

## **Analysis on the Spatial Characteristics of Traditional Settlements in Harmony with Nature in Loess Plateau of Northern Shaanxi**

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**Abstract.** Northern Shaanxi is the typical area of Loess Plateau in China with alleys and gullies crisscrossed. In such a distinctive geographical environment, the traditional settlements rely on the natural landscape and make full use of topographical features. Then the spatial form of the mountainous human settlements is formed in harmony with nature. Combined with literatures and field investigation, from the aspects of spatial distribution, site selection, spatial form and layout, the spatial characteristics of the traditional settlements in Northern Shaanxi are analyzed. What's more, the internal regularities and useful experience of how to adapt to nature and make use of it are summarized, providing a research foundation for the sustainable development of human settlements in this region.

### **1. Introduction**

Northern Shaanxi is located in the Loess Plateau of China, famous for its thick loess accumulation and high-density of the valleys and gullies. Drought, lack of rain and rolling landscape become the restraining factors for the development of human settlements. In the harsh environment, the traditional settlements seek benefits and avoid disadvantages, adapt to local conditions and maintain harmony with natural ecology in its evolution. And the experience and wisdom of construction provide an important inspiration for nowadays sustainable development of human settlements with regional characteristics.

The research on Northern Shaanxi traditional settlements in recent decade made series of gains. It includes researches on historic cities [1], fortress settlements [2, 3], rural settlements [4-9] and etc. From different perspectives of history, nature, culture, ecology and economy, relevant literatures discuss the evolution and development of settlements. The focus of this paper is those rural settlements and the perspective is space. Rural settlements occupy a large number and are widely distributed in Northern Shaanxi. Besides, they are less affected by modernization and urbanization, thus retaining a state of relatively “original ecology”.

### **2. General Characteristics of Traditional Settlements Distribution in Northern Shaanxi**

#### **2.1 General Situation of Natural Environment and Historical Culture in Northern Shaanxi**

Northern Shaanxi is located in the north of Shaanxi province, including the administrative

region of Yan'an and Yulin. The main climate type here is the arid continental monsoon climate, which has little rain and big gap in temperature. The southern and central parts belong to the hilly and gully region of Loess Plateau while the northern part along the Great Wall is the blown-sand region. The most outstanding characteristic of Loess Plateau in Northern Shaanxi is the high density of valley and gully system. Branches of the Yellow River crisscrossed among the gullies of plateau. The topography and geomorphology of loess tableland are complicated and diversified, including ridge, hill and gully, and forming a distinctive mountainous landscape.

Since Northern Shaanxi lies on the semi-arid farming-grazing transitional zone in the north of China, it used to be the military dispute area where the Central Plains Dynasty built borders for defense and Nomads migrated inward to plunder the land. In history, the plowing culture of the Han and the nomadic culture of northern minorities conflicted and integrated here, contributing to the multicultural characteristic with the feature of frontier culture. Due to the severe climate and geographic conditions and the effect of long period of military activities, it forms a rough and heroic regional culture characteristic. Besides, it encourages traditional settlements to make an effort to create an environment suitable for living.

## **2.2 Spatial Distribution of Traditional Settlements Relyed on the Valley and Gully System**

The traditional settlements in Northern Shaanxi are mainly distributed over valleys. The dense ravines and river system are the main factors for the general distribution rules of settlements. The distinctive landscape and watershed system take great rivers like Wuding River, Yan River and Luo River, the first-class branches of the Yellow River as a trunk, medium-sized valleys (the first-class branches of great rivers mentioned above) and many small watershed channels (the second and third class of those great rivers) as the branches. These branch-shaped spatial systems of valleys result in the relatively wide and flat land, becoming the preferred area for farming. The advantages of ecology, cultivated land resources, military defense and traffic in valley areas provide favorable conditions for the human settlements, attracting people to gather. Consequently, it becomes the main area for traditional settlements development in Northern Shaanxi and continues to this day [4].

The general distribution of traditional settlements is closely related to the valley and ravine system, and the scale and class of settlements adapt to this spatial system of valleys [4]. The settlements in the valleys of first-class branches of the Yellow River are characterized by the counties and cities, there being also some villages and towns. The settlements in the valleys of second-class branches of the Yellow River are featured with townships, there being a few counties. The third-class branches are generally small watersheds, and village settlements are distributed over there. The interconnection between the scale and class of settlements and the spatial system of valleys shows the fact that in the agriculture society where the cultivated land plays a core role, water and soil resources become an important condition that affects the human settlement scale. And the development of traditional settlements takes full advantages of the natural ecological conditions and adapts to it.

Meanwhile, the intersection of rivers has a prominent advantage in farming, traffic and military. Thus it tends to form the human settlements. The interjection of large and moderate watersheds tends to appear large cities and towns. And the joint of valleys in the small watersheds also becomes the most centralized area where rural settlements exist [10]. The rural settlements with great numbers are mainly distributed over the main valleys of small watersheds

and extend along the tributary gullies. These villages demonstrate the basic rules and characteristics of traditional settlements construction, and reflect the human settlements construction thought under the influence of traditional idea of harmony between man and nature.

### **3. Traditional Settlements Site Selection under the Effect of Geomantic Point of View to Live in Harmony with Nature**

#### **3.1 General Rules of Site Selection**

During the formation and construction of traditional settlements, usually the natural environment conditions which are helpful for settlement will be selected by purpose. Settlements of Northern Shaanxi based on the cave dwellings usually give their focus to facing the sun, channels and roads [11]. It reflects the traditional geomantic view that man is an integral part of nature. It means the ideal living place should be like fronting river and with hills on the back, locating in north and facing south, and being protected by mountains in the east and west. Thus they can avoid wind and coldness in winter and gain enough sunlight. What's more, it is also convenient to get water, go out and defend themselves. This is the method used to adapt to nature and live in harmony with nature.

#### **3.2 Facing the Sun, out of the Wind, Concave Landform**

In the winter of Northern Shaanxi, the north-west wind is piercingly cold. The concave landform which is out of the wind and faces the sun helps to avoid the blown sand and the coldness. Also, enough sunlight can be attained for farming and living. Among numerous small watersheds, concave contour lines are the preferred place for the development of settlements. The folk house groups have two types here, digging caves relying on mountains and building cave dwellings on the ground. Usually they are distributed over the concave cove of valley or the slope terrace surrounded by ridges and hills.

#### **3.3 Close to Water, Draining Floods Easily**

The winter and spring is dry in Northern Shaanxi. Easy access to water is the rule of site selection of settlements to meet the needs of drinking and farming irrigation. Meanwhile, due to the severe water loss and soil erosion in loess ravines area, the site selection takes the convenience to drain floods in rainy seasons into consideration to avoid the effect of floods. Consequently, villages in the small watersheds are often distributed over the hills above the river course [9].

#### **3.4 Using Nature, Good for Defense**

Another important rule of settlements site selection is to keep the safety of living life and agricultural production. Due to its landscape characteristics and historical and humanistic factors, the importance of safety can't be stressed too much. When choosing the site, the location where landslides often happen is avoided. It is encouraged to use mountains and rivers as the effective natural defense to avoid or lower risks of natural and man-made disasters.

## 4. Traditional Settlements Forms Integrated with the Landscape

### 4.1 General Layout of Settlements

Rural settlements in Northern Shaanxi are mainly distributed over the slopes of ridges and hills, valley sides and tablelands, tributary gullies and valley plains [11]. To attain the best living conditions, the settlements situated in the different landscape environment suit their measures to local conditions. Then different kinds of forms and layouts are formed in the mountainous landscape. Cave dwellings are distributed along river systems or valleys, taking on a belt shape or branch shape. Besides, they are also distributed along hill contours, taking on a circular shape or becoming groups. Traditional settlements are arranged according to landforms and adjusted to nature so farmland can be saved and settlements safety can be guaranteed. It reflects a sense of survival of treasuring resources and creating comfortable human settlements against the fragile ecology.

### 4.2 Villages Situated in the Slopes of Ridges and Hills

This kind of village is mainly located in the zone of the relatively high terrain. Their plane forms exist as linear groups distributed along the mountain contours [11]. Taking the Liujia Mao Village in Yangjia Gou Town, Yu Lin City as an example, it relies on the steep Niujia Liang Mountain. For the sake of farming and southern sunlight, cave dwellings are built near the farmland and extend linearly along the mountain and river. Cave-houses scatter randomly over the mountains, contributing to the typical ladder-shaped mountainous settlements landscape (refer with: Fig. 1).

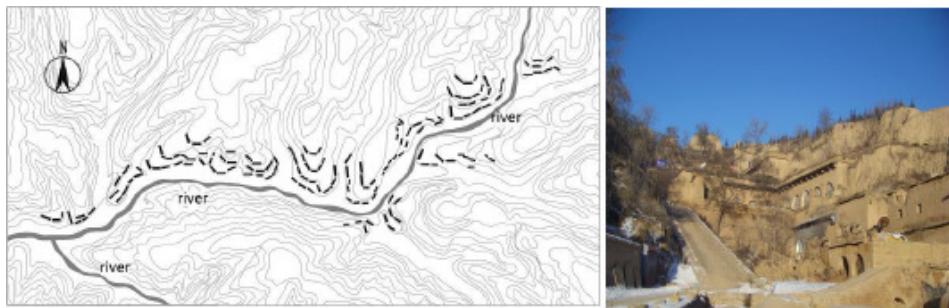


Figure 1. Village in the slopes of ridges and hills—Liujia Mao Village.

### 4.3 Villages Situated in the Valley Sides and Tablelands

This kind of village is mainly distributed over the tableland trailing edges and valley sides of the first-class branches of Wuding River, Yan River and etc. Inside the settlements, the layout of cave-houses is relatively loose [11]. For example, Wei Ta Village in An Sai Town, Yan'an City, is surrounded by hills, located in a gentle slope. Cave-houses are mainly distributed along the valleys and contours, and scattered randomly according to landforms. To reclaim and occupy more farmland, a sporadic layout characteristic is formed (refer with: Fig. 2).

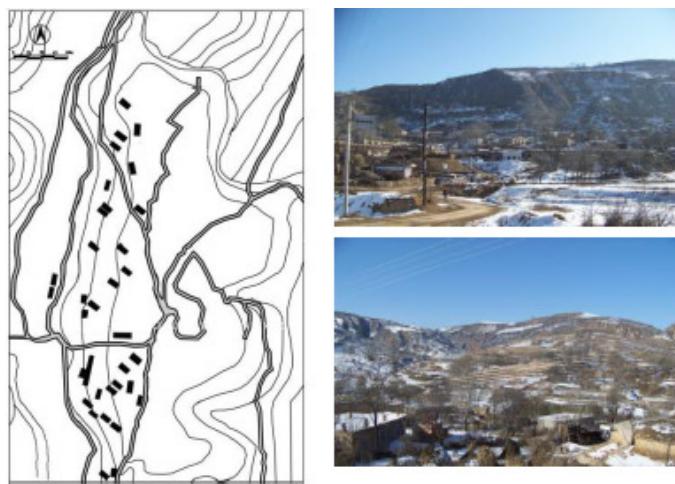


Figure 2. Village in the Valley Sides and Tablelands—Wei Ta Village.

#### 4.4 Villages Situated in the Tributary Gullies

This kind of village is mainly distributed in the valleys of the second-class branches (small watersheds) of Wuding River, Yan River and etc [11]. Cave-houses develop along the major river course and tributary gullies. The plane form takes on a comb-shaped or branch-shaped look. For example, Gaoxi Gou Village in Yin Zhou Town, Yu Lin City, has a sweep of hills and long and narrow gullies. The farmland is mainly distributed over the hillsides, dam fields and terrace in valleys. Cave-houses are built according to the landforms of the loess valley sides. The density of houses decreases gradually from the main river channel to tributary gullies, resulting in the comb-shaped form (refer with: Fig. 3).

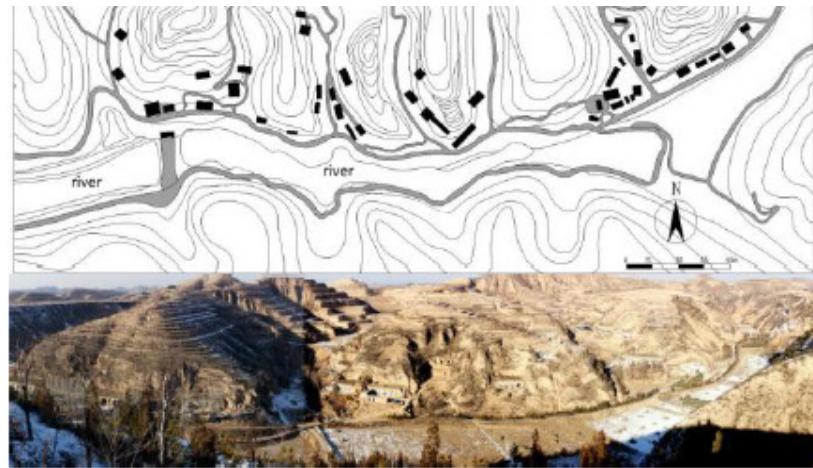


Figure 3. Village in the Tributary Gullies—Gaoxi Gou Village.

#### 4.5 Villages Situated in the Valley Plains

This kind of village is often distributed in the low terrace of great rivers like the Yellow River, Wu Ding River, Qing Jian River, Yan River and etc [11]. Due to the advantages in land and space resources, the settlement scale is relatively large and houses are relatively

concentrative. The spatial form appears in blocks or belts along river valleys. The Mutou Yu Village in Yu Lin City, is located in a terrace on a side of the Yellow River. The village is based on the quadrangles made of earth, stone and brick cave-houses. The layout is compact and the plane form takes on a belt shape along the trend of the Yellow River (refer with: Fig.4).

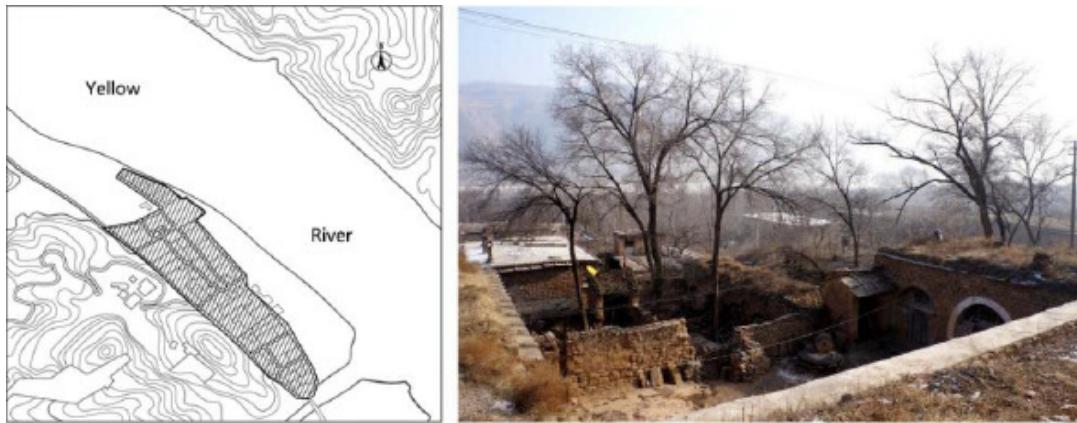


Figure 4. Village in the Valley Plains—Mutou Yu Village.

## 5. Diverse Settlements Spatial Structure Adapted to Nature

### 5.1 Characteristics of Spatial Arrangement

Settlements in Northern Shaanxi make use of the complicated and changeable landforms, resulting in the free spatial arrangement and pattern. The farming land should be occupied as much as possible due to broken landforms. It brings about basic spatial characteristics of vague boundaries of settlements, scattered cave-houses and the unclear road systems. Under the premise of complying with nature, different types of distinctive spatial structures of settlements are created by the historic causes, multi-regional culture and settlement function.

### 5.2 Landlord Manor

Farming is not easy because of the barren land in Northern Shaanxi. But still a few people accumulated great wealth and became a local prominent family through ages of entrepreneurship on agriculture and commerce. Thus the settlement focused on the manor is gradually formed. However, these large and rich manors are more likely to become the target of robbery in the age of wars and chaos. In addition to meeting the needs of comfortable living, it is also necessary to guard the house against theft and burglars to ensure peoples' safety. The manor settlements often rely on mountains to build barriers, creating a defense system which is easy to defend but hard to attack. There are some famous examples such as the Jiangshi Manor, Mashi Manor and Dangshi Manor in Yulin.

The Jiangshi Manor is located in the hillside fields with high terrain and complicated landforms. It was built against mountains, creating a spatial pattern of layers of terraces and yards. The spatial sequence of the manor changes with the shape of mountains, forming a three-dimensional building group in harmony with nature. It is surrounded by towering walls and takes all measures to prevent any risks. The fort barbette is used to guard the gate. The manor adopts a tunnel entrance, narrow paths and steep slopes to connect courtyards and

terraces of different height. It can limit and delay the invasion of bandits which is good for attack and defense (refer with: Fig.5).

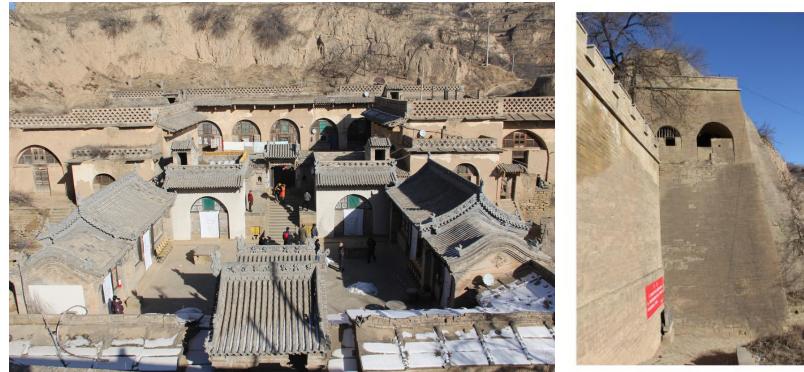


Figure 5. Yards and Barrier Walls of Jiangshi Manor.

### 5.3 Ferry Commercial Villages

During the Ming and Qing Dynasties, the water transportation of the Yellow River promoted the prosperity of the trade between the two provinces, Shanxi and Shaanxi. Especially the busy ferry had become the distribution center for materials and personnel. The tablelands and plains along the coast of Yellow River gradually became the docks because of the location at traffic fortress. The unique geographical location and economic activities produced the settlements where the social class like merchants, landlords and literary families lived together. Generally the commercial settlements are arranged relatively compact, and the distribution of their buildings is relatively concentrated.

For example, the Mutou Yu Village is located in the alluvial beach of the Yellow River in the west bank of Qin Jin Valley. It was a port where people of Qin area and Jin area did trading in ancient times. The layout form is square and neat. And as a whole, it takes on a belt-shaped structure between the river and the hill, extending in a long and narrow direction on the beach. The main road in the village forms a north-south axis, and the secondary alleys vertical to the main road in the east and west. All of these constitute an orderly street space (refer with:Fig.6).

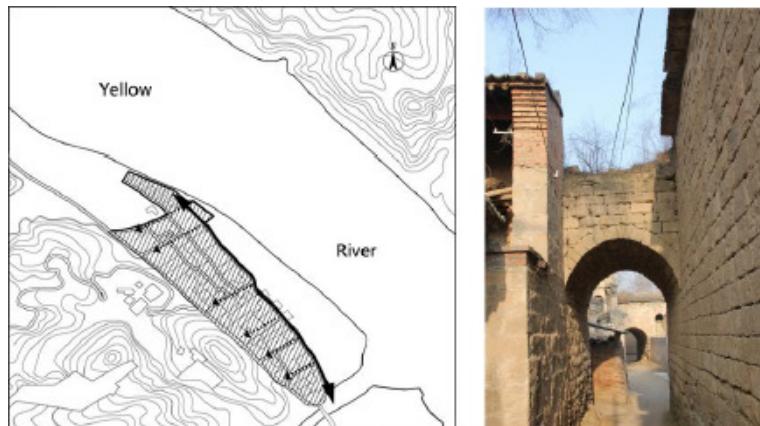


Figure 6. Belt-shaped Form and Street Structure of Mutou Yu Village.

## **6. Summary**

Under the special natural environment conditions and region culture in Loess Plateau, the traditional settlements in Northern Shaanxi developed their unique form and style. The site selection and scale of the settlements, spatial distribution and layout are limited by the factors like geographical features, water and soil resources and etc. The settlements spatial form is closely related to the mountain land and river system.

Its typical characteristics include the following 3 aspects: the site selection, the layout of settlements and the architectural form. When selecting the site, choosing the land and water source, relying on mountains and facing the sun are taken as the rules. And In terms of layout, the settlements adapt to the mountains and change with the forms. Lastly, loess cave dwellings are created through excavating mountains and adapting to nature. The spatial form and layout of traditional settlements contain the construction experience of adapting to the natural ecological environment that people concluded in the long period of development. It reflects the construction idea of human settlements that humans live in harmony with nature. It still needs to be further and entirely studied to conclude and carry forward this valuable rural culture wisdom, and explore the sustainable development of the human settlements of how to keep the regional characteristics in Northern Shaanxi.

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