Research Article

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Research on the traditional zoning, evolution, and integrated conservation of village cultural landscapes based on "production-living-ecology spaces" – A case study of villages in Meicheng, Guangdong, China

https://doi.org/10.1515/geo-2020-0279 received December 22, 2020; accepted July 19, 2021

Abstract: Using traditional remains and the evolution of cultural landscapes as bases for overall protection and "production-living-ecology spaces" (PLE spaces) as carriers, we have established a regional and holistic research path, "evaluation - zoning - zone evolution - integrated conservation," to cultural landscape protection. The traditional cultural landscape of more than 97% of all administrative villages in Meicheng was evaluated, and the overall Hakka cultural landscape was divided into three zones of low, medium, and high traditional values. The study found that the different impacts of urbanization on geographical space were leading contributors to the generation of different spatial zones. To accommodate the evolving trends of the zones, three conservation modes and their corresponding protection strategies have been proposed: construction with traditional elements; parallel conservation and development; and authenticity preservation. Meanwhile, the regional artery-tributary pattern has been constructed to foster interconnection across hubs, artery-tributary systems, and different zones. Cultural tourism routes should be established, and regional courier roads and greenways should be linked, to ensure the alignment of traditional landscape networks with modern Hakka cultural landscape networks, featuring traditional elements to facilitate integrated regional conservation of the Hakka cultural landscape.

Keywords: cultural landscape, PLE spaces, integrated conservation, Meicheng, Hakka villages

1 Introduction

Since the start of the reform and opening-up policy (in 1978, China began to implement the policy of internal reform and opening to the outside world), China has experienced rapid industrialization and urbanization. The rate of urbanization rose from 17.9% in 1978 to 57.4% in 2016 [1]. This rapid urbanization has encroached upon a great amount of land in village settlements and has caused various "rural problems," such as vacant residences, aging populations, and declining cultures around many villages. Villages, especially traditional villages of rich historical and cultural value, represent the greatest heritage kept by Chinese farming civilization and the largest collection of farming civilization heritages in the world. Protecting and rebuilding [2] these villages has become an important issue in this context, and research efforts in recent years have been made in space production and social change [3,4], space living and cultural memory [5-7], and space ecology and protective compensation [8,9]. Research concerning village rebuilding mainly focuses on topics such as agricultural production transformation, land utilization evolution, ecological environment and lifestyle evolution, village society transformation, and other fields [10-13]. A literature review shows that village protection and rebuilding are processes based on "production-living-ecology spaces" (PLE spaces) and land. The 18th National Congress of the Communist Party of China articulated in 2012 how we should increase "spatially efficient production spaces," "livable living spaces," and "picturesque ecological spaces" to optimize the utilization of

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land resources. Optimizing and rebuilding PLE spaces has become a vital strategy for addressing the conflict between village protection and development [14–16].

In 1925, Carl O. Sauer initially introduced the notion of "cultural landscape" to the English world: "The cultural landscape is fashioned from a natural landscape by a culture group. Culture is the agent, the natural area is the medium, and the cultural landscape is the result" [17]. A cultural landscape is interpreted as a complex system, the result of the action and interaction of natural and human factors constituting the regional features in any given period, and it is constantly evolving along with human activities – cultural landscapes tangibly illustrate the evolution of human society and settlements over time, amid the impact of physical constraints and/or opportunities presented by their natural environment and of social, economic, and cultural forces [18]. Since then, the field of cultural landscape research has broadened. After Sauer, many scholars carried out relevant studies. Mikesell and Jackson studied landscape performance and landscape significance by using the methodology of positivism [19,20]. Lowenthal and Prince explored the effect of social class on the construction of cultural landscapes [21]. Meinig argued that the cultural landscape is influenced by a combination of cultures [22]. Samuels believed that the cultural landscape is shaped by people of all cultural backgrounds [23]. Under the influence of postmodernism, research on the cultural landscape began to rely on theories from architecture, postindustrialization, and so on [24]. The cultural landscape began to play an important role in the exploration of social, cultural, and political systems [25,26], entailing diverse descriptions of the cultural landscape [27]. However, foreign studies focused primarily on urban areas. In the field of cultural heritage research, the cultural landscape has been identified as the fourth category of heritage by the World Heritage List. In China, the study of the combination of cultural heritage and cultural landscape plays a positive role in promoting the evolution and protection of cultural heritage [28–30]. However, there are some limitations. First, cultural landscape protection initiatives privilege discrete, small patches of land and architectural spaces; for instance, the holistic protection of regional cultural landscapes has given way to the protection of architecture and historic sites. In addition, traditional regional culture landscape protection endeavors emphasize isolated protection over spatial network protection [28]. Limited research will not effectively address the "fragmentation" and "isolated island" problems of cultural landscapes. Therefore, there is a pressing need to provide regional and holistic research on the combination of cultural heritage and cultural landscape.

This article explores village cultural landscapes from the perspective of PLE spaces. Meicheng, which possesses remarkable historical and cultural value, is the study area used to construct a regional and holistic research path of "evaluation – zoning – zone evolution – integrated conservation" for the Hakka village cultural landscape. Combining the studies of PLE spaces and cultural landscapes can optimize ecological patterns, making up for the overall lack of regional research. It will significantly contribute to the overall preservation of the cultural heritage of Hakka villages and the protection methods and ideas in other regions with an outstanding cultural heritage.

2 The PLE spaces: Village cultural landscape carrier

Villages are the sites where farmers and other groups closely related to the land engage in production and make a living. Traditional villages and vernacular cultural landscapes are spatial environment complexes created by predecessors, representing at once an environmentally friendly approach to land utilization and one of the basic habitation modes for the survival of mankind [31]. Villages are a typical evolving cultural landscape that embodies PLE spaces. In villages, the production space directly reflects agricultural production and farming civilization through a specific pattern that recognizes and utilizes nature [28]. The living space is a primary site that has witnessed the production and development of regional culture, including both tangible physical spaces and intangible social and cultural forms. The ecology space is the main showcase of physical geography features and the ecological guarantee of human settlements (Figures 1 and 2). Conserving villages is a process of protecting and reconstructing cultural landscapes based on PLE spaces.

3 Survey region and data sources

3.1 Survey region

The "Hakka" is a subgroup of the Han Chinese. The Hakka culture has persisted amid the southward migration of the Central Plains culture for 2,000 years. It is an outstanding example of the construction of a human settlement environment through human confrontation with and adaptation to nature (Figure 3). Currently,

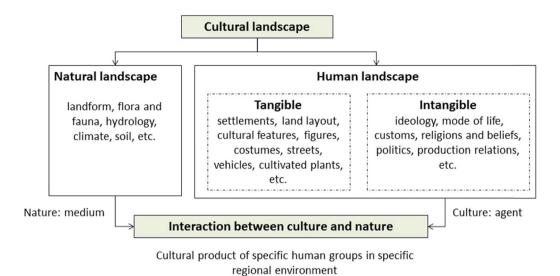


Figure 1: Cultural landscape and its components.

approximately 80 million Hakka people live in different places worldwide, and roughly 50 million live in Guangdong, Jiangxi, Fujian, and other places. An estimated 15

million Hakka people reside in more than 80 countries and regions, mainly in Indonesia, Malaysia, Thailand, Singapore, and other places [32].

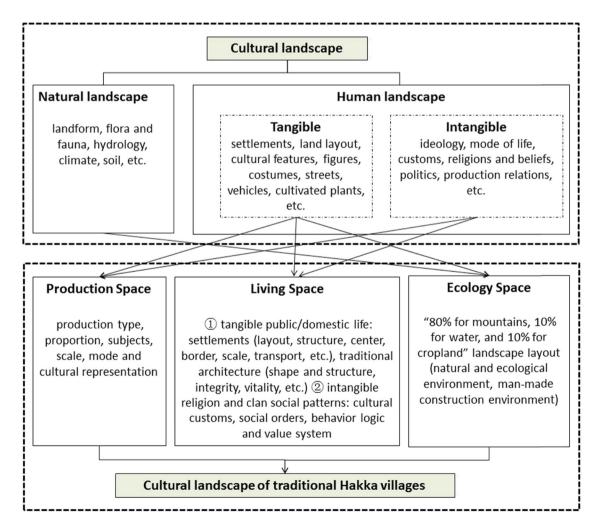


Figure 2: Cultural landscape and its interaction with the PLE spaces.

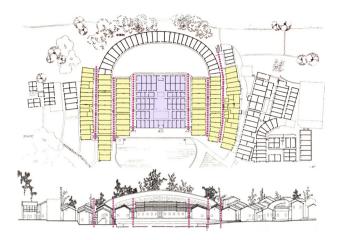


Figure 3: Typical shape drawing of Wei Long Wu (Round Dragon Housing).

The area under investigation - Meicheng District (Figure 4) - is located to the northeast of Guangdong Province at its intersection with Jiangxi Province and Fujian Province (Figure 4). With a predominant Hakka population (more than 90%), Meicheng District is one of the most representative Hakka communities in the world, where the cultural characteristics of the Hakka people can be clearly observed. In 2010, the Ministry of Culture of the People's Republic of China approved the establishment of the National Hakka Culture (Meicheng District) Ecological Preservation Experimental Zone. Meicheng District was founded during the Qin Dynasty. With its long history, one can still observe the intact preservation of traditional Hakka culture and the inheritance of spatial patterns and architectural forms typical of traditional Hakka villages, making Meicheng District an unusual case, even within China. Given its outstanding cultural value, a regional and holistic study of the Meicheng District is urgently needed.

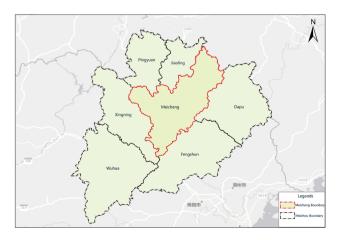


Figure 4: Survey region of Meicheng District.

Research concerning the integrity of Hakka villages in the Meicheng significantly impacts the inheritance and protection of Hakka cultural heritage in Guangdong Province and across the world. Meanwhile, the study of cultural landscapes based on PLE spaces is an important part of China's current national development strategy of ecological civilization construction and rural revitalization.

3.2 Data sources

The essential data for this research come from field surveys, basic collections, and Google Earth high-definition remote sensing image interpretation. The cultural landscape evolution data were obtained from the Geospatial Data Cloud: Landsat remote sensing images for Meicheng in 1995, 2001, 2005, 2010, and 2018, with a resolution of 30 m, were interpreted via the knowledge decision tree classification method using ENVI software. Given the data's precision, the land was divided into five types: built-up land, farmland, forestland, water bodies, and others. Built-up land includes land for residential and industrial purposes, roads, and so on. Farmland includes paddy fields, upland fields, and other croplands. Water bodies comprise rivers, lakes, and so on. Forestland refers to shrub wood and forested land, while the category of others mainly includes bare land. The ENVI accuracy test shows that the precision of the results interpreted from the images during various periods is greater than 80%. The river system and road data were downloaded using 91 Maps Downloader and then vectorized with ArcGIS. The population and economic data of various towns in the survey region are drawn from the Meizhou Statistics Yearbook 2019.

4 Traditional evaluation and zoning of the Hakka village cultural landscape in Meicheng based on PLE spaces

4.1 A traditional evaluation system for the cultural landscape

4.1.1 Definition of traditional evaluation of cultural landscape

Following the description of the cultural value of traditional Chinese villages given by Xi Jianchao (2014), Wang

Yuncai (2011), and Yang Liguo (2018), this article defines the "traditionality" of villages as the historical and cultural form that remains in villages today according to three aspects: traditional forms of production (agricultural production activities, agricultural space, etc.), traditional life forms (village spatial patterns, traditional architecture, clan society, etc.), and traditional ecological forms (natural landscape patterns, ecological networks, etc.). The "traditionality" evaluation of villages based on the cultural landscape is a comprehensive judgment of their production, life, ecological history, and cultural forms.

Culture results from the interaction of natural, economic, and social factors. Hakka villages were formed by the southward migration of the Han people in the Central Plains. The historical and cultural forms of Hakka villages have characteristics similar to those of other Chinese villages in agricultural production activities, village public centers, architectural courtyard structures, architectural hierarchy concepts, and so on [33]. It is the "regional" aspects of the Hakka area in Meicheng that gave rise to the remarkable particularity of the villages in terms of PLE spaces (Table 1).

4.1.2 Construction of evaluation system

We chose certain Hakka villages in the survey region as samples and established an evaluation index system for the Hakka village cultural landscape with the three aspects of PLE spaces. The selection of evaluation indexes consists of three parts: (1) Referring to the Circular on Printing and Distributing the Indicator System for the Evaluation of Traditional Villages (Jian Cun [2012] 125) issued by the Housing, Urban, and Rural Construction and other departments; (2) from the evaluation and research of scholars such as Jianchao et al. (2015) and Shujia and Jiuxia (2021) on the authenticity and sustainability of village protection [34,35]; (3) a combination of the historical and cultural characteristics of Meicheng Hakka villages. The cultural landscape evaluation system is constructed from the following parts (Table 2):

- 1. In terms of production space, indicators such as industrial proportion, producers, agricultural scale and layout, plantation, farming practices, and so on were incorporated, with the focus on those traditional indicators for agricultural production and other production functions and their coordination.
- In terms of living space, the settlement spaces supporting social and public life and architectural space accommodating families and small extended families were included; therein, the settlement space mainly

"80% mountains, 10% water, and 10% cropland" Built along the mountain and the water ypical building form 2 (Transverse Hall Housing), Gang Wu (Bar Housing), and other (1) Spatial pattern of "mountain – water – house – field" (2) Wei Long Wu (Round Dragon Clan society, living together unique architectural forms Landscape pattern of Meicheng Hakka village $\widehat{\mathfrak{S}}$ In Meicheng, each small basin is a relatively complete many mountains, few fields, farming society, with and limited farmland **Production space** The PLE spaces description Character

Table 2: Traditional evaluation system for the cultural landscape of Hakka villages in Meicheng

The PLE		Index level	
spaces		Index	Weight
Production	Industrial	Agricultural	0.3
space	proportion Producer	proportion	0.4
	Agricultural	Villager proportion	0.1
	-	Scale and layout	0.3231
	production	Planted crops Means of	0.1318
		means of production	0.0726
		,	0.0726
Living anges	Settlement	Farming practices	0.0726 0.0391
Living space	Settlement	Spatial layout Environmental	0.0391
		features	0.05/1
		Building complex	0 122E
		Layout structure	0.1235 0.0697
		Village center	0.0097
		Village border	0.0213
		Road	0.0158
		Lifestyle	0.0263
		Folk culture	0.0736
	Traditional	Typical architecture	0.0730
	architecture	Remains scale	0.209
	arcintecture	Complete	0.209
		architectural	0.1246
		features	
		Living state	0.0548
		architecture	0.0340
Ecospace	Natural	Nature	0.1124
Leospace	landscape	Regionalism	0.1124
	tanastape	Network	0.2641
		Green scale	0.1987
		Blue series	0.1124
		connection	•
	Man-made	Harmony	0.2
	ecology		

includes spatial pattern, environmental features, building complexes, the layout structure, village centers, borders, traffic accessibility, and lifestyle. The architectural space includes historical standing, typical shape and structure, remains scale, complete features, living state, and so on.

In terms of ecology space, this mainly focuses on the primordiality and network of the natural landscape environment of villages and their alignment with the man-made ecological environment.

4.1.3 Index weight

The hierarchy analysis method was used to ascertain the index weights of the three spaces. The relative importance of evaluation indexes was determined by the Delphi method.

The Delphi method is a kind of consulting decision-making technology that can be used across various fields and was proposed by the Rand Corporation in 1964 [36]. Expert judgment is the key to the success or failure of the Delphi method [37]. Experts should not be limited to authorities in one field; generally, 15-50 people should be appropriate [38]. The experts selected in this article are composed of scholars and government staff related to traditional village and Hakka studies. Of these, there were two professors, three associate professors, three staff members of the Meicheng Housing and Construction Bureau, six villagers' representatives, and three researchers from the Jia Ying Hakka Research Institute, for a total of 17. The judgment matrix was obtained through expert judgment. The weight of the evaluation index was produced by calculating the feature vector through a Yaahp 12.3 software expert group decision calculation, and all matrix CRs were less than 0.1 (e.g., Table 3), which is in line with the consistency check.

4.2 Traditional zoning of the cultural landscape

Integrating field surveys, the collection of village qualities, and Google Earth high-definition remote-sensing image interpretations, a traditional database for the cultural landscape of 425 Hakka villages in Meicheng (accounting for more than 97% of all administrative villages in the Meicheng districts) was established (the indexes were scored on a scale of three grades: 3.5–5 points (high), 2–3.5 points (medium), and 0–2 points (low)). The multiple targets weighting function method was employed to calculate the traditional indexes, $E_{\rm production}$, $E_{\rm living}$, and $E_{\rm ecolology}$, of an individual landscape in terms of production space, living space, and ecological space, which were superposed on each other to attain the complex index $E_{\rm complex}$:

$$E = \sum_{i=1}^{m} p_i f_i; \sum_{i=1}^{m} p_i = 1,$$

where p_i is the score of a single index and f_i refers to the weighted value of the single index i. The hierarchy analysis method was applied to ascertain the evaluation index weight, and the relative importance of the evaluation indexes was scored by experts to create a judgment matrix and calculate the weighted value based on the feature vector W.

Utilizing the traditional indexes of the cultural landscape of the villages in this study, the Kriging interpolation method was employed to designate the cultural landscape traditional index grades and their corresponding space

Table 3: Settlement judgment matrix

Settlement	Spatial layout	Environmental features	Building complex	Layout structure	Village center	Village border	Road	Lifestyle	Folk culture	Wi
Spatial layout	1	0.5	0.3333	0.5	2	3	2	0.5	0.5	0.0782
Environmental features	2	1	0.3333	1	3	4	3	0.5	0.5	0.1143
Building complex	3	3	1	2	5	5	4	2	2	0.247
Layout structure	2	1	0.5	1	4	4	3	1	1	0.1394
Village center	0.5	0.3333	0.2	0.25	1	2	0.5	0.3333	0.3333	0.0426
Village border	0.3333	0.25	0.2	0.25	0.5	1	0.5	0.25	0.25	0.0317
Road	0.5	0.3333	0.25	0.3333	2	2	1	0.3333	0.3333	0.0526
Lifestyle	2	2	0.5	1	3	4	3	1	1	0.1471
Folk culture	2	2	0.5	1	3	4	3	1	1	0.1471

CR: 0.0176; λ_{max} : 9.2054.

zones. The Kriging interpolation method presumes that the distance or direction between sampling points can be used to illustrate the apparently changing spatial correlation. The mathematical function and a designated number of points were fitted to determine the output value of each position. The value of the point is a linear combination of several sample point variable values within its surrounding sphere of influence [39], which is applicable to the case of multiple sample points, which fits this case study well (Figure 5).

4.3 Traditional zone features of the cultural landscape

4.3.1 Traditional zone features of the production space cultural landscape

In terms of production space, the low-value zones are concentrated primarily around Jinshan Street, Xijiao Street, Jiangnan Street, and Jiangnan Street in the central area of Meicheng. The low-value zones are of high urbanization, where the agricultural space of the villages is sharply reduced. On the one hand, some traditional farming production spaces have gradually given way to industrial and tourist production; on the other hand, some have shifted to living spaces. The villages in the medium-value zones account for 69.4% of all villages, having a broad spatial distribution. These villages, under the impact of modernization, witness a decrease in the industrial proportion for agriculture; Baidu and Nankou towns, for example, have clearly given way to industrial expansion. The high-value zone, located in the north of Songyuan Town, a major town of agriculture in Meicheng, has dominant distinctive plantations surrounding it and linked as a massive system

of agriculture, preserving the cultural landscape of production space quite well.

4.3.2 Traditional zone features of living space cultural landscapes

Traditional zoning in terms of living space is quite similar to the zoning of production space. The high-value zones have a wider range in terms of production space, covering most areas of Songyuan Town, Taoyao Town, and Songkou Town, incorporating 37.8% of all villages. Most villages in the low-value zones witness a "mountainhousing-water-farmland" spatial layout, separated by urban construction. The villages are not in harmony with the surrounding modern urban features. The remaining traditional architecture and historical environmental elements are on a small scale, scarce, and out of tune with those new buildings. The remaining Wei Long Wu (Round Dragon Housing), Heng Tang Wu (Transverse Hall Housing), Gang Wu (Bar Housing), and other traditional buildings are not in a highly active state. Field surveys, however, show that the people in these villages, even around neighboring urban spaces, still generally maintain strong traditional family and clan ideologies, carrying out their traditional rites, etiquettes, and customs. These high-value zones are located in areas far from the downtown area, so their settlement layout and traditional architecture are to a great extent well preserved, while the natural decay of the villages is a key to the persistence of traditional remains.

4.3.3 Traditional zone features of living space cultural landscapes

In terms of living space, the low-value, medium-value, and high-value zones are distributed around the center of

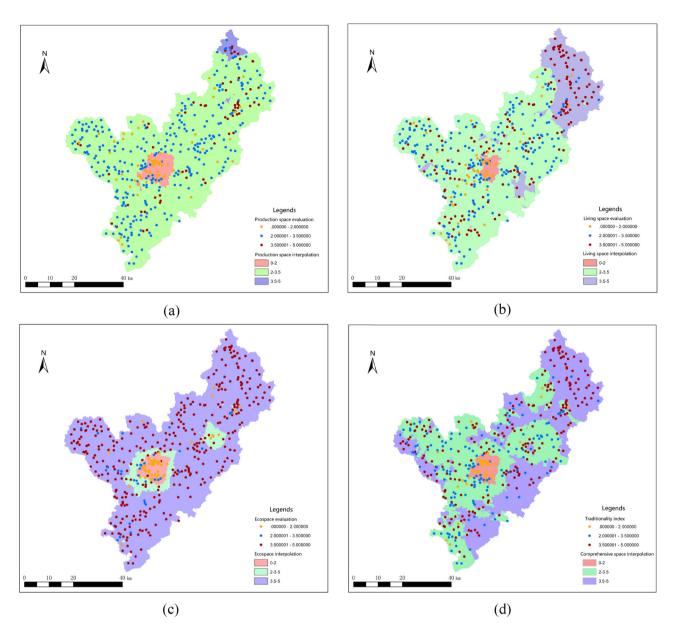


Figure 5: Spatial interpolation of traditional evaluation indexes of the cultural landscape in Meicheng: (a) production space interpolation, (b) living space interpolation, (c) ecospace interpolation, and (d) comprehensive space interpolation.

the Meicheng District in a layered structure from within. The natural ecosystem of the low-value zones is seriously eroded by urban construction and gradually replaced by some artificial construction systems, which is quite different from the primitive landscape environment. The medium-value zones, impacted by the expanding central urban area, witness a somewhat locally damaged econetwork of the natural landscape. The "80% for mountain, 10% for water, and 10% for farmland" landscape pattern of Meicheng helps most villages on the outskirts of the urban area to maintain their complete ecological patterns – their villages surrounded by green forest undergoing

the passing-by or cutting-through of rivers – in a relatively complete blue-green eco-network pattern.

4.3.4 Comprehensive traditional zone features of the cultural landscape

In terms of comprehensive indexes, the traditional lowvalue villages still show some features of central concentration. The medium-value zones are located in the mid-west area of Meicheng, including some secondary key towns such as Shejiang New Town and Yanyang New Town. The high-value zones are mainly distributed around the eastern and northern fringe areas, including Songkou town, Meinan town, and Shikeng town, where the cultural landscape is highly traditional, entailing relatively intact traditions.

5 Zoning-based analysis of Meicheng "PLE lands" evolution features and contributors

5.1 Analysis of evolution features

Based on the zone features and ArcGIS spatial overlay, raster calculator, and other functions, we interpreted and analyzed the five periods of Landsat remote-sensing images to conduct a zoning inverse analysis of the last 23 years of the evolution of the PLE spaces and explored

the causes and rules for different grades of value-based zoning of the cultural landscape to help predict the evolution trend in the future and provide bases for an integrated follow-up regional conservation (Figure 6). The annual statistics (1995–2018) of evolving PLE spaces in different zones are presented in Table 4.

The proportion of built-up land in the low-value zones from 1995 to 2018 increased by 11.22% – a relatively rapid annual rate. Other lands, however, have seen various decreases in their proportion. Massive urban construction projects in low-value zones have converted farmland, forest, water, and land used for other products and ecological purposes into built-up land. The various lands in the medium-value zones have seen smaller changes than those in the high-value zones, and the proportion of the land for construction purposes has increased by 2.7%, mainly distributed around the urban development space in Shejiang Town and Baidu Town from 1995 to 2005. Other regions have not experienced a high degree of annual mutual conversion. The proportions of land for construction

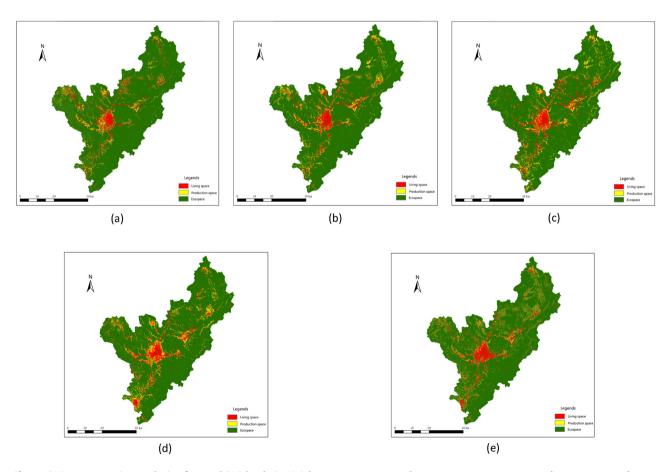


Figure 6: Remote sensing analysis of annual PLE lands in Meicheng: (a) 1995 year, (b) 2001 year, (c) 2005 year, (d) 2010 year, and (e) 2018 year.

Table 4: Analysis of annual land changes in different zones (%)

Zoning	"PLE"	land uses	The prop	ortion of lan	ds for variοι	ıs purposes	1995–2018	The proportion of changing
		Land use	Year 1995 (%)	Year 2001 (%)	Year 2005 (%)	Year 2010 (%)	Year 2018 (%)	land uses 1995–2018 (%)
Low-	Living	Built-up land	43.18	48.18	52.31	53.33	54.40	11.22
value zone	Production	Farm land	13.67	14.06	13.67	13.04	8.32	-5.36
	Ecology	Forestland	36.43	31.8	27.61	27.99	32.28	-4.15
		Water	6.72	5.96	6.42	5.65	5.00	-1.72
		Total	43.15	37.76	34.03	33.64	37.28	-5.87
Medium-	Living	Built-up land	6.64	7.45	8.47	8.87	8.82	2.17
value zone	Production	Farmland	7.74	8.03	7.52	8.83	8.29	0.55
	Ecology	Forestland	82.95	82.70	81.62	80.61	81.44	-1.51
		Water	2.67	1.82	2.40	1.67	1.45	-1.22
		Total	85.62	84.52	84.02	82.29	82.89	-2.73
High-	Living	Built-up land	3.04	3.01	3.72	3.70	4.22	1.18
value zone	Production	Farmland	4.11	5.12	6.11	5.29	6.22	2.11
	Ecology	Forestland	91.78	91.14	89.11	90.19	88.83	-2.95
		Water	1.08	0.73	1.06	0.82	0.73	-0.34
		Total	92.85	91.87	90.17	91.01	89.56	-3.29

and farmland have increased by 1.18 and 2.11%, respectively. Accounting for the physiographic conditions in this region as well, we have found that large-scale agricultural production and cultural ecotourism are the main contributors to regional development. For example, Meinan Town has reclaimed forestland for agricultural plantations to promote economic benefits, while Songyuan Town has led the way by featuring its agriculture, preserving its traditional agricultural landscape quite well.

5.2 Analysis of evolution contributing factors and rules

5.2.1 Analysis of evolution contributing factors

5.2.1.1 Topography

Topography affects human activities. The plains regions, prioritized as the area for concentrated urban construction, typically experience a relatively rapid rate of urbanization, as is quite destructive to complete village cultural landscapes. Statistics were gathered on the elevation of the Hakka villages in various zones: the average elevations for the low-value, medium-value, and high-value zones were 73.9, 141.9, and 173.6 m, respectively; the elevations of traditional villages in the low-value zones were all below 200 m; and those with elevations greater than 200 m within the high-value zones accounted for 67% of all villages. The higher the average elevation of the zone, the better its village cultural landscape tradition is.

5.2.1.2 Road construction

Road construction is an important indicator of urbanization because roads are vital to the economic and social development of the area along the road. Therefore, roads are an important contributor to the evolution of the traditional village cultural landscape. The distribution and evolution of roads (including national highways, provincial highways, county highways, and expressways) are illustrated in Figure 7. Statistics of highway density show that from 2000 to 2018, new road network densities in the low-, medium-, and high-value zones are 0.347, 0.156, and 0.035 km/km², respectively. Hence, the traditional cultural landscape is inversely proportional to highway construction. The lower the level of tradition, the more massive the road construction is. In the medium- and low-value zones, relatively many roads have been successively built up: S12 and G25, newly built in 2005; G206 and G78; Shejiang Section's recently constructed G206 and G78; and G206 and S66, newly added in 2018. These roads have been constructed to enhance the traffic accessibility of Meicheng districts, playing an important economic role by impacting development along roadsides. Meanwhile, road construction may also lead to changes in land purpose, land cutting, and an increase in human activities, thereby affecting various aspects, including the production mode, spatial layout, and natural landscape

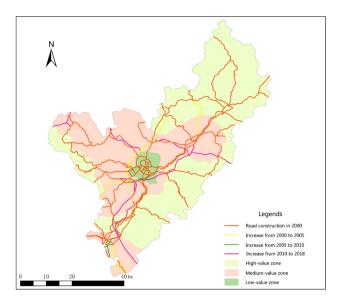


Figure 7: The road construction over the years.

features, while reducing the remnants of the village cultural landscape.

5.2.1.3 Economic and social development

The Meizhou Statistics Yearbook 2019 shows that in 1995 the primary, secondary, and tertiary industries in Meicheng were 27:48:25. In 2018, however, they were 13:43:44. During this period of 23 years, the industrial structure in Meicheng's districts evolved rapidly, impacting the production and living modes around those villages. Moreover, in 2000, the fixed investments in this region were approximately 367.25 million dollars, approximately 1.28626 billion dollars in 2010, and, in 2017, approximately 5.16257 billion dollars. The regional economy developed at a rapid rate from 2010 to 2017. Moreover, the statistics of population density around all streets and towns (Figure 8) demonstrate how the population density distribution and overall spatial zoning are highly aligned: the low-value zones in the central area have the highest population density, and the high-value zones of Meinan, Baidu, and Taoyao towns have relatively low population density. Economic and social development has inevitably led to more urban construction and landscape environment transformation, invading agricultural and ecological spaces while transforming traditional lifestyles.

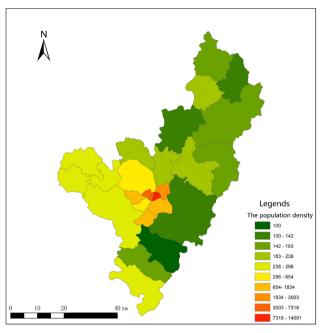


Figure 8: The population density of Meicheng.

5.2.2 Summary of the evolution

Urbanization is a leading contributor to the evolution of PLE spaces. This study's inverse analysis indicates that the cultural landscape traditions in different zones have been affected by urbanization to quite different extents due to different urbanization trends. (1) The low-value zones in terms of the overall zoning of cultural landscape traditions are located in central Meicheng's smooth topography, still the main region for urbanization's spatial expansion and layout optimization because of central place theory and favorable topography for construction. This will inevitably and significantly convert the PLE spaces of the Hakka villages located there and affect the traditional features of the cultural landscape in the future. (2) The medium-value zones display a clear coexistence of traditional and modern features. The cultural landscape has been to some degree affected by expanding urbanization, but most regions, except for a few that may be converted to low-value zones, will experience an internal adjustment of their PLE spaces through increasingly friendly living spaces and modernized production spaces, facilitating the evolution and preservation of the cultural landscape in a coordinated manner. (3) The cultural landscape in the high-value zones has experienced a more natural decline than artificial construction

destruction. In the future, it is plain that national land space planning for agricultural and ecological space protection will play a positive role in retaining the traditional features of the cultural landscape in this region, while the living space within these villages can be reshaped within the clan and social relations of the Hakka people to gradually implement parallel policy and self-organized protections.

6 Strategy recommendations for integrated conservation of the cultural landscape of Hakka villages in Meicheng

The concept and policy of "integrated conservation" were initiated in the practices of protecting cities in Europe during the 1960s. Following the Second World War, rapid industrialization and urban expansion were increasing concerns about the environments of European villages, so natural reserves were established in Europe in 1965 [40]. Traditional villages in China boast rich historical information and cultural landscapes as both the greatest heritage of Chinese farming civilization and the largest collection of farming civilization heritages. Nevertheless, amid rapid urbanization, traditional production spaces have been invaded, farming production has been neglected, and living spaces over the generations have been threatened by new construction, leading to the man-made destruction of naturally declining traditional architecture, the serious fragmentation of natural ecosystems, and other problems. In the context of increasing efforts to foster ecological civilization and rural revitalization, we have analyzed the interaction processes between the cultural landscape of the Hakka villages in Meicheng and the regional environment to build a dynamic approach to integrated regional conservation.

6.1 Zone-specific conservation strategies in line with the evolving trends of the PLE spaces zones

In view of the evolving trends of the PLE spaces zones, we can propose certain zone-specific conservation strategies to achieve targeted integrated regional conservation. First, based on the guiding principles, "conservation during development, and development during conservation," we

should specify the modes for each zone to protect their traditional features. Second, we can propose some zonespecific strategic recommendations for cultural landscape conservation (Table 5). (1) For traditional high-value zones, the mode of authenticity preservation should be taken. Traditional production modes should be maintained, with leading agriculture comprising a higher proportion of autonomous farming among villagers. In villages with favorable conditions, smart agriculture, countryside complexes, and other projects can be introduced, which increases villagers' income and employment, effectively addresses the aging and hollowing trends of villages, and revitalizes village communities to restructure social relations and facilitate self-organized conservation. In terms of living spaces, the traditional lifestyle and community order of these villages should be retained, a relevant system for the rigorous conservation and reutilization of village spatial layout and traditional architecture should be established, and new construction should be restricted. All these measures are taken to maintain authentic spatial forms of the Hakka settlements. Within those ecological spaces, natural mountain and water systems should be rigidly retained to reduce man-made ecological construction. (2) Within the traditional medium-value zones, some conservation zones should be designated to protect authenticity; outside the conservation zones, construction projects promoting traditional features can be launched, adding some traditional Hakka architecture symbols, colors, vegetation, and other elements to attain a coordinated, harmonious coexistence of traditional and modern features in their PLE spaces. (3) The traditional low-value zones boast quite favorable urbanization conditions, so innovative construction projects bearing traditional elements should be encouraged, and key traditional architecture rigidly preserved.

6.2 Integrated regional cultural landscape network pattern for dynamic regional interaction

Traditional cultural landscape network patterns for the Hakka regions in Meicheng should be established to foster connectivity within and between zones (Figure 9). First, dynamic connections of cultural landscape features within the high-value zones in terms of traditional remains should be established. Given the village settlements built along with water systems within Meicheng, we can establish an artery-tributary connection pattern featuring artery water system-connected zones and tributary water systemconnected villages. The leading roles of Songkou Town,

Table 5: Protection modes and strategies of the Hakka village cultural landscape in different zones of Meicheng

Spatial zoning	Protection modes	Three s	Three spaces cultural landscape protection strategies	
		Production space	Living space	Ecology space
Traditional high- value zones	Authenticity preservation	Traditional agricultural production and smart agriculture, and countryside complexes	Traditional Hakka clan social space and order maintained, with rigid policies to preserve settlements and architectural spaces	Natural ecosystems rigidly maintained and reducing artificial ecosystems as far as possible
Traditional medium-value zones	Parallel conservation and development	Comprehensive agricultural and tourism development	Hakka village reserves designated to protect the traditional spatial order and architecture; traditional elements bearing construction projects encouraged outside these reserves	Protecting natural ecosystems and ensuring harmonious coordination between natural and man-made ecosystems
Traditional low- value zones	Traditional element featured construction	Comprehensive agricultural and tourism development to encourage the establishment of PPP pilot zones for agriculture and tourism	Traditional village spatial forms maintained as far as possible, and traditional elements encouraged in new constructions	Ensuring harmonious coordination between natural and man-made ecosystems

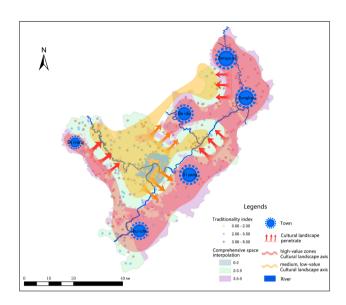


Figure 9: Network pattern of the Hakka village cultural landscape in Meicheng.

Meinan Town, and other village concentration zones that act as complex hubs should be encouraged. Their internal village environment features and spatial structures, typical Hakka architecture, and other cultural landscape elements and features should be sorted out to form categories of interaction hubs like mountain-water-housing-farmland village spatial layouts, clustered bead string spatial structure, and typical Wei Long Wu housing architecture, facilitating interconnection between hubs through artery-tributary systems within the zones. Meanwhile, the formation of a cultural landscape network depends not only on traditional elements but also subject to the harmonious integration of Hakka elements into the newly established cultural landscape. Connections can be achieved via cultural tourism routes, regional courier routes, and greenways to ensure the alignment of traditional landscape networks with modern Hakka cultural landscape networks that feature traditional elements and form a connected contemporary tradition that integrates modern and traditional features into an interconnected network system.

7 Conclusion

Taking cultural landscape as a point of departure for village conservation and the PLE spaces as its carrier, we have established a research approach of "evaluation – zoning – zones evolution – integrated conservation" for analyzing the cultural landscape of the villages,

pinpointing the zones with remaining traditional features and future development trends of the village cultural landscape in Meicheng, thereby proposing certain targeted, zone-specific conservation measures and strategies to realize integrated regional conservation. Villages in Meicheng, in general, boast abundant Hakka culture remains. First, we established an evaluation system for the Hakka village tradition and evaluated the traditional features of the cultural landscape in approximately 97% of administrative villages. We identified zones with high-, medium-, and low-value amounts of three grades of Hakka culture remains and conducted spatial zoning. Second, we conducted an inverse analysis of the evolving features of the cultural landscape within various zones, explored their internal contributors, and found that the difference in geographic spaces during urbanization is a leading contributor to different spatial categories. In the future, the traditional low-value zones will remain the principal regions for urban construction, whereas the medium-value zones maintain a clear coexistence of traditional and modern features and will be partially converted into low-value zones. High-value zones are not significantly affected by urbanization, but the problem of natural decline's impact on the cultural landscape remains to be addressed. To accommodate the evolving PLE spaces, we proposed authenticity preservation, parallel conservation, and development, with traditional elements using construction as conservation modes for the three zones, and proposed corresponding protection strategies. Meanwhile, we also proposed an artery-tributary connection pattern to foster the interconnection of classified interaction hubs, arteries and tributaries, and zones. Through connection modes such as cultural tourism routes, regional courier routes, and greenways, we established an alignment of traditional Hakka cultural landscape networks with traditional elements bearing modern Hakka cultural landscape networks within Meicheng to form a connected contemporary tradition with modern features integrated into the Hakka cultural landscape network system. This study is of great significance for the protection of the cultural heritage of Hakka villages across the world and provides a reference for the overall protection of regional cultural heritage. Furthermore, the study of cultural landscapes based on PLE spaces is an important part of China's current national development strategy of an ecological construction of civilization and rural revitalization.

Funding information: Philosophy and Social Sciences Planning Project of Guangdong Province, No. GD19LN11.

Scientific Research Project of Education Department of Guangdong Province. No. 2018KTSCX070.

Conflict of interest: Authors state no conflict of interest.

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