The Evaluation and Optimization of Satisfaction with the Rural Living Environment in the Southern Terraced Area: A Case Study of the Ziquejie Terrace in Hunan Province

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Abstract Rural living environment is an important part of the habitat environment science, but there is the serious phenomenon of "favoring city" in current researches on the habitat environment. There is not enough attention paid to the deteriorating rural environment. Taking the case of Ziquejie, coupled with the heritage-abased community characteristics of the rural living environment, we establish the evaluation indicator system of satisfaction with the quality of rural living environment, and use fuzzy analysis method to analyze and process the data obtained from the questionnaire survey, to initially derive the development status and general law of evolution of the rural living environment in Ziquejie. Based on these, we put forth the relevant recommendations for promoting the sustainable development of the rural living environment in Ziquejie.

Key words Ziquejie, Rural living environment, Fuzzy comprehensive evaluation

The discipline system of the habitat environment has been gradually formed on the basis of "human settlement science" of Douglas since the 1990s. It has made significant contribution to the improvement of human living environment, and also provided important theoretical basis for urban planning science, building science and other disciplines. However, as the important content in the habitat environment science system, rural living environment has not yet attracted the attention of academia, in sharp contrast with China's current population of about 900 million in rural areas[1]. In most of China's rural areas, the economic development is slow, the environment is increasingly deteriorating and the quality of the habitat environment is very poor, thus the research on rural living environment is conducive to improving rural living environment and promoting the realization of comprehensive well-off society in China.

In February 2005, Ziquejie, a typical heritage-abased community, was included in the first batch of National Natural and Cultural Heritage List. Relative to the general village, the development of the habitat environment is of unique attributes. The evaluation of the rural living environment in Ziquejie is of great practical significance to sustainable tourism development in Ziquejie. This paper conducts effective exploration of the habitat environment evaluation of heritage-abased community.

1 Overview of the study area and data sources

1.1 Overview of the study area The Ziquejie terrace in Shuiche Town, Xinhua County, Loudi City, Hunan Province, took shape before 2000. It is the crystallization of labor of Miao, Yao, Han and other ethnic groups, and the historical relics landscape integrating mountain hunting and fishing culture and rice culture. Ziquejie, located in the middle of Mount Xuefeng, has 80 000 mu of terraced land, with the Ziquejie terrace as center. The area of contiguous terraces in Ziquejie reaches more than 20 000 mu, with altitude of 500 to 1 200 m and terrace gradient of about 30. Ziquejie scenic spot is honored as the key national scenic spot and the first batch of natural and cultural inheritance, successfully establishing the gold brand image of Ziquejie terrace in central Hunan. Meanwhile, the Ziquejie terrace was successfully included in "new eight scenic spots", successfully included in 28 rural eco-tourism demonstration sites of the Provincial People's Government; Louxia Village was honored as the province's famous historical and cultural village.

In February 2005, it was approved as a provincial - level scenic spot; in December 2005, it was approved by the State Council as a key national scenic spot; in January 2006, it was included in the first batch of national natural and cultural heritage list; in February 2007, it was approved as provincial agricultural tourism demonstration site.

1.2 Data sources This data in this article are mainly from the field research and survey in Ziquejie in August 2011 and the official statistics of Xinhua county government. Due to great differences in the development of different villages in Ziquejie, in order to obtain scientific and actual data, we select some representative villages in the field research and survey. Through questionnaire survey and field research, we obtain most of the information on the habitat social environment.

In order to make reasonable assessment of the sustainable development level of the habitat environment, this article conducts

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statistical description of the sustainable development level of the habitat environment in Ziquejie before the evaluation of the status quo. The statistical description of residents' satisfaction evaluation results is shown in Table 1.

Table 1 The statistical description of residents' satisfaction evaluation results Unit: %

Evaluation object	Very dissatisfied	Not satisfied	Can not tell clearly	Satisfied	Very satisfied	Overall evaluation
Living conditions	0.315	0.408	0.054	0.161	0.062	Poor
Economic conditions	0.315	0.513	0.061	0.091	0.020	Poor
Social environment	0.117	0.287	0.206	0.342	0.048	General
Ecological environment	0.043	0.104	0.185	0.469	0.199	Good
Sustainability	0.075	0.308	0.395	0.146	0.076	Comparatively poor
Comprehensive level	0.1930	0.3440	0.1802	0.2018	0.0810	Comparatively poor

Data source: Data are derived based on the evaluation results, and the significance of the proportion is the proportion of the number of people selecting this item to the total number of people.

2 Establishment of evaluation indicator system of rural living environment and selection of evaluation method

2.1 The principles of establishment of indicator system

The rural living environment in Ziquejie has the characteristics of scattered settlement, underdeveloped economy and lagged social security. There are many factors involved, so in building the evaluation system, we must follow the principle of comprehensiveness, hierarchy and streamlining, taking the countryside as a unique society – economy – nature complex system. The indicator system we establish should not only reflect the local and individual characteristics, but also reflect the global, long-term and comprehensive features[2].

2.2 Evaluation indicator system and evaluation method

The idea for the establishment of evaluation indicator system of the rural living environment in Ziquejie is as follows: the comprehensive evaluation indicator system consists of three levels, namely the target layer, system layer and indicator layer.

Target layer is to achieve the objectives of habitat environment that can promote sustainable man-nature harmony; system layer includes rural living conditions, economic conditions, social environment, ecological environment and sustainable capacity. Several indicators are selected to reflect the rural living environment in Ziquejie from each system, respectively (Table 1).

Table 1 Evaluation indicator system of rural living environment

Target layer (A)	System layer(B)	Indicator layer(C)
Evaluation indicator system of rural living environment	Living conditions(B_1)	Supply and demand of water and electricity (C_1), Per capita living space (C_2), Family TV Telephone penetration rate (C_3), Housing comfort (C_4)
	Economic conditions(B_2)	Annual per capita GDP (C_5), Rural residents' annual disposable income (C_6), Proportion of tourism revenue (C_7), Agricultural industrial structure and employment ratio (C_8), Non – agricultural labor productivity (C_9), Engel Coefficient (C_{10})
	Social environment(B_3)	Transportation accessibility (C_{11}), Number of primary and secondary school (C_{12}), Per capita health resources (C_{13}), Per capita public land area (C_{14}), The security situation (C_{15})
	Ecological environment(B_4)	Type and quantity of the natural landscape (C_{16}), Losses from natural disasters (C_{17}), Per capita greenbelt area (C_{18}), Air quality (C_{19}), Comprehensive evaluation index of surface water (C_{20}), Disposal rate of garbage and human and animal excreta (C_{21}), The township standard industrial discharge rate (C_{22})
	Sustainability(B_5)	Annual economic growth rate (C_{23}), Annual growth rate of residential investment (C_{24}), Annual growth rate of tertiary industry (C_{25}), Public infrastructure investment growth rate (C_{26})

Many domestic scholars have done a lot of researches on the establishment of the habitat environment evaluation indicator system, evaluation methods and empirical research. The evaluation methods of the indicator system include principal component analysis[5], Analytic Hierarchy Process (AHP)[6], simple weighting method (SAW)[7], factor analysis[8], expert rating, fuzzy evaluation method, artificial neural network evaluation method and data envelopment analysis (DEA). In order to scientifically evaluate the habitat environment of Ziquejie, by comparison we select the fuzzy comprehensive evaluation system to evaluate the habitat environment of Ziquejie.

In fuzzy comprehensive evaluation, the comprehensive evaluation of each level is derived from the comprehensive evaluation of the lower level. First the fuzzy comprehensive evaluation is conducted on the system layer to derive P_{B1}, P_{B2}, P_{B3}, P_{B4}, P_{B5}; then the comprehensive evaluation matrix of the target layer is derived; finally the fuzzy comprehensive evaluation score F_A of the target layer is derived. The calculation formula of fuzzy comprehensive evaluation of system layer and target layer is as follows:

$$P_B = W_B \times \sum_i^n W_i \times C_{ij} \quad (1)$$

$$F_A = \sum_{B=1}^{5} P_B \quad (2)$$

where P_B is the score of system layer indicators; W_B is the weight of system layer; W_i is the weight of each indicator; C_{ij} is the dimensionless value of the raw data; F_A is the development level of habitat environment of target layer.

2.3 Standard classification of the level of development The standard of the development level of habitat environment has uncertainty and ambiguity factors, so on the basis of summing up the past development level of habitat environment in urban and rural areas, combined with the development characteristics of the rural living environment in Ziquejie, we divide the standard of the development level of habitat environment into five levels: poor, relatively poor, general, relatively good and good (Table 4).

Table 1 Division standard of development level of the rural habitat environment

Assessment score	0 – 0.25	0.25 – 0.50	0.50 – 0.65	0.65 – 0.80	0.80 – 1.00
The level of development	Poor	Relatively poor	General	Relatively good	Good
Membership	V_1	V_2	V_3	V_4	V_5

3 Empirical results analysis of the habitat environment

The article selects the indicator data of four years in Ziquejie during the period 2000 – 2007. Through the fuzzy comprehensive evaluation method, we calculate the development index and comprehensive development level of five indicator systems (Table 3).

Table 3 The development level of habitat environment in Ziquejie during the period 2000 – 2007

Year	Living conditions	Economic conditions	Social environment	Ecological environment	Sustainability	Membership	Comprehensive level
2000	0.015 6	0.030 1	0.039 8	0.097 5	0.012 7	V_1	0.195 7
2001	0.026 4	0.042 2	0.040 1	0.099 6	0.023 9	V_1	0.232 2
2002	0.039 1	0.043 4	0.053 1	0.110 1	0.047 8	V_2	0.293 5
2003	0.045 9	0.047 9	0.061 4	0.112 4	0.049 6	V_2	0.317 2
2004	0.061 8	0.051 2	0.070 1	0.120 9	0.053 6	V_2	0.357 6
2005	0.064 5	0.051 3	0.076 1	0.121 1	0.053 5	V_2	0.366 5
2006	0.067 9	0.054 3	0.085 6	0.125 1	0.060 1	V_2	0.393 0
2007	0.077 3	0.059 1	0.102 3	0.127 3	0.069 9	V_2	0.435 9

Based on the division standard of development level of habitat environment in Table 3, we derive the following characteristics of development of the rural living environment in Ziquejie through the analysis.

(1) The overall level is poor and the development is slow. From the data in the above table, we find that during the period 2000 – 2007, the habitat environment in Ziquejie was always in the state of low-speed development, only developing from V_1 to V_2, with not rosy development situation.

(2) The economic growth is slow and infrastructure development lags behind. Like other rural areas, the economy in Ziquejie develops slowly and the phenomenon of slow development of infrastructure is also very obvious. The economic condition in the above table in 2 000 was 0.030 1 and still only 0.059 1 in 2007, always in a poor state.

(3) Sustainability is poor. Sustainability mainly relies on the growth rate of various economic indicators, and especially the development of the tertiary industry. Ziquejie is now a national scenic area, but due to the early stage of development, there is a serious shortage of tourists; the tourism industry and other related industries have not yet showed good momentum of development, which leads directly to poor sustainability of Ziquejie.

(4) The quality of ecological environment is good. Ziquejie is a famous national scenic area, with good ecological environment, high score (an average of more than 0.11), and strong development advantage.

4 Recommendations for promoting the sustainable development of the rural living environment in Ziquejie

(1) Vigorously promoting the sustainable development capacity. In construction of the habitat environment, Ziquejie must rely on its own strengths, fully tap the tourism resources, and promote the development of the tourism industry. At the same time, it is necessary to take advantage of the tourism industry to drive the development of services, processing and related industries, thereby promoting the sustainable development capacity.

(2) Speeding up the community building. It is necessary to focus on inheriting of historical tradition, including inheriting of architectural style and inheriting of the traditional lifestyle under the new economic conditions; actively promote the masses to participate in the construction and transformation of rural living environment; strengthen disaster prevention and mitigation research; establish harmonious and friendly neighborhood relationships, so that communities are full of vitality, creating comfortable, convenient, safe, healthy communities with local features[9].

(3) Playing the government's leading role and promoting the building of infrastructure. Infrastructure is the basis for the habitat environment and also tourism development. Only when a sound infrastructure system is established can the habitat environment be fundamentally improved, to achieve sustainable development.

(4) Effectively protecting good ecological environment, and achieving natural ecological homeostasis. It is necessary to take full advantage of the climate conditions and natural features of Ziquejie, use original natural topography of village, protect the ecological environment, and seek the balance between the economic benefits of tourism development and the ecological efficiency of environmental protection.

The construction of rural living environment is a systematic project and there are many areas in need of construction. How to find the breakthrough point of rural living environment building

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protectors being benefited", we encourage government, enterprises and individuals to invest and develop the tourism industry in the form of joint venture, cooperation or shareholding system, to speed up development of the scenic spot[4].

4.3.4 Energetically developing tourism series products. (1) It can develop tourism souvenirs and local products. Rich medicinal materials and biological resources of Dahengshan can be made into local characteristic souvenirs and local products to attract tourists. (2) It is better to develop original ecological sightseeing products. Dahengshan is basically not developed, so most parts can be kept original. For example, it can develop a "4 ancient spots – 8 beauty spots – Danxia landform" travelling route, to make tourists appreciate unique original ecological beauty of Dahengshan. (3) It is recommended to develop farmstay tourism products. Specifically, it can launch characteristic tourism of Hui People, to let tourists feel ethnic customs and culture.

4.3.5 Strengthening propaganda to raise popularity. It is proposed to strengthen propaganda of ecological tourism of Dahengshan with the aid of newspaper, radio, television and network, to raise popularity of the scenic spot[5].

4.3.6 Strengthening regional tourism cooperation to build big Mingguang tourism circle. Regional tourism cooperation is reallocation and recombination of tourism resources in the range of certain regions by economic entities on the basis of certain regulations, agreements and contracts, to obtain maximum economic, social and ecological benefits[6]. Mingguang City has long history and civilization. Apart from Dahengshan scenic spot, there are a lot of ancient cultural relics, such as Niaobutan relic of Ming Dynasty, Fushanyan relic of the Southern Dynasties, Zhaoxincheng relic of Song Dynasty, and Birth Place of Zhu Yuanzhang, *etc.* Dahengshan scenic spot is very close to these historic cultural relics. Therefore, to develop and take full advantage of precious tourism resources in depth, Dahengshan should combine local characteristics, strengthen regional cooperation with other tourism scenic spots of Mingguang City, make proper traveling routes, realize resource sharing, information sharing, and mutual benefit, to build big Mingguang tourism circle, and form the open and combined tourism market zone.

5 Conclusions

Dahengshan of Mingguang City is rich in tourism resources, beautiful natural landscape and long history, rare and precious animal and plant resources, and unique landform, as well as cultural relics. Thus, the development of tourism resources should stick to the principle of "protection first and development second". In addition, it is required to develop in accordance with actual local conditions, and make proper planning within the limits of its own resources.

References

[1] HI ZS, HUANG CL. A discussion of tourism resource development mode of Fengyang County [J]. Journal of Anhui Agricultural University(Social Science Edition),2012 (06):24 – 26. (in Chinese).

[2] YAN ZW, LI JM, CHAI HY, CHENG CX, *et al*. Primary investigation on the development and utilization of Wudang Mountain tourism resources [J]. Theory and Practice, 2004(10):67 – 68. (in Chinese).

[3] LU LG. Red resources protection and development in Jinggangshan: situations, problems and counter strategies [J]. Journal of Jinggangshan University(Social Sciences Edition),2010 (06):21 – 23. (in Chinese).

[4] LI WJ. Discussion on the development and utilization of tourism resources in Lincang City of Yunnan Province [J]. Journal of Lincang Education College,2010 (3) :31 – 32. (in Chinese).

[5] LI BJ, ZHANG QZ. The tour resource's development and exploitation of Nanwan Scenic Spot[J]. Journal of Xinyang Agricultural College ,2006(9): 62 – 64. (in Chinese).

[6] TIAN DN. Discussion on regional tourism cooperation [J]. Journal of Dalian Nationalities University,2007(4):78 – 81. (in Chinese).

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become critical[10]. Through the evaluation of rural living environment, we can have a clear understanding of the aspects of the habitat environment needing to be improved, thereby well guiding the construction of the habitat environment. Taking the case of Ziquejie, coupled with the heritage-abased community characteristics of the rural living environment, we establish the evaluation indicator system of satisfaction with the quality of rural living environment, and use fuzzy analysis method to analyze and process the data obtained from the questionnaire survey, to initially derive the development status and general law of evolution of the rural living environment in Ziquejie. Based on these, we put forth the relevant recommendations for promoting the sustainable development of the rural living environment in Ziquejie.

References

[1] LI BH, LIU PL. Rural human settlement environment: a new field of human settlement environment research[J]. Resource Development and Market, 2010, 26(6): 525 – 527. (in Chinese).

[2] LI JN, HUANG Y, YAN LJ. Study on evaluation of rural human settlement [J]. Chinese Journal of Eco – agriculture, 2006, 14(3): 192 – 195. (in Chinese).

[4] LUO YL. On rural tourism development and new socialist countryside building[J]. Journal of Higher Correspondence Education(Natural Science Edition), 2006(4): 13 – 15. (in Chinese).

[5] TAN MJ. Niche fitness model of urban human settlement quantitative evaluation[D]. Hangzhou: Zhejiang University, 2006. (in Chinese).

[6] LIU S, LIU BY. Study on evaluation index system of sustainable development for urban human settlement[J]. Urban Planning Forum, 1999(5): 35 – 37. (in Chinese).

[7] ZHENG GR. Evaluation and calculation of north cities human settlement sustainable development level[C]// China Environmental Science Society. Symposium of the annual academic meeting of China Society of Environmental Sciences. Beijing: China Environmental Science Press, 2006: 510 – 514. (in Chinese).

[8] ZHANG WX, WANG R. Analyses on the current situation of urban human settlement environment in China[J]. Urban Studies, 2007, 14(2): 115 – 120. (in Chinese).

[9] ZHAO ZF. A way for sustainabile development of rural settlement environment[J]. Ecological Economy, 2001(5): 50 – 52. (in Chinese).

[10] LI BH, LIU CM, ZENG JX. An evaluation on the satisfaction degree and optimization strategy of rural human settlements—A case study of Jiuheyuan Town in Shishou City[J]. Human Geography, 2009(5): 28 – 32. (in Chinese).