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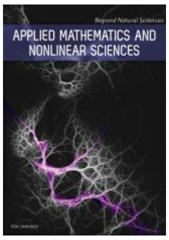

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Research on Rural Ecological Landscape Optimization and Traditional Style Preservation Design Based on Spatial Gene Inheritance Technology

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Abstract

In this paper, after clarifying the key concepts of spatial form genes and GIS, the overall form of rural settlements is analyzed by using spatial gene inheritance technology. The most important spatial genes are identified, and these genes are inherited in the design to preserve the traditional characteristics and cultural charm of the countryside. The effectiveness of the application of the spatial gene inheritance technique is evaluated by using various methods such as field surveys, qualitative research, inductive deduction, and combining with specific rural cases. After the optimization of the ecological landscape, the ecological landscape service value of L countryside increased significantly, including food production increased by 32.90% compared with that before optimization. The sensitivity of the optimized ecological landscape was also calculated to be reduced to 0.074~0.86. In addition, in terms of ecological landscape genetic inheritance, the overall score of the spatial elements of the optimized ecological landscape was the highest in the L countryside. The results of the questionnaire survey showed that the residents were highly satisfied with the effect of this paper's method on the preservation of traditional features in the ecological landscape of the countryside.

Keywords: Spatial genetics; Geographic information system; Field survey method; Rural ecological landscape.
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1 Introduction

With the acceleration of urbanization, the development and protection of the countryside have become one of the focuses of social concern. The countryside, as a place rich in Bai Ran resources and a beautiful environment, is also an ideal place for people's leisure and vacation in the protection of natural ecology. Rural ecological landscape is an important part of rural development, rural revitalization, ecological protection, and ecological restoration, and also an important part of people's living environment and leisure experience [1-3].

Rural ecological landscape refers to the natural and humanistic landscape of rural areas, which includes many aspects such as idyllic scenery, natural landscape, village architecture, rural culture, and so on [4-5]. Compared with the urban landscape, it is closer to nature, simple, and has a unique flavor. The rural ecological landscape has multiple values. First of all, the ecological value cannot be ignored. The farmland, woodland, and waters in the countryside constitute important ecosystems, provide habitats for biodiversity, regulate the climate and water resources, and maintain the fertility and stability of the soil [6-7]. Secondly, the rural ecological landscape contains a rich cultural value. Ancient villages, traditional architecture, folk activities, etc., are the carriers of rural culture, witnessing historical changes and human wisdom [8-9]. In addition, the rural ecological landscape has aesthetic value, and its peaceful rural scenery and beautiful natural scenery can bring people physical and mental pleasure and relaxation. In addition, the rural ecological landscape also has economic value and environmental value, such as the development of rural tourism can drive the growth of the local economy and promote farmers' income [10-13].

However, at present, the rural ecological landscape is facing multiple threats. First, with the acceleration of urbanization, cities are expanding outward, a large amount of rural land has been expropriated, and the rural ecological landscape has been damaged; the construction mode and lifestyle of the city have gradually penetrated the countryside, resulting in the loss of rural characteristics [14]. Secondly, in order to pursue short-term economic interests, some places carry out excessive development, such as large-scale mountain quarrying, enclosure of lakes to create fields, etc., which destroys the natural ecological environment of the countryside; at the same time, irrational tourism development may also have a negative impact on the rural ecological landscape, such as environmental pollution and ecological damage caused by too many tourists [15-16]. Thirdly, a large number of the rural population flows to the city, resulting in a shortage of rural labor. Many farmlands are deserted, and the phenomenon of villages hollowing out is serious; at the same time, most of those who stay in the countryside are old people who lack the consciousness and ability to protect the rural ecological landscapes. Fourthly, the impact of modern culture has led to the gradual decline of traditional culture in the countryside. Many traditional skills and folk activities have not been inherited. Traditional buildings have been repaired for a long time, which makes the cultural connotations of the rural ecological landscape gradually tarnished and influences the countryside's appearance and the inheritance of vernacular culture [17].

The study interprets spatial morphogenetics, rural ecological landscape, landscape ecology, and geographic information systems with a view to revealing the effectiveness of spatial gene inheritance technology in the optimization of rural ecological landscapes and the preservation of traditional features. The study used the literature research method to determine the evolution and development of the countryside in a certain region, combined with field surveys and other methods to collect and quantitatively analyze the rural ecological landscape data. The spatial gene inheritance technique was used to identify the topographic genes of the countryside, and geographic information technology was used to extract the key potentials and main axes of the countryside so that the research on ecological landscape optimization and traditional landscape preservation was carried out in the countryside of County A of a certain region as a case study.

2 Defining the research base

2.1 Spatial morphology genes

The spatial morphogenetic [18] is multidisciplinary and has been studied in geography, architecture, urban planning, economics, and other disciplines. The "spatial pattern gene" exists either in the material constituent elements or in the influencing elements of the elements. Combined with the expression process of biological genes, the composition of traditional rural spatial morphology genes can be divided into the following constituent structures:

1) Essential elements, i.e., basic units in space. Similar to the nucleotides composed of phosphate, base, and ribose.

2) Laws of formation of combinations of basic elements of space forms. This is similar to the different arrangement and combination laws of nucleotide molecules of organisms.

To synthesize the above analysis, this paper defines the spatial morphology gene as influenced by the natural environment, production and life, technical conditions, and other comprehensive elements. With certain self-organizing behavior, it is a kind of spatial element organization pattern and spatial unit with heredity, stability, and representativeness, which contains all the genetic information of various spatial morphology features such as landscape pattern, street space, courtyard space, and so on.

2.2 Rural ecological landscape

A rural ecological landscape [19] is a landscape type with unique landscape characteristics, forms, connotations, and evolutionary processes, which involves the industrialization process of resource protection, development, and utilization. Landscape ecology explores how to better protect and utilize rural landscapes from the perspective of aesthetics and explores and analyzes the aesthetic value and significance of rural landscapes. Rural Tourism emphasizes the influence and role of the rural ecological landscape on the development of rural tourism and explores the development and utilization of rural tourism resources. Different disciplines define the concept of rural ecological landscape with different focuses on different aspects and explore the rural ecological landscape from different perspectives such as nature, society, ecology, planning, and culture, etc., which illustrates that rural ecological landscape is a multi-dimensional concept that needs to be researched and managed by comprehensively taking into account various factors.

2.3 Landscape ecology

Landscape ecology [20] is a comprehensive discipline based on the theories of geography, ecology, economics, and other disciplines to conduct systematic and in-depth research on the evolution, function, structure, and management of natural and human landscapes. The goal of landscape ecology is to understand the dynamic processes of biological communities and species diversity in landscapes, as well as the effects of human activities on landscape patterns and ecosystem functions. Nowadays, the theory of landscape ecology is widely used in many fields, such as nature conservation, water resource management, and ecological risk assessment. In this study, the theory of landscape ecology is used to conduct scientific research on the optimization of rural ecological landscapes and the preservation of traditional features so as to better guide the application of the research results in landscape planning and design.

2.4 Geographic Information Systems

Geographic Information System (GIS) [21], as a powerful spatial information system, can collect any location or object with geographic information within the study area into a usable data resource and then manage and analyze the resulting data using the powerful analytical capabilities of GIS technology. As a rapidly developing information processing system, GIS has the following functions:

1) Data acquisition

   Data acquisition in the geographic information system is usually a different format of data in accordance with uniform specifications into data that can be directly operated. From the current point of view, most of the data used in the geographic information system by other collaborative software is directly imported or manual input methods to obtain geographic information system data.

2) Data management

   As one of the most important functions of the geographic information system, the geographic information system data types used are roughly divided into vector data and raster data and can rely on conversion tools to convert the two formats to each other. Data management in GIS focuses on data classification, editing, integration, and conversion and ultimately generates a mesh structure of the database with strong logic.

3) Spatial analysis and statistics

   Another key function of GIS is spatial analysis and statistics. In all kinds of analysis planning and practice management, this function for the popularization and application of geographic information system technology has an indispensable role because it can not only analyze and show the connection between the geographic elements but also the data can be counted up to more perfect management, and finally provide users with a basis for decision-making.

4) Data output

   Geographic information system output modes in accordance with different file formats have different types. Forms, maps, statistical reports, and other file output modes are usually used as vector format file output. For raster files, grid format output is more effective. In addition, the user can layer the data images according to individual requirements before printing them out.

3 Research methodology and data sources

3.1 Research methodology

3.1.1 Literature research method

By collecting relevant literature, it is possible to build on the current status and dynamics of genetic research on traditional villages and natural landscapes, thus laying the foundation for the study of genetic mapping of regional landscapes. The research basis of this paper is to identify the evolutionary development of traditional villages in a region through record analysis and to find the common elements of villages.

3.1.2 Field Survey Method

Relevant information and data are obtained through field research, interviews, filming, and visits to relevant administrative departments as the core component of this study. Aiming at some problems in the traditional rural environment, this study conducts interviews in the form of rural villagers, administrators, and experts in related fields. Through face-to-face conversations, the actual needs of local villagers in rural development, landscape genes, traditional customs, and their functions and meanings are obtained. The developmental evolution, spatial layout, and architectural structure of traditional villages are analyzed and recorded to establish a resource bank of interviews with different interviewees on their perceptions of traditional rural environments at different levels, which serves as a database for quantitative analysis.

3.1.3 Qualitative Research Methods

Since it is difficult to quantitatively analyze the optimization of rural ecological landscapes and the preservation of traditional landscapes, this study is based on qualitative research methods, combining the basic methods of geography, sociology field surveys, and architectural building mapping architecture. A field study of 10 traditional villages in a region was conducted, taking into account the primary and secondary characteristics of the landscape, and 5 traditional villages with significant landscape genetic features were selected for focused investigation. Relevant theoretical methods of qualitative research were applied in the analysis of overall landscape characteristics at the macro level, the identification and mapping of landscape genes at the meso level, and the protection and inheritance study of villages at the micro level.

3.1.4 Inductive Deduction

At the macro level, when analyzing the overall characteristics of the current situation of traditional rural landscapes, this study combines basic data with the basic mathematical and statistical methods of statistics and GIS spatial analysis methods. The mathematical language of GIS and SPSS and the graphical language of geometric parameter simulation, such as Grasshopper and Depthmap, are used to assist the qualitative research, which is the data basis for the mining and analysis of the genetic characteristics of the traditional rural ecological landscape in a certain region.

3.2 Research Sample and Data

This study conducts three levels of research: macro, meso, and micro. Macro is the overall spatial form and structural characteristics of traditional villages. Meso is the street space, road network structure, and open space. Micro is the landscape nodes and detailed features. In this study, traditional villages in a certain area are selected for the study of protection and inheritance, mainly based on landscape genes.

From the distribution characteristics, the region is distributed in the area around the Yellow River basin, mainly concentrated in counties A, B, and C. The terrain is mainly the Yellow River impact plain, with the terrain high in the southwest and low in the northeast. No traditional villages in other counties have been selected as national or provincial traditional villages, and they are the missing areas of the traditional rural landscape in a certain region so that no in-depth study will be done. This study uses two winter and summer vacations to carry out detailed research on 10 traditional villages in a certain region, adopting the forms of collection, interview, photography and other forms of documentation, field exploration, data collection, etc., to provide a basis for related research.

4 Research on ecological landscape optimization and landscape preservation under spatial genetics

4.1 Research ideas

Using the relevant technical methods of computer information science to research the abstract expression and modeling of rural spatial form camping genes, and on this basis to develop intelligent excavation algorithms and establish a technical system of traditional rural spatial form gene mining technology. The research route is shown in Figure 1.

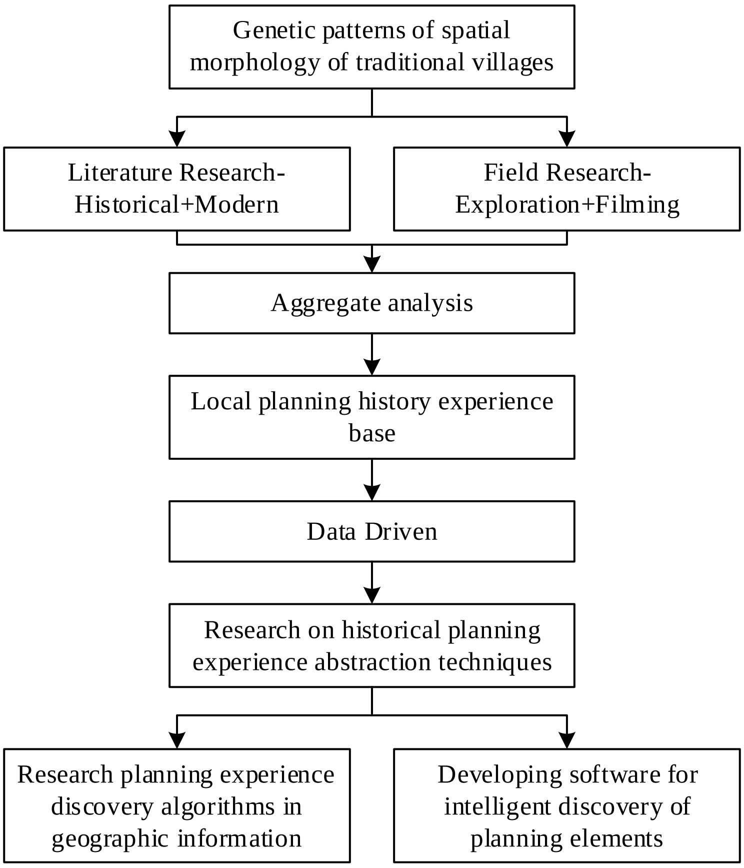

Figure 1. Study path diagram

4.2 Rural conservation and inheritance based on the database of basic information

Aiming at the problems of discovery, identification, extraction, and application of traditional rural spatial morphological genes, geographic information science and artificial intelligence technology were introduced. The "digital excavation and modeling expression" of a large number of traditional rural landform features, mountain-shaped water systems, spatial forms, rural skeletons, and other site selection and construction genes were carried out, and the "digital and scientific" mining technology of key genes was studied.

Among them, about 300 case villages were investigated, collected, and organized, and their spatial morphology genes were investigated and categorized. Using a new generation of big data and artificial intelligence technology, we have carried out simulation development and experimental testing of digital gene mining algorithms for a large number of traditional villages in terms of site selection, spatial layout, key points, and construction skeleton, etc., and laid the technical foundation for the intelligent discovery of spatial morphology genes and inheritance application. From the macroscopic level, it reveals the intrinsic connection and law between the characteristics of each element in the construction of traditional villages and constructs a gene recognition model.

4.3 Identification of Traditional Rural Ecological Landscape Genes

The step-by-step process of categorizing and recognizing the morphology of the settlement site is shown in Figure 2. Two major models realize this technique:

1) 91 satellite maps were used to download remote sensing images $R=\{R_1,R_2,\ldots,R_i\}$ and digital elevation models $D=\{D_1,D_2,\ldots,D_i\}$ of traditional villages, and the site morphological types of villages and their surrounding mountains, water systems, vegetation, farmlands, wastelands, and settlements were manually labeled, and a "settlement site element classification database" composed of remote sensing images R, elevation model D, and environmental feature classification and marker map G was constructed, and a "settlement site morphology classification database" composed of environmental object classification marker pattern G and settlement site morphology category label L was constructed.

2) Construct a topographic element recognition model (VOSM for short) based on semantic segmentation, and train the VOSM model by using the “classification library of feature elements of a colony” constructed in step (1).

3) Construct a meta-learning-based settlement pattern recognition model (VPRM for short).

4) Train the VPRM model by utilizing the “cluster site morphology classification library” constructed in step (1).

5) Call the trained VOSM, input remote sensing images and DEM data of the countryside to be identified, extract the environmental feature distribution map of the settlement, and input it into the VPRM to identify the site morphology category of the settlement.

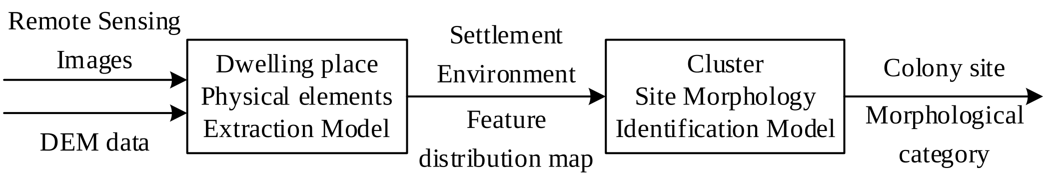

Figure 2. Classification and identification of settlement grounds

4.4 Extraction of key potentials in the countryside

The following steps realize this technique:

1) Collecting remote sensing images and elevation DEM data of traditional villages to establish a case library.

2) Extract the boundary mask of the settlement from the remote sensing image of the countryside, and if the remote sensing image contains water systems such as rivers and lakes, extract the boundary mask of the water system at the same time.

3) Calculate the geometric center of the colony based on the boundary mask of the colony.

4) Mapping the coordinates of the center of the colony to the DEM data as the starting point for geographical investigation, calculating the path length from it to each grid point of the DEM, and forming a distance matrix.

5) Calculate the slope factor on the DEM data to obtain the slope matrix. Set the walking benchmark speed, take the slope as the adjustment factor affecting the traveling speed, and measure the traveling speed matrix of each point according to the slope matrix.

6) Divide the distance matrix with the speed matrix to obtain the walking duration matrix from the center of the colony to each grid point of the DEM.

7) Set the traveling time threshold t0, compare the relationship between the element values in the walking time matrix and the threshold t0, and generate the walking reachable domain.

8) Measure the view domain of each point in the reachable domain, establish the view domain labeling matrix, and form the view domain set of each point.

9) Count the size of the view domains of each point and rank them in descending order. Select the top-ranked ones to form the collection of the points of access to the colony.

10) Stack and sum the elements of the matrix of all points in the reachable domain and rank the elements of the matrix in descending order. Select the top-ranked ones to form a collection of viewpoints of the colony.

4.5 Rural spine skeleton extraction

The functional composition of the rural spindle skeleton extraction technology is specifically shown in Figure 3.

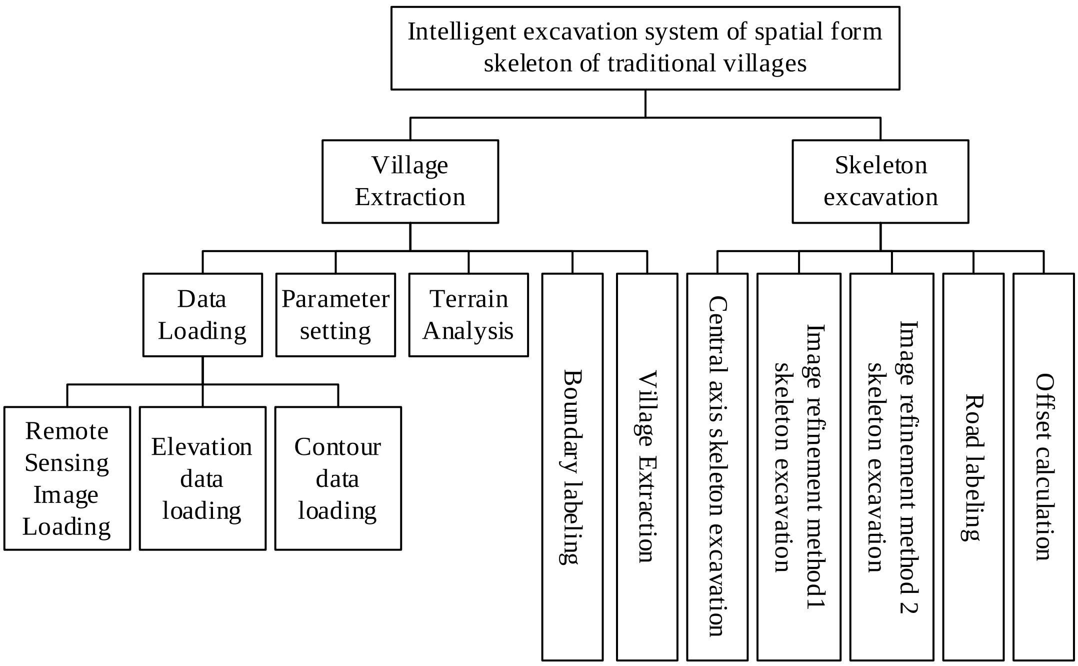

Figure 3. The functional composition of the resulting skeleton extraction system

The following steps realize this technique:

1) Collecting remote sensing images and digital elevation DEM data of the countryside to be analyzed.

2) Marking countryside boundaries and landscape area boundaries in the remote sensing images of the countryside, performing countryside and landscape area boundary extraction, and generating their mask images.

3) According to the countryside to be analyzed, the user is allowed to adjust the operating parameters of the system.

4) Utilizing three countryside spindle skeleton excavation algorithms to carry out skeleton excavation and obtain countryside skeleton lines.

5) Mark the constructed roads in the remote sensing image of the countryside.

6) Perform offset measurement between the extracted camping skeleton and the constructed roads to obtain the countryside skeleton offset.

5 Example analysis of the effects of ecological landscape optimization and traditional landscape preservation

5.1 Comparison of ecological service values after optimization

L village belongs to a certain area, A county, located on the border of X province and Y province, about 60 kilometers away from the urban area. The permanent population of the village is about 1,000 people. More than 600 years ago, L village had a unique ancient village ecosystem. The village is surrounded by water on all sides, poldered fields, and the east-west streets and lanes are extended to the water. Villagers live in water, with a beautiful ecological environment. L village has a spatial distribution pattern of groups, with the central part being the main part of the village, and the surrounding groups expanded after the 1970s due to population growth. The center of the village is the main part of the village, and the surrounding clusters expanded after the 1970s due to population growth the village is surrounded by dike fields, which become the unique natural background of the village. In order to have a clearer understanding of the spatial pattern of the village, the study area is about 50 hectares, and the study area mainly consists of the built-up area of the village, the peripheral ponds, and the dikes such as Chenjia dike, Qiaonan dike, Beitou dike, and Dongmen dike.

Based on the above field study of L village in a certain area and the identification of ecological landscape genes, the ecological landscape land use type of L village was optimized and constructed. Based on the reconstructed land use type, the ecological service value generated by the ecological landscape of L countryside is evaluated. The types of ecological service values included are food production, waste treatment, climate regulation, gas regulation, biodiversity conservation, soil formation and protection, recreation and culture, raw materials, and water conservation.

The results of the comparison of values before and after the optimization of ecological service values are shown in Figure 4. As can be seen from the figure, before the optimization of land use type in L countryside, the highest proportion of ecological landscape service value was land formation and protection, with a service value of 606819.1 yuan, accounting for about 18.59% of the total value. Food production had the lowest service value of 70895.51 yuan. Based on the reconstructed land use types, the ecological service value of L countryside was recalculated, and it was found that the ecological service value of different types was increased by 20,000-30,000 yuan compared with the pre-optimization period, among which the food production type had the highest percentage of value enhancement of 32.90%, which was due to the fact that the value of services of this type was relatively low compared with other types. While soil formation and protection had the highest improvement of 26,057.2 yuan, the percentage of ecological value was still the highest at 18.21%.

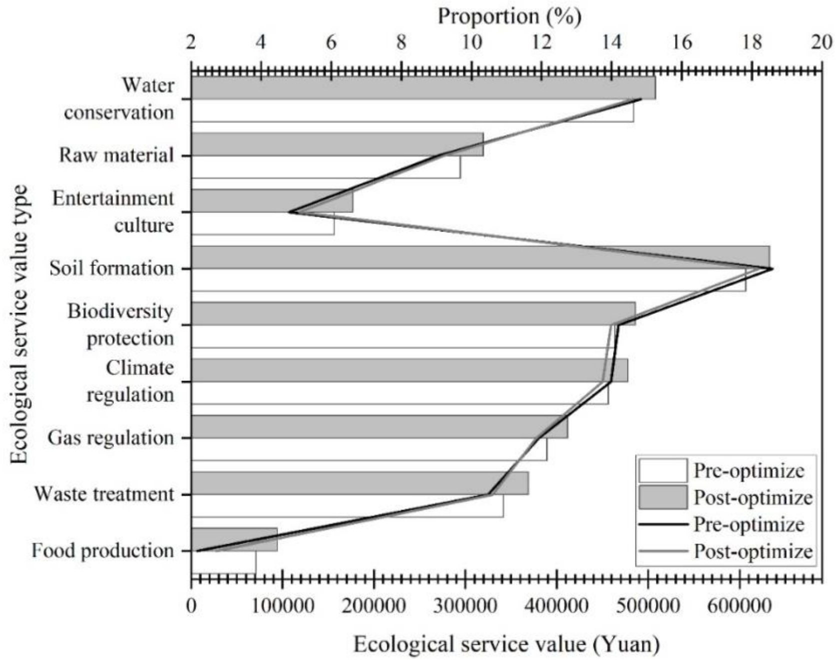

Figure 4. Numerical comparison of ecological service value optimization

5.2 Ecological sensitivity of rural natural landscapes

Through reviewing the literature and consulting experts, seven index factors of topography, slope, slope direction, geohazard, land use type, transportation fluency, and water distance were determined.

All the collected data were processed with ArcGIS 10.0, and the expert scoring method was adopted to judge the rural ecological landscape sensitivity factors. Experts were invited to make professional judgments, and each expert prejudged and scored the above factors from the perspective of their discipline. The differences generated by the experts in scoring are counted, and the factors with differences are re-argued and re-judged to finally arrive at a comprehensive scoring table. After that, the experts score the comprehensive factors, and the weights are calculated using the variance formula according to the established scoring table:

$$S^2 = \frac{\sum_{i=1}^{n}(x_i - x)}{n} \tag{1}$$

Where: S^2 represents the variance, n represents the number of experts, x is the mean, and x_i is the score of the i th expert. After the evaluation of single-factor indicators, it is necessary to evaluate the criterion layer and target layer. Based on the results of expert scores, a weighted sum is taken to calculate the ecological sensitivity index of each type of comprehensive indicator:

$$A_i = \alpha S_{1i} + \beta S_{2i} + \gamma S_{3i} \tag{2}$$

Where: A_i is the comprehensive ecological sensitivity index of indicator i, S_{1i}, S_{2i} and S_{3i} are the single-indicator ecological sensitivity indices of indicator type i, and α, β and γ are the weights, which are determined by the coefficient of variation method.

The seven index factors assigned were weighted and superimposed according to the weights using a Raster Calculator in GIS to carry out ecological landscape sensitivity analysis. The ecological landscape sensitivity index before and after optimization of the local area of L countryside was obtained, as shown in Figure 5. The color depth in the figure represents the strength of ecological landscape sensitivity in the countryside. The darker the color, the less sensitive, and vice versa, the sensitive. Analyzing the data in the figure, the color of sensitivity is obviously deepened after the optimization of the ecological landscape in L countryside. That is, the optimization of the ecological landscape reduces the ecological landscape sensitivity in the local area of L countryside. The sensitivity of the area before optimization ranged from 0.13 to 1.23 and decreased from 0.074 to 0.86 after optimization.

The field survey was found to be influenced by the fact that the area with more anthropogenic disturbances after optimization was the least sensitive, with generally sensitive areas interspersed around its periphery in a scattered manner. The ecological sensitivity is highest in the water area and the area adjacent to the water area, and the area with steep slopes of the surrounding mountains and prone to geologic hazards also has a high ecological sensitivity. Areas with gentle slopes and some distance from the water are more sensitive. Other areas at the foot of the mountains that are farther away from the water source and have very gentle slopes are mostly reclaimed by villagers as agricultural land, and their ecological sensitivity is average.

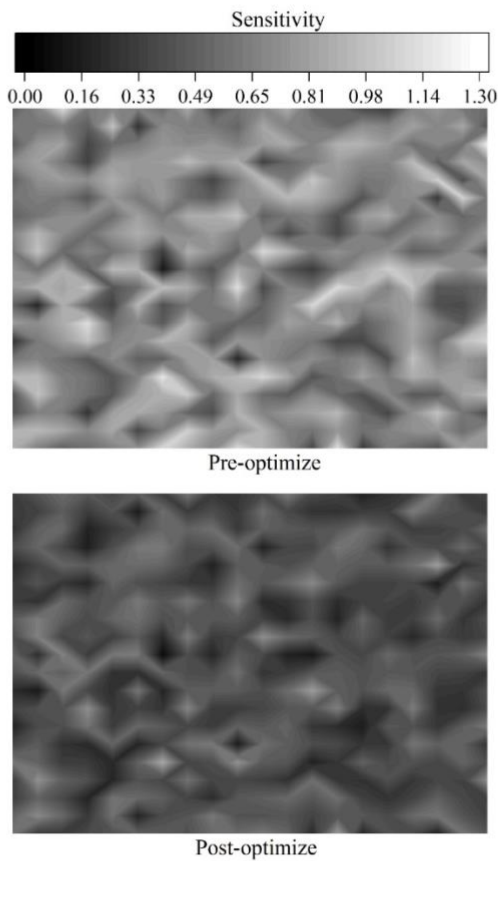

Figure 5. The ecological landscape sensitivity index in the local area of L village

5.3 Evaluation of genetic status of ecological landscape genes

Combined with relevant research results, this paper selects landscape structure preservation, spatial element completeness, spatial element sequentiality, landscape richness, water network ecological status, and genetic evaluation as the evaluation indexes and scores the indexes from the level of landscape definition, the level of situation and shape, and the level of interaction between people, culture, and landscape.

The scoring of each factor is based on the principle of truthfulness and objectivity, and the quantitative scores are obtained by comparing the original spatial genes and the existing spatial genes in time slices. The values applied in the ratings are assigned with objective ratings (0~1 points; the higher the score, the better the genetic effect), and the specifics of the existing spatial elements and the original spatial elements are summarized with reference to the status quo research. According to the constructed evaluation indexes of the genetic status of ecological landscape genes, the optimized genetic effect of the carrier space that can express gene characteristics in L countryside was evaluated.

Figure 6 shows the evaluation results of the genetic status of ecological landscape genes. The data in the figure shows that the overall score of the optimized spatial elements' sequentiality is the highest at 0.96 and basically reaches the full score at the level of landscape definition, the level of situation and shape, and the level of humanistic landscape interaction. The degree of preservation of landscape structure and completeness of spatial elements are the next highest, both at 0.93, thanks to the better genetic landscape elements in the L countryside. The ecological status of the water network has the lowest score of 0.87, which is due to the gradual pollution of water bodies with the development of the economy, and part of the historical water system in the densely populated urban areas has been truncated, and the genetic status of ecological landscape genes of L countryside has a high score of 0.9, therefore, in the future, the protection and inheritance of ecological landscape genes should be considered for restoring ecological nature of the landscape elements and improving the landscape quality of the landscape elements.

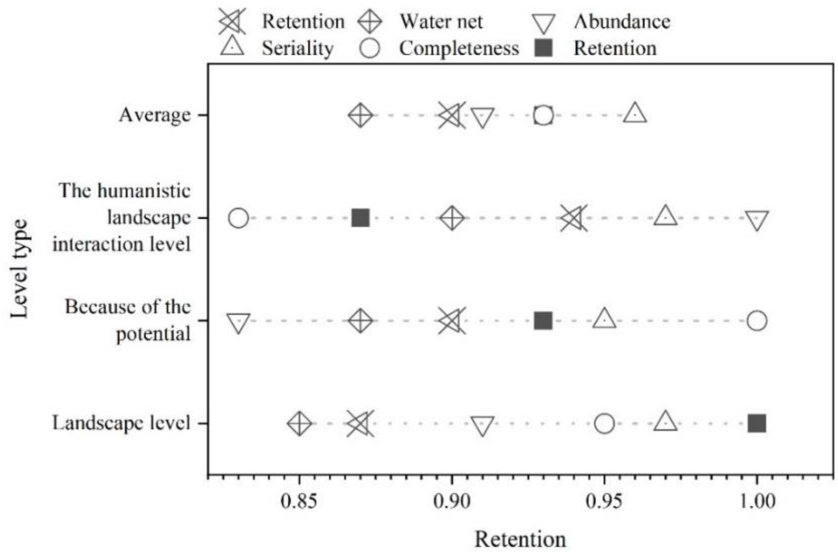

Figure 6. Evaluation of the status of ecological landscape gene retention

5.4 Effect of retaining traditional features in rural ecological landscapes

Most of the studies on the traditional landscape preservation of rural ecological landscapes are carried out from the aspects of planning, planning implementation effect, and evaluation of protection performance. In this section, we analyze the method of this paper to evaluate the effect of preserving the traditional features of L's rural ecological landscape from the perspective of the value and characteristics of the ecological landscape. By setting up a questionnaire, the satisfaction of 100 residents with this paper's method was investigated from six levels: ecological landscape value, naturalness and originality, biodiversity conservation, ecological landscape area, historical and cultural dimensions, and development sustainability. The questionnaire was based on a 5-level scale, with ratings 1 to 5 representing very dissatisfied, dissatisfied, average, satisfied, and very satisfied in that order.

Figure 7 shows the results of the satisfaction survey on the effect of traditional landscape preservation in rural ecological landscapes. As can be seen from the figure, the overall satisfaction of the residents with the methods proposed in this paper is more than 4 points. Among them, the highest satisfaction score is in the area of ecological landscape, with an average score of about 4.6. It shows that the method of this paper has achieved certain achievements in the optimization and development of ecological landscape in L villages, which has a positive impact on the quality of life of the residents as well as the preservation of the traditional features of ecological landscapes.

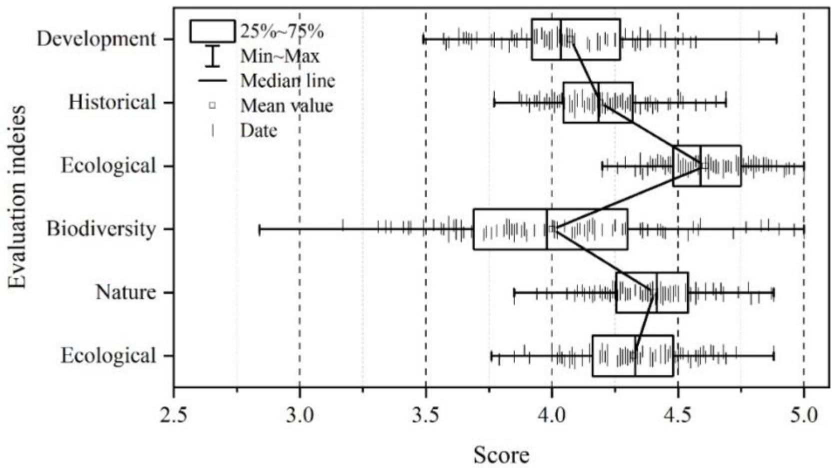

Figure 7. The results of the survey of the experience of ecological landscape retention

6 Conclusion

In this paper, information on rural ecological landscapes in several regions is collected by means of literature review, interviews and photography. The spatial gene inheritance technology and geographic information system are utilized to extract the rural ecological landscape genes, key potentials, and the main axis skeleton. Finally, a case study of ecological landscape optimization and traditional landscape preservation was carried out in L countryside. The experimental results are shown below:

1) After optimization, the ecological service value of soil formation and protection in L countryside rises the most, which is 26,057.2 yuan, accounting for 18.21% of the total ecological value.

2) The optimized design of ecological landscape based on spatial gene inheritance technology reduces the sensitivity of ecological landscape, and the sensitivity of local areas in L countryside is 0.074~0.86.

3) The ecological landscape genes of L countryside had the lowest score (0.87) on the ecological condition of the water network and the highest score (0.96) on the spatial element sequentiality.

4) Residents were most satisfied with this paper's method in terms of ecological landscape area, with an average satisfaction score of 4.6.

The study proves that the spatial gene inheritance technique can be used to protect and restore the ecological landscape and traditional features of the countryside while promoting the sustainable development of the countryside.

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