



A study on the spatial characteristics and transformation development of villages from the perspective of "production-living-ecology" : A case study of Dan Village, Foluo Town, Hainan Province

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Citation: Tang, Y. (2025). A study on the spatial characteristics and transformation development of villages from the perspective of "production-living-ecology" : A case study of Dan Village, Foluo Town, Hainan Province. *Mediterranean Archaeology and Archaeometry*, 25(2), 15-23.

ARTICLE INFO

Received: 26 June 2024

Accepted: 22 July 2024

ABSTRACT

In order to explore the spatial characteristics of villages from the perspective of "production living ecology" space and seek the development path of traditional village transformation and new village optimization, this paper takes Dan Village as an example and analyzes the spatial characteristics of traditional villages from the two scales of village area and settlement by using satellite image visual interpretation, literature study, graphic analysis and other methods. The results show that the spatial characteristics of traditional villages and new villages are significantly different. The traditional villages are natural and organic, while the new villages are uniform and regular, which are mainly influenced by factors such as the reconstruction of social relations, technological change and the evolution of ecological consciousness. Based on the above results, suggestions are put forward for the development path of traditional villages from three aspects: the construction of the living space form dominated by neighborhood relationship, the production mode of multi-scale collaborative development and the ecological space of diverse landscape levels.

Keywords: "production-living-ecology" space; village spatial characteristics; transformation development; Dan Village

With the rapid development of urbanization, a significant number of traditional Han villages in Hainan are exhibiting characteristics of new-era villages during the rapid transformation process, gradually losing the style of traditional villages or deteriorating into "hollow villages". The urgent issue we currently face is how to transform and develop these traditional villages amidst the flood of modern times.

In recent years, there have been an increasing number of researches on the spatial form of Han traditional villages in Hainan. From the perspective of the research content, the focus primarily lies on the residential building form^{[1][2]}, spatial form characteristics^[3], form evolution and factors^[4], and landscape pattern^[5]. In terms of research scale, most studies concentrate on provincial and city levels with limited investigations at the village level. Moreover, there is a lack of achievements in studying the morphological characteristics and reasons for transformation during the "production-living-ecology" process. Therefore, this paper aims to explore the morphological features of villages at different times through analyzing their transformation and development trajectory from a "production-living-ecology" space perspective while considering cultural connotations and employing graphic analysis as a starting point. It deeply analyzes the traditional village's forms that embody traditional dwelling culture, investigates their developmental processes and evolutions, explores traditional wisdom within settlement development veins, and seeks paths for transforming and developing these traditional villages. This study holds significant reference value^[6] for protecting and developing traditional Han villages in Hainan.

1. ANALYSIS OF VILLAGE SPATIAL CHARACTERISTICS FROM THE PERSPECTIVE OF "PRODUCTION-LIVING-ECOLOGY"

1.1 The spatial composition of villages from the perspective of "production-living-ecology"

The division of "production-living-ecology" space is primarily determined by the dominant function of the space. Therefore, the results of dividing the "production-living-ecology" space at different scales reflect different contents, with more spatial details being revealed as the scale decreases. In the process of studying the spatial characteristics, most of the research results divide the "production-living-ecology" space in the village area into: living spaces dominated by the settlement building group, production space dominated by production land around residential buildings, and ecological space for maintaining the village's ecological environment. This division of "production-living-ecology" space reflects the basis of village site selection within the scope of the village, as well as the overall spatial relationship among the main spatial elements, which highlights subjective thoughts and intelligent responses of the overall living environment in villages. However, there are still areas within living spaces dominated by residential building groups that possess both production and ecological functions (Figure 1). These areas on a smaller-scale, such as courtyards, streets and alleys, reflect the diversity of the village 's living environment and a more delicate and true manifestation of the village 's construction ideas and wisdom.

Table 1 Analysis of spatial composition of traditional villages from the perspective of "production-living-ecology"

Spatial classification	Spatial hierarchy		Spatial function
	Village level	Settlement level	
Ecological space elements	Mountains, rivers, woodlands, grasslands, etc	Ancient and famous trees, wind ponds, brush trees, etc	Have natural properties, provide production services or ecological products
Production space elements	Farmland, garden plots, etc	Vegetable bed, grain pile, breeding pond, etc	Undertake the production function and realize the production value
Living space elements	Residential buildings and their clusters	Residential buildings, temple buildings, squares, road intersections, etc	Population gathering, social relations interaction

In order to provide a clearer explanation of villages' spatial characteristics from the perspective of "production-living-ecology", this paper aims to further explore an analysis of these characteristics on a smaller scale, focusing on the living space which divided by the dominant function of settlement groups. This analysis builds upon previous analyses conducted at the village scale, allowing for a deeper understanding and discussion from two levels of the spatial morphological characteristics related to village "production-living-ecology".

In the village level, within the dominant framework of "production-living-ecology" space analyses, the living space encompasses the settlement group and other primary functions related to human habitation. The production space comprises arable land, farmland, and other areas responsible for productive activities. Ecological spaces encompass rivers, forests, and other areas primarily serving ecological functions. Furthermore, within the smaller scale range of the settlement level, the individual elements on micro scales, such as trees, green spaces, ponds, vegetable beds, garden greening and other small spaces are further categorized based on their respective functionalities. Based on these two levels of analysis, a comprehensive examination of village spatial characteristics is conducted by the author (Table 1).

1.2 Research methods and ideas

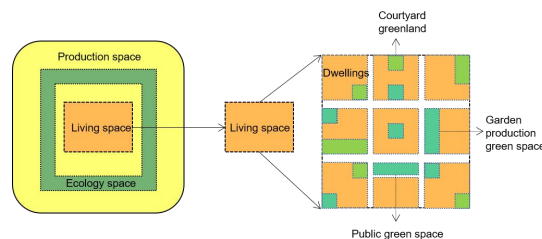


Figure 1 Research scale analysis

The research mainly uses satellite imagery, historical maps and other image data combined with land survey data to distinguish the "production-living-ecology" space, and depict its pattern at different scales. By conducting field investigation and interview, combined with the results of schema expression, the distribution characteristics of "production-living-ecology" in Dan village were sorted out. By consulting local records, statistical yearbooks and other documents while considering the historical development of Dan village, this paper explores the spatial distribution forms of both new and old Dan villages as well as their differentiation characteristics during the development process. Additionally, it investigates transformational strategies for traditional villages in the new era.

2. THE SPATIAL DISTRIBUTION CHARACTERISTICS OF "PRODUCTION-LIVING-ECOLOGY" IN DAN VILLAGE

Dan Village is located in Fuluo Town, Ledong Li Autonomous County, Hainan Province. It was established during the Ming

Dynasty and boasts a rich history and cultural heritage. It was included in the third batch of Chinese traditional villages list. During the Kangxi era, as a result of drought and flooding disasters, the original location was relocated to the ancient Dan village, now known as "Dan Village," while the original site itself was renamed "Old Dan Village." Until the end of the last century, in order to solve the problem of "the lack of housing foundation", the New Dan Village was relocated to the north to expand. Old Dan Village and New Dan Village showed significant differences in spatial form. Old Dan Village has typical spatial characteristics of traditional Han villages in Hainan, while New Dan Village, which was built in the period of rapid urbanization, has typical spatial characteristics of new era villages.

2.1 Spatial characteristics of Dan Village at the village level

Old Dan Village is located in the flat area along the southwest coast of Hainan Island. The elevation of the village is small and the terrain is flat. The southwest side is adjacent to the Dan Village River and the east side is overlooking the Jianfeng Mount, forming a spatial pattern with mountains and water facing the village on a large scale. The settlement group of Old Dan Village has a northeast-to-southwest trend as a whole, and the direction of settlement is perpendicular to the flow direction of Dan Village River. The surrounding area of the settlement group is first connected with the cultivated land, forming the traditional farming range. The outer area of the cultivated land is connected with the Feng-shui forest, which forms the spatial level of the old village (Figure 2). At the village level, the spatial organization form of various elements around the old village follows the living space (settlement group) as the core; the traditional cultivated land area (production space) follows the principle of farming radius and surrounds the living space in a small area; the Feng-shui forest around the village means the ecological space surrounds the traditional cultivated land area and surrounds the production and living space. Formed the old village with the living space as the core and the production ecology surrounded by a circular "production-living-ecology" pattern. (Figure 3).

New Dan Village is also located in the coastal area, the terrain is flat, and the north side looks far to the Baisha River. Compared with the old village, the settlement group of the new village is far away from the Baisha River, and most of the ecological forest land along the river. The edges of the settlements in the new village are regular, and the settlements are oriented southwest to northeast, towards the Baisha River in the north. The surrounding areas are connected with agricultural greenhouses and other production spaces, and the ecological green spaces along the river are far away from the settlements (Figure 4). At the village level, the spatial organization form of each spatial element in New Dan Village tends to take agricultural production land as the core, and the living function of the settlement group shifts to the edge, which weakens the organizational ability of each element. On the other hand, production land and ecological land are concentrated in the river and other ecological factors, forming a strip-type production-ecological layout on both sides of the river bank (Figure 5).

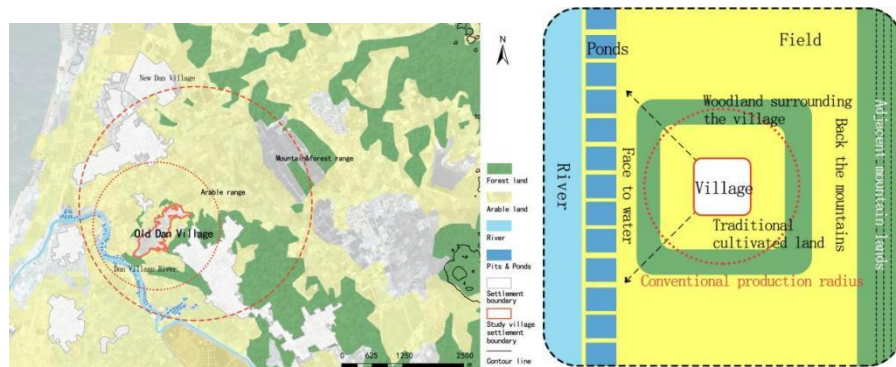


Figure 2 The "production-living-ecology" spatial plan of Old Dan Village at village level

Figure 3 The "production-living-ecology" spatial model of Old Dan Village at village level

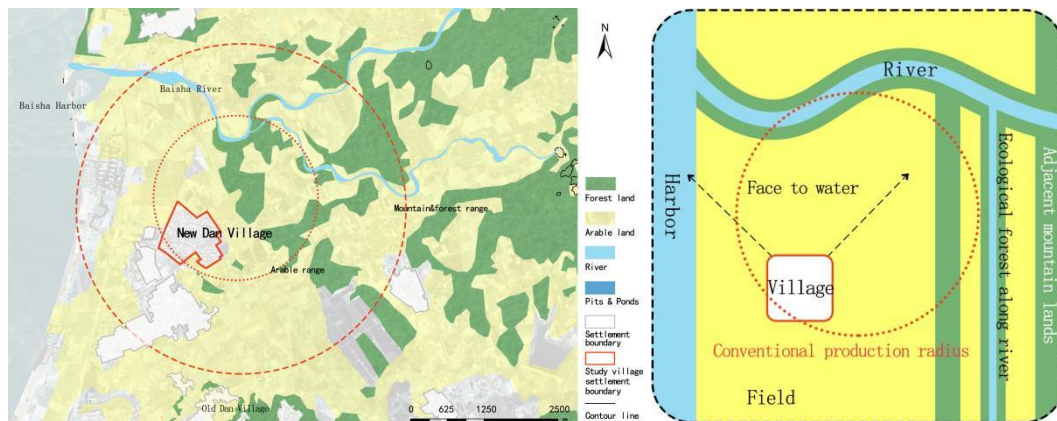


Figure 4 The "production-living-ecology" spatial plan of New Dan Village at village level

Figure 5 The "production-living-ecology" spatial model of New Dan Village at village level

In the process of spatial development from Old Dan Village to New Dan village, on the one hand, the siting needs of

traditional villages were retained. Both the old and new villages were built on flat terrain and the settlement groups were oriented towards the adjacent river, which retained the recognition of feng shui relationship in the siting process of traditional villages. On the other hand, the organizational core of village spatial elements has gradually changed from the traditional life core to the production core, which shows the shift of the cultural village center of gravity from agricultural life to economic development.

2.2 Spatial characteristics of Dan Village at the settlement level

At the settlement level, the village takes roads and alleys as the skeleton, and courtyards, public Spaces and landscape nodes connected with roads as the key elements to form the settlement group of the village^[7]. In the settlement group, individual elements such as streets, courtyards and other living functions are divided into living space, vegetable fields and grain piles are divided into production space, street corner landscape and tall trees are divided into ecological space, and the spatial characteristics of Dan Village at the settlement level are analyzed from the perspective of three spatial elements.

2.2.1 Living space

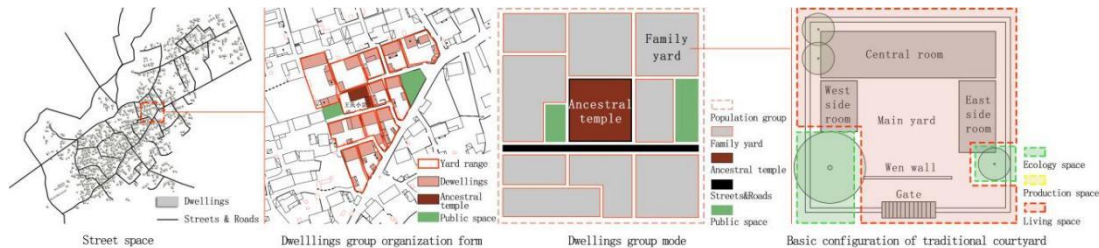


Figure 6 Living space characteristics of Old Dan Village at settlement level

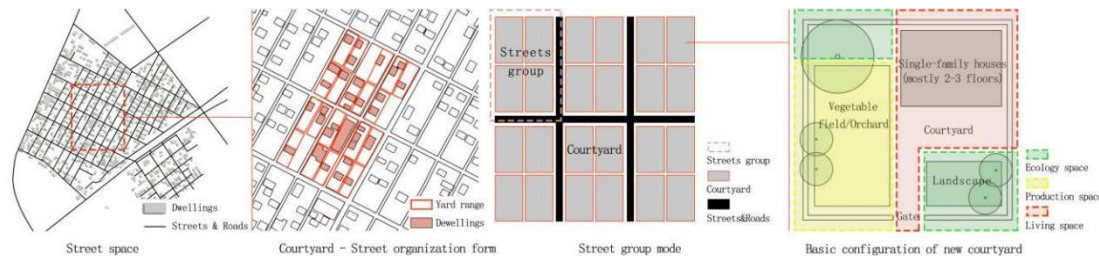


Figure 7 Living space characteristics of New Dan Village at settlement level

The street system of Old Dan Village is formed gradually with the development of the village, so the road width is different and the connectivity is not strong; In the core areas where ancestral temples and large families are located in the early period, the road network is relatively dense and the road form is relatively regular, and the more the road network is loose and the road breaks are more likely to occur in the peripheral areas or places where ethnic groups are not strong. The courtyard organization form is closely connected with the road system. The courtyards of old villages are mainly courtyard-type or single-type brick and tile dwellings in the Ming and Qing dynasties. The courtyards are compact in arrangement, and the spacing between the houses is narrow and the boundaries are blurred. A number of courtyards or single houses were clustered around ancestral halls to form a large residential cluster, which constituted the traditional courtyard layout in Dan Village. The traditional residential courtyards are mainly composed of five parts: gate gate, upright house, horizontal house, main house and text wall^[8]. Many flowers and trees are planted in the courtyard, which is not only the view, but also the outdoor activity space of the family. In terms of function, it is mainly for life, with both ecological and production functions. Production and ecological space occupy less space in the courtyard, and the courtyard of Old Dan Village is still a spatial organization form with traditional life as the core. (Figure 6)

The distribution characteristics of living space in the new village are quite different from those in the old village. The road system of the new village is formed by unified planning. The roads are straight and of the same width. The longitude and latitude are intersected, and the roads are orderly and well-connected. Different from the complex and changing street layout of the old village, the street layout of the new village shows an extremely regular shape. The horizontal and longitudinal roads divide the entire living space into a grid of courtyards of similar scale, and the residential areas are arranged in an orderly manner along the roads in the grid. The construction of the new village adopts the equal scale of each household, and the composition pattern of each household is roughly the same. The new courtyard takes the new small western-style building as the core, and the courtyard space is wide. In addition to meeting the basic courtyard activities, most of the courtyard space is used for planting cash crops such as vegetables and fruit trees, which has formed a small and reputable courtyard economy. Production and ecological functions are gradually enriched in the courtyard space, forming a spatial pattern of three living side by side. (Figure 7)

2.2.2 Production space

The distribution of production space mainly revolves around the living space, and the distribution characteristics of production space in new and old Dan villages show significant differences (Figure 8). At the settlement level, the distribution pattern of production space in Old Dan Village presents the characteristics of stage-type distribution. The production space of Old Dan Village is limited by the distribution of buildings, and the courtyards are closely connected. A small amount of open space is developed into production space for planting vegetables and fruit trees. In the early stage of village development, the space between houses was very limited and could only provide basic transportation. Only a few places could be used for production. In

the process of the development of the village to the periphery, the distance between the houses becomes larger, and the basic transportation needs are met, and the idle land is developed into production space.

The new courtyard layout of New Dan Village determines the existence mode and form of production space. The production space is distributed evenly in multiple points within the settlement group. The inner space of the new village is more closely organized, and the open space between the courtyards is very limited, so the production space mostly exists in the courtyards, which generates the courtyard economy in the new era. Since the production demand can be basically satisfied now, the production space in the courtyard is no longer unilaterally pursued for production efficiency, and at the same time, it has ecological functions, improved landscape, and multiple attributes. (Figure 8)

2.2.3 Ecological space

At the settlement level, the expression of ecological space is more abundant. In addition to natural landscapes such as ancient and famous trees and wind ponds, ecological functions are also more prominent in many public Spaces, such as irregular Spaces formed at corners of streets and on both sides of streets, mostly covered by tall trees, where villagers play and enjoy the cool, forming Spaces for gathering, life communication, leisure and entertainment. Or in the idle land in front of and behind the house, more trees are planted to become dense forests. In these types of Spaces, there are both living and ecological functions, but ecological functions are still the leading role. The distribution of ecological space in the old village is relatively concentrated in the core area of the village, and relatively dispersed in the edge area. The organic integration of ecological space and village life forms a natural and livable ecological model.

Due to the "network format" road pattern in the new village, each courtyard strives for the largest area and is arranged along the road rules. The ecological space presents two types: One is to set belt green space along the road, and the other is the courtyard landscape inside the courtyard. Compared with the old village, the main function of the ecological space in the new village is ecological beautification, while the functions of villagers' gathering, life communication, leisure and entertainment are concentrated in the living space. The division of the three-life space in the village is more clear, and the multi-functional compound space is gradually reduced. In terms of spatial distribution characteristics, the ecological space distribution of the new village shows the characteristics of concentrated distribution along the road and scattered distribution in the courtyard. (Figure 9)

3. EVOLUTION AND DIFFERENCE ANALYSIS OF SPATIAL DISTRIBUTION CHARACTERISTICS OF "PRODUCTION-LIVING-ECOLOGY" IN DAN VILLAGE

Dan Village has experienced hundreds of years of development since its establishment in the Ming and Qing Dynasties, and the village form of Dan village has undergone great changes under the influence of various factors, from the traditional village form of the old village to the "new village" form of the New Dan village in recent years. The change of the Old Dan village represents the adaptation and persistence of the old civilization in the new era; The establishment of New Dan Village is the stage product of the development of the new era.

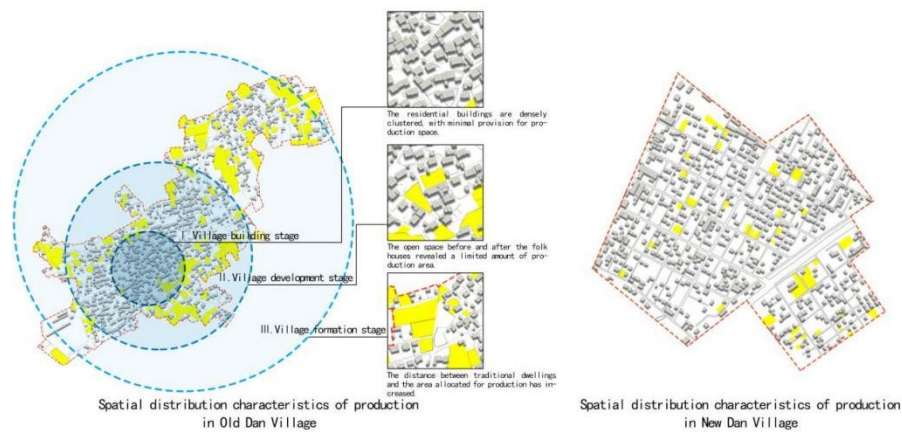


Figure 8 Comparison of spatial distribution characteristics of production in new and old Dan Villages at settlement level

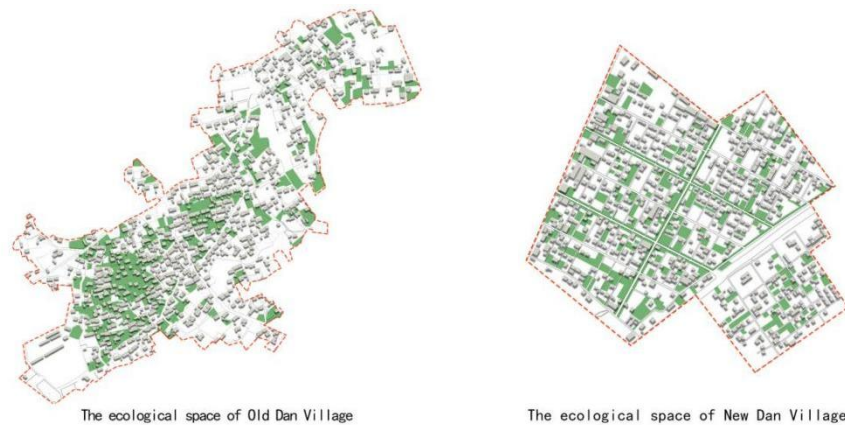


Figure 9 Comparison of ecological spatial distribution characteristics of new and old Dan Villages at settlement level

3.1 Modification of lifestyle : the collapse of kinship and blood ties and the reconstruction of social relations

After more than 300 years of development since the Ming Dynasty, the villagers of Dan village have the same essential needs for life, that is, to choose a livable and living environment. Dan Village has been relocated twice, both in order to meet the basic livable environment. For Old Dan Village, livability means having abundant water, being close to the sea and being self-sufficient; For New Dan Village, the standard of livability has also changed into convenience, freedom and comfort under the influence of The Times.

With the development of The Times and the improvement of living environment requirements, living standards are improving, the living environment is improving, and social relations are also changing. The family group pattern formed under the influence of clan blood culture at the time of village construction has changed to the heart-shaped living space pattern into the family-type independent living layout dominated by neighborhood culture. Under the impact of class culture, social relations are also constantly broken and reorganized, constituting a modern social form. The disintegration of clan blood and the reconstruction of social relations have promoted the evolution of living space. In the village living space, the cultural core of the old village is clan blood, while the modern layout of the new village has lost the cultural core that condenses the village life. With the development and changes of The Times, the new village should also re-establish a cultural network in line with the characteristics of the new era, and regain the cohesion and vitality of the village.

3.2 Transformation of production mode: Scientific and technological change leads to the improvement of social productivity

In the traditional society, farming mostly relies on limited manpower and animal power, so the farming scale is small, with the development of society and the gradual expansion of material needs, in order to meet the increasing demand for production efficiency and life happiness, traditional means of production can not meet the needs of the new era, the innovation of means of production is the brilliant result of the progress of The Times. With the advancement of science and technology and the improvement of people's cognition level, mechanized agriculture has effectively promoted the adjustment of agricultural production structure, and greatly improved agricultural productivity and competitiveness. With the gradual deepening of the "three rural" policy, the state's investment in agricultural production gradually increased, the agricultural comprehensive production capacity steadily improved, the promotion and use of agricultural mechanization laid a solid foundation for the development of modern agriculture, and promoted the integration of plots in New Dan Village in the new era, realizing the transformation from the Old Dan Village small field farming mode to the New Dan Village large-scale field intensive agriculture mode.

Large-scale production has certainly improved the production efficiency in the village space, but at the same time, it also causes the new village to pay too much attention to the production efficiency, so that production exists apart from life. Although the production space types of the old village are relatively rich, the production efficiency cannot meet the current production demand. Therefore, it is necessary to combine the rich production space types of the old village and the improvement of production efficiency of the new village to build a village production space model in the new era.

3.3 Development of ecological concept: "Symbiosis - occupation - sustainability"

Since the establishment of Dan Village, an ecological pattern of "harmony between nature and man" has been formed. The ancestors were supported by the land, mountains and rivers of Dan Village, and "used the food in accordance with The Times and with the rites", adhering to the concept of conforming to The Times and respecting nature and living in harmony with nature. With the rapid development of economy and society, the rapid development of production has led to the encroachment of a large number of production Spaces on the ecological environment, and the ecological pattern has gradually broken down. It was not until the natural environment attacked the living environment of Dan Village that people gradually realized the value of ecology. With the gradual recovery of ecological awareness, the ecological space has gradually expanded once again. The people of Dan Village are concentrated in greening by the government organization, and the ecological space of Dan Village has gradually evolved from points and surfaces to the present form. In the development process, the ecological space of the old village has been showing a contradictory situation with the production space. At the same time, the new village built under the guidance of the new era planning, in order to meet the basic ecological benefits, concentrated green planting in the village, forming the current

ecological space pattern. The formation process of the production space of the new village is completely different from that of the old village, and the organic distribution of natural ecology has been lost. Therefore, to create a natural and organic multi-level ecological environment is the ecological goal that villages should pursue in the new era.

4. RESULTS AND TRANSFORMATION DEVELOPMENT STRATEGY DISCUSSION

4.1 Research results

From the perspective of "production-living-ecology" space, this paper takes Dan Village as an example to analyze the spatial characteristics and evolution differences of traditional villages from different scales. The results show that: (1) the spatial characteristics of "production-living-ecology" in Dan Village are as follows: at the village level, the living space of the old village is the core, the production space and ecological space are in a circular sequence, the living space of the new village are concentrated, and the ecological space and production space are banded and inlaid; At the settlement level, the living space of the old village is complex and diverse, maintained by the clan as the core, the production space gradually increases from the center to the edge, and the ecological space is scattered in the central centralized edge; The living space of the new village has a patterned layout and a single composition, the production space is evenly distributed, and the ecological space is concentrated along the road and dispersed in the courtyard. (2) During the evolution of Dan Village's "production-living-ecology" space, the breakdown of kinship and the reconstruction of social relations promoted the transformation of living space from family group to modern intensive; The improvement of social productivity caused by scientific and technological change promoted the production space from traditional farming to modern agriculture; The fading and recovery of ecological consciousness has made the ecological space shift from "harmony between nature and man" to the priority of ecological benefits.

4.2 Discussion on transformation development strategy

Under the guidance of the government's policy of vigorously promoting rural revitalization and building beautiful villages, how to protect, inherit and develop traditional villages in this new era will be the direction of the author's continuous research. In order to explore the strategic system of future planning and development of Dan Village, as well as the optimization paradigm of collaborative development of new and Old Dan Village, the author puts forward the following ideas.

4.2.1 Building the living space form dominated by neighborhood relationship

Under the new social form, the previously established life pattern dominated by blood relationship has basically collapsed, and a new life pattern dominated by neighborhood relationship has been formed. In order to break the dilemma of single living space in New Dan Village, the living space form suitable for the current life style is constructed through the social relationship of the new era -- the neighborhood relationship. By building different living and cultural circles, the villagers are encouraged to diversify their lifestyles. In order to meet the needs of diversified neighborhood activities, in addition to the social space provided by the village committee square, the construction of public infrastructure is actively promoted, and activity Spaces such as culture rooms and basketball courts are added, so as to establish a social bond between neighbors with the village committee as the core and public infrastructure as the secondary core. To enhance the cohesion of village groups in the new era; Construct small Spaces on street corners and before and after courtyards, increase the activity space of residents in different circles, and enrich the level of living space; Establish appropriate village rules and covenants, manage and supervise the living relations under the neighborhood model, and form a new form of regular and orderly life.

4.2.2 Build a production model of multi-scale coordinated development

On the premise of not destroying the traditional spatial texture, in order to meet the needs of production and construction in the new era, the production mode of multi-scale coordinated development should be established. At the village scale, it adopts the development model of efficient production in new villages, adheres to large-scale production in field and ensures mechanized production to meet production benefits. On the spatial scale of settlement, integrate the fragmented production space to develop other industries, such as establishing family farms around the village, integrate the rural lifestyle into the production space, and retain the life atmosphere of traditional villages; Retain the traditional small field texture, and develop the production mode of family workshops according to local conditions. Courtyard development of village life as the core of the courtyard economy, enrich the production space level, create "production-living-ecology" integration of small courtyard production, awakening the new era of village life "nostalgia" meaning.

4.2.3 Construct ecological space with diverse landscape levels

Under the current village construction form, although the ecological benefits of New Dan Village have met the basic needs, its landscape level is single, in order to enhance the rural style of the village and build an ecological space with diverse landscape levels. Strengthen the construction of the overall landscape pattern, retain the landscape pattern formed in the development history of Dan village, and follow the natural ecological pattern; Make full use of streets, courtyards and other small Spaces to create street landscape space and create a public space integrating ecological life functions; Enrich the construction configuration of the courtyard, break the deadlock of the stereotyped construction, and integrate the ecological landscape into the courtyard from multiple perspectives such as architectural characteristics and courtyard space distribution.

5 EPILOGUE

This paper analyzes the spatial distribution characteristics of Dan Village from the perspective of "production-living-ecology" space, explores the evolution process of Dan Village spatial form in different periods, and analyzes and explores the evolution

mechanism of traditional village spatial pattern. In the new era of rapid urbanization in China, the protection and renewal of traditional villages is an issue that we have been committed to exploring. The author hopes that through the research of this paper, we will try to build a strategic system for the future planning and development of traditional villages as well as a development paradigm for inheritance and optimization, so as to provide references for guiding traditional villages to achieve sustainable development under the inheritance of "nostalgia".

Note: All the satellite image data in this paper come from Tuxin Earth; The charts and graphs in this paper are self-drawn by the author.

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