

Ecological Adaptability of Chinese Traditional Consanguine Settlements: The Study of Daiwei Village

Nan Chen

School of Architecture and Urban Planning, Huazhong University of Science and Technology, Wuhan, China
Email: dracula3131cn@sina.com

Abstract—In terms of arcology, Chinese traditional settlements is considered as an integrated ecological system. The forming of the system will experience dwelling selecting and adapting process. This paper tries to analyze the composition of ecosystem of Daiwei village (located in Zhangzhou city, Fujian province, China) under the theory of arcology. Moreover, the forming process and influencing factors will also be studied in view of natural, social and artificial environments, so as to study the ecological adaptability of Daiwei village from the perspective of ecological development.

Index Terms—arcology, Chinese traditional settlements, Ecological Adaptability

I. INTRODUCTION

A. The Settlement

The word “settlement” originally refers to the residential areas that are different from urban settlements, but now it refers to villages and towns in human living regions, even including the residential areas in the city. Settlement is a kind of social relations with social activities and the specific way of living formed in certain geographical areas. The dwellers in the settlement makes up a relatively independent regional society [1]. It is a kind of space environment system including sub-systems of natural ecological environment, social organizations, and the humanities environment, etc.

B. The Daiwei Village

Daiwei Village is located in Dongyuan town, Zhangzhou city in Fujian province, China. The village is founded in Ming dynasty (AD 1450) by Chen Shijin, the descendant of the so-called “Saint King of Zhangzhou city” Chen Yuanguang. Therefore, all the villagers are Chen Shijin’s descendants and share the same family name “Chen”. It is a typical consanguine settlement with general characteristics: 1, The ancestral temple is the positional and spiritual center, which shows a strong cohesiveness; 2, The strict and integrated structure of the clan organization shows strong stability. After the constant construction of hundreds of years and modern planning following the elders’ teachings and advices, the ancient village has formed distinctive

characteristics: the ancient and modern buildings are perfectly combined in unified and grant styles with neat streets and roads planning, finally formed a well-arranged integrity with unique features during the developing of the village.

II. METHODOLOGY

Ecology is the scientific analysis and study of interactions among organisms and their environment [2], while architecture is the study of the dwelling environment of a certain kind of organism—human beings. In 1960s, western scholars have integrated ecology theory with architecture theory. Consequently a new subject called arcology came into being. American architect Paolo Soleri first put forward the theory of arcology. He was also the first scholar to make a combination of ecology and architecture and create the new term “Arcology (Architecture+Ecology)” [3]. In order to achieve a coordinated development of people, architecture, nature and society, adopting the principle and method of ecology, arcology aims at taking a controlled advantage of nature and moderately transforming the nature to seek the most suitable living environment for human beings.

Early arcology focuses on two aspects: 1. Urban ecology; 2. Study on application of ecological technology. However, it is still on the exploring and developing stage to introduce the idea of “adaptation” from arcology and to apply arcological theory and method into the traditional settlement study in China.

From the perspective of arcology, settlement could be regarded as a blend of natural, artificial and social elements, etc., an integrated compound ecological system. The ecological environment of the settlement includes natural ecology (natural environment), social ecology (social environment), and the existing artificial ecology (existing building environment). In the ecosystem, organism definitely has a interdependent relationship with the environment it lives. The coexistence and mutual benefiting in different organisms or sub ecosystems are defined as “symbiosis”, which will coordinate the evolution of the ecosystem and maximum the overall function and efficiency, thus ensuring the ecosystem to develop in a sustainable way as much as possible. “Adaptation” is the precondition of symbiosis, while the

fundamental purpose is to guarantee the survival and evolution of the organisms so as to ensure the continuation of life. The ecological adaptation of settlement, actually is the dynamic process of how this ecosystem initiatively adapt to the environment through self-adjustment during its growing and developing.

III. RESULT

In the developing of the settlement, the action and reaction between the elements within the ecosystem as well as between the ecosystem and environment will make them adapt to each other. With the ideal goal of coordinate coexistence and under the preconditions of “adaptation and coexistence”, the elements within the settlement system develops harmoniously so as to promote the overall settlement system development [4].

This paper is a qualitative study. Daiwei village is considered as an integrated complex ecosystem with natural, social and artificial elements and during its growth and development, it can initiatively adjust itself to adapt to the environment, that is the so-called adaptability. This paper analyzed three important factors affecting the Daiwei ecological adaptability—the natural, artificial and the social environment. Under the premise of meeting the needs of producing, living, customs and beliefs, taking full consideration of climate, geography, resources and other natural conditions, such a “complex” ecosystem of this settlement environment can adapt to natural, artificial and the temporal social environments harmoniously to achieve the macro ecological balance and make settlement develop smoothly.

IV. DISCUSSION

A. The Dwelling Selection Process of Settlements

Selection is the initial process of settlement formation, to make it easier, it means “to choose a place that meets your expectation to settle down” [5]. Ancient Chinese selected the best settlement environment through the “Feng shui” theory, which showed Chinese ancient ecological experience in old times. The word “Feng shui” showed the collective unconsciousness of living environment selection, and the space environment they chose and manage has a good ecological, production and living environment. Guo Pu, the renowned Feng shui scholar defined Feng shui in his work titled *Zang Jing* (The Sutra of Burial) as “Qi (Breath) rides the wind and scatters, but is retained when encountering water. The ancients collected it to prevent its dissipation, and guided it to assure its retention, so it is named Feng shui. According to the laws of Feng shui, the site which attracts water is optimum, followed by the site which catches wind” [5]. In Chinese ancient philosophy, “Qi” is the essential element that builds everything in nature. Heavily polluted air belongs to Yin, while light and clear air belongs to Yang. Yin and Yang together make up the universe. Selecting the settlement location is to look for the sites where vital Qi hides, because the sites attracting the vital Qi of water and mountains are the best. (See Fig. 1). Aiming at examining the geographical and ecological

elements, people use the theory of Feng shui to choose an auspicious site and manage the dwelling environment. From the perspective of arcology, such environment enjoys the superior natural conditions in coordination with the natural ecological environment, so as to achieve the purpose of pursuing good fortune, avoiding disaster and creating a comprehensive living environment suitable for human beings.

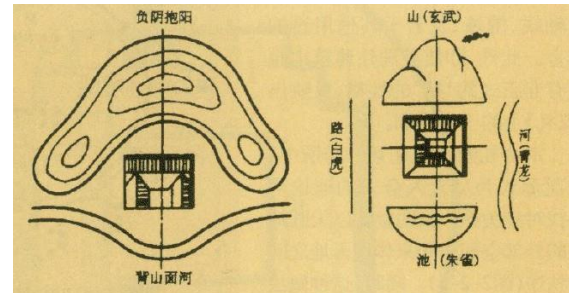


Figure 1. Selecting settlement location under the Feng Shui theory

The theory of “Feng shui” also plays an important role during the dwelling site selecting by the ancestors of Daiwei village. When they were searching for the ideal place to live, they also gave full consideration to “Feng shui” elements. In Feng shui theory, the mountain represents the “dragon”. Its height, ups and downs, twists and turns look like the morphological changes of a “dragon”, therefore the mountains are called the “dragon vein”. The coil upon coil and spiral of the mountain, like a dragon crouching and waiting, like a dragon grasping and holding, which could be seen as retaining the wind and accumulating the energetic air. Besides, the ideal flow of water is supposed to be slow, steady, bending and circling because if it rushes down, the turbulent flow is considered to be “bad waters” which will wash the “Qi” away. Daiwei Village is located in the lower reaches of Nan Stream (Jiulong River’s branch), surrounded by Jilong Mountain, Damao Mountain and Edan Mountain. The village is rightly placed in the basin formed by the three mountains with farming lands separating it from the mountains. Dwellings are around Touqian, Wanding and Houding rivers, forming the ideal landscape of site selecting that “with Yang and Yin blended and mixed, the site is against the mountain and facing the water” (See Fig. 2), so villagers can take the advantage of mountains as barriers to protect themselves from the cold wind in winter, while water can be used for drinking, irrigating, transportation and washing. Therefore, a suitable living environment is provided for dwellers.

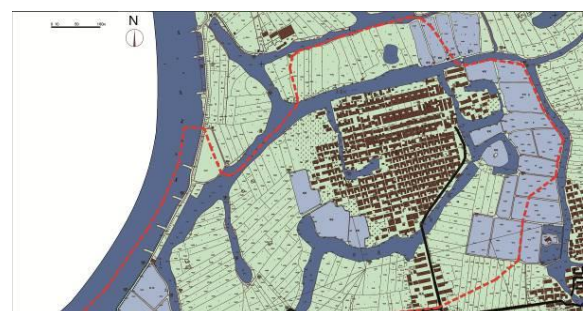


Figure 2. The general plan for Daiwei village

B. The Adaptation Process of Settlement

Settlement is a highly humanized system, in which human activities will be inevitably affected over time. After dwelling site selecting, in the gradual forming and improving process of the artificial settlement ecosystem, the settlement will absolutely adapt to various internal and external environmental elements. Since the improvement of settlement depends largely on the degree and the constancy of human management, when it comes to the adaptation process of Daiwei village, the study need to be conducted on three aspects: the natural, social and artificial environments.

1) To adapt to the natural environment

The natural ecological adaptability of settlement means to follow the law of nature and take a series of measures to create the relatively comfortable living environment[6]. By grasping the law and characteristics of the natural environment, Daiwei villagers' making full use of local natural resources, to a large extent, reflected the adaptation process to the natural environment.

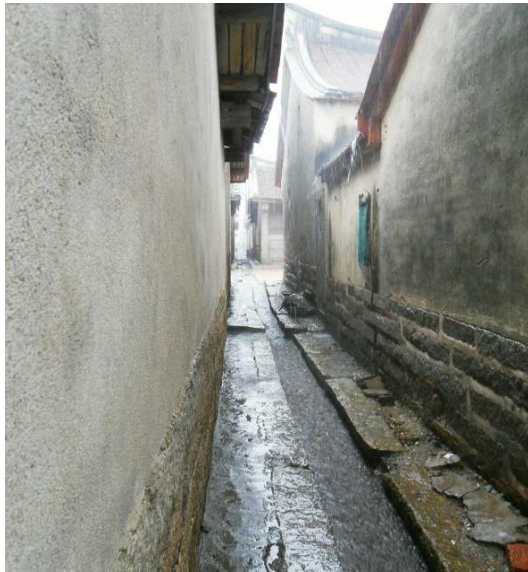


Figure 3. The ditch in the lane between buildings in Daiwei Village

a) The artificial control of water environment

Taking advantage of natural water system is one of the ways used in almost all the Chinese traditional settlements to manage natural environment. Living water flows, bringing infinite vitality for settlements. However, it is only a premise to meet the basic survival needs for settlements. In order to further enhance the environmental quality, a series of artificial organizing and controlling should also be done, which is known as the "water-management".

At Daiwei Village, the Touqian River, as a major river flowing through the village, is an indispensable part; the Wanding River, the river links to Touqian river, encircling the whole village, forms the overall water rounding landscape; the Houding River stretching into the village as a tributary of Touqian river, enables the village a good water environment. In accordance with the terrain, buildings are arranged orderly from south to north and from high to low. Moreover, the lane between two

buildings is also unique with ditches, working both as footpath and drainage system (See Fig. 3). On rainy days, rainwater drains downstream along the ditches into the Touqian River. Therefore, the ponds in the village will be drained effectively and timely, which will maintain water quality, reduce pollution, stabilize humidity and improve local microclimate, thus enhancing the environmental self-purification capacity. In short, Daiwei villagers artificially control water environment, manage the natural water resources and make it into artificial water system so that to use it in various ways.

b) To adapt to the climate

The climate in Daiwei Village is the typical climate of Southern Fujian Province with short winters and long summers without cold climatic conditions, so the dwellings are designed according to summer weather conditions. In order to ventilate the air, indoor and outdoor spaces are more interconnected with larger open windows and doors, and most of the halls and the main screen partition boards are removable. In order to overcome the hot and muggy climate in summer, avoiding the direct sunlight and strengthening the ventilation are two ways adopted to solve the problem. Besides, the house is constructed in deep length and eaves, with widely set veranda to avoid the direct sun beating inside, creating a cool indoor feeling. Moreover, there are "cold lanes" around the room to accelerate the air circulation, making the room cool. What's more, the space between patio and main hall is completely open to embrace the nature into the interior. Rainwater which falls down along the patio roof into courtyard drains from the blind ditch. That is the so called "four water coverage to the hall", a symbol of fortune, while the actual function is to improve the microclimate in the courtyard, especially in the southern China's scorching summer, where patio in a house plays a role of daylighting as well as ventilating at the same time, adding moist and cool to the house. Looking from the layout of the building complex, due to the narrow streets and large building density, the sun can't shine directly at the building, thus enabling the ventilating and sun blocking.

In order to adapt to the humid climate of southern Fujian Province, the floor of the main hall connected to the courtyard also has special damp proofing structure. The common way is to spread a layer of lime and a layer of sand one after another on the ground before paving the floor. On both sides of the hall are the narrow and small bedrooms normally with elevated floor to avoid dampness. Obviously, the Daiwei village settlement's geographical features are largely related with the adaptive management of the local natural ecology.

2) To adapt to the social environment

Social environment system including residents and its social structure, economic level and culture environment, often tends to reflect the trend of the times, people's living desire and practical needs, which is the main factor of the variation of residents' values. The social ecological adaptability of a settlement is the adaptation to the characteristics of social environment. The social ecology of the settlement always has a significant impact on

settlement construction [7]. The social and ecological characteristics of Daiwei village mainly manifest in two aspects: 1, the social organization of settlement featured with typical consanguinity and family system; 2, the decorative art and culture reflecting the dwellers' good will.

a) The clan environment of the settlement

Blood relationship is the tie of China's ancient patriarchal clan system while the concept of family is the basis of China's ancient patriarchal clan system. Maintaining and emphasize on the concept of consanguinity shows the impact of traditional residence's adhering to the patriarchal system. Clan originated from primitive stage of patriarchal clan commune and all the descendants from the same male ancestor belonged to the same clan group are called clansmen. The internal intimacy established inside the clan came from the close contact in daily life, the systematic sacrificing and ritual activities and clan law lessons and instructions, etc. For a long time, in the traditional Chinese society, blood relationship was thought as the link of the society to form a social group called clans, within which served one as the leader among members and all the members of the family were included. Strictly speaking, clans are "social groups" composed by paternal consanguineous families under the norm of patriarchal ideas [8].

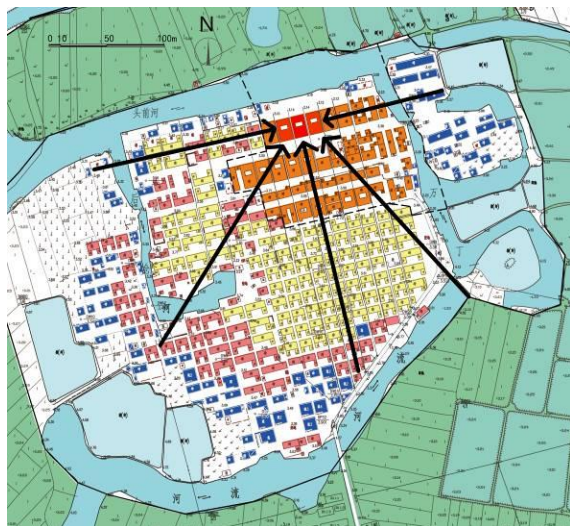


Figure 4. The cohesive pattern of the settlement

Daiwei village is in Fujian Province—a province where family system is the most prosperous compared with other places in China and this can be found in the clan dwellings and widely built ancestral halls—the important form of family system. In rural areas where family system is popular, clan dwellings are very common. Villagers of one village usually have the same family name. Although the layout is different due to the adjustment to local conditions, this kind of village reflects the authority of the ancestral hall and the concept of cohesiveness [9]. Daiwei villagers have the same family name "Chen", and the patriarchal clan system and concept based on the blood relationships have always been the connection to maintain the harmonious living. The integrated structure and formation of the clan

organization made it great stability. Living together with consanguinity let family members follow the same rules, have similar ways of living, thinking, emotional experience and similar value orientations. Under the patriarchal clan system, as an important public activity center in a family, ancestral temple also became the center of settlement members' spiritual life. Corresponding to this, the Daiwei settlement shows a layout as follows: the ancestral temple plays a dominant role on a grand scale of construction and becomes the core building of the whole settlement, surrounded by the smaller temples as well as dwellings in a certain order (See Fig. 4). Nowadays, though lots of things have changed from values to lifestyles, Daiwei village still adheres to the way the clan society did to construct and develop their dwellings, which always ensures common family interests during the village's development so as to adapt to the clan environment of the settlement.

The basic form of Daiwei village is directly affected by the lineage idea. People in the collective dwelling share the same gate, hall and patio, which represents the idea of lineage. The hall is the core part in dwellings in Daiwei village with living rooms around it. The layout of the dwelling shows a integrity of etiquette system and worship of ancestors. Furthermore, the spatial order clearly shows what is primary and what is secondary, showing the idea of patriarchal clan held by Daiwei villagers, stimulating the sense of pride and consolidating the family community. The family members live in different rooms with specific locations according to their different status in the family, which is a correspondence to the etiquette thought of ordering relationship by status and observing the order .

b) Decorative art and culture

In Daiwei Village, not only the layout reflects the features of the adaptation to local social ecology, the decoration theme also reflects the features. Take brick and wood carvings for examples, for they are the most typical decorations there.

Brick is mainly used on a gate with carving methods of intaglio and rilievo. The creation of the delicate and exquisite carvings and vivid, various artistic images showed people's wishes for fertility, peace and safeness (which is pronounced "Ruyi" in mandarin (See Fig. 5), fortune, longevity, happiness, fame, honor, a thriving business and so on. These topics are presented mainly in methods of ideography and homophonic. For example, brick carvings of dragon and phoenix to pattern the Chinese character "Fortune", shows straightforward beauty; with pine crane, vases to metaphor "macrobiosis" and "peace and safe". Moreover, people carve some folk stories such as "Carp jumps over the dragen gate", "Kylin sending sons" or historical allusions as well as vines or gourd vine full of fruits to express people pursuit for fame, the thoughts of "the more children the more blessings". However, a more straightforward way is to use the technique of homophonic. For instance, we often see patterns on brick carvings in local dwelling houses as follows: a halberd or Ruyi stick is in a vase, sometimes with a Qing hanging on

the stick, that is because the mandarin pronunciations of all the things in the pattern together have a homophonic sound to the good intentions of “auspicious peace as one wishes”. In addition, we can often see the bats with a homophonic sound of the character fortune, reflecting the folk pursuit for fortune and being rich.



Figure 5. Brick carvings of “Ruyi”

The wood carving is not famous for its exquisite techniques, but for its grandness in its concise and sketchy style. Normally, wood carvings could be seen on crescent beams, carved angle braces, corbel brackets, diagonal braces, sunk panels, screen doors and windows. The theme reflected from the wood carvings varies according to the decorative places. The theme patterns on crescent beams and carved angle braces are mainly grass and flowers (See Fig. 6). The technique applied is mainly staccato with a few round sculptures and engravings.



Figure 6. The wood carvings

With broad themes, deep intensions and superb techniques, these carvings are influenced by the dense traditional culture and spirit. Chinese traditional philosophy is also widely reflected in the form of metaphor in the brick and wood carvings, which fully demonstrates its community cultural forms.

3) To adapt to the artificial environment

Artificial environment is the long time production of continuous living conditions improvement by residents in the settlements and it is a reflection of human labor and wisdom. The environment construction process of almost all the traditional settlements embodies the adaptation and coordination of artificial, natural and social environment. The Daiwei village we see today is the phased achievement after continuous adaptating, developing and evolving. The adaptation to artificial environment is a dynamic process and such an adaptation not only inherited people’s achievement in the history but also inherited the local traditional context during its continuation and development [10].

a) The formation and evolution of the settlement pattern

Due to the original geographic environment, Daiwei Village lays on the south side of the river, along the water front, the settlement initially presents a banded distribution parallel with the river. As the population increases, residents area gradually develops into the deep hinterland, which means in the end it may also develop into a block shape. According to the existing geographical environment, most of the dwelling houses are facing the north while a few houses facing east and west are unified in the whole landscape of the north and south orientation.

Generally speaking, the present overall pattern of settlement not only develops contemporarily but also carries on the original pattern, conforming to the settlement’s original mechanism and the traditional style. It seems that it is the natural growth of the villages while the settlement also meets the needs of the modern life, thus promoting the whole village to constantly adapt itself to the changing of the artificial environment in its physical form.

b) The formation and evolution of architectural morphology

From the perspective of architectural morphology, the plan, space form and facade of buildings in the traditional settlements—no matter public buildings or residential buildings, are often maintained with unified “prototype” features and different originalities of “variation” forms, reflecting the creative adaptation to the artificial environment [11].

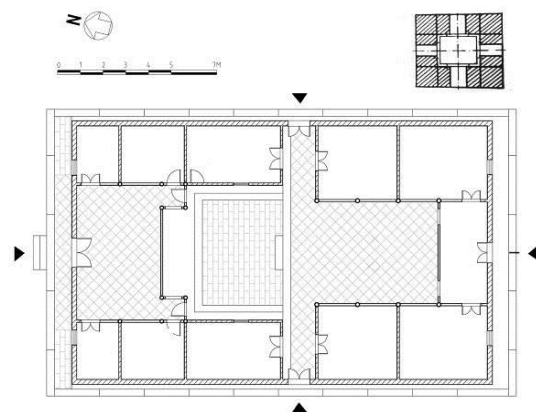


Figure 7. The plan of dwelling No.8

The local dwelling houses in southern Fujian Province could be divided geographically into two big schools: Quanzhou and Zhangzhou schools. Based on dwelling model as the prototype, the planar pattern is developing longitudinally, horizontally or a combination of the above two types. Inheriting and unifying the values of the residents made buildings in the settlements located in the same region a generally similar pattern. Daiwei village belongs to Zhangzhou city in Fujian Province, therefore the dwellings structure building belongs to Zhangzhou School, mainly having three kinds of plans: one kind is the quadrangle called “Sidianjin”, such as the Dwelling No.8 (See Fig. 7), with two rows of building in three big adjacent houses in three lines. In the middle is the hall

and the fete space, while the left and right sides are rooms and corridor connected kitchen, with large scale patio as connection; The three-section compound house known as “Pashi”, with three single building widths. The left and right sides functions as the protection adjacent to the middle—the main hall, as shown in Fig. 8(See Fig. 8). Moreover, in Daiwei Village there is also another variant building whose plan is simpler, such as dwelling No. 28(See Fig. 9), the lined up forms of three rooms called “dragon form”, with rooms on both sides of the main hall.

So far, in addition to meet the modern daily needs, the plan and the external appearance of Daiwei building houses are following the original form of houses that new and old buildings are integrated organically, which is neither imitating deliberately with the old buildings nor incompatible with the new buildings. That is to say, it is a continuation of traditional style during the settlement’s developing, and a constant adaptation to the artificial environment.



Figure 8. The picture of dwelling No.15

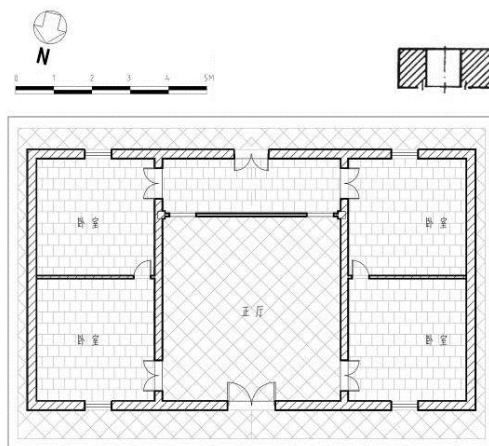


Figure 9. The plan of dwelling No.28

V. CONCLUSION

Though Daiwei village at present is in a physical form, however, this form has its social and natural connotation. Through the study above, it is proved that during the “dwelling selecting and adaptation”, Daiwei village has strong vitality and adaptability through the selection and elimination of nature and society. This paper demonstrates the ecological adaptability of Daiwei village from perspectives of natural, social and artificial

environments as follows: 1. In order to adapt to the natural environment, villagers control the water environment though “water-management” measures like traditional sunshading, ventilating and dump proofing to make sure the development of the settlement system is in accordance with the law of nature; 2. In order to adapt to the social environment, the ancestral hall is the core in the overall layout of settlement development, while the hall is the core part of a individual building. The arrangement above makes it possible to extend the patriarchal clan system and idea. Meanwhile, decorative arts of architecture in the dwellings also reflect the good will of villagers and the continuation of traditional thoughts, which civilize the villager in their daily lives. 3. In order to adapt to the artificial environment, the overall landscape of the settlement follows the original layout and the form of the buildings presents regional characteristics, meeting the needs of the villagers during the constant changing times and development, thus making settlement a sustainable continuation and adaptation to the environment in its physical form. Therefore, from the perspective of arcology, the establishment of relevant ecological adaptive mechanism in the environment of Daiwei village makes it reach the ecological balance and enable the ecosystem of the settlement to develop in a harmonious and sustainable way.

ACKNOWLEDGMENT

The authors wish to thank Professor Xiaofeng Li, Professor Zhijian Dai and Cancan Yang. This work was supported in part by a grant from School of Architecture and Urban Planning at Huazhong University of Science and Technology, and Architecture and Culture Institute of Fujian and Taiwan at Xiamen University.

REFERENCES

- [1] Y. Yu, *A Study of Vernacular Architecture In Southeast China*, Beijing: China Architecture & Building Press, 2001, p. 12.
- [2] Ecology. [Online]. Available: <https://en.wikipedia.org/wiki/Ecology>
- [3] P. Soleri, *Arcology: The City in the Image of Man*, Cambridge: MIT Press, 1969.
- [4] X. F. Li, *Vernacular Architecture*, Beijing: China Architecture & Building Press, 2005, p. 205.
- [5] X. F. Li, *Vernacular Architecture*, Beijing: China Architecture & Building Press, 2005, p. 209.
- [6] X. F. Li, *Vernacular Architecture*, Beijing: China Architecture & Building Press, 2005, p. 224.
- [7] X. F. Li, *Vernacular Architecture*, Beijing: China Architecture & Building Press, 2005, p. 224.
- [8] X. F. Li, *Vernacular Architecture*, Beijing: China Architecture & Building Press, 2005, p. 24.
- [9] Z. J. Dai, *Dwelling in Fujian Province*, Beijing: China Architecture & Building Press, 2009.
- [10] X. F. Li, *Vernacular Architecture*, Beijing: China Architecture & Building Press, 2005, p. 234.
- [11] X. H. Deng and X. F. Li, “Ecological development: The future of the traditional Chinese settlements,” *New Architecture*, vol. 3, pp. 3-4, p. 4, Mar. 1999.
- [12] D. Han, “Type and vernacular architecture environment,” *Architectural Journal*, vol. 8, pp. 52-55, Aug. 1993.
- [13] Qiheng Wang, *Research on the theory of Feng Shui*, Tianjin: Tianjin University Press, 2005.



Nan Chen was born in Fujian Province, China, in October, 1987, doctoral student at School of Architecture And Urban Planning of Huazhong University of Science and Technology, Wuhan, China. He has received his Master of Architecture degree, majoring in Architectural History and Theory from Huaqiao University, Xiamen, Fujian, China in 2012.

He has worked as an architect in Tianjin University Research Institute of Architectural Design & Urban Planning in 2011. He is currently pursuing his Ph.D degree in Huazhong

University of Science and Technology and his research focuses on the field of China's traditional architecture. So far, he has published Conservation and renewal of historical block of sustainable in *Journal of Yangtze University* (Natural Science Edition) Sci & Eng on Jul. 2012, vol. 9, no.7.

Dr.Chen has won the First Prize in the campaign of Zhang Gong Pavilion Design Project for the 10th China (Wuhan) International Garden Expo in 2013, the First Prize in the National Garden Landscape Design Competition in 2010, the Excellent Post Graduate Thesis Award of the 9th session of the Cross-Straits Academic Seminar on the Theory Traditional Architecture in 2011.