Assessing the Adaptability of Rural Households to Tourism from the Perspective of a Social-ecological System: A Case Study of Two Villages in Beijing Suburbs

Linlin Dai*1, Lun Liu2 and Jingjing Cui3

1 Associate Professor, College of Urban and Environmental Sciences, Peking University, China
2 Associate Researcher, Department of Land Economy, University of Cambridge, UK
3 Bachelor, College of Urban and Environmental Science, Peking University, China

Abstract

A framework is established for evaluating the adaptability of rural households to tourism disturbance in the suburbs of a metropolis, based on the theory of the social-ecological system with tourism as the system disturbance. Two traditional villages in Beijing suburbs are selected as study cases and compared in terms of the development stage of tourism and the phases and approaches of adaption by rural households to tourism disturbance. Stepwise regression and grey relational analysis are applied to investigate the factors influencing the functionality and stability of the rural social-ecological system.

Keywords: rural tourism; livelihood diversity; adaptation; social-ecological system; system functionality and stability

1. Introduction

Rural tourism in China emerged since the mid-1980s (Cai, 2002) and has gradually become a major type of tourism. In Beijing, for example, there were 17,000 host families and 69,000 employees in rural tourism by the end of 2014; they received 38.3 million tourists and made a revenue of 3.6 billion RMB. Rural tourism has become the most important approach for the farmers to get out of poverty and has been implemented throughout the country.

The booming of rural tourism plays a positive role in promoting economic development in rural areas and increasing the employment and income of farmers. Meanwhile, it has a positive effect on improving the agricultural added value and enriching the lives of rural residents (Hall et al., 2003; Jiang et al., 2008). However, the rapid development of rural tourism has strongly disturbed the rural social-ecological system (SES) and increased the eco-environmental load, leading to a significant impact on the work and lives of rural households.

Studies on rural tourism have assessed the economic, social, cultural and ecological impacts of tourism on rural areas (Liu, 2000). However, few research has been conducted from the perspective of rural households and the dynamic changes of their activities. We here define rural households as aboriginal residents in rural areas, who were formerly engaged in farming. First, an on-site survey is conducted to compare different phases of adaption and identify approaches of adaption by rural households. Next, qualitative and quantitative analyses are performed to identify the key factors influencing the adaptability of rural households and to select an appropriate set of indicators of adaptability and functionality. Furthermore, rigorous statistical methods are used to calculate the impact of various factors and evaluate the adaptation level and adaptation potential of rural households in the rural SES.

2. Theoretical Background

The theory of SES is one of the frontiers of research in tourism geography for its integrated and dynamic perspective linking both social and ecological elements. The SES, which regards tourism as a disturbance, is a special platform that examines the human-land relationship from the perspective of tourism (Folke et al., 2002). The theory of SES concerns the impact of tourists' activities on the entire SES, including the impact of living (mainly human-beings) and non-living entities in the system. According to this theory, various factors and activities in the system have a non-linear impact (Strickland-Munro & Allison, 2010). In terms of system theory, although conventional linear approaches may provide effective information in the short term, it still needs to be improved (Farrell & Twining-Ward, 2004). There is a need to reflect the concerns regarding a non-linear, integrated environmental matrix, in addition to the energy flow, material flow, and information flow. Therefore, in
addition to the conventional linear research approach, it is necessary to establish a model with closely linked economic, social, and environmental phenomena and network structures.

The SES is closely associated with the theory of adaptability, resilience and vulnerability (Walker & Salt, 2012), which are the key words to describe how the system is responsive to disturbance (Wang et al., 2010; Holling, 1973). The theory of adaptability emphasizes the responsive subjects in the system (Nelson et al., 2007). It considers that the behavioral subjects in the system have massive self-organizing behaviors that, to a certain degree, ensure the homeostasis of the system by adapting to its spontaneous change or external disturbance (Wang et al., 2010). The theory of adaptability has a clear view on the subjects, which considers the features of the adaptive subjects and the dynamics and scope of their adaptation (Niehof, 2004). With regard to adaptability, both theories identify the same elements, i.e., the features, processes, and results of adaptation (Engle, 2010; Smit & Wandel, 2006). Based on the theory of adaptability, the theory of resilience not only takes into consideration the capacity of the system to cope with disturbance but also gives consideration to the difference between incremental regulation and mode conversion (Below et al., 2012).

Here, adaptability refers to that, to adapt to the impact brought by tourism development, rural households adjust the use of land, labor and other resources to maintain the current or achieve better living conditions. The core issue is to adjust and use resources and their inherent capability to adapt to the environment.

3. Methodology and Data

3.1 The Cases

Cuandixia and Huanglingxi are two adjacent villages located in the western suburbs of Beijing. Both of them were formed in the Ming Dynasty, and they are typical representatives of settlements in the northern mountainous areas of China. These two traditional villages belong to the Cuanbai Scenic Area.

Cuandixia has a population of 98. Tourism started in the early 1990s, and nearly all of the current villagers are engaged in tourism. Huanglingxi has a population of 180. Tourism development started in 2010, and one-third of current villagers are occupied in tourism. The preservation of the overall architectural style is slightly better, while tourism is relatively less developed in Huanglingxi compared to Cuandixia.

As a rural tourism destination in Beijing, Cuandixia has received numerous tourists. The volume of tourists brings intense disturbance, for example, parking problems. The village has widened the main street and built two large parking lots at the foot of the mountain. The car park on the south side of the main street occupies the space that was originally used for farming, which is approximately one-tenth of the total area of the village. Moreover, other problems such as on-street parking and catering constantly emerge.

3.2 Data Collection and Methods

Background data were obtained from the official tourism website and the local tourism management departments’ website. Primary data were collected through questionnaire surveys and recorded interviews through an on-site investigation during the May Day Holiday in 2015.

According to the development level of tourism reception and the population levels of the two villages, we first surveyed the host families in Cuandixia and assigned equal numbers of host and non-host families in Huanglingxi. Each household was counted as one valid sample. Forty-seven valid samples were obtained from Cuandixia, all of which were households involved in tourism; forty-eight valid samples were obtained from Huanglingxi, including eighteen households involved in tourism and thirty non-involved households. The contents of the survey mainly included demographic information, social capital, agricultural production, tourism business-running, the opinion towards tourism development, and cognition of policies etc. In-depth interviews were conducted with village cadres to understand the tolerance and adaptability of households to rural tourism. The time span of the interview and survey for each person was 30 minutes at minimum.

The survey results were analyzed to identify the phase characteristics and typical approaches of adaption of rural households in the two villages at different stages of tourism development. Next, an influencing factor and indicator system of functionality was established by referring to the existing research (Below et al., 2012). We then use grey relational analysis to indicate the influencing factors of system stability.
Eighteen influencing factors from seven categories were considered, all of which meet the first three Gauss-Markov assumptions. Stepwise regression was applied to further select the variables, using the last two Gauss-Markov assumptions as criteria. In brief, the dependent variables were regressed against each explanatory variable; then, the explanatory variable with the greatest contribution was chosen, and the other explanatory variables were gradually introduced. Through stepwise regression, only the important explanatory variables that had no significant multicollinearity were retained in the model.

All data were normalized before regression. Therefore, the constant was excluded from the estimates, and the regression coefficient of each factor could be regarded as the level of impact. Given that five Gauss-Markov assumptions were taken into consideration for the model estimation, the estimation ability of the model was not affected by data normalization.

4. Level and Process of Adaptation of Rural Households to Tourism Disturbance

4.1 Comparison of the States Before and After Adapting to Tourism Disturbance

The original work of villagers in Cuandixia was farming, and it was mainly conducted in terraced fields and farmland near the village. Now it has transformed into the solicitation of customers on the main street, in addition to the preparation of meals, the reception of tourists, and the sale of agricultural products grown in their own courtyard. There exists intense competition between the villagers. Meanwhile, their activities are mostly limited to the main street and the courtyards, thereby reducing the likelihood of conversation at the edge of a field in the past.

Huanglingxi was previously one of the major coal-producing villages, thus coal mining used to be the leading industry. In addition to developing ecological agriculture and tourism, the village continues to integrate the primary and tertiary industries now. However, the on-site investigation reveals that a large population of villagers in Huanglingxi do not work in the village but are migrant workers in nearby cities. The remaining adults cannot leave the village due to the need to care for children or elder people. Therefore, these villagers "have to stay here" for tourism or other work.

4.2 Comparison of Different Phases of Adaption to Tourism Disturbance

In Cuandixia, 92.7% of rural households are currently engaged in tourism. In Huanglingxi, the current structure of livelihood is more balanced, with 38.4% of rural households engaged in tourism, 24.9% being migrant workers, and 34.8% engaged in sheep raising, beekeeping and business; the remainders live from rental income.

We compare the samples from the two villages in terms of mean household income, living conditions, the population engaged in tourism and the types of tourism services (Fig.2.). The results show that in terms of tourism services, 33.3% of the host families in Huanglingxi only provide accommodations, whereas the remaining households have only one more service, which is catering; in Cuandixia, all host families offer accommodations and catering, whereas 17% of them also provide transport services, souvenirs, exhibition visiting guide, and agricultural products, among various other services. The income of rural households is remarkably different between the two villages. Households in Cuandixia earn a substantially higher income. Meanwhile, family size is larger in Cuandixia since more villagers are migrant workers in Huanglingxi. Moreover, the villagers of Huanglingxi are less satisfied with the quality of life, the living environment, and tourism-related income. Nonetheless, they are more satisfied with the neighborhood.

4.3 Typical Adaptive Patterns to Tourism Disturbance

The choice of adaption approaches is influenced by the individuals, the community system, available resources, socio-cultural background within the village, and the neighborhood.

The basic choice that rural households need to make is the main source of income, which includes tourism services, wages, and the government subsidies. Four types of adaption by rural households are summarized by combining the above choices. The four types are: (1) exclusive tourism – rural households have been exclusively engaged in tourism for years; (2) primarily tourism – rural households are also engaged in other work in addition to tourism, the income from tourism
accounts for 60% of total household income or more; (3) partly tourism – the income from tourism accounts for 30-60% of the total household income; and (4) primarily other work – rural households rely on other sources of income, either without involvement in tourism operation or the income from tourism accounts for 30% or less of the total family income. The types of adaptation are compared in the two villages. The outcomes of the four types are illustrated in Fig.3. Points in the upper right-hand corner indicate the optimal choice that maximizes both annual family income and the diversity of livelihood simultaneously. The 'primary tourism' type is close to the optimal situation, while for the 'partly tourism' type, it is difficult to achieve the optimal level.

4.4 Process of Adaption to Tourism Disturbance

The environmental homeostasis and the development of rural households have changed after tourism development. The initial imbalance is mainly manifested by the occupation of ecological resources by tourism and the vanishing of traditional agricultural lifestyle. In various respects, the life satisfaction of rural households has declined. The basic needs of rural households remain unmet, prompting them to change and adapt. Moreover, different rural households are subject to various driving factors of adaptability, resulting in the differentiation of adaptability. This result, in turn, affects the SES to varying degrees.

For instance, all of the households in Cuandixia are exclusively engaged in agritainment, leading to traffic congestion and challenged by limited land and water resources. Available natural resources for rural households are reduced, and various crops are no longer planted. Approximately fifty households have added floors or renovated and covered the courtyard for more reception capacity. The newly added parts of houses take different architectural styles and materials compared to the original buildings, thereby destroying the landscape and the identity of the village.

Prior to tourism development, most villagers in Huanglingxi worked nearby in coal mining, which guaranteed their income. When the coal mines were closed, a large number of villagers lost their livelihood and thus migrated to work in urban areas. The remaining residents are unwilling but have to stay to take care of family members or for other reasons. These villagers have no option but to operate tourism.

5. Influencing Factors of Adaptability

5.1 Influencing Factors of System Functionality

(1) Annual Family Income as the Proxy Variable of System Functionality

Stepwise regression is performed using a 95% confidence interval (the same applies below), and the results are as follows. Four variables are introduced: M1, indicating the amount of family asset, G2, indicating village factor, L1, indicating the total labor (family members working in tourism and employees), and L5, indicating the number of employees. The equation is expressed as

\[ Y_1 = 0.399M1 + 0.283G2 + 0.262L1 + 0.209L5 \]

All of the significance values are smaller than 0.03, indicating that the validity of the equation is good and up to 97%. The regression equation has \( R = 0.791 \) and adjusted \( R^2 = 0.601 \), indicating that it can explain 60.1% of the system functionality. The result falls within an acceptable range. The collinearity diagnosis shows that the four variables have low linearity, with the eigenvalues being approximately 1. The maximum condition index value is 1.978, which is much smaller than 10, suggesting that the equation has no significant multicollinearity. In summary, the model is acceptable, and all four factors introduced have a positive impact.

L1 and L5 are both labor factors. The sum of their impacts is greater than that of the material resources factor represented by M1. The relationship between the impact of various factors is labor factor > material resources > geographic location, which is explained below.

Labor factor: The number of labors shows a highly positive correlation with the family income. The family size has a slightly stronger impact than the number of employees.

Material resources: Compared to other material resources, the operating area in tourism development is retained in the model and obtains an impact of 0.399. Thus, this factor is an important material resource of rural households, since it represents the scale of operation and the maximum number of tourists that can be accommodated.

Village factor: The village is an important indicator of geographical location. Different villages may have remarkably different resources and conditions, in addition to different phases and patterns of tourism development. In the proposed model, the village factor is set as Cuandixia = 1 and Huanglingxi = 0. The regression coefficient is positive, indicating that the rural households of Cuandixia have better adaptability to tourism and stronger system functionality.

Drivers of adaptability that are not retained include: economic resources (E), natural capital (N), social
capital (S), and cognition factor (R). As stated below, these factors are more relevant to the tourism operating income of rural households.

(2) Tourism Income as the Proxy Variable of System Functionality

The following variables are introduced: M1 – the amount of family asset, G2 – village factor, E1 – the number of available acquainted lenders, L5 – number of employees, R1 – the evaluation of tourism development opportunities, and L6 – training or not. The equation is expressed as

$$ Y_2 = 0.498M1 + 0.304G2 - 0.246E1 + 0.212L5 + 0.239R1 + 0.176L6 $$

All of the significance values are smaller than 0.024, suggesting that the validity of the equation is good and up to 97.6%. The regression equation has $R = 0.892$ and adjusted $R^2 = 0.775$. Thus, the equation can explain 77.5% of the system functionality and has good explanatory power. The equation has very slight and negligible collinearity. Therefore, the model is acceptable.

The relationship between the impact of various factors is material resources > labor factor > geographic location > economic resources > cognition factor, which is explained below.

Labor, material resources and geographic location are the three most important factors that determine the family income and the tourism income. With respect to tourism income, the impact of labor is reduced, whereas material resources surpass the labor factor and become the most significant influencing factor.

Capital availability is chosen as the proxy variable of economic resources. The regression result shows that this factor has a negative impact, which can be related to the system error of statistical analysis. The reason is, in the on-site investigation, many households responded to the question based on an impression. 29.2% of households stated that "I have no need to borrow money from acquaintances" or "I have no idea how many acquaintances I have that will loan me money". We consider the households that have no need to borrow as that they use their own capital to raise the funds for tourism operation and business expansion.

Regarding the cognition factor, the evaluation of tourism development opportunities is chosen as a proxy variable. The implication is that rural households, as the subjects of activities with subjective initiative and rational behavior, can effectively recognize the opportunities and risks of tourism development.

Among the labor drivers, the newly added proxy variable is L6 – training or not. This variable indicates that, although the number of labors can greatly affect total family income, the quality of labor can affect the income from tourism operation to a higher degree.

5.2 Influencing Factors of System Stability

We choose livelihood diversity as a proxy variable of system stability and introduce the measure of income volatility. The purpose is not only to indicate system stability by livelihood types but also to measure the income fluctuation of rural households over a relatively long period of time (one year).

Livelihood diversity is measured as the number of types of livelihood activities undertaken by each family. The time engaged in a livelihood activity should be no less than thirty hours per month and no less than two months per year (Du et al., 2012). Therefore, we assign value 1 to households engaged in one livelihood activity value 2 to households engaged in two livelihood activities, and so on.

The income volatility of rural households is measured as follows: the monthly income of each household is calculated for 12 months a year to obtain the level of income fluctuation. The results are processed by grey relational degree before being used as the indicator to measure income volatility.

The relational degrees of various factors with livelihood diversity and income volatility have a correlation coefficient of 0.815. This result indicates that these two factors have a strong correlation with each other and that the indicator of income volatility can be used as a reference. The relational degrees of various factors are shown in Table 1. The relational coefficients are all above 0.54, and the maximum value is 0.89.

According to existing research, we treat the factors with a relational degree greater than 0.75 as key variables. The impact of various variables is then analyzed.

(1) Labor

Among the six factors, four relevant variables are selected: L1, L3, L4, and L6, which indicates that the quantity, structure, and quality of labor have a great impact on system stability. In terms of relational degree, L4 ranks 1st and 9th and L3 ranks 2nd and 5th in livelihood diversity and income volatility, respectively; L1 ranks 7th and 8th; and L6 ranks 11th and 7th.

The survey shows that villagers concurrently engaged in tourism and migrant work and those relying on wages and government subsidies are mostly from Huanglingxi. There are mainly two kinds of situations. For middle-aged couples, men are mostly concurrently engaged in tourism and migrant work, while the spouse assists with tourism operation and child care. In a few cases, the man is only engaged in tourism in the busy season and engaged in migrant work or relies on the government subsidies in the off season. For old couples, they mostly cooperate in operating tourism and also receives retirement pension or the government subsidies, with their children being migrant workers.

Total labor is a major factor that affects system functionality and stability simultaneously. Thus, the amount of labor is fundamental for guaranteeing sound system functions, addressing tourism disturbance and maintaining system stability. This factor is also a key impact factor for the adaptability of rural households.
Training or not can also affect system functionality and stability simultaneously. The survey reveals that trained labor can choose migrant work during the tourism off-season and thus enhance system stability.

(2) Material Resources

The relational degrees of M1 rank 6th and 3rd. The larger the family asset is, the more likely the family is to run tourism exclusively or primarily. In other words, rural households who have large family asset tend not to choose other means of livelihood. Moreover, the choice is inevitably influenced by seasonal fluctuations in the tourism industry.

(3) Social Capital

The relational degrees of S1 rank 3rd and 4th, whereas those of S3 rank 15th and 18th. The investigation shows that rural households with a higher proportion of family members as cadres in the village/town have a relatively high quality of family culture and more advanced operating philosophy. However, there is only one cadre at the village/town level in each of the four households from Cuandixia and in each of the three households from Huanglingxi. Owing to the small sample size, there may be a large error in the impact of S1 on system stability.

With regard to the promotion and utilization of network media, many rural households have recognized its importance. In Cuandixia, for example, most households have registered on an agritainment union website (http://www.njllm.com) and have posted the operating information and real pictures online. Although the website shows a large page view number, online registration charges a fee, thus no households in Huanglingxi has registered. After some households registered on a review website (http://www.dianping.com/), turnover suddenly increased. However, the majority of rural households in Huanglingxi do not know how to use this network platform. Therefore, we believe that the impact of S3 may have been underestimated in this investigation.

(4) Cognition

The relational degrees of R2 rank 5th and 12th. However, both of these values are relatively high. This result indicates that rural households that are optimistic about the prospect of tourism development and a higher cognition of relevant policies will be more proactive in tourism operation and thereby improve the livelihood diversity. However, the survey reveals a significant polarization in the cognition of national and local policies. Middle-aged couples exclusively engaged in tourism typically do not understand and are not optimistic about the policies. Although middle-aged to old couples do not understand the policies, they are highly optimistic and supportive. Many of them stated “thanks to the country” and “thanks to the government”. Because many people in middle-aged to old-aged couples have pensions or the government subsidies, their income is more stable.

Table 1. Relational Degree of Various Factors with Livelihood Diversity and Income Volatility

| Variable | Relational degree with livelihood diversity | Ranking | Relational degree with income volatility | Ranking |
|----------|------------------------------------------|---------|------------------------------------------|---------|
| L1 Total labor | 0.822779 | 7 | 0.879219 | 8 |
| L2 Number of tourism operations | 0.735879 | 19 | 0.790019 | 16 |
| L3 Number of villagers relying on wages and government subsidies | 0.879279 | 2 | 0.904136 | 5 |
| L4 Number of villagers concurrently engaged in tourism and migrant work | 0.85058 | 1 | 0.862633 | 9 |
| L5 Number of employees | 0.740985 | 17 | 0.854723 | 10 |
| L6 Training or not | 0.793378 | 11 | 0.894175 | 7 |
| E1 Number of available acquainted lenders | 0.785652 | 12 | 0.784610 | 17 |
| E2 Time of operation | 0.571678 | 23 | 0.545151 | 23 |
| N1 Arable land area | 0.838297 | 4 | 0.899584 | 6 |
| M1 Amount of family asset | 0.824476 | 6 | 0.924029 | 3 |
| M2 House renovation time | 0.716756 | 21 | 0.729552 | 20 |
| S1 Number of cadres in the village/town | 0.862118 | 3 | 0.908939 | 4 |
| S2 Internet promotions | 0.646871 | 22 | 0.612663 | 22 |
| S3 Promotion and utilization of network media | 0.764471 | 15 | 0.765384 | 18 |
| R1 Tourism development opportunities | 0.747403 | 18 | 0.763611 | 19 |
| R2 Policy usefulness | 0.824750 | 5 | 0.833058 | 12 |
| G1 Accessibility | 0.720056 | 20 | 0.824758 | 13 |
| G2 Village factor | 0.818351 | 8 | 0.941193 | 2 |
| Y1 Annual family income | 0.804153 | 10 | 0.947666 | 1 |
| Y2 Annual tourism income | 0.750163 | 16 | 0.795347 | 15 |
| Y3 Satisfaction with quality of life | 0.769437 | 13 | 0.819621 | 14 |
| Y4 Satisfaction with environment | 0.765952 | 14 | 0.847297 | 11 |
| Y5 Satisfaction with income | 0.814738 | 9 | 0.706962 | 21 |
(5) Geographic Location
The relational degrees of G2 rank 8th and 2nd, with a large gap in between. Despite the higher level of tourism development in Cuandixia, a higher proportion of villagers are exclusively engaged in tourism, and the operation is strongly homogenized. These phenomena lead to greater income volatility and result in lower system stability in Cuandixia.

(6) Economic Resources
The relational degrees of E1 rank 12th and 17th. As noted above, many households do not care about the number of available acquainted lenders. Thus, the explanatory power of E1 is poor.

(7) Natural Capital
Although the relational degrees of N1 rank 4th and 6th, the on-site investigation shows that many households do not value how much land they own. Large areas of land are currently abandoned and unmanaged. Rural households give no consideration to transferring the contractual operation right of the land. The reason is that the water for irrigation is inadequate in Beijing. Meanwhile, rural households often choose migrant work or tourism for a higher payment, holding that the economic return of planting crops is too small.

6. Conclusions
This study discusses the capacity, the approaches and processes of adaption in the SES with the case of traditional villages’ coping with the disturbance of tourism. The following conclusions are drawn.

The village factor has a great impact on the rural SES. The government needs to pay close attention to this factor and regulate it properly. Despite the close proximity of Cuandixia and Huanglingxi in the Cuanbai Scenic Area, the two villages are in completely different development phases of tourism. The development of tourism is relatively lagging behind in Huanglingxi, and many villagers indicate that the government shows "partiality" to certain villages. In the underdeveloped village, villagers are unable to enjoy the improvement of life brought by tourism development, and many of them are forced to migrate for work or rely on the government subsidies.

The labor and material resources factors are important variables that determine the adaptability of rural households to tourism. The amount (i.e., total labor) and quality (i.e., labor training or not) of labor, in addition to the amount of material resources (i.e., operating area), greatly impact system functionality and stability. Economic resources have less impact on the adaptive behavior of rural households, given that most villagers use their own cash for turnover, without borrowing.

Among rural households’ basic choices for livelihood, the conflict between work and tourism operation needs to be balanced and coordinated. The quality and structure of the two means of livelihood also need to be optimized and improved. In Cuandixia, although tourism operation has created a higher level of income and improved system functionality, its excessive homogenization has also brought greater income volatility and reduced system stability. In Huanglingxi, the large numbers of villagers dependent on wages and government subsidies and those concurrently engaged in tourism and migrant work are advantageous for improving system stability; however, they are disadvantaged for improving system functionality.

Tourism as a disturbance can facilitate the system in reaching a new homeostasis that is not necessarily desirable. Only the collaborative development of various types of operation can promote the healthy development of the system. The development of tourism contributes to the income improvement of rural households and the occurrence of their adaptive behavior. Meanwhile, the situation leads to a gradual dominance of tourism in the villages, resulting in challenges to the limited infrastructure resources and seriously homogenized landscape. Moreover, it increases the mutual competition between rural households, which is unfavorable for the long-term development of the village. Therefore, the development of various types of operation should be encouraged to improve system functionality and stability and which could ultimately protect and vitalize the traditional villages.

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