

# Analysis of the Spatial Distribution Characteristics and the Natural Influencing Factors of Traditional Villages in Anshun City, Guizhou Province.

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## Abstract

**This study focuses on 78 traditional villages in Anshun City, Guizhou Province. By utilizing spatial analysis techniques such as average nearest neighbor index, kernel density, and regional frequency, along with mathematical and statistical methods, it analyzes the spatial distribution characteristics and the natural influencing factors of traditional villages in Anshun City from three aspects: distribution types, distribution clusters, and county-level distribution. The study indicates that the traditional villages in Anshun City exhibit an overall clustered distribution, with more villages in the north and fewer in the south. Three highly clustered areas are identified, namely Xixiu District, Pingba District, and Zhenning County. Through in-depth analysis. Through in-depth analysis of this study, it is found that three natural factors, namely topography, slope direction, and river water systems, have important impacts on the formation of spatial distribution patterns of traditional villages in Anshun City.**

## Keywords

**Anshun, Guizhou; Traditional villages; Spatial distribution; Influencing factors.**

## 1. Introduction

China's southwestern region is located deep inland and has complex terrain, with numerous ethnic minority villages. As of 2023, Anshun City, located in the Yungui Plateau, has 78 Chinese traditional villages, accounting for 10.30% of the 757 Chinese traditional villages in Guizhou Province. In its unique natural and social historical context, Anshun City has nurtured nationally renowned "Tunpu" traditional villages, which have distinct regional characteristics. Strengthening research on the current status of traditional villages in Anshun City through the integration of the latest data will contribute to exploring the unique features of settlement construction and development, and lay a foundation for the adaptive protection and sustainable development of settlements in the southwestern region.

## 2. Summary of the Research Area

Anshun City is located in the flat central-western part of Guizhou Province, with a land area of 9,228.34 square kilometers. It is only 90 kilometers away from the provincial capital, Guiyang. It is known as the "abdomen of Guizhou, the throat of Yunnan, and the lips and teeth of Sichuan and Guangdong provinces," and is an important growth pole in the central Guizhou economic zone and a key center in the central Guizhou urban agglomeration [1]. Anshun City administers six administrative districts and counties, namely Xixiu District, Pingba District, Puding County, Zhenning Buyi and Miao Autonomous County, Guanling Buyi and Miao Autonomous County, and Ziyun Miao and Buyi Autonomous County. It also has an economic and technological development zone and the Huangguoshu Tourism Zone. The development zone oversees Xihang Street, Yaopu Town, and Songqi Town in Xixiu District, while the Huangguoshu Tourism Zone oversees Longgong Town in Xixiu District, Baishui Town in Guanling County, and

Huangguoshu Town in Zhenning County [2]. As of 2023, Anshun City has had a total of six batches, comprising 78 villages, listed in the directory of China's traditional villages. Strengthening research on traditional villages in Anshun City will effectively promote the study of settlements in the southwestern region of China.

### 3. Data Sources and Research Methods

The study collected traditional villages in Anshun City from the six batches of China's traditional village directory released by the Ministry of Housing and Urban-Rural Development of the People's Republic of China (<https://www.mohurd.gov.cn/>). The geographic coordinates of the traditional villages were determined using the coordinate picking system of the Baidu Map Open Platform (<https://lbsyun.baidu.com/>), and the geographical information was loaded into the ArcGIS 10.2 platform for vectorization. The administrative division map of Anshun City used in this study was sourced from the National Basic Geographic Information Center (<https://www.webmap.cn/>) and was based on 1:1,000,000 vector data from 2021. The DEM data used was from the SRTM3DEM 90M dataset.

In this study, quantitative analysis and visualization of the spatial distribution characteristics of traditional villages in Anshun City were conducted using spatial analysis tools such as average nearest neighbor index, kernel density analysis, and area frequency analysis in the ArcGIS 10.2 platform, along with statistical methods. The study aimed to explore the factors influencing the spatial distribution of traditional villages.

## 4. Characteristics of Spatial Distribution in Traditional Villages

### 4.1. Spatial distribution type analysis

In geographical analysis, point features can exhibit three spatial distribution types: clustered, random, and uniform. These can be determined using nearest neighbor distance and nearest neighbor index [3]. The nearest neighbor index ( $R$ ) is an important indicator that describes the degree of proximity between point features in geographic space. Its basic formula is as follows:

$$R = \frac{\bar{r}_1}{r_E} = 2\sqrt{D} \quad (1)$$

In this formula,  $\bar{r}_1$  represents the observed nearest neighbor distance,  $r_E$  represents the expected nearest neighbor distance under the assumption of complete spatial randomness, and  $D$  represents the density of villages within the region. When  $R < 1$ , the point features exhibit a clustered spatial distribution. When  $R = 1$ , the point features demonstrate a random spatial distribution. When  $R > 1$ , the point features tend to have a uniform spatial distribution. Based on the average nearest neighbor analysis of the administrative divisions and 78 traditional villages in Anshun City. In this analysis, the value of  $\bar{r}_1$  is 0.0469, the value of  $r_E$  is 0.0484, and the value of  $R$  is 0.968465. Since  $R < 1$ , it can be concluded that the traditional villages in Anshun City exhibit a clustered spatial distribution.

### 4.2. Spatial distribution cluster analysis of traditional villages

Spatial clustering analysis often utilizes distribution density for measurement [4]. Using the Kernel Density Analysis tool in the ArcGIS 10.2 platform, an analysis of traditional villages within the city boundaries of Anshun City reveals that there is a general pattern of more clustering in the northern part and less in the southern part. Specifically, three cluster hotspots are visually evident in the northern part of Anshun City, located at the border of Xixiu District

and Pingba District, the northwest part of Zhenning County, and the southwest part of Xixiu District. In the southern part of Anshun City, there are only scattered traditional villages.

### 4.3. Analysis of County-Level Distribution Characteristics

On the basis of the analysis of the overall distribution of traditional villages within the city, further analysis is conducted to explore the distribution characteristics of traditional villages in Anshun City at the district and county level. Among them, Xixiu District has a distribution of 37 traditional villages, which is the highest number among the six districts and counties, accounting for a high proportion of 47.44%. Pingba District and Zhenning County both have a distribution of 13 traditional villages, accounting for 16.67% each. These three districts and counties together account for a substantial proportion of 80.78%. In addition, Ziyun County (7), Puding County (5), and Guanling County (3) have only a small number of traditional village distributions (Table 01). Furthermore, analyzing the distribution density of traditional villages at the county level (Table 02), there is no substantial change in the overall distribution density characteristics relative to the number of distributions. This highlights the unevenness in the distribution of traditional villages within the county.

**Table 1.** The Number of Traditional Villages in Each County

County	Quantity	Proportion	Ranking
Xixiu	37	47.44%	1
Pingba	13	16.67%	2
Zhenning	13	16.67%	2
Ziyun	7	8.97%	3
Puding	5	6.41%	4
Guanling	3	3.84%	5

Source: author's table

**Table 2.** The Distribution Density of Traditional Villages in Each County

County	Land area	Density	Ranking
Xixiu	1728.87	0.0214	1
Pingba	987.10	0.0132	2
Zhenning	1717.30	0.0076	3
Ziyun	1079.94	0.0046	4
Puding	2250.83	0.0031	5
Guanling	1464.30	0.0020	6

Source: author's table

## 5. The Natural Factors That Influence The Spatial Distribution of Traditional Villages.

### 5.1. Topography

Using ArcGIS 10.2 for elevation analysis, it is found that Anshun City is located on the Yungui Plateau, and the overall topography exhibits a "higher in the north, lower in the south, with hills in the north and mountains in the south" characteristic, dominated by karst hills and terrains [5]. The terrain is undulating, and the land is generally infertile, with local small-scale topography consisting of mountains, hills, and river valleys. By overlaying the geographical coordinates of traditional villages, it is discovered that traditional villages in Anshun City are

mainly concentrated in the northern hilly areas, while there are few traditional villages in the southern low mountains and river valleys.

Referring to the classification indicators of China's basic landforms [6], the analysis of the altitude distribution types of the 78 traditional villages in Anshun City reveals that 75 traditional villages are located in the middle-altitude zone of 1000-1500 meters, while only 3 traditional villages are situated in the lower-middle-altitude zone of 500-1000 meters. The three villages, namely Mulong Village in Zhennan County, Banpao Village in Zhennan County, and Dapingdi Village in Guanling County, are all located in the southern mountainous area of Anshun City. It can be seen that the karst hill landform dominated by the Qianzhong Mountains has become an important factor influencing the selection of traditional village locations.

## 5.2. Slope of the mountain

According to the slope classification criteria established by the International Geographical Union's Commission on Landforms and Geomorphological Mapping [7], this article utilizes ArcGIS 10.2 to divide the geographical slopes in Anshun City into eight basic types. In Anshun City, 60 traditional villages (76.93% of the total) are located on slight slopes (8), gentle slopes (18) and inclined slopes (34). A small number of villages are scattered on steep slopes (14), rugged slopes (3) and cliff (1) (Table 03). This fully reflects the close relationship between the spatial location of traditional villages in Anshun City and the slope of the terrain. Due to geographical constraints, the ancestors of the villages either voluntarily or involuntarily settled in the areas with gentle slopes, which has resulted in the distribution pattern we see today.

Based on the analysis of slope distribution types in traditional villages, further exploration can be conducted to examine their relationship with the slope direction of the terrain. The study found that there is only a 15.38% difference in the proportion of traditional villages located on sunny slopes (45) compared to those located on shady slopes (33) (Table 04). This indicates that the slope direction of the mountains does not have a significant impact on the distribution of villages.

**Table 3.** The number of slope gradient in traditional villages in Anshun City.

Slope gradien	Types of slopes	Quantity	Proportion
0-0.5	Flat ground	0	0.00%
0.5-2	Slight slope	8	10.26%
2-5	Gentle slope	18	23.08%
5-15	Inclined slope	34	43.59%
15-25	Steep slope	14	17.95%
25-35	Rugged slope	3	3.85%
35-55	Cliff	1	1.27%
55-90	Vertical wall	0	0.00%

Source: author's table

**Table 4.** The number of slope direction in traditional villages in Anshun City.

Slope direction	Types of slopes	Quantity	Proportion
-1	Flat ground	0	0.00%
315-45	Shady slope	14	17.95%
45-135	Partially shady slope	19	24.36%
135-225	Sunny slope	29	37.18%
225-315	Partially sunny slope	16	20.51%

Source: author's table

### 5.3. The river system

Through the selection of major rivers within the territory of Anshun City and conducting multiple buffer zone analysis, it was found that traditional villages have a significant affinity to water [8]. Within a one-kilometer range along the main rivers, there are 30 traditional villages, accounting for 38.46%. While within a two-kilometer range along the main rivers, there are 51 traditional villages, accounting for a percentage of 65.39%. During the early stages of village formation and development, due to the limitations of productivity levels, villages often had to choose locations near water sources to obtain better irrigation conditions. The integration of water and fields directly influenced the selection of locations for agricultural civilization villages.

## 6. Conclusion

- (1) Traditional villages in Anshun City exhibit a cohesive distribution pattern, with uneven spatial distribution and a higher concentration in the north compared to the south. There are three areas of aggregation: the border between Xixiu and Pingba, the northwestern part of Zhenning County, and the southwestern part of Xixiu District. It is recommended to explore methods for concentrated and contiguous protection of traditional villages within the region.
- (2) Influenced by terrain and landforms, traditional villages in Anshun City are mostly distributed in the mid-elevation mountainous areas, displaying distinct characteristics of plateau settlement and "Tunpu" (fortified village). It is suggested to investigate the natural and cultural site selection features of traditional villages in Anshun City, and analyze the defensive mechanisms of settlements by examining village architecture, morphology, and structure.
- (3) Traditional villages in Anshun City have a strong affinity for water, with most villages gathering near rivers, showing a prominent "living by water" characteristic. It is recommended to analyze the spatial characteristics of waterfront traditional villages and explore their unique spatial features.

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