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Research on the Spatial–Temporal Distribution and Morphological Characteristics of Ancient Settlements in the Sichuan Basin

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Abstract: An investigation into the spatial–temporal distribution characteristics of ancient settlements and their relationship with the environment in the Sichuan Basin can enhance our understanding of the evolution of the regional human–land relationship. Utilizing kernel density analysis by GIS, this paper obtained the spatial distribution characteristics of 1100 settlements in the Neolithic, Shang–Zhou, and Qin to Southern Dynasties periods. Subsequently, a GIS spatial analysis was performed to examine the distribution of these settlements in relation to the natural environment, focusing on four aspects: elevation, slope, aspect, and water buffer zone. The results demonstrate that: (1) The distribution of settlements from the Neolithic to the Southern Dynasties has expanded from the Chengdu Plain in the west and the Xiajiang Area in the east to the hilly areas in the center. (2) The settlements in the Neolithic and Shang–Zhou periods are predominantly located at elevations between 300–600 m, slopes between 0–3°, aspects between 135–225°, distances to rivers between 0–1000 m, and soil choice on Luvisols, Cambisols, Regosols, and Anthrosols. The influence of aspect on settlements during the Qin–Southern Dynasties period was notably reduced. The settlements mainly grow in the Chengdu Plain and the smaller plains along the river from the Neolithic to the Southern Dynasties in the Sichuan Basin. (3) The emergence and advancement of primitive agriculture, the construction of early water conservancy facilities, commercial and trade exchanges, and the establishment of regimes led to a shift from a double core to a more dispersed distribution in the Sichuan Basin from the Neolithic to the Southern Dynasties periods. The evolution of settlements reflects the adaption and competition of the residents to the natural environment in the Sichuan Basin. Furthermore, it provides insights into the complex social development in the region, ranging from the formation of early states to the establishment of the Qin and Han Empires.

Keywords: Sichuan Basin; ancient settlements; spatial–temporal distribution; morphological characteristics

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1. Introduction

The natural environment serves as the foundation for human survival, and the alterations observed in ancient settlements across extensive regions are closely linked to environmental changes. Simultaneously, as a socio-economic entity within a defined geographical area, shifts in economy, culture, and social organization influence the development of ancient settlements [1]. As primary material evidence reflecting human activities during specific historical periods, the spatial configuration and evolutionary trajectory of ancient settlements provide valuable insights into the human–earth relationship of ancestors in a particular region. Therefore, investigating the evolution of the spatial distribution of settlements in a particular area, alongside analyzing the mechanisms through which the natural environment and social culture shape the spatial patterns of settlements, will illuminate the characteristics of early human settlements and social cultures. This exploration will ultimately enhance our understanding of the choices and adaptations made by our ancestors in response to the environment.

The Sichuan Basin represents a distinctive and comprehensive natural and human geographic entity located at the upper reaches of the Yangtze River. The Sichuan Basin was the center of ancient civilization in Southwest China, an organic part of the ancient Chinese civilization, and a red basin with a unique subtropical evergreen broad-leaved forest landscape in the center of the world's ancient civilization on the 30-degrees north latitude [2]. It is on the intersection line between the southeastern rice-crop agricultural culture plate and the northwestern corn-crop agricultural culture plate [3]. Due to its unique location, the Sichuan Basin maintains close contact with the civilizations of the upper reaches of the Yellow River, the Central Plains, and the middle and lower reaches of the Yangtze River [4]. And the nurturing of the Ba Shu culture is the result of the convergence and continuous integration of various factors of Chinese culture. The motives for every climax of cultural change in the Basin are related to the migration of outside populations and are probably related to the major social unrest in the Central Plains region. At the same time, the ancient culture of the Sichuan Basin had a certain influence on the neighboring areas, especially the southwestern region. It is recognized as one of the eight principal cradles of Chinese civilization [5]. Numerous discovered settlement sites prove that the Sichuan Basin has been a suitable habitat since the Holocene. Positioned on the eastern periphery of the Tibetan Plateau, the outer edge of the basin is delineated by a series of medium mountains, with elevations ranging from 2000 to 3000 m. The interior of the basin is characterized by water systems interspersed with hills, valleys, and plains, creating an independent natural geographic unit (Figure 1). Climate and environmental factors were the primary determinants of initial settlement patterns and subsequent cultural evolution in the Sichuan Basin. From the Neolithic Age to the Southern Dynasties, the Sichuan Basin experienced a significant climatic transition marked by fluctuations in temperature and precipitation, which profoundly influenced vegetation growth, the development of human communities, and the distribution of settlements [6].

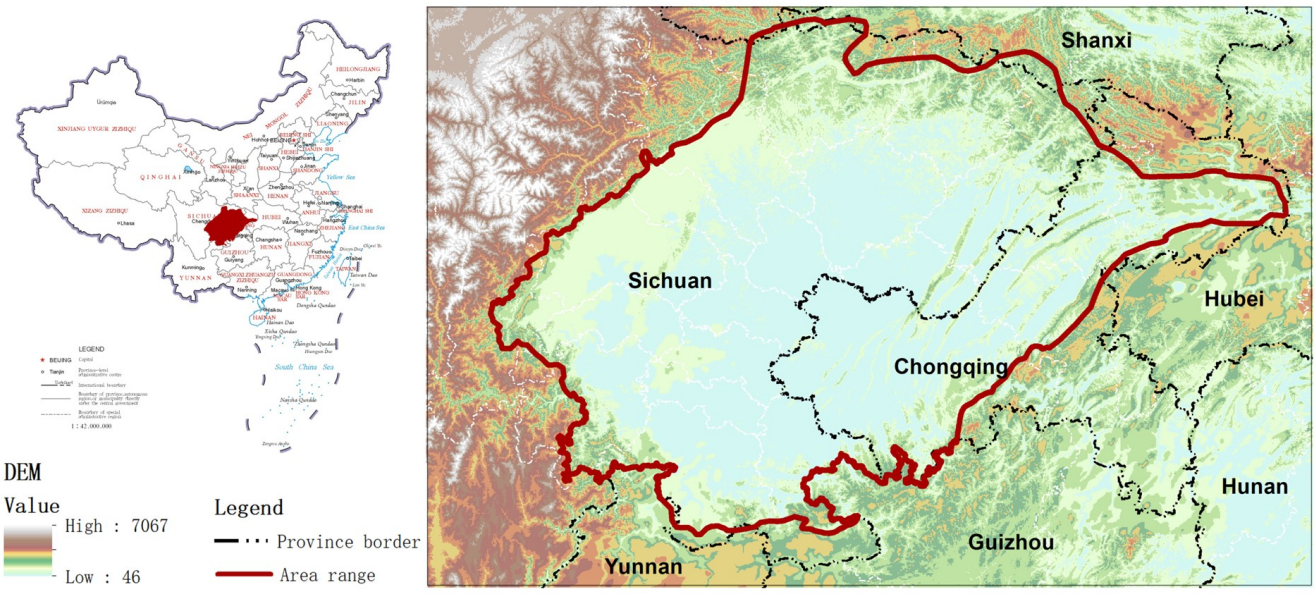


Figure 1. Location map of Sichuan Basin.

The concept of environmental archaeology was first introduced in the 1930s, leading scholars to begin investigating ancient settlement sites [7]. In terms of research content, this field explores the correlation between settlement sites and various natural environmental factors, including climate, topography, and hydrology [8–10], as well as socio-economic factors, political regimes, and cultural aspects [11–13]. In terms of research methods, the analysis of data using GIS, remote sensing, and other techniques has become the principal approach for examining the spatial and temporal distribution of settlements, the

morphology characteristics of settlements, and the human–land relationships [14,15]. In terms of geographical scope, recent years have seen scholars focusing their attention on several regions, including the Luzhong Area, the Songhua River Basin, the Dalian Area, the Dongting Lake Basin, and the Guanzhong Area, among others [16–20]. The study of ancient settlements in the Sichuan Basin primarily focuses on the morphology and evolution of the settlements, as well as the human–land relationships [21–23]. This approach aims to deepen our understanding of the evolution of the ancient human–land relationship in the region. A vertical comparison from the Neolithic, Shang, and Zhou Periods, as well as the Qin to Southern Dynasties Periods, will illuminate the historical trajectory of the Sichuan Basin from "Ancient State–Fang State–Empire" and facilitate an exploration of the early state-formation processes within the area. The potential driving forces behind the evolution of settlements in the basin will be examined from multiple perspectives, including climate, geography, agriculture, social culture, and regime. Additionally, this research will contribute to a more comprehensive understanding of ancient settlements in the upper reaches of the Yangtze River.

2. Data and Methods

The Sichuan Basin is one of the four major basins in China, encompassing the regions of Chengdu, Chongqing, Ya'an, Bazhong, Zigong, Luzhou, Deyang, Mianyang, Guangyuan, Suining, Ziyang, Leshan, Meishan, Nanchong, Yibin, Guang'an, and Dazhou, with a total area of approximately 260,000 km^2. The basin can be distinctly divided into two principal sections: the marginal mountains and the basin lowlands. The Sichuan Basin is surrounded by a series of low-to-medium mountains, with the topography dropping sharply from the edge inwards to form an independent natural geographical unit [24]. The study area focuses on the lower reaches of the Sichuan Basin, which can be subdivided into three parts: western river alluvial plain area–the Chengdu Plain, the central terrace-like square mountain and hilly area, and the eastern parallel ridge and valley regions–the Xiajiang Area. The Sichuan Basin belongs to the subtropical humid monsoon climate, characterized by an average annual temperature of 16–18 °C, with "annual precipitation" ranging from 1000 to 1300 mm, and an annual sunshine duration of 900 to 1300 h. It is part of the Yangtze River basin, with numerous rivers converging on both the northern and southern banks, including the Minjiang, Tuojiang, Fujiang, Jialing, and Qujiang, as well as the Changning, Chishui, and Wujiang Rivers. Additionally, a multitude of smaller rivers and tributaries contribute to the formation of a dense river network. Furthermore, the specific surface composition plays a pivotal role in influencing year-round temperature and humidity, as well as the prevalence of cloudy and foggy weather [25].

The advancement of archaeological research has led to a gradual enhancement of settlement sites within the Sichuan Basin, which serve as the foundation for investigating settlement morphology and spatial patterns in the region. The settlement information utilized in this study was primarily sourced from the following reference materials: the "Atlas of Chinese Cultural Relics–Sichuan Branch", the "Atlas of Chinese Cultural Relics–Chongqing Branch", the "Catalogue of Immovable Cultural Relics of the People's Republic of China–Sichuan Volume", and the "Catalogue of Immovable Cultural Relics of the People's Republic of China–Chongqing Volume" [26–29]. Additionally, published archaeological excavation reports and research papers were consulted, leading to the identification of 2337 ancient settlements by keywords: ancient city, mountain city, stone city, castle, and settlement site [30,31]. Topographic data (SRTM DEM) for the Sichuan Basin were obtained from the Resource and Environment Science Data Centre of the Chinese Academy of Sciences (CAS) at a spatial resolution of 30 m, while water system data were sourced from the Geospatial Data Cloud Platform (GDCP) [32,33].

This research establishes a spatial information database by importing settlements' data from the Neolithic Age to the Qing Dynasty into ArcGIS software with their names, addresses, coordinates, and areas. In ArcGIS 10.8, digital elevation model (DEM) data for the Sichuan Basin were superimposed along with settlement data transformed into

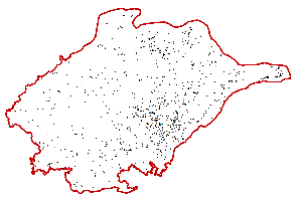
a projected coordinate system. According to the information of addresses where the sites are located, the coordinate information of the site is extracted by the coordinate picking system of Baidu map. The initial step involved utilizing kernel density analysis to illustrate the aggregation of the spatial distribution of ancient settlements within the region. Subsequently, spatial analyses of elevation, slope, slope direction, river buffer zones, and soil were conducted using ArcGIS 10.8 to compare the relationship between the settlement spatial distribution and the natural environment. Based on the above analysis, the spatial and temporal distribution and influencing factors of ancient settlements can be derived.

3. Analysis

3.1. Spacial and Temporal Distribution of Settlements

The settlement database has gathered a total of 2337 sites from the Neolithic Period to the Qing Dynasty (Table 1). In terms of total site numbers, the quantity of sites from the Shang and Zhou Periods reflects a substantial increase of 95.69% compared to that of the Neolithic Age, indicating a significant transformation. In contrast, the number of sites from the Qin–Southern Dynasties saw an increase of only 73 sites relative to the Shang and Zhou Periods, representing a comparatively minor change. Subsequently, the spatial configuration of settlements within the Sichuan Basin demonstrated a general stability, with the construction of settlements during the Sui–Five Dynasties, Song–Yuan, Ming–Qing periods largely maintaining the fundamental pattern established during the Qin–Southern Dynasties Period.

Table 1. Number and visualization of ancient settlements in each period.

Period	Neolithic Age	Shang–Zhou	Qin–Southern Dynasties
Number of Settlements	209	409	482
Visualisation based on GIS			
Period	Sui-Five Dynasties	Song-Yuan	Ming-Qing
Number of Settlements	189	274	774
Visualisation based on GIS			

The kernel density analysis indicates a trend of settlement expansion from the Neolithic to Qin–Southern Dynasties, originating from the western plains and the eastern ridge and valley areas toward the Jialing River basin in the central region (Figures 2–4). Among these, a total of 209 sites from the Neolithic Age have been identified, with the largest concentration located in Chongqing, followed by Chengdu. Smaller numbers are found in Deyang, Ya'an, Dazhou, and Bazhong. The Chengdu–Deyang area is notable for having the highest density of sites from this period, particularly around Chengdu. Although the Chongqing Area has the highest total number of sites, it can be further subdivided into three distinct concentration zones: downtown Chongqing, the Fengdu–Wanzhou Region, and the Fengjie–Wushan Area. Additionally, a total of 409 sites from the Shang and Zhou periods have been identified, with the largest proportion located in Chengdu, followed by Chongqing, and a smaller number distributed in Deyang and Nanchong. The

distribution of sites from this period aligns with that of the Neolithic Age, showing a greater concentration in the western plains and eastern valleys. The distributions in the Chengdu–Deyang Area, as well as in downtown Chongqing, the Fengdu–Wanzhou Region, and the Fengjie–Wushan Region, are notably more concentrated than in other regions. A total of 482 sites from the Qin–Southern Dynasties period have been identified, with the largest proportion located in Chongqing and Chengdu, followed by Deyang, Guangyuan, Nanchong, Dazhou, Bazhong, and Ya'an. The distribution illustrates the phenomenon of multi-center clustering in the western plains, the Jialing River Basin, and the eastern valleys. Further analysis reveals that Chengdu and Chongqing served as the primary locations of human activity during the Neolithic and Shang–Zhou Periods. It also suggests that during the Qin–Southern Dynasties Period, human activity expanded from the eastern and western cores to the central region. During these periods, the number of sites in Chongqing increased at a greater rate than in any other area, followed by Guangyuan and Nanchong. Conversely, Chengdu experienced a notable decline.

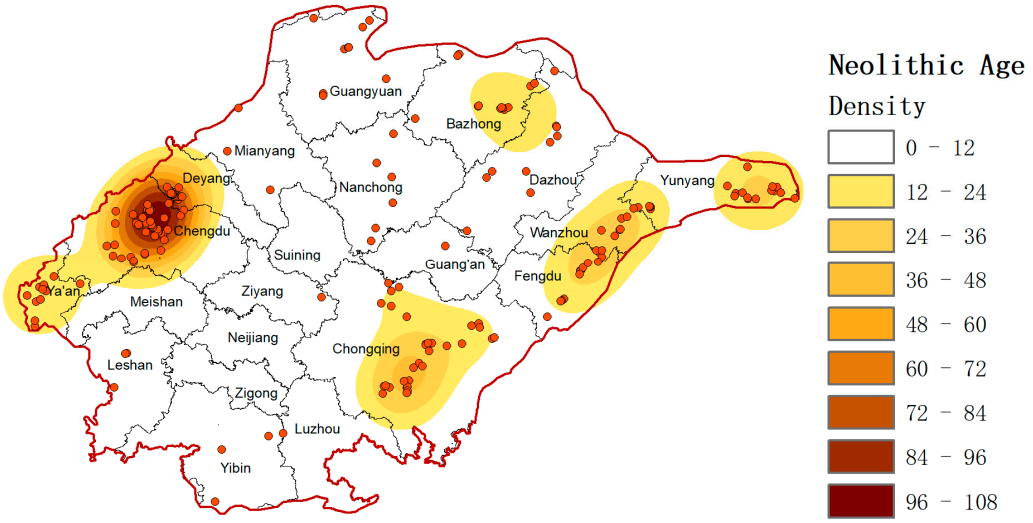


Figure 2. Kernel density of ancient settlements in the Neolithic Period in Sichuan Basin.

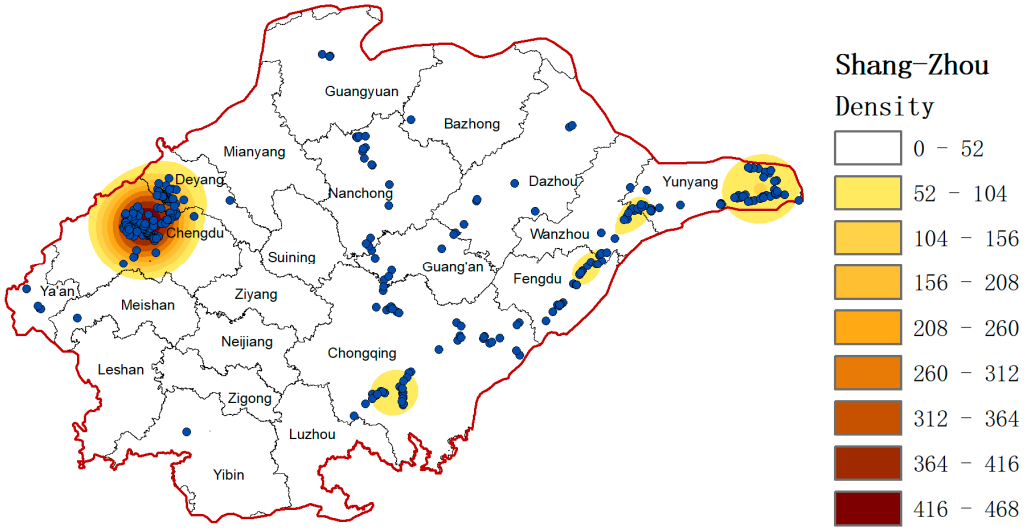


Figure 3. Kernel density of ancient settlements in the Shang–Zhou Period in Sichuan Basin.

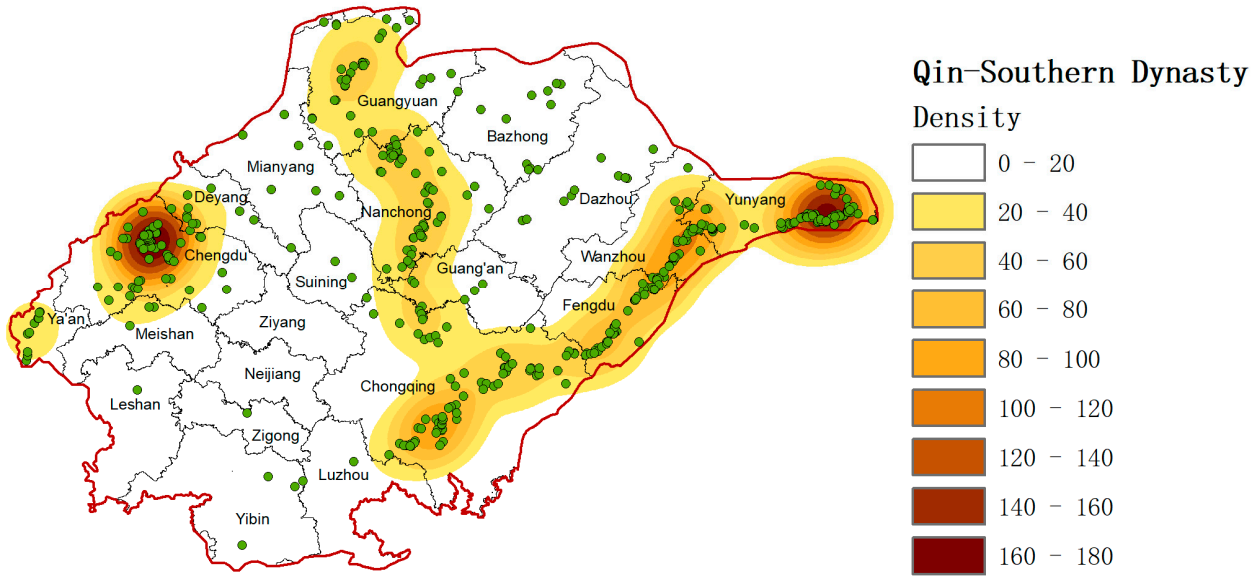
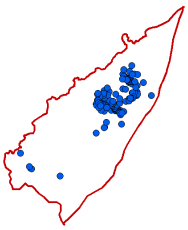
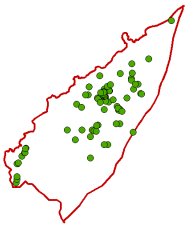
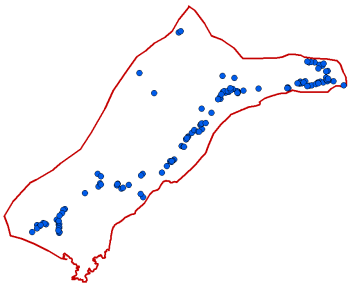
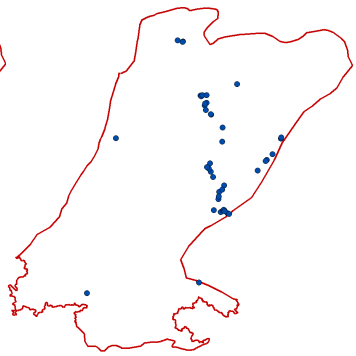
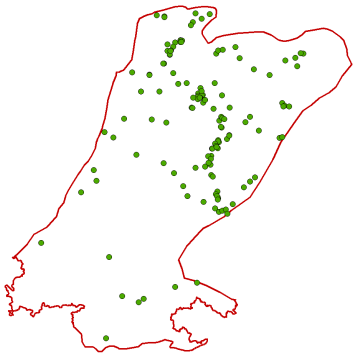


Figure 4. Kernel density of ancient settlements in the Qin–Southern Dynasties in Sichuan Basin.

The analysis presented above reveals that the ancient settlements in the Sichuan Basin exhibit a distinctive combination of completeness and continuity over time, alongside notable shifts and expansions in partial areas (Table 2). The earliest evidence of human activity in the Sichuan Basin dates back to the Paleolithic Age. However, the formation of settlements is believed to have begun in the Neolithic Age, with two major centers of settlement distribution emerging in the Chongqing Xiajiang Area and the Chengdu Plain. In the Chongqing Xiajiang Area, the settlements commenced during the early Neolithic Period, leading to the emergence of two distinct cultural sequences in the Wushan Region, located to the east of the Qutang Gorge, through the Chengbixi–Liulinxi–Daxi–Qujialing–Baimiao sequence; and in the eastern part of the Wushan Area, through the Yuxi–Yuxiping–Shaozuipeng sequence. The Chengdu Plain began to develop in the late Neolithic period, leading to the formation of the Guiyuanqiao–Baodun sequence. The subsequent Shang and Zhou Periods, as well as the Qin–Southern Dynasties period, marked two significant milestones in the accelerated growth of settlements. During the Shang and Zhou Periods, a two-center pattern of Neolithic settlement distribution persisted, offering a discernible shift towards a more concentrated distribution trend. In the Qin to Southern Dynasties, the centers of large-scale settlement distribution transitioned from the two cores to two contiguous belts and one core. Until then, the settlement system in the Sichuan Basin was essentially established, significantly influencing the current urban patterns. Simultaneously, the Sichuan Basin experienced a reduction in conflict, emerging as a stable southern frontier. The scale of construction in the Chengdu Plain diminished, with notable exceptions during the Southern Song, Yuan, late Ming, and early Qing Dynasties, which were primarily for defensive purposes to construct several mountain towns and hill fortresses, most of which have since been abandoned. Consequently, the settlements in the Sichuan Basin transformed from a peripheral status in their initial phase to a pivotal component of the national urban system, thereby contributing to the cohesion of Chinese civilization.

Table 2. Ancient settlements in the Chengdu Plain, Chongqing Xiajiang Area, and central hilly area.

Area	Neolithic Age	Shang–Zhou	Qin–Southern Dynasties
Chengdu Plain			
Chongqing Xiajiang Area			
central hilly area			

3.2. Settlement Distribution in Relation to the Natural Environment

In the initial phases of human history, the establishment of settlements was inextricably linked to the characteristics of the natural environment. An optimal natural environment could serve as a foundation for the establishment of settlements. However, with advancements in technology and the growth of the population, the influence of environmental factors on settlement construction has diminished [34]. This paper aims to extract relevant information across different periods by examining these environmental factors, including elevation, slope, aspect, and buffer zones (Figures 5–8). This study investigates the relationship between the formation of early human settlements and the conditions of the natural environment, as well as the preferences regarding the four environmental factors influencing settlement construction in the Sichuan Basin.

3.2.1. Settlement Distribution in Relation to the Elevation

The Sichuan Basin is characterized by a well-developed water system. The Chengdu Plain, the Xiajiang Area, and the Jialing River Basin have experienced numerous episodes of flooding throughout history. This has significantly impacted the potential for further settlements. To adapt to the natural environment, the topography of the terrain was the primary factor in determining the location of human settlements. The selection of elevated locations for habitation serves to protect inhabitants from the dangers of flooding and other natural disasters, thereby safeguarding their livelihoods. The GIS spatial analysis is utilized to extract elevation data for each site, with the results presented in Table 2. The elevation

data have been categorized by Zeng Chao (2021) according to the basic geomorphological types of the Sichuan Basin. The results are as follows: plains (<300 m), low-elevation, small-undulating mountains and low hills (300–600 m), low-elevation, medium-undulating low hills (600–900 m), and medium-elevation, medium-undulating hills, as well as medium-elevation, large-undulating hills (≥900 m).

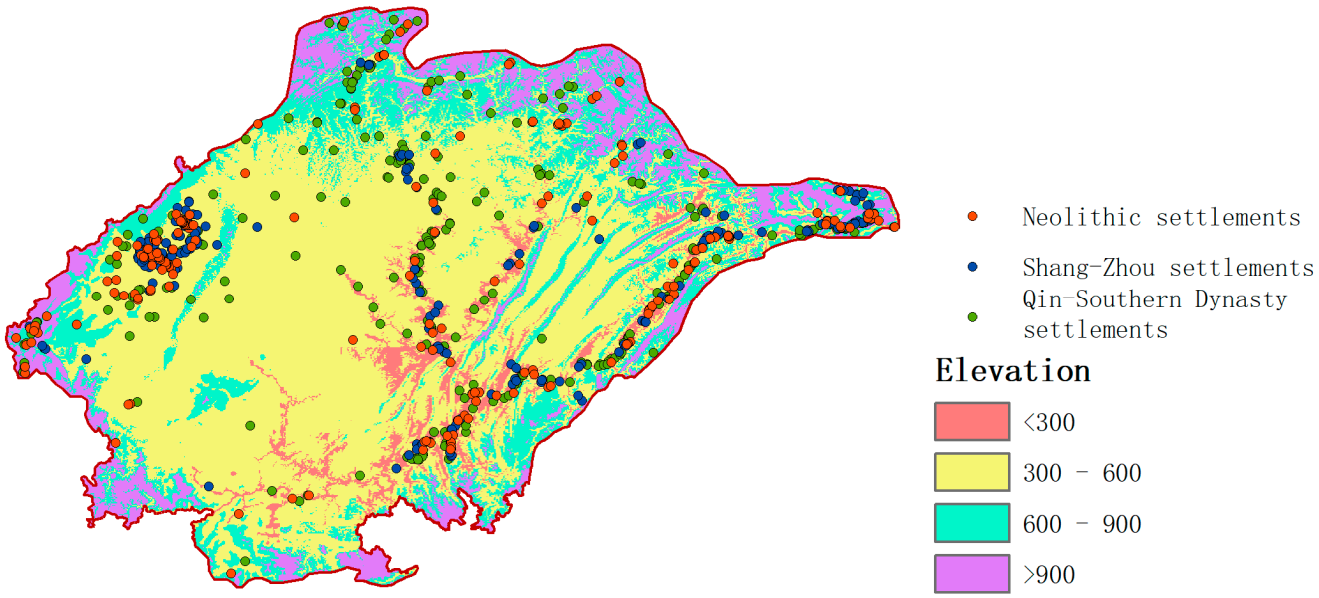


Figure 5. Elevation distribution of ancient settlements in three periods.

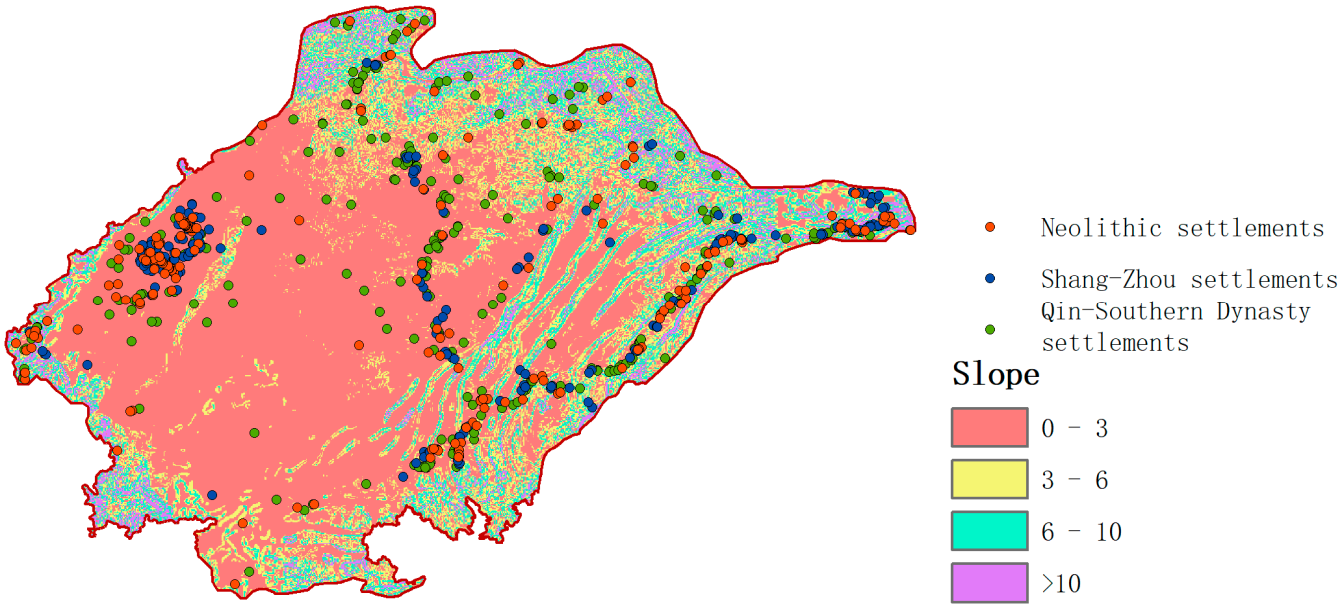


Figure 6. Slope distribution of ancient settlements in three periods.

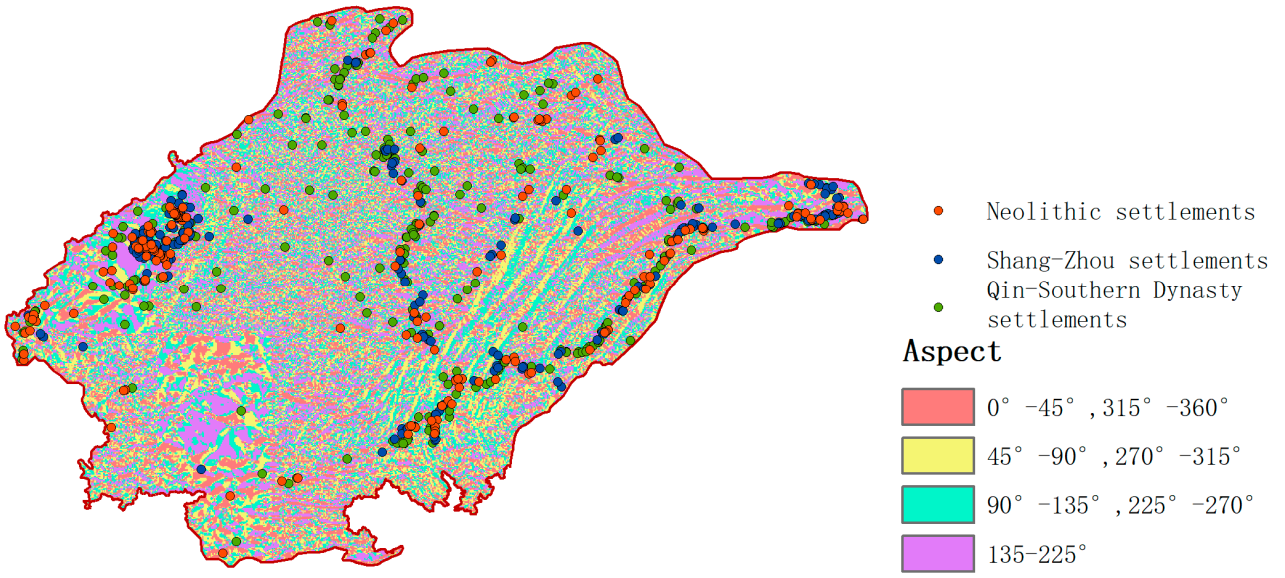


Figure 7. Aspect distribution of ancient settlements in three periods.

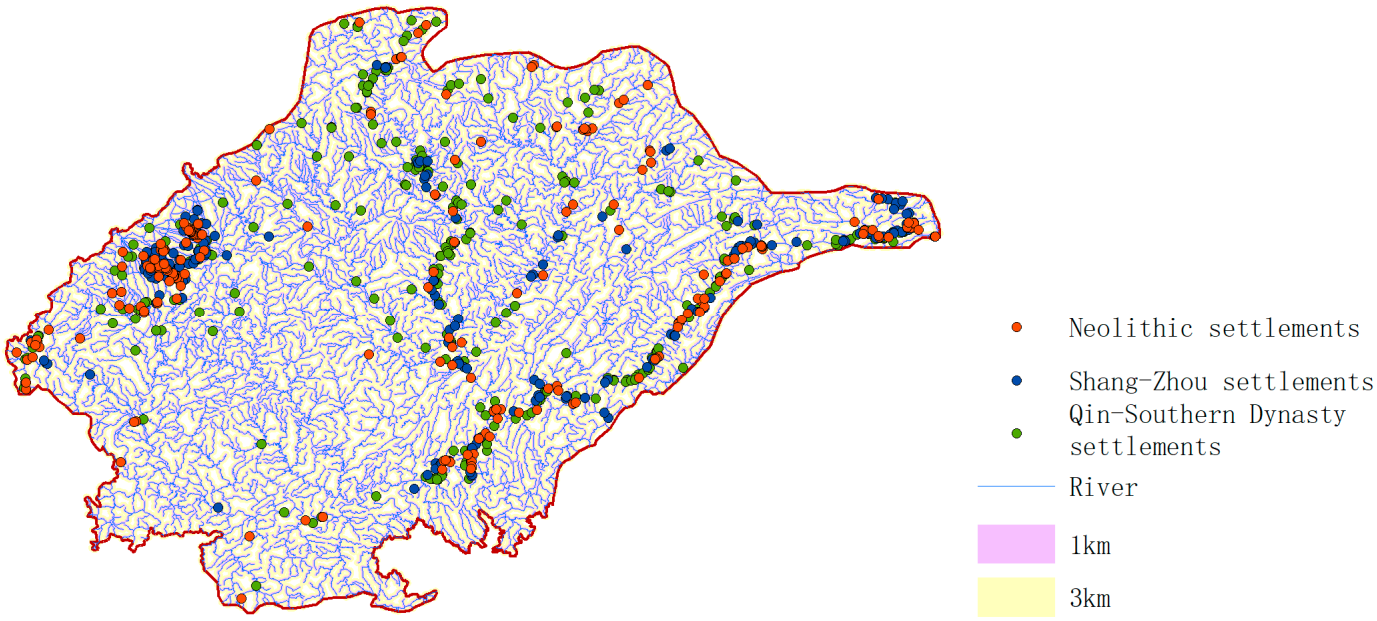


Figure 8. Buffer zones of rivers in three periods.

As illustrated in Table 3, 84.69% of Neolithic sites in the Sichuan Basin are located in areas with elevations below 600 m above sea level. The largest proportion of these sites, representing 54.55% of the total, is found at elevations between 300 and 600 m. A limited number of settlement sites are distributed across other elevation zones. During the Shang and Zhou Dynasties, 96.62% of the sites were situated in areas below 600 m above sea level, with the majority, accounting for 66.30%, located at elevations between 300 and 600 m. The number of settlements in the high-altitude zone experienced a notable decline. In the Qin–Southern Dynasties Period, 89.42% of the sites were found below 600 m above sea level, with 47.51% located between 300 and 600 m and 41.91% situated at elevations below 300 m. Compared to the Shang and Zhou Periods, there was an increase in the number of settlements constructed at lower altitudes, while the number of sites at higher altitudes rose significantly, reaching a maximum elevation of 1709 m.

Table 3. Elevation distribution of ancient settlements in each period.

Elevation/m	Neolithic Period		Shang–Zhou Period		Qin–Southern Dynasties	
	Number	Percentage/%	Number	Percentage/%	Number	Percentage/%
<300	63	30.14	124	30.32	202	41.91
[300, 600)	114	54.55	271	66.30	229	47.51
[600, 900)	28	13.40	13	3.18	42	8.71
≥900	4	1.91	1	0.20	9	1.87

The Sichuan Basin is characterized by optimal water and heat conditions. The Yangtze River, along with numerous tributaries in the upper reaches of the basin, forms a dense river network. The topography of the eastern valleys, the central hills, and the western plains are susceptible to flooding. Consequently, elevation has emerged as the primary factor influencing the location of ancient settlements within the Sichuan Basin. The Chengdu Plain features low-lying topography and a high degree of planarity. The river is frequently subject to diversion, and flooding poses a significant concern for the city, necessitating the implementation of robust flood prevention and control measures. Selecting a location for a settlement on relatively high terraces between the rivers facilitates both flood control in the settlement and the development of agriculture. In the Xiajiang Area, the settlement site was chosen along the Yangtze River and its tributaries on the first and second terraces, predominantly on gentle slopes, river alluvial zones, river floodplains, or river islands [23].

3.2.2. Settlement Distribution in Relation to the Slope

The term "slope" effectively describes the morphology and structural characteristics of the land surface. Areas with significant slopes are generally unsuitable for human production activities, with the upper limit for optimal cultivation land slope typically set at 15° [35]. In accordance with the findings from the ArcGIS slope analysis, this paper categorizes the slope into four grades: 0–3°, 3–6°, 6–10°, and 10° or more. This classification is based on the topographic characteristics of the Sichuan Basin, which predominantly features plain and hilly terrain, with a limited proportion of steep and very steep slopes. The relationship between ancient settlements and slopes in the Sichuan Basin is illustrated in Figure 6.

As illustrated in Table 4, there exists a discernible negative correlation between slope and the distribution of sites. Specifically, a steeper slope corresponds to a reduced number of distributed settlements. The highest concentration of sites, accounting for 65.55% of the total, is observed within the 0–3° slope range during the Neolithic Period. This percentage increases to 73.60% in the Shang and Zhou Periods, and it subsequently decreases to 56.43% during the Qin to Southern Dynasties. This slope range is situated in close proximity to water sources, which facilitates agricultural activities. Notably, the proportion of settlement sites within the 3–6° slope range increased during the Qin to Southern Dynasties. This trend suggests that ancestors were capable of cultivating arable land with a moderate slope and chose to settle there, likely due to enhancements in productivity levels during this period. Overall, the distribution of settlements tends to concentrate in areas characterized by micro-slopes and gentle slopes, while the number of settlements located on steeper slopes remains comparatively limited.

Table 4. Slope distribution of ancient settlements in each period.

Slope	Neolithic Period		Shang–Zhou Period		Qin–Southern Dynasties	
	Number	Percentage/%	Number	Percentage/%	Number	Percentage/%
<3°	137	65.55	301	73.60	272	56.43
[3°, 6°)	32	15.31	52	12.71	105	21.79
[6°, 10°)	29	13.88	38	9.29	70	14.52
≥10°	11	5.26	18	4.40	35	7.26

It is evident that the ancestors of this region tended to establish their settlements in areas characterized by relatively flat terrain with an inclination below 6°. Notably, over 70% of all settlements, spanning various historical periods, were located within this particular zone. The lower slopes are conducive to agriculture, which facilitates the development of land reclamation, water conservancy, and agricultural irrigation systems. The reduced surface runoff in this area minimizes soil erosion and helps maintain soil fertility. In contrast, high slopes are situated at a considerable distance from water sources, which restricts conditions for vegetation growth, complicates transportation, and severely limits opportunities for production activities such as gathering, fishing, and hunting. For residents of the valley and hilly regions of the Eastern and Central Sichuan Basin, high-gradient and steep slopes are particularly vulnerable to natural disasters like landslides and mudslides, posing significant risks to safety. Constructing settlements and buildings on steep slopes is a challenging endeavor. Furthermore, a limited number of settlements are found on slopes with a gradient of $\geq$10°, which may be related to military defense functions.

3.2.3. Settlement Distribution in Relation to the Aspect

The aspect of a slope significantly influences the amount of solar radiation received by the ground surface, particularly on south- and north-facing slopes where the slope's angle has the most pronounced effect on the total solar radiation absorbed. Conversely, east- and west-facing slopes have a negligible impact on solar radiation, highlighting the critical role of slope orientation in regulating vegetation growth. The Sichuan Basin, surrounded by plateaus and mountains, experiences the accumulation of water vapor, which leads to the formation of fog that substantially reduces the amount of solar radiation reaching the basin. As a result, the Sichuan Basin records the lowest levels of total solar radiation in China. The southward orientation is particularly advantageous for residential and agricultural activities. Due to the relatively low levels of total solar radiation in the Sichuan Basin, the east, west, and north orientations exert less influence on the region's suitability for residential and agricultural activities compared to areas with more favorable solar radiation conditions.

In this paper, slope orientation is categorized into four types, with the range of 135–225° identified as the very suitable orientation, 90–135° and 225–270° as the relatively suitable orientation, 45–90° and 270–315° as the not well-suited orientation, and 0–45° and 315–360° as the unsuitable orientation. The GIS spatial analysis was utilized to extract slope direction information for each site and reclassify them according to slope orientation to assess light conditions. The results are presented in Table 5. The statistics indicate that the proportion of Neolithic sites located in very suitable aspects is 36.37%, while those in relatively suitable aspects account for 28.23%. During the Shang and Zhou Periods, the proportion of sites with very suitable aspects was 38.14%, while the proportion of sites with relatively suitable aspects was 33.01%. This suggests that slope orientation was a significant factor for prehistoric ancestors in selecting settlement locations. In the period spanning the Qin to Southern Dynasties, the proportion of very suitable aspects for settlements was 28.84%, with relatively suitable aspects accounting for 25.73%. Conversely, slope directions considered not well-suited for settlement constituted 23.44%, while 21.99% were unsuitable. It is evident that as time progressed and lifestyles evolved, the ancestors' demand for favorable slope orientation in their settlements diminished.

Table 5. Aspect distribution of ancient settlements in each period.

Aspect	Neolithic Period		Shang–Zhou Period		Qin–Southern Dynasties	
	Number	Percentage/%	Number	Percentage/%	Number	Percentage/%
135–225°	76	36.37	156	38.14	139	28.84
90–135°, 225–270°	59	28.23	135	33.01	124	25.73
45–90°, 270–315°	37	17.70	66	16.14	113	23.44
0–45°, 315–360°	37	17.70	52	12.71	106	21.99

In general, the necessity for ancient populations in the Sichuan Basin to select slope orientation diminished over time. In the period preceding the Qin Dynasty, the number of settlements situated in favorable and superior orientations was markedly greater than those positioned in less optimal locations. The selection of sites for early settlements was significantly influenced by slope orientation, as the most suitable orientations facilitated the acquisition of sunlight and regulated temperature. The basin's lack of light resulted in a relatively stable wind environment, with minimal influence from monsoonal patterns in all directions. During the cold season, the variation in light received across different orientations was relatively minor. In the Qin–Southern Dynasties period, the distribution of settlement orientations became more balanced. It is evident that the influence of slope orientation on settlement locations is considerably less significant than that of elevation and slope.

3.2.4. Settlement Distribution in Relation to the River

The significance of water as a vital resource for the survival of early humans cannot be overstated. Indeed, the locations of early settlements were largely influenced by the availability of water. Therefore, it is crucial to develop a comprehensive understanding of the relationship between these settlements and the surrounding water systems. The accessibility of water resources and their proximity determine the residents' ability to obtain sufficient water and facilitate convenient agricultural irrigation, thereby ensuring a safe living environment that mitigates the risk of flooding. Using ArcGIS 10.8, 1 km, 2 km, and 3 km river buffer zones were established for each major river in the Sichuan Basin. Subsequently, the distribution of sites from the Neolithic Period to the Qin–Southern Dynasties was analyzed concerning their distance to water sources. As shown in Figure 8, with the exception of the dense concentration of sites found in the Chengdu Plain, most other sites display a linear distribution along rivers.

The data presented in Table 6 demonstrate that a significant proportion of Neolithic settlements were located in close proximity to water sources. Specifically, 84.69% of these settlements were situated within 2000 m away from rivers, with 112 settlements located within 1000 m, representing 53.59% of the total. This trend continued during the subsequent Shang and Zhou Periods, where 75.80% of settlements were found within 2000 m, and 196 settlements were within 1000 m, accounting for 47%. In the period from the Qin to Southern Dynasties, 88.80% of settlements were situated within 2000 m, with 290 settlements located within 1000 m, representing 60.17%. A comparative analysis of the data indicates that Shang and Zhou settlements were situated at greater distances from river sources than those from the Neolithic and Qin–Southern Dynasties Periods.

Table 6. Number of ancient settlements distributed in the buffer zone in each period.

Buffer Zone	Neolithic Period		Shang–Zhou Period		Qin–Southern Dynasty	
	Number	Percentage/%	Number	Percentage/%	Number	Percentage/%
<1000	112	53.59	196	47.93	290	60.17
[1000, 2000)	65	31.10	114	27.87	138	28.63
[2000, 3000)	24	11.48	61	14.91	44	9.13
≥3000	8	3.83	38	9.29	10	2.07

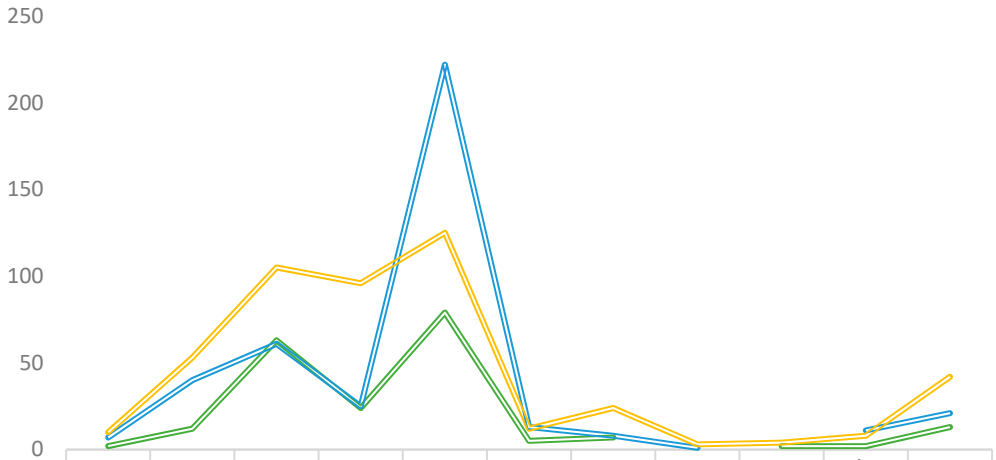
The availability of water sources allowed early humans to cultivate crops and raise livestock, as they could depend on hydrothermal resources in close proximity while ensuring their safety [36]. During the Neolithic Age and Shang–Zhou Dynasties, the Chengdu Plain and the Xiajiang Area were the cores of settlement distribution, and in order to avoid flooding, settlements and dwellings were located on relatively safe riverside terraces or gentle slopes. According to archaeological excavation data, Xinjin Baodun, Wenjiang Yufu, and other six prehistoric city sites are mostly located at the river parallel to the ridge-like terrace [37]. For the convenience of picking water, settlements were located within a dis-

tance of no more than 3 km from the water. And from the Qin–Southern Dynasties, when ancients were more experienced in the selection of sites and flood control was conducted through the construction of a large number of water conservancy projects, more settlements were able to be located closer to the water source.

3.2.5. Settlement Distribution in Relation to the Soil

Soil type is an important factor affecting settlement construction and agricultural development, and fertile land is favorable to agricultural production. This paper uses the Chinese soil dataset from the National Glacial and Permafrost Desert Data Centre to analyze the soil types of ancient settlements in the Sichuan Basin [38].

The data presented in Figure 9 demonstrate that Luvisols, Cambisols, Regosols, and Anthrosols are the four main soil types related to the settlements. In the Neolithic Age, the proportion of sites located on the four main soil lands was 85.17%, in which Anthrosols and Cambisols accounted for the highest percentage of 37.80% and 30.14%. In the Shang and Zhou Periods, the proportion of sites located on the four main soil lands was 85.09%, in which Anthrosols accounted for the highest percentage of 54.28%, followed by Cambisols at 14.91%. In the Qin–Southern Dynasties period, the proportion of sites located on the four main soil lands was 78.63%, in which Anthrosols, Cambisols, and Regosols accounted for the higher percentage of 25.93%, 21.78%, and 19.92% respectively. A comparative analysis of the data indicates that Neolithic and Shang–Zhou settlements were more sited on the four main soil types than those from the Qin–Southern Dynasties Period.



	FLUVISOLS	LUVISOLS	CAMBISOLS	REGOSOLS	ANTHROSOLS	GLEYSOLS	ALISOLS	LIXISOLS	PLANOSOLS	Urban, mining, etc.	Water bodies
Neolithic	2	12	63	24	79	5	7		2	2	13
Shang-Zhou	7	40	61	25	222	13	8	1		11	21
Qin-Southern Dynasty	10	53	105	96	125	12	24	3	4	8	42

Figure 9. Soil in three periods.

4. Result and Discussion

4.1. Result

This paper presents a geographic information database of ancient settlement sites in the Sichuan Basin. The database is collecting a total of 2337 settlements from the Neolithic Age to the Qing Dynasty, concluding with 1100 settlements from the Neolithic Age to the Qin-Southern Dynasties. By integrating ArcGIS spatial analysis, the study effectively analyzes the spatial and temporal distribution characteristics, as well as the environmental impact factors of the settlement sites. This analysis incorporates a quantitative assessment of kernel density, elevation, slope, aspect, and water buffer zones. The findings reveal

significant variations in the construction of settlements from the Neolithic Period through to the Qin–Southern Dynasties in the Sichuan Basin.

Firstly, the Sichuan Basin experienced three distinct phases of development, spanning from the Neolithic period through the Qin to Southern Dynasties. Kernel density analyses of settlement sites indicate an anomalous concentration in the western plains near Chengdu and the Xiajiang area in Chongqing. During the period from the Qin to Southern Dynasties, the distribution range expanded significantly, with the center of gravity shifting from Eastern and Western Sichuan to Central Sichuan. This shift led to the formation of a structure characterized by a centralized core in the Chengdu Plain, a centralized belt along the Xiajiang Area in Chongqing, and a centralized belt along the Jialing River.

Secondly, the selection of settlement sites is influenced by various factors, including elevation, slope, aspect, and water buffer zone. Most sites are situated in plains, terraces, or hills at elevations ranging from 0 to 600 m above sea level, with slopes between 0 and 3 degrees. During the Neolithic Period and the Shang and Zhou Dynasties, the slopes generally oriented southward. However, from the Qin to Southern dynasties, the slope orientations became more varied. The distance to water sources typically ranges from 0 to 2000 m. And Luvisols, Cambisols, Regosols, and Anthrosols are the four main soil types related to the settlements. Quantitative analysis of the settlement site points in relation to environmental factors reveals a strong correlation between site selection and elevation, slope, water, and soil in the Neolithic and Shang–Zhou Periods. Notably, slope orientation has less impact on site selection. In contrast, during the Qin to Southern Dynasties, the influence of elevation, slope, and soil on settlement site selection diminishes while the impact of water increases and the slope orientation plays no role.

Finally, a discernible pattern emerges when examining the selection of sites for settlements across various historical periods and geographical regions. It could be seen that the influence of the natural environment on settlement distribution diminishes over time, and social, political, and economic development could become the main influencing factors. During the Neolithic, Shang, and Zhou Periods, the majority of settlement sites were concentrated in the Chengdu Plain and the Xiajiang Area. This concentration can be attributed to the Xiajiang Area's status as the first region to transition from the Paleolithic to the Neolithic Era. The Xiajiang Area served as the sole conduit between the Sichuan Basin and the eastern inland, facilitating significant settlement development with various production activities including fishing, hunting, rice cultivation, animal breeding, and salt industry. In contrast, the Chengdu Plain began its development during the middle and late Neolithic periods, primarily driven by agricultural production. This era marked a transition from dryland farming to rice cultivation. The ancient population constructed settlements and defensive ditches, leading to the formation of settlement clusters. Social differentiation continued, evidenced by the emergence of several large settlement sites during the Baodun culture period. The abundance of material resources, coupled with advancements in productivity and production technology, resulted in a shift of power from the Neolithic Fang State to the Shang and Zhou Kingdoms, and ultimately to the unified dynasties from the Qin to Southern Dynasties. These periods also witnessed the ongoing flourishing of settlement construction, characterized by the expansion of settlement clusters.

4.2. Discussion

The formation, development, and exchange of human cultures are often influenced by geographic environments. This is evidenced by the effects of climate change and extreme weather events on human migration and cultural turnover [39]. Throughout the Holocene Period, the Sichuan Basin underwent a climatic transition from a warm and humid environment to one that was hot, followed by a return to a warm and cool climate [40]. During the middle and late Holocene, the climate was generally more adverse, characterized by significant fluctuations in temperature and precipitation. In the Chengdu Area, it was warm and hot before 3 ka BP; mild and humid during 3–0.8 ka BP; mild and cool during 0.8–0.2 ka BP; and warm and humid during 0.2 ka BP to the present [41].

In the Chongqing Area, it was dry and hot before 3.2 ka BP; mild and humid during 3.2–0.2 ka BP; and warm and humid during 0.2 ka BP to present [42]. These climatic changes likely impacted the spatial distribution of settlements. A comparative analysis of the accumulation of cultural layers enables the identification of how climatic factors influenced the evolution of site distribution from the Neolithic Period to the Qin–South Dynasties period in the Sichuan Basin.

The archaeological evidence indicates that during the Paleolithic Period in the Sichuan Basin, early humans produced stone tools, including hand axes, hand picks, and heavy scrapers [43]. However, no evidence of house construction has been found, suggesting that the ancestors in the Sichuan Basin had not yet adopted a sedentary lifestyle at this time. In the Neolithic Age, the natural environment was the main factor influencing the distribution of settlements, and agriculture was also mainly affected by the environmental factors. The settlements in the Sichuan Basin were primarily concentrated in the eastern Xiajiang Region and the western Chengdu Plain, leading to the emergence of two distinct centers of settlements. The Chengdu Plain in the west experienced a slight increase in temperature and humidity in response to the global "5.2 ka BP" event, which followed the 5.1 ka BP period, creating a suitable hydrothermal environment. Moreover, this area is characterized by flat terrain and an abundance of water sources within the Tuojiang and Minjiang River Basins. The natural environment is relatively stable and conducive to agriculture, making it an ideal location for the survival and reproduction of early ancestors and the establishment of settlements during the late Neolithic Period. Archaeological findings from the Guiyuanqiao and Baodun relics indicate that crops such as millet, broomcorn millet, and rice were cultivated [44]. Agriculture tools also appeared in large quantities in the Baodun culture period (618–907 BC), such as axes, adzes, chisels, shovels, and knives unearthed less [45]. The archaeological record indicates that the ancestors in the Xiajiang Area primarily relied on fishing, hunting, and gathering during the Neolithic Period, with farming playing a supplementary role. A significant quantity of animal bones, exhibiting evidence of human intervention such as fragmentation, cutting, and barbecuing, has been unearthed at the sites of Chengbeixi and Guanmiaoshan relics. The practice of primitive agriculture is only documented in a limited number of the wider valleys that were conducive to agricultural activities [46]. Archaeological evidence suggests the presence of rice at the Dadiping and Suolong relics dating back to 5–4.5 ka BP [47]. At the same time, floods often resulted in the destruction of ancestral settlements, as evidenced by signs of washing out the center of the Baodun site. In the Baodun culture period (2000 BC), the Chengdu Plain experienced a group of floods, which led to a settlement distribution diverted from the six ancient cities along the Minjiang River (Baodun ancient city, Gaoshan ancient city, Yandian ancient city, Zizhu ancient city, Shuanghe ancient city, and Mangcheng ancient city) to the southwestern hinterland of the Tuojiang River along the Yufu ancient city and Pixian ancient city [48].

During the Shang and Zhou Dynasties, the natural environment was still the main factor influencing the distribution of settlements, and the development of resources and handicrafts, the establishment of states and wars, and population changes had an increased impact on the construction of settlements [36]. At this time, agricultural technology had been greatly developed. The Zhongbazi relic has provided evidence of paddy fields from the Shang and Zhou Periods, while the Jinsha site has yielded China's earliest wooden shovels [49]. The emergence and evolution of agriculture in the Sichuan Basin indicate that a mature primitive civilization had already been shaped. In contrast, the Xiajiang Area, where Ba is located, faced geographical constraints that limited agricultural development. Consequently, fishing and livestock breeding remained vital modes of livelihood for the ancestors in this region. Additionally, the Yudong Area was characterized by an abundance of salt springs, which provided a significant economic foundation during the Shang and Zhou Dynasties. The salt trade not only facilitated the growth of settlements in the Xiajiang Region but also contributed to the expansion of the Ba population [50]. During the Shang and Zhou Dynasties, the State of Shu on the Chengdu Plain and the State of Ba on the Xiajiang River were established in the Sichuan Basin. The Shu was relatively stable due

to its location within the inner basin. During the spring and autumn period, the Ba and Chu were in frequent wars, and Ba lost more. The Ba was forced to withdraw from the Han River and move westward along the Three Gorges of the Yangtze River. And Ba's capital was forced to move westward many times, and it occupied the Shu's Langzhong Area. And the settlements of Ba began to develop towards the Jialing River Basin [51]. At the same time, the wars between the Ba state and the Chu state and the Indigenous inhabitants (Sanmiao, Jingman) in the middle reaches of the Yangtze River facilitated to a certain extent the migration of the population and cultural exchanges and promoted the social development and the construction of the settlements in the Xiajiang Area. The excavation of bronze artifacts and precious relics such as Yucong and Yubi indicate that the civilisation of the Central Plains and the Ba–Shu civilisation of the Sichuan Basin interacted closely during the Shang and Zhou Periods [11]. They also show that the communal-based clan communes were increasingly disintegrating, and that the distribution of settlements was centered on the kingdom's capital.

During the Qin–Southern Dynasties period, the influence of the natural environment on the distribution of settlements was significantly weakened, and diversified economic patterns and trade, population migration, the establishment of a unified country and county system, and the construction of water conservancy facilities have become important factors affecting the distribution of settlements. During the Qin to Southern Dynasties, frequent population migrations and commercial interactions between the Sichuan Basin and the outside transformed the Sichuan Basin from a closed system into an open system. This period resulted in significant population growth, the construction of settlements, and the exchange of material and culture [52]. The emergence of the Shu Road contributed to the growth of silk weaving, iron smelting, salt production, and other handicrafts. This development, in turn, fostered closer business and trade between the Sichuan Basin and the Guanzhong Plain, which housed the Qin capital of Xianyang and the Han capital of Chang'an. Furthermore, the hinterland along the Jialingjiang River saw a significant increase in settlement construction [53]. In 316 BC, Qin completed the occupation of the Ba and Shu and began mass immigration to Ba Shu [54]. After the unification of China, the Qin introduced the county system throughout the country, set up Ba and Shu Counties in the Sichuan Basin, and organized large-scale immigration to the Sichuan Basin on several occasions, accelerating the construction of the Sichuan Basin. In addition, a series of water conservancy projects, such as the Dujiangyan, built since the Qin Dynasty, effectively managed the flooding of the Chengdu Plain, and the number of settlements increased and became more widely and evenly distributed [55]. At the same time, with the development of handicrafts, waterway transportation brought about material and cultural exchanges, especially in the Xiajiang Area, which was the only open area in the Sichuan Basin. The Ba people of the Xiajiang River were good at driving canoes, going up to Shu in the west and Jingchu in the east to carry out the salt trade [56].

5. Conclusions

This study constructed a geographic information database of ancient settlements in the Sichuan Basin, analyzed the spatial and temporal evolution of ancient settlements, and visualized the settlement patterns and the relationship between settlements and the natural environment. By analyzing 1100 settlements from the Neolithic to the Qin–Southern Dynasties period, it is found that the distribution of settlements in the region has gone through a process from the "double cores" pattern in the Neolithic period to the "aggregated double cores" in the Shang and Zhou Periods, and then to the "one core + two belts" in the Qin–Southern Dynasties Period. Among the natural factors, the influence of the water system on the distribution increased, elevation, slope, and soil showed a significant decrease, while the aspect was weaker in all periods. The Sichuan Basin settlement location emphasizes the relationship between the water system and the need for orientation. This change is related to the environmental characteristics of ancient flooding and insufficient sunshine in the Sichuan Basin. The settlements in the Sichuan Basin continued to develop

over time, and the spatial pattern showed the characteristic of obvious continuous local changes in the main composition. By analyzing the distribution, morphology, and natural environmental relations of ancient settlements in the Sichuan Basin, it is possible to glimpse the development of settlements in the southwestern origin region of Chinese civilization. Over time, social, economic, and regimes became important driving forces influencing the evolution of settlements. Factors such as the change in livelihood patterns, war, population migration, commerce, exchanges with the outside world, technological development, and water conservancy construction in the Sichuan Basin became the main factors of the changes in the distribution characteristics of the settlements from the pre-Qin to the Qin to the Southern Dynasties.

In the existing research on ancient human–land relations in the Sichuan Basin, scholars have increasingly focused on the interrelationship between climate evolution, cultural development, and changes in settlement patterns. Additionally, some researchers have explored the impact of ancient floods on site alterations. However, there remains a notable lack of scholarship examining the spatial and temporal distribution characteristics of settlement sites. Most prior studies have adopted a qualitative approach, drawing on archaeological findings and historical documents through the lenses of settlement archaeology and environmental archaeology. This study integrated the research methods of landscape and environment science, settlement archaeology, and cultural geography. This study analyses the spatial and temporal distribution of ancient settlements in the Sichuan Basin and the morphological characteristics so as to conduct a comprehensive and systematic examination of the history of ancient settlements in the Sichuan Basin, with a particular emphasis on the prehistoric era. The aim is to systematically organize the resources associated with these ancient settlements, thereby facilitating the excavation of their heritage value. This approach will provide a foundation for the conservation of cultural heritage and the history of regional settlements. Moreover, these ancient settlements serve as the basis for understanding the spatial structure of contemporary towns and villages in the Sichuan Basin. Analyzing the spatial patterns of ancient settlements can yield valuable insights for the development of the Chengdu–Chongqing urban agglomeration and the planning of the national spatial system. Additionally, the formation and development of ancient settlements reflect the ancestral wisdom of coexistence with the environment and the concept of urbanization. They also serve as a cognitive tool for exploring the formation and evolution of the human–land relationship. Furthermore, the traditional knowledge of ancestors regarding respect for nature will support the sustainable development of urban and rural areas in the present era.

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References

1. Wu, W.H. From Jade to Settlement-Lingjiatan practice and the problem of constructing regional prehistoric societies. *Nan Fang Wen Wu* **2020**, *03*, 116–135.
2. Shi, X.B. *The Chinese Neolithic Cultural System and Its Related Issues, Asian Civilizations Series*; Sichuan People's Publishing House: Chengdu, China, 1986.
3. Lin, X. A New Exploration of the Civilization Process in the Sichuan Basin. *J. Chin. Cult.* **2018**, *11*, 11–15.
4. Jiang, Z.H. The Position of the Sichuan Basin in the Formation and Development of Chinese Civilization from Archaeological Materials. *J. Chin. Cult.* **2015**, *4*, 16–20.
5. Yu, M.Z.; Xia, W. A Survey on Archaeological Studies of the Pre-Qin Times in Sichuan Basin. *J. Xihua Univ. (Philos. Soc. Sci.)* **2015**, *34*, 40–47.
6. Gao, Y.Y. *Research on Botanical Resource Use and Human-Land Relationship from Neolithic to Bronze Age in Southwest China*; Sichuan University: Chengdu, China, 2019.
7. Wang, F.; Yang, Z.P.; Luan, F.M.; Xiong, H.; Shi, H.; Wang, Z.; Zhao, X.; Qin, W.; Wu, W.; Li, D. Spatiotemporal characteristics of cultural sites and their driving forces in the Ili River Valley during historical periods. *J. Geogr. Sci.* **2015**, *25*, 1089–1108. [CrossRef]
8. Jia, T.J. *Environmental Archaeology of the Impacts of Earthquake and Paleo-Floods of the Neolithic Age in the Chengdu Plain, China*; Nanjing University: Nanjing, China, 2016.
9. Fu, S. *Research on Regional Environment and Culture of Ancient Sichuan*; Chengdu University of Technology: Chengdu, China, 2006.
10. Luo, L.P. *Environmental-Climate Changes of Chengdu Plain from 4ka and Its Influence on Ancient Shu Civilization*; Chengdu University of Technology: Chengdu, China, 2007.
11. Zhao, B.Q. Population Migration and Cultural Exchanges in the Ba-Shu Region during the Pre-Qin Period. *Sichuan Cult. Relics* **2015**, *4*, 62–70.
12. Han, Y. Minjiang River Flood Control and the Rise of Early Cities in the Chengdu Plain. *J. Chengdu Univ. (Soc. Sci.)* **2021**, *4*, 55–62.
13. Zheng, Y.H. Exploration on the Construction of Shu in the Early Period of Qin and Shu. *J. Harbin Univ.* **2022**, *43*, 86–90.
14. Jordi, M.H. *Creative Ways to Apply Historical GIS*; Springer: Berlin/Heidelberg, Germany, 2023. [CrossRef]
15. Liu, J.G. *Archaeological Mapping, Remote Sensing and GIS*; Peking University Press: Beijing, China, 2008.
16. Tong, M.F.; Li, B.H.; Li, Z. Research on the Spatial-Temporal Distribution and Morphological Characteristics of Ancient Settlements in the Luzhong Region of China. *Land* **2022**, *11*, 1579. [CrossRef]
17. Zhu, M.; Dong, J.F.; Gao, Y.Z. The Research on Temporal–Spatial Distribution and Morphological Characteristics of Ancient Settlements in the Songhua River Basin. *Sustainability* **2019**, *11*, 932. [CrossRef]
18. Liu, L.; Liu, F.F.; Zhang, W.; Xu, Z.F. Spatial Distribution and Evolution of Ancient Settlements from the Neolithic to the Bronze Age in Dalian Area, China. *Front. Earth Sci.* **2022**, *10*, 917520. [CrossRef]
19. Du, X.Y.; Hu, X.J.; Jin, X.L.; Gong, W.; Liu, M.R.; Hu, H.R.; Wang, Y.Z. Relationship Between Spatial-temporal Distribution and Its Natural Environment of Neolithic Settlement Sites in Dongting Lake Area. *Econ. Geogr.* **2021**, *41*, 167–176.
20. Zhou, T.T.; Cui, J.X. Spatiotemporal distribution and driving force of settlements from Yangshao to Shang-Zhou periods in Guanzhong area based on GIS. *J. Earth Environ.* **2022**, *13*, 163–175, 195.
21. Jiang, Z.H. Analysis of Pre-Qin Settlement Changes in Chengdu Plain. *Archaeology* **2015**, *4*, 67–78.
22. Tang, Q.C. A Review of Prehistoric Settlement Patterns in the Chengdu Plain. *Huaxia Archaeol.* **2012**, *01*, 47–53,62.
23. Yang, P.Q.; Tang, Y. New Exploration of Pre-Qin Period Settlement Pattern in Xiajiang Area of Chongqing: Taking the Sites in Shang and Zhou Dynasty of Panshicheng in Yunyang as an Example. *Southwest Cult. Relics Archaeol.* **2023**, *02*, 105–111.
24. Chen, J.Q. The Sichuan Basin is surrounded by a series of low to medium mountains, with the topography dropping sharply from the edge inwards to form an independent natural geographical unit. *Yunnan Geogr. Environ. Res.* **1993**, *2*, 52–61.
25. Wang, T. *Research on Cultural Development and Man-Environment Interactions in the Chengdu Plain during the Pre-Imperial Period*; Jilin University: Changchun, China, 2015.
26. State Administration of Cultural Heritage. *Atlas of Chinese Cultural Relics: Sichuan Volume*; China Map Press: Beijing, China, 2009.
27. State Administration of Cultural Heritage. *Atlas of Chinese Cultural Relics: Chongqing Volume*; China Map Press: Beijing, China, 2010.
28. National Cultural Heritage Administration. *Catalogue of Chinese Unmovable Cultural Relics: Sichuan Volume*; Wenwu Publishing House: Beijing, China, 2011.
29. National Cultural Heritage Administration. *Catalogue of Chinese Unmovable Cultural Relics: Chongqing Volume*; Wenwu Publishing House: Beijing, China, 2011.
30. Sichuan Provincial Institute of Cultural Relics and Archaeology. *Sichuan Archaeological Reports*; Cultural Relics Press: Beijing, China, 1998.
31. The Chongqing Municipal Administration of Cultural Heritage, Chongqing Cultural Heritage Research Institute. *A Collection of Archaeological Reports on the Follow-Up of the Three Gorges in Chongqing*; Science Press: Beijing, China, 2019.
32. DEM for the Sichuan Basin. Available online: https://www.resdc.cn/data.aspx?DATAID=217 (accessed on 11 July 2024).
33. Water System Data. Available online: https://www.gscloud.cn/sources/accessdata/51756266ea8c41c088a4da0e6713d274?pid=eafee2c80c844412b9d5bee58a3fc9ab (accessed on 15 July 2024).
34. Zhang, B.P.; Yao, Y.H.; Liu, J.J.; Li, J.Y.; Jiang, Y. Geographic perspective on the origin of Chinese civilization. *Acta Geogr. Sin.* **2024**, *7*, 1631–1646.

35. Huang, M.; Ma, C.M.; He, K.Y.; Tang, M.; Xu, J.; Zhu, C. Environmental changes and human activities recorded by the pollen in the Middle-Late Holocene at Baodun site, Chengdu Plain. *Quat. Sci.* **2022**, *42*, 1078–1093.
36. Zhang, D.; Zhou, H.W.; Huang, T.F.; Zhang, G.Y. Temporal and Spatial Distribution Characteristics of Early Historical Settlements and Influencing Factors in Hunan Province, China. *Mt. Res.* **2020**, *5*, 763–775.
37. Li, J.; Mo, D.W.; Wang, H. The Geomorphological Characteristics, Palae-environment and Paleo-culture of the Chengdu Plain. *Res. Soil Water Conserv.* **2005**, *4*, 39–42.
38. Chinese Soil Dataset. Available online: http://www.ncdc.ac.cn/portal/metadata/a948627d-4b71-4f68-b1b6-fe02e302af09 (accessed on 26 September 2024).
39. Fang, X.Q.; Ge, Q.S.; Zheng, J.Y. Progress and prospect of researches on impacts of environmental changes on Chinese civilization. *J. Paleogeography* **2004**, *1*, 85–94.
40. Li, N. *Temporal and Spatial Distribution of Late Neolithic Settlement Sites in the Middle Reaches of the Yangtze River Based on GIS*; Nanjing Normal University: Nanjing, China, 2018.
41. Luo, L.D. The method for calculating quaternary air-temperature and water-precipitation index in the pollen-spore analysis-for example to stody1-stody terrace of Jinjiang river, Chengdu plan. *J. Guizhou Norm. Univ (Nat. Sci.)* **1996**, *3*, 42–50.
42. Wang, N.; Zhong, J.; Li, Y.; Bao, L.; Lu, T. Research progress on pollen-inferred Holocene climate histories in southwestern China. *Chin. J. Appl. Environ. Biol.* **2018**, *5*, 1015–1022.
43. He, K.N.; Ding, Y.F. Late Paleolithic stone tool industry in the Sichuan Basin. *Huaxia Archaeol.* **2013**, *4*, 27–33.
44. Xu, J.J. *Mid- to Late Holocene Environmental Archaeology in Chengdu Plain, China*; Nanjing University: Nanjing, China, 2017.
45. Fu, S.; Li, F.S.; Yan, Z.K.; Zheng, Y.R. The Study of Relativity on Chengdu Plain Holocene Climatic Change and the Evolution of Ancient Shu Culture. *J. Sichuan Norm. Univ. (Nat. Sci.)* **2011**, *3*, 417–421.
46. Li, Y.Q. *Prehistoric Subsistence and Habitation in the Three Gorges Area*; Nanjing Normal University: Nanjing, China, 2012.
47. Luo, Y.B.; Yao, L.; Yuan, J. The Subsistence and Economy of the Pre-Qin Period in the Upper Yangtze River Region. *Nan Fang Wen Wu* **2018**, *04*, 96–110.
48. Yang, Q. A study on the correlation between the migration of major city sites of the ancient Shu civilization and climate change. *Sichuan Archit.* **2015**, *3*, 7–10.
49. Jiang, S.B. Pre-Qin Agriculture in Chengdu Plain. *Agric. Archaeol.* **2002**, *03*, 26–34.
50. Liu, W.G. Salt and Ancient Warfare in the East of Chongqing. *Salt Ind. Hist. Res.* **2014**, *04*, 57–65.
51. Li, J.J. Ba state into Qin. *J. Lit. Hist.* **2010**, *6*, 58–60.
52. Xie, Y.L. Energy and Information Exchange in Sichuan Basin Economic Zone from Qin-Han to Sui-Tang. *J. Sichuan Norm. Univ. (Soc. Sci. Ed.)* **1990**, *2*, 74–83.
53. Wang, Z.J.; Liu, L. Formation of the key cultural position of Xianyang-Chang'an and main route alternation of ancient Shu Dao. *J. Chang. Univ. (Soc. Sci. Ed.)* **2012**, *14*, 1–6.
54. He, J.H. On the Rupture and Rise of Ba Shu Culture in the Qin and Han Dynasties. *J. Lit. Hist.* **2017**, *5*, 67–73.
55. Li, Y.N. Agricultural Water Conservancy in the Eastern Jin and Southern Dynasties and the Formation of Economic Regions in Southern China. *Agric. Archaeol.* **2023**, *04*, 70–78.
56. Zhu, S.Z. Agricultural Structure and its Ecological Background of Early Ba People. *Anc. Mod. Agric.* **2020**, *02*, 27–36.

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