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# The Spatial Characteristics of the Hmong Rural Settlements Landscape in Huayuan County at Western Hunan, China

Lingege Long[1], Qingxiang Li[2], Zhenkun Gan[3*]

[1] School of Art and Design, Beijing Institute of Fashion Technology, Beijing, China
[2] Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong, Shatin, NT, Hong Kong
[3] School of Architecture and Urban Planning, Beijing University of Civil Engineering and Architecture, Beijing, China

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**ABSTRACT**

Diverse and inclusive cities should prioritize the preservation and development of traditional culture. In China, traditional culture is more concentrated and better preserved in rural areas. As the connection between natural and humanistic systems in traditional culture, the rural settlement landscape is created by inhabitants through daily activities, possessing aesthetic, functional, and environmental values. They contribute to the construction of individual, local, and community identities and can promote local socio-economic development through the heritage process. However, urbanization conflicts between urban and rural spatial concepts and lifestyles have affected rural spaces and culture, with rural settlement landscapes being threatened by neglect and deterioration. Therefore, this paper selects the Hmong rural settlements as the research object, aiming to identify their spatial characteristics and values to recognize, acknowledge, and extend the traditional culture. Huayuan County, as the largest Hmong settlement county in western Hunan, combines the religious beliefs, concepts, and customs of the Hmong with the natural mountains and rivers, constituting a unique settlement landscape with outstanding spiritual value and cultural significance. By typology, morphology, to identify eight elements of settlement landscape space. We derive the distinctive features of the settlement landscape characterized by its adjacency to mountains, valleys, and rivers, its overall layout according to local conditions, and the clever forms of dwelling, and explore the inherent influence of Hmong culture, where are imbued with spirituality, collective social structures prevail, and a romantic and exuberant ethnic character resonates through the landscape space. It emphasizes that rural settlement landscapes are essential for ethnic and regional culture carriers, which could help understand traditional cultures, reconstruct local identities, and identify with rural heritage.

* *Corresponding author.*
*E-mail address: strider@tntlab.cn*

# 1. Introduction

The Hmong people have a long history; however, since ancient times, they were discriminated against and oppressed by the ruling class and were forced to choose remote mountainous areas as their habitat. After five great migrations [1], some Hmong compatriots decided to live in the western Hunan area and gradually formed a relatively stable settlement region [2]. Due to their remote location, the feudal dynasty less influenced beliefs and customs, and they retained their cultural characteristics, creating a regional landscape of minority settlements. However, unplanned construction and population loss have damaged the local rural settlement landscapes in rapid urbanization, and the differences and diversities of local landscapes have been shrinking, with serious homogenization of features [3-5]. The landscape space of Hmong rural settlements in western Hunan is not only integrated with the natural environment of mountains and rivers but also carries "Wuchu" cultural genes of the mysterious, romantic, and naive; it is necessary to carry out an in-depth study of the spatial characteristics of the Hmong Nationality rural settlements landscape.

The research on the Hmong rural settlement landscape mainly includes three aspects. First, it summarizes the characteristics of the settlement landscape on a macro-to-micro scale. Li [6] graded the landscape characteristics of traditional settlements in the Wuling Mountain area from three scales: territory scale, corridor scale, and settlement scale. Li [7] analyzed the landscape characteristics of the settlements along the wall of the Hmong border from the levels of the whole settlements and the elements of the settlements. The second is to explore the formation mechanism. Shang [8] and Han [9] have explored the internal mechanism of the generation and evolution of the settlement landscape of the Wuling Mountain Area. The third is to identify the gene symbols of landscapes. Cao *et al.* [10] combined the cultural genes with the natural environment and analyzed the mapping characteristics of the landscape gene symbols in the west Hunan region; Li *et al.* [11] and Long *et al.* [12] identified the genes of the traditional architectural landscapes of the Hmong and explored the differences in the characteristics and the influence factors based on the landscape gene mapping; Zheng *et al.* [13] constructed an index system for the similarity of the cultural landscapes.

Existing studies mainly focus on generalized research on the characteristics of the Hmong settlement landscape in western Hunan, with insufficient depth and focus. Huayuan County is the largest Hmong settlement county in Hunan West (Fig.1), the rural settlement landscape combines unique religious beliefs and customs with the local natural environment, which has outstanding spiritual value and cultural significance. This paper selected 38 the Hmong rural settlements with relatively complete preservation of landscape, spatial pattern, and architectural features as samples. Identify the spatial elements of the settlement landscape using Field surveys, typology, morphology, and other methods. Qualitatively and quantitatively analyze the settlement environment, spatial patterns, and features of the dwellings to systematically explore the spatial characteristics of the rural settlement landscape and influencing factors.

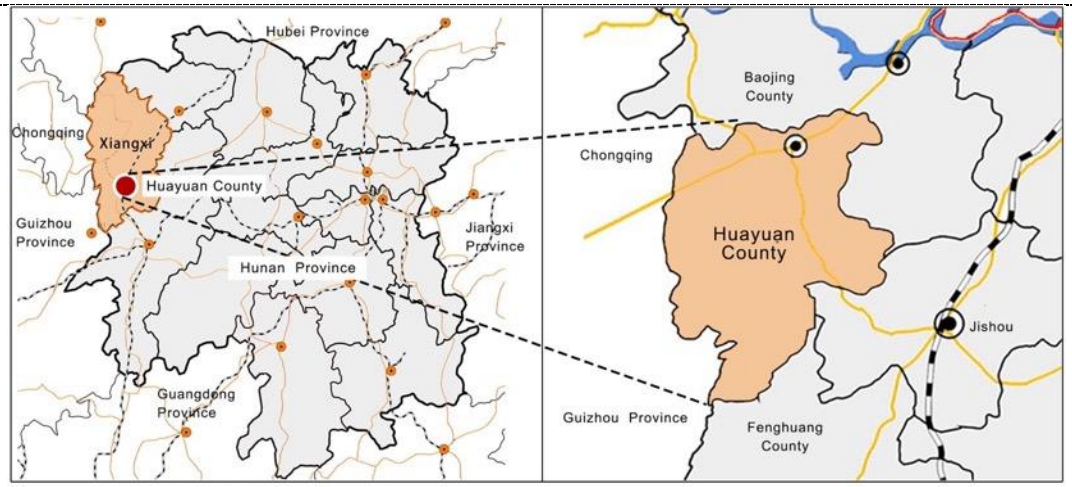



**Fig. 1.** Location

## 2. Methodology

### *2.1 Definition of Settlement Landscape and Settlement Landscape Space*

Different disciplines have different perspectives on the perception of the settlement landscape. Architecture takes material space as the primary basis, starting from the structure and form of space, and considers that the settlement landscape consists of spatial structure, texture, edges, centers, nodes, and buildings [14]. On the other hand, landscape architecture classifies the settlement landscape as a component of the vernacular landscape, together with the natural landscape and agricultural landscape as its subsystem [15-16]. Geography regards the settlement landscape as a humanistic landscape superimposed on the natural landscape [17-19]. This paper defines settlement landscape as a landscape type dominated by a specific culture, attached to human settlements' production and life, combined with natural and humanistic environments, with high territoriality and recognizability.

The characteristics of the settlement landscape directly affect the physical space, which is the space of the settlement landscape. It is the physical manifestation reflected by the influence of social, economic, cultural, and other elements in the settlement formation process, specifically embodied in the settlement environment, spatial form, structural organization, architectural space [20]. The settlement environment is the external geographic space of the settlement related to people's production and life, including the surrounding mountains, rivers, topography, and geomorphology; the spatial form includes the overall spatial form of the settlement and alley interfaces; the structural organization consists of the spatial structure, edges, nodes, landmarks.; the architectural space includes the layout of the courtyard, the shape of the building, architectural materials and decoration.

### *2.2 Settlement Landscape Genes*

The concept of settlement landscape genes originated from biology, referring to genetic factors unique to a settlement that distinguish it from others[19]. Settlement landscape genes play a decisive role in shaping a particular settlement landscape and serve as the basic unit for determining the characteristics of indigenous settlement landscape spaces from those of other settlements. The determination of settlement landscape genes in a specific area generally follows some principles: (1) the principle of external uniqueness, manifested externally as features not present in other settlement areas; (2) the principle of internal uniqueness, characterized by internal influencing factors not found in other settlement areas; (3) the principle of part uniqueness, where specific local but crucial elements are absent in other settlement areas; (4) the principle of overall superiority, wherein although other

settlement areas may have similar landscape elements, those of this settlement area are particularly prominent.

Settlement landscape genes typically comprise the following types: (1) Two-dimensional representation, which includes horizontal and vertical representations, such as the plan forms of settlements, courtyards, and individual buildings, as well as the facade forms of buildings, including roof styles and wall patterns. (2) Three-dimensional representation encompasses settlement spatial structures, street and alley interfaces, public spaces, etc. (3) Visual representation, including specific patterns of settlements, building materials, and architectural decorations.

### *2.3 Extraction of Spatial Elements of The Hmong Rural Settlement Landscape in Huayuan County*

Based on the theory above and methodology, combined with the landscape representation of rural settlements in Huayuan County, eight elements of settlement landscape space are extracted from three aspects of genes: settlement environment, overall layout, and dwelling form. These elements are based on the settlements' natural environment and cultural connotations, and shown in Table.1. They include:

i. Settlement Environment: The landscape composition of settlement environmental genes is natural landscapes. By analyzing the spatial organization relationship formed by terrain features and river systems with settlements, the site selection rules and landscape patterns of settlements are extracted, elucidating the environmental foundation characteristics of settlement landscapes.
ii. Overall Layout: The overall layout is composed of settlement spatial forms and structures, including settlement plan forms, boundaries, street and alley spaces, and node spaces.
iii. Dwelling Form: Dwelling Form encompasses the courtyard and individual building levels, including courtyard spatial textures, facade styles, and architectural decorations.

**Table 1**
Identifying Paths of Spatial Factors of Hmong Vernacular Settlement Landscapes in Huayuan County

| Tape of settlements landscape gene | Spatial of landscape | Identification paths of spatial factors of landscape |
|---|---|---|
| Settlements environment | Mountain and river | Topography and geomorphology, river→ Relationship with spatial organization of settlements → Rule of site selection → Landscape pattern |
| Overall layout | Spatial form and construction | Spatial form → Boundary → Street and alley space → Node space |
| Dwellings form | Courtyard and building | Courtyard layout →Building forms: Enclosure materials → Roof forms → Decoration |

## 3. Results

This part shows the results of spatial characteristics from settlement environment, overall layout and dwellings form.

### *3.1 Characteristics of The Settlement Environment*

#### *3.1.1 Settlement Site along Natural Terrain*

Xiangxi has long been characterized by the saying "nine mountains, half water, half divided fields," and the Hmong village proverb goes, "Hmong families live on hilltops." [21] In the Hmong rural settlements of Huayuan County, to reduce land occupation for cultivation, sites were chosen to "occupy the mountains but not the fields," with distribution ranging from the foot to the top of the

mountains. Based on elevation, slope, and aspect data extracted from samples in ArcGIS, we can find that among 38 sampled settlements, 30% are distributed in the foothill areas, 52% on the slopes, 5% on mountain tops, while the rest are distributed in hilly and valley areas (Fig. 2). Settlements in the foothills have convenient transportation and ample flat land for agricultural production. Settlements on the mountain slopes, chosen for Feng Shui and pleasant climates, enjoy abundant arable land. Those on mountain tops have broad vistas, enhancing defence capabilities by leveraging natural surroundings. Settlements on terraces or hillsides near rivers utilize high ground close to the water without directly facing it, enabling agricultural production and preventing erosion from water flow[22]. In summary, the Hmong settlements in Huayuan County adhere to the natural terrain, supported by mountains and streams. They skilfully utilize the terrain to demonstrate a harmonious coexistence between humans and the environment.

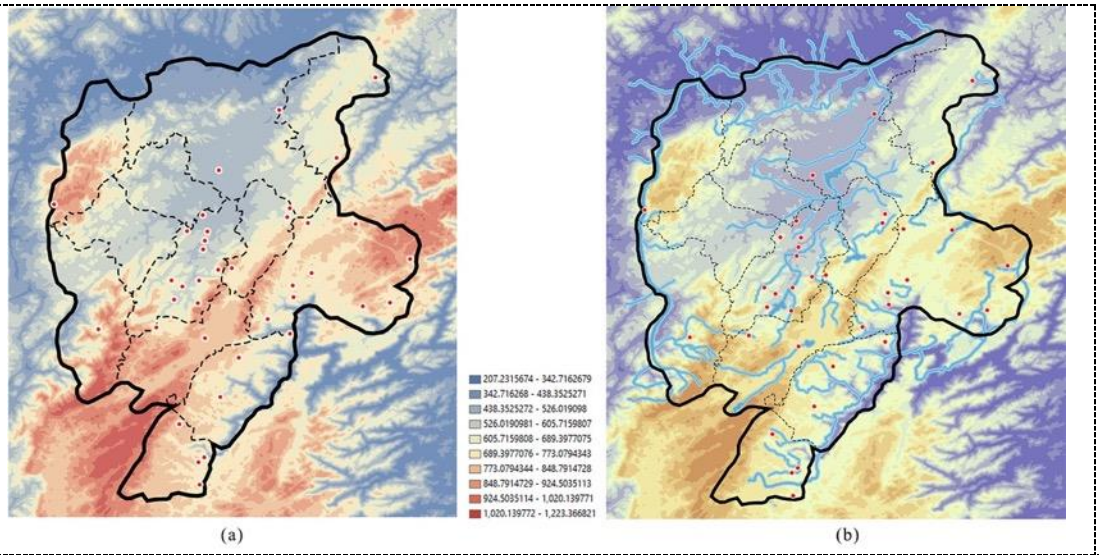



**Fig. 2.** Distribution pattern of sample settlements (a) Correlation of settlements with altitude (b) Correlation of settlements with river

### *3.1.2 Landscape Pattern with Unfolding in Layered*

The Hmong people's adaptation to and respect for nature resulted in settlements seamlessly integrating with the mountains and rivers. In the face of complex and changing terrain, settlements consistently obeyed the three essentials of "facing the sun, backing the mountains, and nearing the water," demonstrating a landscape characteristic of the interwoven integration of "mountains-water-village-farmland." Based on their site selection characteristics, settlements can be classified into two pattern systems: Settlements in hilly areas and settlements in river valleys.

Settlements in hilly areas are nestled against the mountains, with the settlement base formed by hills, streams, and terraced fields and shown in Figure 3(a). Dwellings are constructed layer by layer along contour lines from bottom to top, with forests obscuring the settlements, revealing only the grey-tiled roofs. Streams meander around the village, while fields and settlements are interwoven and distributed. The combination of green mountains, flowing water, yellow fields, and grey tiles form a landscape pattern of "mountains encircling, water embracing, fields surrounding the village" .

Settlements in river valleys are near rivers, as the river valley area provides abundant farmland resources, shown in Figure 3(b). Settlements are distributed linearly along the river, backed by mountains. They grow organically along contour lines from the valley's lowest point upwards. Fields surround the settlement, and the outermost areas are rolling hills. This pattern gradually ascends from the river to the mountains, demonstrating a landscape pattern of "living by the river, facing the sun".

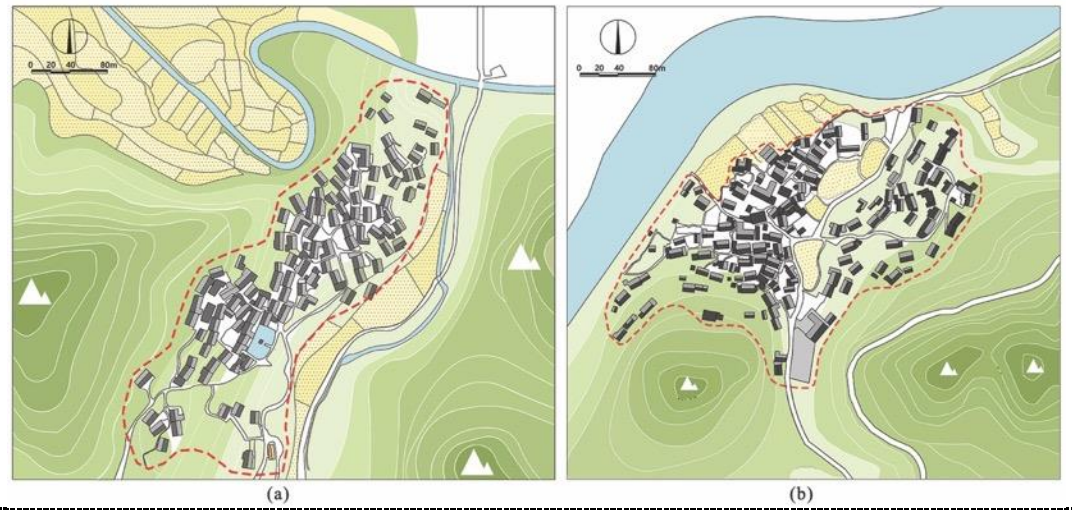



**Fig. 3.** Landscape pattern of settlements (a) Settlements in hilly areas (b) Settlements in river valleys

### *3.2 Characteristics of Overall Layout*

#### *3.2.1 Spatial Form in Response to The Situation*

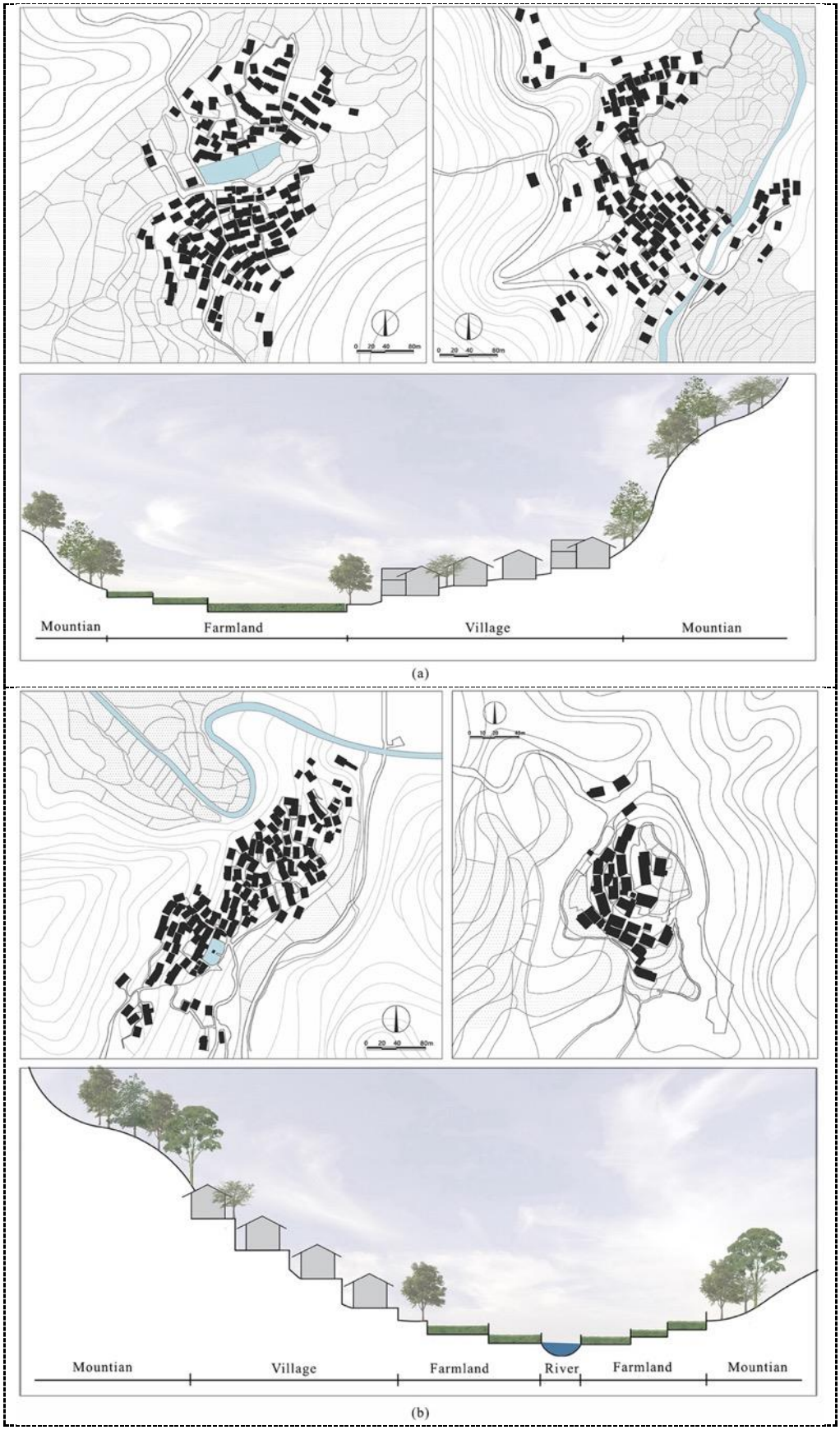
With limited land resources in the mountainous areas, the settlements often follow the slopes, resulting in a free and orderly arrangement of spaces. Combined with the characteristics of the plan layout and vertical organization, the overall layout of the settlements can be roughly divided into the following four types :

(1) Fan-shaped settlements. These are mostly distributed in the gently sloping foothill areas, with a medium scale. The plan layout unfolds along gentle contour lines, forming a fan-shaped radial pattern, and vertical performance of the cascading slow rise, and shown in Figure 4(a). Transportation is organized in a fishbone-like structure. The main street is perpendicular to the contour, parallel to the contour of the secondary alleys linked to the courtyard.

(2) Linear Settlements are shown in Figure 4(b). These are relatively small scale in the hillside and hilltop areas. The contour lines are distributed relatively evenly, and the settlements are arranged along the slope with a clear growth direction. Transportation is organized in an irregular grid structure. Buildings are placed in a stepped upwards, which can adapt to changes in elevation while ensuring good lighting, ventilation, and views for each level of buildings.

(3) Ring Settlements. Commonly found in valleys with some undulating terrain, these settlements are of larger scale. Typically centered around depressions such as ponds or squares, buildings surround them, facing towards the center, as shown in Figure 4(c). The overall form shows a trend of expansion from the center to the periphery and an elevation rise from low ground to high ground. The sense of enclosure is strong, and vertical layering is more pronounced, demonstrating a staircase-like orderly variation.

(4) Cluster-shaped Settlements. These are primarily situated in valleys or foothill areas on a medium scale and shown in Figure 4(a). Due to the surrounding hills encroaching, the settlements spread out along the valleys in a finger-like manner. The plan layout presents an irregular, stepped clustering shape, with vertical organization varying with the undulation of the terrain. Dwellings are arranged facing the sun.


Mountian
Farmland
Village
Mountian
(a)
Mountian
Village
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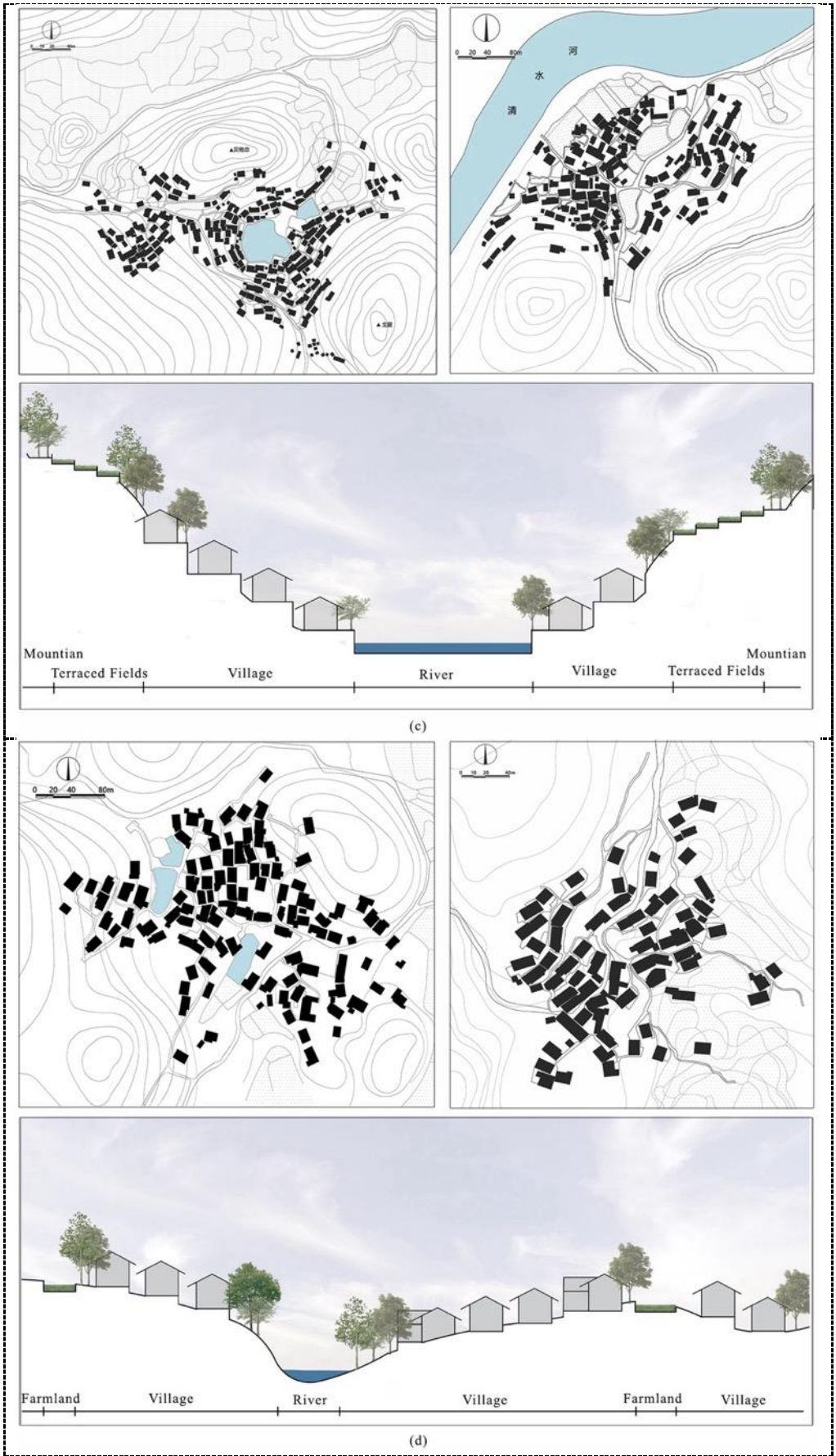


**Fig. 4.** Spatial form of settlements (a)Fan-shape Settlements (b) Linear Settlements (c) Ring Settlements (d) Cluster-shaped

### *3.2.2 Boundary Pattern with Openness and Freedom*

The settlement boundary is the demarcation line between natural surroundings and human-made spaces. It includes natural boundaries defined by mountains and rivers that limit the growth of settlements and artificial boundaries delineated by farmland, defence walls, etc. They constitute three types of settlement boundaries: "mountain + farmland," "water system+ mountain + farmland," and "mountain + village wall" (Fig. 5). "mountain + farmland" is the most common boundary form. Foothill settlements have flat and open terrain, backed by mountains with farmland surrounding them on three sides, with fields extending to blend into the hills. Valley settlements are supported by mountains and face farmland, with farmland gradually extending along the terrain towards both ends of the valley, enveloping the settlement within it. Settlements on mountain slopes or tops are surrounded by mountains on three sides, with terraced fields developed along contour lines forming a well-defined boundary. "water system + mountain + farmland" is surrounded by rivers and mountains from different directions, with farmland arranged along the rivers extending to the foothills. The "mountain + village wall" boundary is due to the historical defence needs of the Hmong people against external invasions. They built defensive village walls leveraging the mountainous terrain to ensure settlement safety. With social stability, the defensive need diminishes, but the village walls remain today, becoming part of the boundary landscape of the villages.

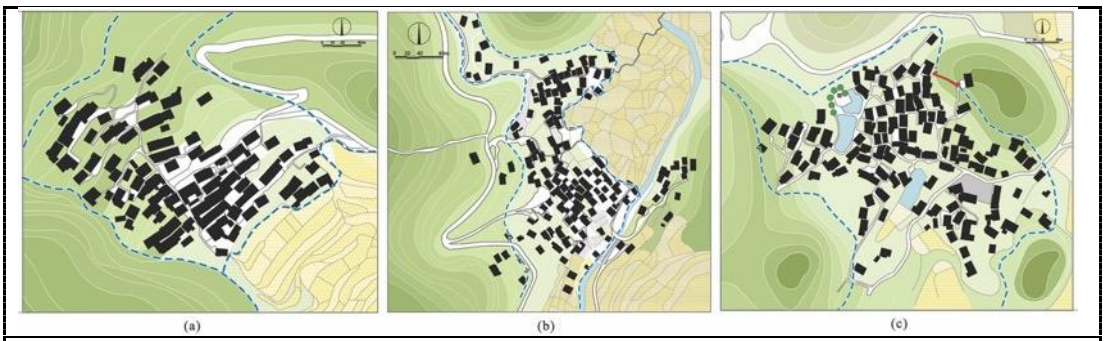


**Fig. 5.** Boundary of settlements (a) Mountain + Farmland (b)Water system + Mountain + Farmland (c) Mountain + Village wall

### *3.2.3 Street and Alley Space with Diverse Scenery*

Street and alley spaces enrich the hierarchy and perception of the Hmong settlements landscape in Huayuan County. The spaces are divided into three categories(Fig. 6): i. Streets and alleys lined with buildings on both sides; ii. Streets and alleys with buildings on one side and retaining walls or courtyard walls on the other; iii. Streets and alleys with buildings on one side and farmland, ponds, or squares on the other. The D/H ratio can determine the perception of street and alley spaces at different scales[23]. For the first type, when $D/H < 0.3$, the alleys are narrow with high eaves, creating a sense of enclosure and narrowness. When $0.3 < D/H < 0.5$, the view gradually opens up, and the rich architectural components positively affect the space, creating a relatively closed but not oppressive feeling. When $0.5 < D/H < 1$, the eave's height is close to the street's width, producing a sense of comfort and stability. For the second type, the D/H ratio is usually around 0.8 to 1.2, and the lower retaining walls do not obstruct sight, resulting in a comfortable and relaxed space. For the third type, where H represents one side of the street without any objects blocking the view, its value is always 0, creating a strong sense of openness. The hard interfaces such as mountain walls, courtyard walls, and retaining walls form relatively closed and inward street and alley spaces characterized by privacy. Soft interfaces such as ponds and farmland create more lively and open, with more vital landscape permeability. Coupled with the winding and undulating spatial hierarchy, they make a shifting

landscape effect, demonstrating an overall rustic quality characterized by romance, freedom, and harmonious unity.

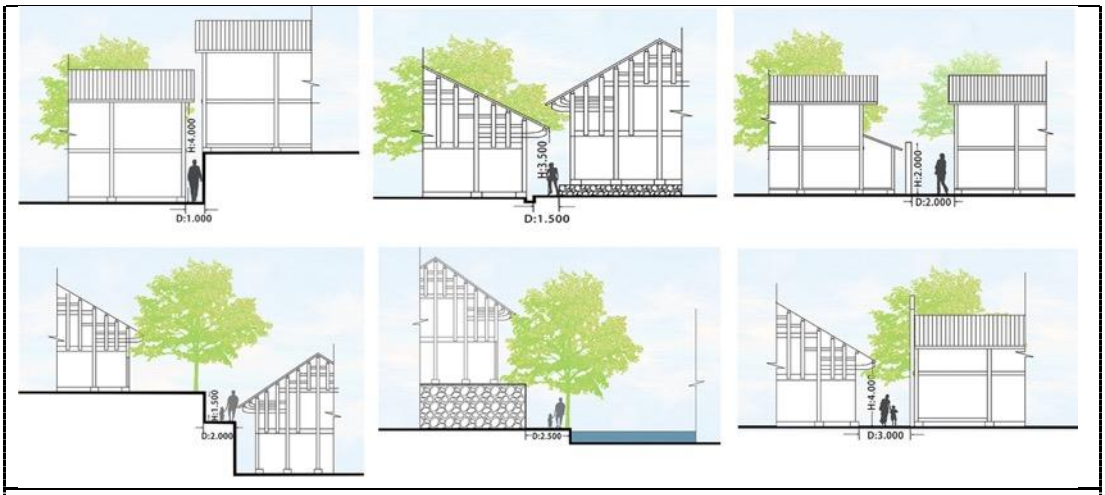


**Fig. 6.** Section of alleys

*3.2.4 Nodal Space for Spiritual Beliefs*

As the physical carrier of ethnic and cultural customs, node spaces bear the collective symbols and spiritual totems of the Hmong[24]. Therefore, their spatial order is dominant in the settlements, characterized by public and gathering features with significant spiritual significance. The main types include squares, land temples, under the tree, etc. (Fig. 7). Node spaces often seem to "squeeze in" spontaneously in the settlements. They typically rely on the give and take of surrounding buildings or structures, with spaces compact but capable of flexible adjustments, resulting in a sense of freedom and variability.

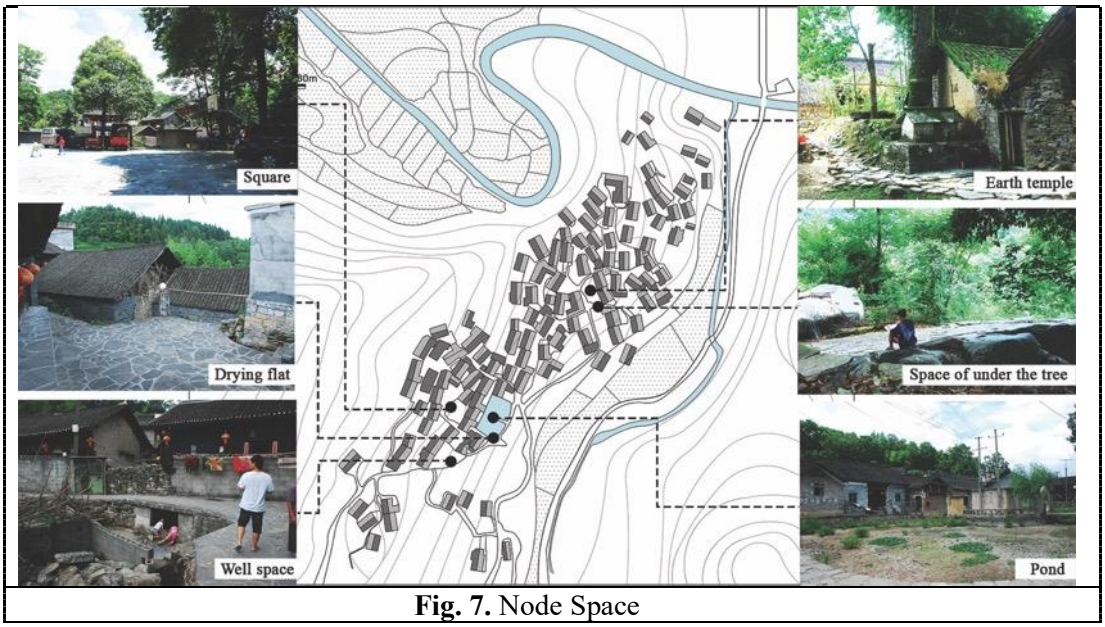


**Fig. 7.** Node Space

The Hmong people are adept at singing and dancing, and they enjoy celebrating various festivals and ritual activities, such as the Hmong New Year, as well as ceremonies like "Zhuiniu" and "Huannuo

Yuan." These events require large venues but are limited by available land. Therefore, squares are often constructed on flat terrain with convenient transportation. Although irregular in shape, these squares are multifunctional and spacious. They serve as the spiritual and secular centres of the people, possessing strong cohesion and attraction.

The worship of the land represents the folk belief of the Hmong people in the land. There are many mountains and few fields, and the land is directly related to the survival and development of the community. Therefore, the Hmong in Huayuan County have built buildings for the mountain god "Gama" [25]– land temples, to express their reverence for the land, hopes for a bountiful harvest, and prayers for peace. Different from the architectural style of Han land temples, Hmong land temples are typically small stone structures. They are usually less than half a person's height. Behind the temple, a maple tree often symbolizes the ethnic totem for peace and harmony in the settlement. Although not extensive, people usually linger in these places, praying or resting, making them unique cultural landscapes within the Hmong settlements.

### *3.3 Characteristics of Dwellings Form*

#### *3.3.1 Courtyard Layout Balancing Skillful Selection*

The mountainous terrain influences the courtyard layout of the Hmong settlements. To minimize earthwork, excavating the mountainside backward is expected, then using the excavated soil to fill in front, forming a complete terrace suitable for houses. The courtyard layout does not pursue strict squareness, and the orientation of buildings does not necessarily require facing south. The courtyard is enclosed by buildings and the mountain's contours, often forming irregularly shaped platforms, presenting an accessible and dynamic spatial form characteristic.

The courtyard space can be classified into three types based on the layout: single-courtyard, corner-courtyard[26], and concave-courtyard (Fig. 8). A single courtyard consists of only the main building and the courtyard, seamlessly integrated with the terrain, presenting an open space with the most landscape interaction. A corner courtyard refers to the arrangement where the main house and the wing rooms form a right angle, with the wing rooms typically in the form of overhanging buildings, presenting a semi-enclosed spatial pattern. A concave courtyard is based on the corner courtyard but adds another wing room on the other side, forming a spatial form of one main house and two wing rooms, creating a relatively enclosed courtyard space.

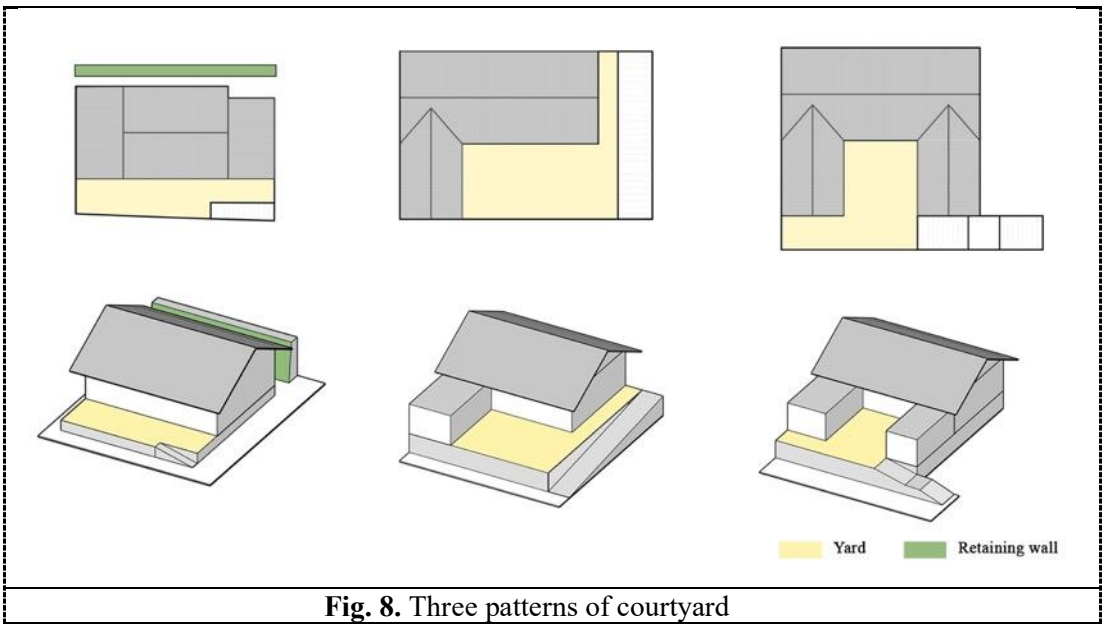


**Fig. 8.** Three patterns of courtyard

### *3.3.2 Building Materials and Decorations Based on Clarity and Simplicity*

Building materials mainly consist of locally abundant shale stone, bamboo, rammed earth, and wood. The building is green and yellow-brown, exuding a natural solid ambiance. Building structures are all timber-framed with a typical "walls collapse, but the house remains standing." Therefore, there is a wide selection of enclosure materials (Fig. 9).In the southern region of Huayuan, where temperatures are lower at higher altitudes, and the enclosure materials are against the damp and cold, they typically consist of stone or adobe bricks. In the central and northern regions where temperatures are high, ventilation and cooling are prioritized, employing breathable wooden boards or local bamboo walls with cow dung and mud as enclosure structures.


**Fig. 9.** Materials of building (a)earth (b)stone (c)brick (d) bamboo walls with cattle dung and mud

The roof forms enrich the external appearance of the buildings, featuring saddlle roofs, gabbled roofs, hip roofs, and saddlle roofs with horsehead walls, all covered with tiny tiles. These roofs cleverly blend the buildings into the mountains, presenting a light, dynamic, and elegant style. A row of standing tiles is usually laid along the roof ridge, with tiles raised at both ends and a "ridge flower" made by stacking tiles in the center, forming various patterns. That prevents tiles from being blown away or loosened while symbolizing auspicious wishes (Fig. 10). Additionally, door and window panels adorned with plant motifs such as flowers, grass, and birds, as well as evil-repelling wooden plaques on door decorations, add more elements of Wuchu culture of mystery.


**Fig. 10.** Roof decoration (a) hip roof (b) Warping roof corners (c)ridge flowers

## 4. Discussions

This part explores the influence of traditional culture on the spatial characteristics of the Hmong settlements landscape.

### *4.1 Harmonizing with Natural Environment*

For a long time, the Hmong people in the Xiangxi region considered religious beliefs essential to their daily lives. They worship nature, fear ghosts and gods, and believe all things have spirits. This thinking forms the basis of their religious beliefs and profoundly influences society. In terms of the characteristics of settlement landscape space, this belief manifests as worship and compliance with nature, mainly reflected in the following three aspects:

Integration with the landscape: In site selection and layout, settlements are situated by the mountains, with terraced fields cultivated along the mountainside, forming a landscape pattern

interwoven with mountains, water, fields, and villages, creating open and accessible boundaries. Regarding building massing and material selection, they use natural materials and appropriate spatial scales to demonstrate the unity between heaven and humanity harmoniously.

Adaptation to terrain: In settlement layout, the Hmong follow the simple idea of "occupy the mountains but not the fields" and "supporting the weak rather than the strong," transforming the disadvantages of mountainous terrain into favorable factors, forming rich terrace landscape forms. In the design of streets and alleys, they flexibly adjust the levels, making pleasant spatial scales and producing a shifting landscape effect, showing the concept of adapting to local conditions and conserving land.

Adaptation to climate: The Hmong choose sunny and wind-sheltered sites and adopt a terraced settlement layout to maximize sunlight for courtyards. At the same time, they select suitable building materials based on the climate of different altitudes to ensure insulation, moisture resistance, and ventilation or heat dissipation, demonstrating a rustic, natural, and adaptable skill.

### *4.2 Reflecting Social and Cultural Dynamics*

On the one hand, due to the long-standing underdevelopment of Hmong society in Xiangxi, their ability to resist natural disasters is relatively weak, leading to a sense of collectivism where mutual assistance is practiced in daily life. On the other hand, the harsh natural environment and prolonged conflicts have shaped the people's simple, open-minded, mysterious, and romantic character. That is reflected in the settlement landscape space in four aspects:

Defensive security: Regarding boundary forms, the Hmong usually live together, with blood ties as a bond. Several dozen households form a village, relying on the terrain and village walls to establish a defense system to maintain the stability of the settlement.

Centralized gathering: In node spaces, squares materialize ethnic collective consciousness, transforming the disorderly layout of settlements into organized ones. The village temple is often located at the highest or most important position in the settlement, increasing the cohesion of the settlement and collectively illustrating the cultural characteristics of romance, exuberance, and proficiency in singing and dancing.

Freedom: In terms of architectural layout and form, buildings can be irregular, and courtyards may be without prominent axes or symmetry. While the main house is dominated, the overhanging buildings are more eye-catching, reflecting the wild and ingenious.

Romantic: In architectural decoration and style, Warping roof corners, ridge flowers, and carved door and window frames show a romantic, light, and ethereal aesthetic.

## 5. Conclusions

The unique natural geography and cultural history have shaped the spatial characteristics of the landscape of the Hmong rural settlements in Huayuan County. As a form of physical cultural expression, these settlements are based on natural landscapes and enriched with historical and cultural significance, forming standard features in landscape space. On a macroscale, village sites are chosen based on mountains, valleys, and streams, forming a tiered pattern of water, fields, villages, and mountains ascending, reflecting the wisdom of coexistence between humans and nature and adapting to local conditions. On a mesoscale, settlement forms adapt to the mountainous terrain, creating rich terrace landscape forms with clear structures, accessible boundaries, defined centers, flexible streets, and pleasant nodal spaces, demonstrating an adaptable and free-spirited construction philosophy. On a microscale, the architectural layout is flexible and ingenious, with distinct architectural forms and delicate decorations, showing a rustic, natural, and romantically exuberant construction technique.

As the connection between natural and human systems, the rural settlement landscape is complex and diverse. Exploring the spatial characteristics of settlement landscapes helps establish a pattern of

harmonious development between humans and nature, highlighting local characteristics. This exploration also provides a theoretical foundation and practical basis for the continuation and inheritance of traditional culture.

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