q, Li X G, Wu L, et al. 2017. Distribution pattern and spatial correlation analysis of A-level tourist attractions in Hunan Province. *Economic Geography*, 37(2): 193–200. (in Chinese)

Xu J H, Le Y M, Mao Z, et al. 2020. Factors influencing the spatial pattern of traditional villages in Hunan Province and protection patterns. *Economic Geography*, 40(10): 147–153. (in Chinese)

Yan H L, Wang Q, Xiong H, et al. 2019. Analysis of spatial distribution characteristics and influencing factors of leisure villages—Taking the most beautiful demonstration sites of leisure villages in China as an example. *Resources and Environment in Arid Areas*, 33(3): 45–50. (in Chinese)

Yan X R. 2021. Construction of rural eco-tourism development model and industrialization development—Comment on "Exploration of rural tourism development and industrialization development". *World Forestry Research*, 34(5): 129. (in Chinese)

Yang K. 2017. Protection and development measures of famous historical and cultural villages under the guidance of value and implementation—Taking Huzhou Village in Xiajiang County, Jiangxi Province as an example. *Urban Development Research*, 24(5): 26–34. (in Chinese)

Zhang J, Ma X F. 2021. Spatial differentiation and influencing factors of rural tourist areas in Hunan Province—A case study of five-star rural tourist areas. *Journal of Natural Resources*, 36(4): 879–892. (in Chinese)

Zhang R, Zhang X. 2022. Spatial-temporal differentiation and the driving mechanism of rural transformation development in the Yangtze River Economic Belt. *Sustainability*, 14(5). 2584. DOI: 10.3390/su14052584.

Zhang X L, Hong X D. 2022. Strengthen regional plate cooperation and fully promote the higher quality development of the Yangtze River Economic Belt. *Social Sciences in Yunnan*, (1): 122–131. (in Chinese)

Zhu L, Li Y N, Hu J, et al. 2022. Study on the temporal and spatial pattern evolution of the most beautiful leisure villages in China and its influencing factors. *Journal of Agricultural Resources and Environment*, 39(5): 1049–1058. (in Chinese)

中国乡村治理示范村镇空间分布格局及影响因素研究

王吉姝，陈国磊，张纪莎，李练练

贵州师范大学地理与环境科学学院，贵阳 550025

摘　要：村镇治理是推进国家治理体系和治理能力现代化的基本要求，关乎国家乡村振兴战略的实施和国家治理现代化目标的实现。本文以全国 2189 个乡村治理示范村镇为研究对象，综合运用最邻近点指数法、核密度估计法、网格维数分析法、空间自相关分析法，探索乡村治理示范村镇的空间分布结构与影响因素。研究表明：全国乡村治理示范村镇空间分布趋于集聚分布，空间分异较为明显；乡村治理示范村镇核密度分析在空间上呈现出多个核中心，以及由核中心向四周递减扩散而形成的呈带状分布的次级中心的分布格局；乡村治理示范村镇系统具有明显无标度区，分形特征显著；乡村治理示范村镇空间分布主要受自然和人文因素影响明显，其中自然因素中地形地貌和湖泊水系是主要影响因素；人文因素中社会经济、交通、民族文化是主要影响因素，人口分布的影响不显著。

关键词：示范村镇；乡村治理；空间分布格局；影响因素