A Comparative Study on the Ecological Sustainable Development of Traditional Settlements——A Case Study in Yunnan, China

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Abstract. Settlements are the spatial forms of human habitation. Due to the unique natural environment, climate conditions and diverse ethnic cultures, Yunnan province has formed many traditional settlements with different characteristics. Nayun Ancient Town, Xizhou and Chengzi Ancient Villages in Yunnan are the research objects in this paper. By using methods such as data collection and field research, this paper analyzes the characteristics of these traditional settlements. Furthermore, this paper discusses the ecological constituent elements and characteristics in traditional settlements of Dai, Bai and Yi ethnic groups in Yunnan. The article analyzes the ecosystem, the mechanism of ecological balance regulation and the sustainable development of ecosystem in traditional settlement. Ultimately, this paper proposes the strategy of respecting the natural ecosystem and building artificial ecosystem scientifically, using ecosystem balance regulatory mechanism reasonably and building a sustainable development ecosystem in traditional settlements. It attempts to provide some useful theoretical thinking on the preservation, renewal and cultural heritage of traditional settlements.

1. Introduction
Settlement is one of the space forms of human colony. The literal meaning of “Siedlung” in German is the place of residence. According to German geographer Richthofen, he points out that people settle on and occupy the surface of the Earth. One of the types of people's occupation is settlement. Peter Haggett, an English geographer, defines settlement as “a specific performance of occupying the earth’s surface and an important component to form the terrains.” Under the promotion of the new-type urbanization and new rural construction in China, the research on traditional settlement seems more and more important.

Continuity was firstly put forward by an ecologist. The real meaning of this definition is about ecological sustainability. In other words, it illustrates the balance between natural resources and the development and utilization program for natural resources. People define “sustainable development” as “fulfilling the needs for the people in the modern world and not posing any threats for the needs of the future generations.” Ecological sustainable development means the coordinating development between economy, society, resources and environmental protection.
Yunnan is at the southwestern tip of China, which belongs to subtropical plateau monsoon climate. It is possessed with abundant plants, animals, mineral resources and energy resources. Except Han people, Yunnan has twenty-five indigenous ethnic minorities and each minority group has the population of 5,000 people or above. With the unique natural environment, location characteristics and diversified ethnic cultures, Yunnan becomes the cradle for plenty of unique traditional settlements.

This research selects three traditional settlements in Yunnan, namely the Nayun Ancient Town, Xizhou Ancient Village and Chengzi Ancient Village, as objects (Figure 1 and Table 1). The three selected ancient sites belong to Dai people, Bai people and Yi people respectively. Literature research, field research and analytical comparison were adopted in this research.

![Figure 1. Location map of Nayun, Xizhou, Chengzi in Yunnan (All the pictures were drawn by the author, and all the photos were taken by the author)](image)

Table 1. Characteristics of Traditional Spatial Evolution in Traditional Settlements (All the contents in the table were organized by the author)

| Traditional Space | Variable Space | New Space | Evolution Characteristics |
|-------------------|----------------|-----------|---------------------------|
| Nayun Ancient Town | Menglian Xuanfu Department, Buddhist temple, etc. | Streets, folk house, residential restrooms, catering spaces, inns, electricity, water supply and other infrastructure | (1) Traditional space services for local residents. (2) Street and residential space services for residents and outsiders, space functions from single to diversified development. (3) Water supply, drainage, electricity, garbage collection and other infrastructure, new building materials. (4) The use of solar energy has changed the spatial form of traditional settlements. |
| Xizhou Ancient Village | Daci Temple, Local deity temple, Mosque, ancestral Temple, etc. | Square, streets, folk house, residential restrooms, dining spaces, inns, tourist latrines | |
| Chengzi Ancient Village | Chengzi Temple | Streets, folk house, residential restrooms, dining spaces, inns, infrastructure | |

2. Data Collection

2.1. Nayun Ancient Town

Nayun Ancient Town is located in the west part of Lahu autonomous county (Figure 2). It was firstly built in 1289. Since Yuan Dynasty, this place became a garrison for Menglian Chieftain and was one of the earliest place to establish the native chieftain system in Yunnan. Nayun Ancient Town is full of Dai characteristics and it is the most integrated and ancient one in China. It was built in the mid-levels of the mountain facing south. Jinshan Mountain is at Nayun’s back and Nanlei River flowing through the southeastern part of this ancient town. The typical royal building layout can be seen in the whole ancient town with the feature of “tri-cities and two villages”. The existing architecture includes Menglian Xuanfu department, Shangcheng Buddhist temple, the Dai dwellings, ancient giant trees and forests and so on. People there still celebrate “God Fish festival” until now.

2.2. Xizhou Ancient Village

Cangshan Mountain, Dali City, Dali Bai Autonomous Prefecture is the hometown of Xizhou Ancient Village. Xizhou Ancient Village is located in the flat areas between Cangshan Mountain and Erhai Lake with fertile lands (Figure 3). In 109 BC, places near Xizhou were named Yeyu County by Emperor Wu of Han. Seven main streets were stretched to the outside part of the ancient town. The
main streets can reach every household in the ancient town. In each alley, there is one ditch. Fields are on all directions and roads are connected with each other. There are Bai dwellings with “Three squares and one wall” in. Within the Xizhou Ancient Village, one can still visit places such as the Justice Gate, Miaoyuan Temple, mosques, memorial temples, ancient wells and trees. Until now, people there still believe in master faiths and they still dance around the “three spirits”.

2.3. Chengzi Ancient Village
Chengzi Ancient Village is located in Yongning Town, Luxi County, Honghe Hani, Yi Autonomous Prefecture. It has a long history. Chengzi Ancient Village is located at Feifeng Mountain and is east to Longpanshan Mountain, west to Yupingbijia Mountain, north to Furong Mountain (Figure 4). The architecture of the village complies with the natural terrain and it is distributed in a natural parallel contour. The City Abbey is the high ground in the village. The architecture in Chengzi Ancient Village belongs to terracotta houses with flat roofs and mud walls. The architectural style in Chengzi Ancient Village belongs to Han-Yi style. It not only maintains the features of terracotta houses but also mixes some of the style of “carving dragons and phoenix in the hall within the quadrangle courtyards”. Historical sites such as Anggui Chieftain’s House, former residence of General Li, and Sister Walls have been preserved.

3. Discussions
The concept of “ecosystem” was put forward by English ecologist A.G. Tansley (1871-1955) in 1935. He pointed out that ecosystem represented the whole concept of “system” in Physics. He also put forward that this system included not only organic complex but also the whole physical factor complex that formed the environment. Tansley also pointed out that the basic views of us towards organisms must base on the fundamental level. The organisms couldn’t live without the environment but to form a natural system with their environment. Apparently, one can use the theory of ecosystem to analyze the natural ecosystem and artificial ecosystem of the traditional settlements in order to propose strategies for the regulatory mechanism of balanced ecosystem and ecological sustainable development.

3.1. Ecosystems of the Traditional Settlements
The ecosystem of the traditional settlements can be divided into natural ecosystem and artificial ecosystem. Natural ecosystem means the natural environment and resources in the region of traditional settlements. Take Nayun Ancient Town as an example, the weather there is warm and it rains much. Nayun Ancient Town locates in the flat areas in the valley with fertile land, abundant rainfall and convenient irrigation system. Abundant animal and plant resources and mineral resources around this region contribute to the unique natural ecosystem in this region. Xizhou Ancient Village is in the region of subtropical monsoon climate with abundant rainfall and sunshine. It’s warm like springs all the year round in Xizhou. It forms a regional ecosystem because Cangshan Mountain and Erhai Lake provide much animal, plant and mineral resources. Chengzi Ancient Village is located in the tropical monsoon climate of South Asia region. The stereo-climate here is very typical: the summers are long...
and the frost-free days are plenty, the rainfall is little and the weather is hot. With the animal, plant and mineral resources here, a unique natural ecosystem is formed.

Artificial ecosystem means a system of the artificial structures built by the people in the natural environment of the traditional settlements. The artificial systems of Nayun Ancient Village include the Buddhist temple, chieftain’s house, Dai people’s houses, Sala Pavilion and so on. The artificial ecosystem in Xizhou Ancient Village, for example, includes Quadrangle Streets, temples, clan temples, Bai people’s houses and memorial archways etc. The artificial ecosystems in Chengzi Ancient Village consist of the City Abbey, terracotta houses and Sister Wall so and so forth.

3.2. Regulatory Mechanisms of Ecosystem balance in Traditional Settlements

The so-called “ecosystem balance” means the kind of ecosystem in the specific time and state. In this state, the structure and function are stable relatively. In traditional settlements, natural ecosystem and artificial system can be a whole. When the external materials (i.e. species and materials), the input of energies (i.e. solar and new resources) and ecosystem of traditional settlements emerge with one another, the ecosystem balance of the traditional settlements can be reached to the ecological threshold. Traditional settlements also have resistance and resilience being as important components for ecosystem balance. For example, Nayun Ancient Town keeps the features of Dai-style, namely the “tri-cities and two villages”, the Buddhist temples and so on. Though the chieftain culture has filtrated into it, in its ecosystem Dai social and economic culture still exist. Bai people constitutes the main population in Xizhou Ancient Village. Being affected by Han people, Buddhism and Islamic culture, it has formed an ecosystem with multiculture co-existing. The businessmen in Xizhou offered economic aids to the building a unique livable space for Yi people and a specific artificial ecosystem. Under the influence of Han culture, a Han-Yi ecosystem balance has created by the resistance and resilience of traditional settlements.

3.3. Sustainable Developments of Ecosystem in Traditional Settlements

Sustainable development of ecosystem in traditional settlements is closely related to natural ecosystem, artificial ecosystem and ecosystem balance mechanism in settlements. Natural ecosystem is an important material basis for settlements to produce products and develop in a virtuous circle. Artificial ecosystem provides material spaces for the society, culture and economy in traditional settlements. The social systems, cultural beliefs and economic factors in traditional settlements are the impetus for the sustainable development of ecosystem. So far, Nayun Ancient Town still keeps the features of Dai ancient town. Xizhou Ancient Village shows the prosperity of Bai-style building. Moreover, the terracotta houses in Chengzi Ancient Village represent the perfect combination of architecture in agrarian age and natural environment. The sustainable development in these traditional settlements needs to stimulate factors to satisfy the needs of settlements at different periods and characteristics of the times. Those factors include input & output of energies in regulatory mechanism of ecosystem balance and restoration of traditional settlements. Sustainable development in the sense of ecology can be reached only by adjusting to different times and locations to get a balanced state in traditional settlements.

4. Conclusions

As above-mentioned, the traditional settlements in Yunnan, China shows the featured site location, fully usage of local environmental resources displaying social development tracks of different historical periods. Besides, by developing economy, the spatial framework of settlements will be completed and the unique culture constructed by traditional settlements will be developed as well. Then, the quite unique traditional settlements with their corresponding ecosystems and a regulatory mechanism of ecosystem balance will be formed. These factors will be the internal impetus of the sustainable development of ecosystems in traditional settlements (Figure 5). The inspirations getting from this research are as follows:
Figure 5. An ecological sustainable development model of traditional settlements (All the pictures were drawn by the author)

4.1. Respect the Natural Ecosystem and Build Artificial Ecosystem Scientifically in Traditional Settlements

Natural ecosystem is the major material basis for traditional settlements. It is also the fundamental factor for the development of traditional settlements. To respect the natural environment and resources and to form a virtuous circle of natural ecosystem are the greatest guarantee for the sustainable development in traditional settlements. With the growing population and limited resources, it poses new threat for traditional settlements. Therefore, a virtuous circle of sustainable development in traditional settlements can be formed by building spatial framework in a scientific way, using new technology and materials in natural ecosystems and combining natural and artificial ecosystem together.
4.2. Use Ecosystem Balance Regulatory Mechanism Reasonably and Build a Sustainable Development Ecosystem in Traditional Settlements

Ecosystem balance regulatory mechanism introduces new energy for traditional settlements. By using the feedback of ecosystems, the new output energies and products, the resilience and resistance of ecosystems help promote the balance and development of traditional settlements. The modern urbanization affects traditional settlements, and these traditional settlements cannot rely barely on agriculture, handicraft and husbandry but rely more on the input and output of industry, tourism and IT industries. The ecosystems in traditional settlements are faced with new changes and conflicts from the outside world under the new age. So it is important for the ecosystem in traditional settlements to increase its resistance and resilience thus to ensure a good ecosystem balance regulatory mechanism.

Traditional settlements are testimony of history in human civilizations. It is the common wealth for human because traditional settlements are full of precious wisdom. Under the influence of urbanization, industrialization and globalization, ecological sustainable development in traditional settlements has become a focus of people. This research sets out from the sustainable development perspective. Ecological theories are adopted in this paper to make further comparative analysis of field researches of traditional settlements. The authors try to build an ecological sustainable development model for traditional settlement. It provides more effective strategies and methods for the protection, renewal and cultural inheritance of nowadays traditional settlements. All in all, this study not only expands the sustainable development research in a broader way, but also enriches the study methods of traditional settlements.

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