Research Paper

Research on Landscape Feature Classification and Conservation Based on LCA and GIS ： An Example of Protected Countryside in Jinshan District, Shanghai

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Abstract: *[Purpose] The construction of a beautiful China and a beautiful countryside is an important part of the construction of an ecological civilization system, as well as a practical carrier guided by the theory of ecological civilization. The connotation, composition and characteristics of rural landscape have undergone profound changes in the new era ,assessing the impact ofthe local characteristics and character of rural landscape in the future.[Methodology] The rural landscape conservation strategy is regarded as a result of multi-factor coupling effect, and the empirical study is presented in three core links: index evaluation, factor consideration and result application.[Results] It is found that under the background of rural revitalization in the new era, the deep logic of rural design is in the form of multi-factor coupling. This paper provides a systematic feasibility evaluation and protection strategy for rural landscape.*

I. Introduction

The 20th report of the Communist Party of China proposed that rural industries, talents, culture, ecology, and organizations should be vigorously promoted. The ecological civilization construction of rural revitalization is a major measure of rural construction, coordinates the relationship between urban and rural, consolidates rural environmental construction, and the development of rural economy, culture, and the system is a significant development of the present. Rural landscape planning is a kind of comprehensive planning which applies multidisciplinary theory to promote the sustainable and coordinated development of rural society, economy, and ecology. China's rural development is experiencing unprecedented challenges and opportunities. To avoid the phenomenon of rural landscape homogeneity in the process of development, landscape planning, and design should fully explore local characteristics and rationalization, integrate local culture, historical background, folk traditional skills, and original texture, and evolve new planning layout and industry.

Shanghai countryside has the unique characteristics of the "back garden" of the city. Therefore, the development of Shanghai countryside focuses on promoting rural aesthetics and rural culture construction on the basis of protecting the ecological environment and appeals to the connotation pursuit of life aesthetics. Under the background of rapid urban development, it focuses on activating human's original pursuit of beauty and natural attributes and advocating the inherent needs of aesthetics.

II. Literature review and model construction

This paper will explore the theory and method of landscape feature assessment through landscape architecture assessment (LCA) theory has been relatively perfect in foreign countries, and has been applied to a large number of practices. In recent years, more domestic scholars have conducted research, comparison and reference on landscape feature assessment, and applied it in practical cases of different types and scales. The research mainly includes urban landscape features, natural scenic landscape features and rural landscape features (including towns and villages).

This study focuses on sorting out the literature related to the evaluation of rural landscape characteristics. Comprehensively speaking, the indicators of the evaluation mainly include the following four categories.) The index includes natural elements, cultural and social elements, landscape perception elements and landscape unique characteristics.

Form1 Dimensions and elements of landscape character

Natural element	Geology	Characteristic features: land, islands	Cultural and social elements	Land use and management	Land planning
	Geo-morphology	Surface morphology			Land Use
		Stratigraphic structure		Settlements	Type of Settlement
	Hydrology	Rivers Drainage systems			Nature of Building
		Water quality			Building material style
		Waterscape		Spatial patterns	Rural Settlement Spatial Form
	Climate	Weather			Spatial pattern of urbanisation
		Microclimate		Land ownership	Land ownership and management
		Climate		History and Culture	Historical dimension
	Soils	Soil type			Artistic values
		Nature of land use			Rural Folk Culture and Art Context
	Ground cover	Building cover			
		Vegetation, farmland cover			Rural Craft Heritage Areas
		Industrial facility coverage			
Landscape perception		Haptic Sight Smell Hearing Perception Memory Associations Landscape view	Unique landscape elements of the countryside		Ancestral halls, temples Plantation Fish ponds Art and culture dissemination area Handicraft making area Old Town Old Street Academies B&B Natural mountain areas

Since the 20th century, LCA was formulated by the Campaign to Protect Rural England (CPRE), and has been widely applied in many countries such as the UK, the United States and New Zealand. At present, LCA has become the core of regional sustainable development, nature conservation and land management. It is considered as an important tool to assist decision making, providing a basis for decision makers to realize dynamic landscape management and adapt to the new development needs of the region.Landscape character assessment (LCA) is the process of identifying and describing changes in landscape characteristics. LCA identify and interpret distinct combinations of landscape elements and features by mapping and describing landscape feature types and areas. Related descriptions of its unique features show how the landscape is perceived and experienced by people.

The study of spatial distribution based on GIS can be used to explain the evolution process and characteristics of a certain phenomenon or comprehensive human geography phenomenon in a certain region. Location characteristics is a method of human geography to arrange various geographical phenomena in space. "Location" refers not only to an absolute position, such as longitude or latitude, but also to the relative position represented by location or position. Among them, location is generally related to natural elements such as terrain, soil, vegetation and water system.

American geographer Carl O.Sol published Landscape Morphology. He emphasized that landscape is an objective area that can be studied scientifically through observation, and defined landscape as "an area composed of significant forms of connection between nature and culture, and traced the development of natural landscape to cultural landscape. Accordingly, the Berkeley School of landscape studies established by Saul and his students eventually became an important school of human geography and had a profound influence on the future study of cultural geography.
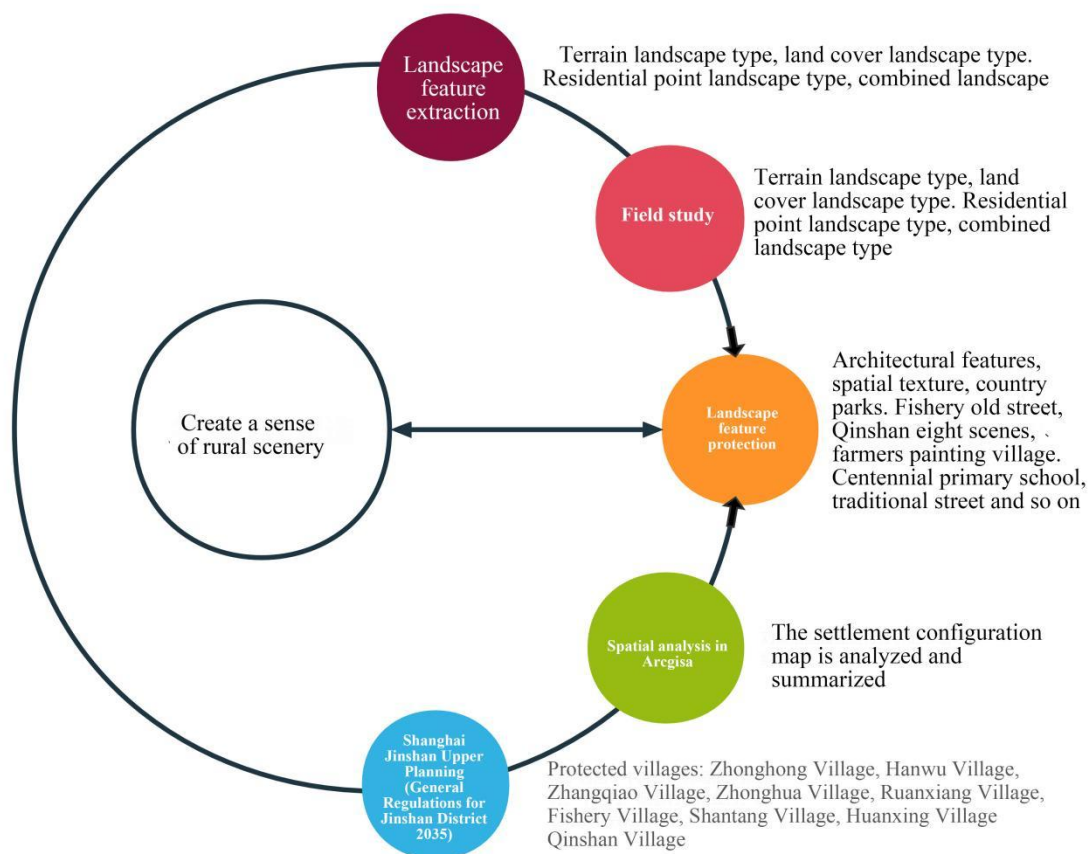
"Landscape features" refers to the combination of terrain, landform, vegetation, land use and soil (Tveit et al., 2006). Landscape features are mainly composed of natural landscape features and cultural landscape features, and there is an inseparable connection between the two.

III. LCA-based landscape character conservation study

The LCA provides a framework system and operational process that helps to identify and describe a given area and its character as distinct from surrounding areas, and uses the information to guide conservation management and planning design. At the same time, it is also concerned with identifying and interpreting the connections between landscape elements and the landscape characteristics they constitute. Commonly identified elements and characteristics include: topography, geology, hydrology, soil, ground cover, land use, settlement patterns, architectural forms, and so on. At the same time, its system can effectively help to understand the element composition of rural landscape and its connection and change reasons. In the context of cultural landscape, cultural and social elements should be considered in the extraction of elements, so as to better integrate the concept of "human" into the landscape evolution process, and more effectively realize self-cognition and introduce public participation in the description and evaluation process.

The main data collection tools used are face-to-face interviews, geographic data analysis and observational research. This approach is concerned with the quality of the data sample, not the quantity. Data collection and analysis in this chapter are carried out simultaneously in grounded theory practice. This process relies heavily on the understanding, comparison, and application of LCA. This constant comparison allows researchers to develop a theory of induction by coding, categorizing, and linking the data that is collected.

In the process of extracting the protective features of rural landscape in the Yangtze River Delta, the LCA process mainly emphasizes the core concept of "landscape sense character". According to the process and method of LCA, this chapter mainly applies the content of the first part of LCA, namely, landscape feature identification. Its operation process and methods are as follows: 1. Scope definition: the protected rural landscape of the Yangtze River Delta, namely the upper planning requirements of ecological resource integration; 2.Desktop research: natural (terrain, ground cover, hydrology, etc.), cultural and social factors (agricultural type, settlement pattern, cultural tradition, etc.). 3. Propose suitable protection strategies according to the research scope.

Figuer 1 LCA research process and method

IV. Study on the characteristics of protected rural landscape in Jinshan District

In 2005, the Planning Department completed a study on the landscape characteristics of Hong Kong. Hong Kong landscape figure map is one of the research results. On the map, Hong Kong is divided into broad landscape types at the sub-regional level (6 LCTS) and at the regional level (41 LCTS) according to different

landscape characteristics. Based on the current perfect landscape characteristics research, the rural terrain landscape types in Jinshan District are divided into seven main categories: coastal plain landscape characteristics, inland plain landscape characteristics, reservoir landscape characteristics, gulf landscape characteristics, intertidal coastal landscape characteristics, island landscape characteristics. Landscape features of coastal waters, channel and typhoon shelter. The main landscape types of rural land cover in Jinshan District include the landscape characteristics of quarry/landfill, reclamation/major ongoing development. The main landscape types of rural residential areas in Jinshan District include golf course landscape characteristics, urban periphery village landscape characteristics, other rural edge landscape characteristics, cemetery landscape characteristics, institutional landscape characteristics, township landscape characteristics, Jinshan District rural combination landscape types mainly include comprehensive residential development landscape characteristics, theme park landscape characteristics, traffic corridor landscape characteristics.

Form2 Description of protected rural landscape features in Kingsland

No.	Terrain Classification	Landscape Character	Landscape Character No. of Hong Kong LCA	Feature Description
1	Topography	Hillside Landscape	6	Consisting of hillsides, hummocks, ridges, and spurs, usually covered with shrubby vegetation with rocky outcrops or boulder fields, woodlands on lower hillsides.
2		Coastal Plain Landscape	7	Villages, hills and woodland blocks are scattered across these plains, connected by winding paths and walkways between active or abandoned fish ponds. In some areas, fish ponds are densely spread over a wide area, creating a landscape with almost as much water as the land.
3		Inland Plain Landscape	8	Agricultural landscape with small-scale, natural and cultural landscape features, and rural landscape retaining the original spatial texture.
4	Land cover landscape	Reclamation / Major Ongoing Development Landscapes	18	A transitional landscape characterized by flat, low-lying terrain, lacking significant vegetation or significant architectural structures, and often characterized by incoherence, desolation, and transience.
5	Settlement views	Other rural fringe landscapes	12	The area consists of lowland agricultural landscapes, open storage, parking, and horticultural Spaces, with fragmentation of traditional landscape patterns.
6		Institutional Landscapes	16	Characteristic attributes of land used for major institutions (including government units, hospitals, schools, armed forces and prisons, etc.). The terrain is flat, with extensive, reasonably open and semi-formal landscape features.
7		Rural Townscape	34	Landscapes characterized by small scale, diversity, privacy, and often vibrant street life and special location.
8	Combined landscape	Integrated residential development landscape	15	Well-planned, self-contained and structured, it usually offers plenty of soft views and is highly ordered with a high sense of continuity and serenity.

The research object of this paper is the landscape characteristics of 9 protected villages, including hillside landscape, coastal plain landscape, inland plain landscape, reclamation/main ongoing development landscape, other rural edge landscape, institutional landscape, township landscape and integrated residential development landscape.
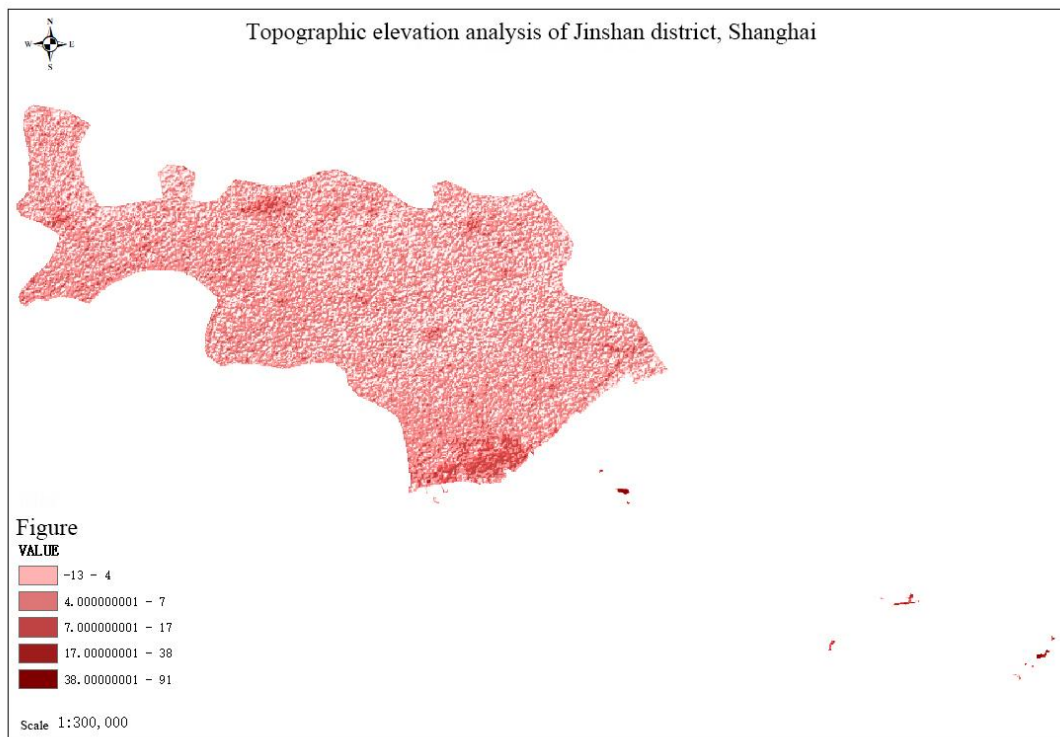
With the gradual modernization of rural landscape, rural traditional and modern, natural and artificial interweaving, the complexity of rural landscape is becoming higher and higher, and the formation elements of rural landscape characteristics and character are becoming more and more complex. Rural landscape elements are the basis of the material and immaterial composition of rural landscape. Landscape elements not only affect the landscape characteristics and character, but also determine the contextual characteristics of the landscape. Therefore, the identification and evaluation of rural landscape characteristics and character needs to establish the classification of landscape elements with the characteristics of The Times, so as to serve as the characterization framework of the basic elements of landscape characteristics and character. The representational quantity of an

element is the detailed statistics and description of the element, including the type, volume, location distribution, nature, density, texture, function and form of the element.

V. GIS-based analysis of protected countryside in Jinshan District

Based on LCA landscape characteristics evaluation and GIS GIS analysis, this paper defines the landscape characteristics of Jinshan District's protected countryside, the characteristics of Jiangnan ancient alleys, spatial texture, architectural style, school style, fishery old street and country park in rural cultural resources and landscape environment, and actively and dynamically develops the balance of landscape sense creation system. It maintains the ecological sustainability of the countryside. The importance of multilevel chromatography method for protection strategy of Jinshan protective village is proposed. And the important characteristic of architectural style and spatial texture. At the level of application methods, the effectiveness of multi-level application of protective strategies in the research of rural landscape sense construction and landscape management at the same scale is verified, which has high promotion value.

Most of Shanghai is located in the flat Yangtze River Delta plain, with dense water network and scattered hills in the southwest, with an average elevation of about 4 meters.

Figuer2 Geographic elevation analysis of Jinshan District, Shanghai
Data source: Shanghai Jinshan District Government Upper planning

According to the latest international research ideas on landscape idiosyncrasies protection, combined with the local characteristics of Jinshan District in Shanghai, the systematic integrity theory of landscape ecology was applied from the aspects of landscape spatial network structure, landscape spatial form, and detailed features of landscape elements. The overall characteristics of natural geography and cultural landscape reserves are studied from the aspects of landscape diversity, spatial permeability and continuity.
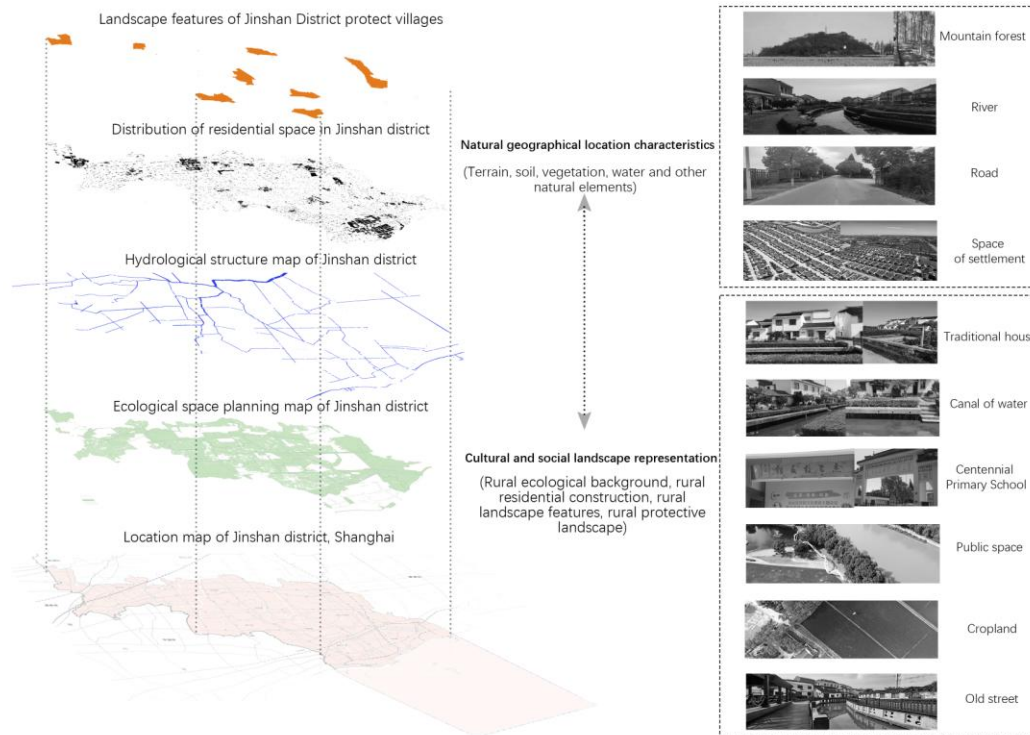
Figuer 3 Rural spatial texture and structural relationship

The protective rural spatial texture and street spatial characteristics are often regarded as the key elements of rural spatial landscape characteristics, which are related to the current rural protective renewal strategy, and may even affect the revision of legal planning in the future. Rural spatial texture combined with structural relations (both functional and spatial meanings) is the basic logic of shaping a protected area.

As shown in FIG. 4, the spatial layout of street buildings in nine protected villages in Jinshan District, Shanghai is selected as the research object of rural spatial form. The rural spatial types can be summarized into four categories: banded, clustered, enclosed and freely scattered. The evolution of rural spatial form is accompanied by the development of farming methods and farming culture in the local historical period. In the later stage of rural prosperity and development, the original rural spatial layout should be respected and the spatial layout characteristics should be strengthened. The strip-like rural spatial texture emphasizes the convenient traffic accessibility, the cluster and enclosed spatial texture emphasizes the enclosed characteristics of the road to the village buildings, and the free scattered spatial texture emphasizes the single architectural style, scale and layout.

The purpose of new rural construction is to expand the coverage of public service facilities and infrastructure to improve the quality of life of rural residents through the relative concentration of villages, and to save infrastructure investment to a certain extent to realize the intensive use of public resources and infrastructure. Therefore, the continuation of the original texture and the intensification of village space become the opposite of the contradiction. The current planning and design basically ignore the significance and function of the continuation of rural spatial texture when dealing with this contradiction and conflict.
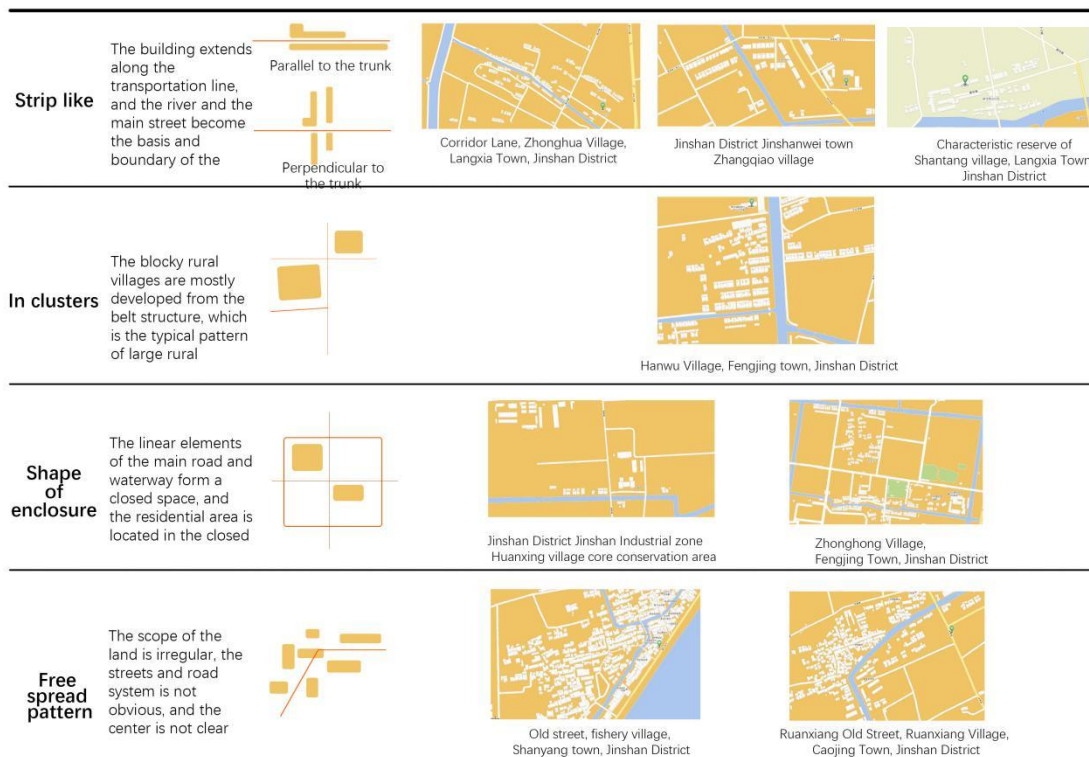
Figure 4 Spatial layout of street buildings in nine protected villages in Jinshan District, Shanghai

Based on the existing superior planning of rural characteristic protection area in Jinshan District of Shanghai, combined with the conclusion of LCA landscape characteristics, we proposed regional landscape feature protection strategies for key landscape protection elements. The landscape characteristic elements of the research object are summarized as follows.

Figure 5 Weight map of landscape feature elements of the research object

According to the superior planning of protecting villages in Jinshan District of Shanghai and the status quo of the site, the following strategies are put forward for the protection elements of protected villages. The architectural features of the 9 protected villages can be regarded as one of the most important factors affecting landscape features. Therefore, the planning of urban characteristic residential areas should fully excavate national characteristics and local culture, combine the original ecological farmland and residential

characteristics, and build the area into an ecological pastoral residential style area. At the same time, the building conforms to the original pastoral mechanism, adopts the dispersive and dense courtyard organization mode, and pays attention to the details of each block to enrich the image of the building group.

The landscape features of the 9 protected villages have their own characteristics. As the architectural style is the main factor affecting the landscape image, this paper puts forward some suggestions on the application of regional architectural symbols in the protection of architectural style. That is to say, when new buildings are built in protective villages, a distinctive and economical and practical architectural style should be formed. At the same time, the coordination between the building and the courtyard should be emphasized, part of the farmland and vegetable land should be retained in the courtyard, and the traditional life and farming mode of the residents should be continued. The building is mainly low-rise, and the height of the building is controlled below 12 meters. With stone, tile and wool concrete as the main building materials, rough material texture to reflect the nature, ecology, pastoral nature; At the same time, the local transparent glass introduces the natural environment into the interior, and realizes the organic integration of the interior and exterior of the building.

VI.   The value of GIS-based landscape character conservation research

Rural landscape is a historical complex of spatio-temporal process. The rural semi-natural landscape space records the cultural progress history of the interaction between people and the land and the shaping history of landscape features. It is a memory space full of historical feelings, the embodiment of nostalgia, hometown, nature complex and id (the cradle of human civilization), and the main battlefield for the maintenance of local landscape. At the same time, rural landscape is also an important starting point to reflect regional characteristics, and should be the main body of rural planning to scientifically and reasonably guide the construction of beautiful villages in the future. The rural landscape in different areas has different landscape characteristics, these differences constitute the localism and identification of rural landscape. If there is a lack of cognition and understanding of the essential characteristics of landscape during the planning and construction process, it will cause irreversible damage to the natural system. Therefore, the effective way to recognize, understand, analyze and reveal the localism of rural landscape is to deeply analyze its landscape characteristics and characters.

The identification and description of landscape characteristics requires not only the understanding of the individual elements that make up the landscape, but also the understanding of how these elements are combined to be unique. Combined with relevant research literature, the system and method of landscape feature assessment are more suitable for large-scale landscape areas, which can reflect the basic characteristics of the regional landscape relatively completely, so as to recognize and understand the spatial differentiation of the current landscape environment and ecological geographic environment. The evaluation of historical landscape characteristics provides a perspective to observe the changes of landscape characteristics based on the time dimension, form historical landscape types from the bottom to the top, and provide reference for future landscape development. Landscape character evaluation excavates and analyzes the characteristics of landscape environment based on landscape resources and its spatio-temporal characteristics. However, the existing evaluation methods of rural landscape characteristics are more used for reference. The rural landscape space not only depends on the regional environment, but also its cultural characteristics are more reflected at the micro scale.

This study only focuses on the evaluation results of the macro indicators of the upper planning and the objective information collection of the actual investigation in Shanghai Jinshan District. The understanding, comment and application of landscape characteristics based on public needs to be further studied to provide theoretical and scientific and effective guidelines for the evaluation and protection of landscape characteristics in the Yangtze River Delta.

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