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PERCEPTION STUDY OF THE CONSERVATION AND UTILIZATION OF LINPAN CULTURAL LANDSCAPE HERITAGE: THE CASE OF DUJIANGYAN CITY

Kabilijiang UMEL[1], Pingpu ZHU[1]✉, Shuyu ZHANG[1], Mikiko ISHIKAWA[2], Liang YU[3]

[1]*Sichuan University, Chengdu, China*
[2]*Chuo University, Tokyo, Japan*
[3]*Shanghai Tongji Urban Planning & Design Institute Co., Ltd., Shanghai, China*

Highlights:

- indigenous villagers of Linpan settlements have autonomous views on conserving Linpan;
- most villagers are willing to participate in the actions of land use in Linpan;
- characteristics of villagers influence their perceptions of Linpan's conservation and use;
- residents' participation is the basis for developing sustainable cultural landscape policies.

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Abstract. Linpan has a long history of over 2,300 years and is a unique cultural landscape heritage of the Chengdu Plain derived from the Dujiangyan hydraulic engineering. As urbanization has gradually degraded the Linpan landscape over the past decades, the government is helping to revitalize the local countryside by preserving it. The purpose of this study was to understand the perceptions of Linpan indigenous villagers about its conservation and use, and to investigate the differences in their perceptions and the factors influencing them. The city of Dujiangyan, located at the source of the Dujiangyan Irrigation Area, was taken as the case study area, and a questionnaire survey and quantitative analysis were adopted. The study shows that Linpan indigenous villagers generally support the protection of water systems and fields; Linpan's vacation and health and wellness functions are recognized by villagers; and regarding Linpan land use, villagers generally prefer to take the form of land market transfer and are willing to transfer arable land and homestead. This also confirms differences in the villagers' perceptions of the conservation and utilization of Linpan in different locations due to their divergent characteristics. This study provides a reference for the villagers' perspective on the planning and action of Linpan conservation and use, suggesting the importance of villagers' distinguishing factors in cultural landscape revitalization.

Keywords: Linpan, Dujiangyan, cultural landscape, conservation and utilization, villagers' characteristics.

✉Corresponding author. E-mail: ***cunshui2022@gmail.com***

1. Introduction

Linpan is the unique rural settlement in the Chengdu Plain, which originated from the construction of the Dujiangyan hydraulic engineering during the Warring States period and has continued for more than 2,300 years. The hydraulic engineering is located at the apex of the entire irrigation area; its head divides the Min River into two rivers: the outer river is used to drain floods, while the inner river flows downstream and continues to divide into four main canals. On this basis, many generations have used the canals countless times to divert water to irrigate farmland, eventually forming an irrigation system comprising main canals, branch canals, medium canals, farmland canals, and capillary canals, which have developed into the present Dujiangyan Irrigation Zone of more than 1.81 million acres, forming approximately 110,000 Linpan settlements and providing the basis for the production and livelihood of more than 3.6 million farmers (Yan et al., 2017). Linpan clusters are in the same landscape system as Dujiangyan; its extended dense water network, carrying high historical, cultural, ecological, and farming technological values, displays outstanding human–land interaction. Ishikawa et al. (2020) consider Linpan to be a cultural landscape heritage constructed by human–nature cooperation; this study also shares the same perspective of Linpan.

The water system, woodland, fields, residence, and roads, each interconnected and coordinated to form a unified landscape system, are the main spatial components of Linpan (Figure 1c). The residential area is located at the heart of Linpan, and it consists of residential houses and enclosed courtyards, which are artificially constructed

living spaces; the periphery of the houses is usually surrounded by lush woods dominated by natural vegetation such as tall arbors and bamboo forests. These act as the basis of Linpan's biodiversity and are its protective ecological layer; the outer edge of Linpan is surrounded by vast farmland or orchards, which is the agricultural production space combining nature and artificiality. The water system guarantees production and life in Linpan, including artificial irrigation canals and natural water bodies. Linpan is often surrounded or crossed by water canals and extends to each household and field through farms and capillary canals. Roads are the link for villagers to travel between fields and residence, and for interpersonal interaction.

In the past three decades, with continuous urbanization, cities have gradually expanded and spread to the suburbs and rural areas, resulting in a gradual decline in rural cultural landscapes. The urbanization rate of the Chengdu Plain Economic Zone rose from 34.22% in 2000 to about 58% in 2021 (Sichuan Provincial Bureau of Statistics, 2022), while the number of Linpan settlements decreased from about 150,000 in 2007 (statistical data not available before 2007) to about 110,000 in 2021 (Rong et al., 2021). Linpan's severe hollowing and aging have been accompanied by the encroachment of arable land, destruction of vegetation and water networks, increased vacancy of land and houses, and growing antagonism between urban and rural areas. Concurrently, under the influence of the new trend of world heritage conservation, heritage conservation in China since the twentieth century has also shown new features: changing from the conservation of natural heritage to the conservation of cultural or dual natural and human heritage (Mitchell et al., 2009), and from the conservation of urban heritage to the shift in focus to the conservation of rural heritage. This was coupled with the implementation of the central government's rural revitalization strategy in 2017 (Central Committee of the Communist Party of China & Chinese State Council, 2018), which proposes the conservation and utilization of agricultural relics and irrigation engineering heritage; thus, the protection of Linpan has started to become the main focus of local governments to promote rural development. The Chengdu Urban and Rural Construction Commission listed the Linpan protection and restoration project as one of the ten critical projects for rural revitalization in Chengdu Plain (Chengdu Urban and Rural Construction Commission, 2017). They issued a series of plans for Linpan's protection and utilization, proposing policy guidance and technical guidelines on landscape, ecology, industry, talent, and facilities to promote the appropriate utilization of Linpan based on protecting its uniqueness.

In addition, at the legal and institutional levels, villagers have the most emphatic voices in the conservation and use of Linpan and are the core forces in maintaining and shaping the landscape. The Chinese Constitution stipulates that land ownership in rural areas belongs to the villagers' collective; the Chinese Urban and Rural Planning Law stipulates that rural planning and construction should be conducted based on obtaining the villagers' full support; according to the Principles Concerning Rural Landscapes as Heritage issued by ICOMOS, ensuring villagers' participation and gaining access to their understanding of the heritage are essential prerequisites for rural cultural landscape conservation (International Council on Monuments and Sites, 2017). In addition, to safeguard the villagers' land rights and restrain the market-oriented behavior of rural land, the Chinese Land Management Law stipulates that the right to use collective construction land may be granted or expropriated subject to the principle of villagers' voluntariness and compensation, and it may be used for tourism and service industries under some conditions and must be used sparingly; the conversion of farmland into construction land is strictly restricted. China's Rural Land Contract Law further guarantees farmers' right to contract and operate agricultural land based on family contracting, stipulating that agricultural land ownership remains unchanged after contracting, but agricultural uses must be maintained. Although explicit institutional provisions exist, the plans and actions for the protection and utilization of Linpan are mainly led by the government, and the conservation awareness of indigenous villagers varies, resulting in villagers being constantly marginalized and using Linpan land controlled by developers and the government.

With the development of practice, academic research on Linpan has been increasing, such as Sun et al. (2011) research on the vegetation community types and diversity of Linpan; Shi and Ishikawa's (2012) research on the value of Linpan in the Dujiangyan idyllic landscape; Li et al. (2019) research on the Linpan settlements' conservation patterns in the Dujiangyan irrigation area; Abramson's (2020) research on the role of Linpan agricultural landscape systems in maintaining regional socio-ecological resilience; and Wan et al. (2022) research on the distribution characteristics of Linpan and its influencing factors. Additionally, the study of cultural landscapes has become a popular topic. Many scholars have explored the issue of cultural landscape conservation from the perspectives of landscape perception and public participation. Tempesta (2010) identifies the main elements of the agricultural and historical landscape and their value in the plains of the Veneto region of Italy through the visual evaluation of the villagers on the actual map of the landscape and proposes the elements of the historical landscape that must be protected as a priority. Ruskule et al. (2013) survey local people and experts on the future use of abandoned farmland landscapes in Latvia, showing that afforestation from the forest edge, as well as continuous and linear patterns, should be utilized for its potential economic benefits, while the mosaic pattern should be maintained the biodiversity function. Tekken et al. (2017) assess farmers' perceptions of the value of rice-farming cultural landscapes in Southeast Asia, as well as the socio-cultural factors that influence them, suggesting sustainable land management strategies to conserve traditional farming landscapes. Santoro et al. (2021) identify farming practices, secondary forests, hydrogeological risks, and high tourism pressure

in the terraced agro-cultural landscape of Italy as critical conservation objects through public participation. Oehler (2022) proposed a conservation plan for the traditional irrigation system in the SAJA landscape involving economic compensation, education and training, volunteer services, and public awareness based on discussions with residents and experts.

This study takes the perspective of the indigenous villagers of Linpan and aims to explore their views and opinions on the conservation and utilization of Linpan and investigate the impact of the differences in their socioeconomic and resource characteristics on their perceptions. The study provides a perspective on villagers' participation for policymakers to improve the conservation and utilization planning of Linpan and provide a reference for the conservation of similar cultural landscape heritage.

2. Materials and method

2.1. Study area

Dujiangyan is a county-level city located in the Chengdu Plain in southwestern China. The city covers an area of 1,208 km^2 and has a population of 717,400 and an urbanization rate of 62.3%. The total number of Linpan settlements in the city is 3,824, concentrated around the plain rural areas in the southeast of the central city (Figure 1a), involving a total area of 332.97 km^2–27.56% of the city's area. The population of Linpan settlements is approximately 250,000, accounting for about 36% of the city's population.

By taking advantage of its geographic location at the source of the irrigation area, Dujiangyan City serves as a critical ecological function and grain production area in Chengdu Plain, aiming to develop modern agriculture and leisure tourism in rural areas based on protecting the water source and farmland in Dujiangyan. Guided by this strategy, the protection and utilization of Linpan in Dujiangyan are profoundly significant. In 2020, the Dujiangyan City Planning Bureau promulgated the "Master Plan for Protection and Restoration of Linpan in Dujiangyan City (2018–2035)" and entered the implementation stage (Dujiangyan City Planning Bureau, 2020). Its general idea is to protect and utilize Linpan in the whole area by grading, classifying, and zoning according to local conditions. The grading divides Linpan into priority protection and general protection Linpan, and different levels of Linpan propose corresponding protection strategies. The classification is based on industrial development and location conditions to guide different types of Linpan for industrial optimization and infrastructure improvement. Zoning is based on the spatial distribution characteristics of Linpan, spatial layout of urban industry characteristics, delineation of Linpan development guidance zones, and provision for different services. The plan determines the integrated development mode of the surrounding Linpan clusters, driven by towns. The plan determines the integrated development mode of the surrounding Linpan clusters, driven by towns, forming different development units, such as scenic areas, agricultural parks, and industrial parks that link the towns and Linpan settlements. For the protection of a single Linpan, six significant tasks have been identified: implement-

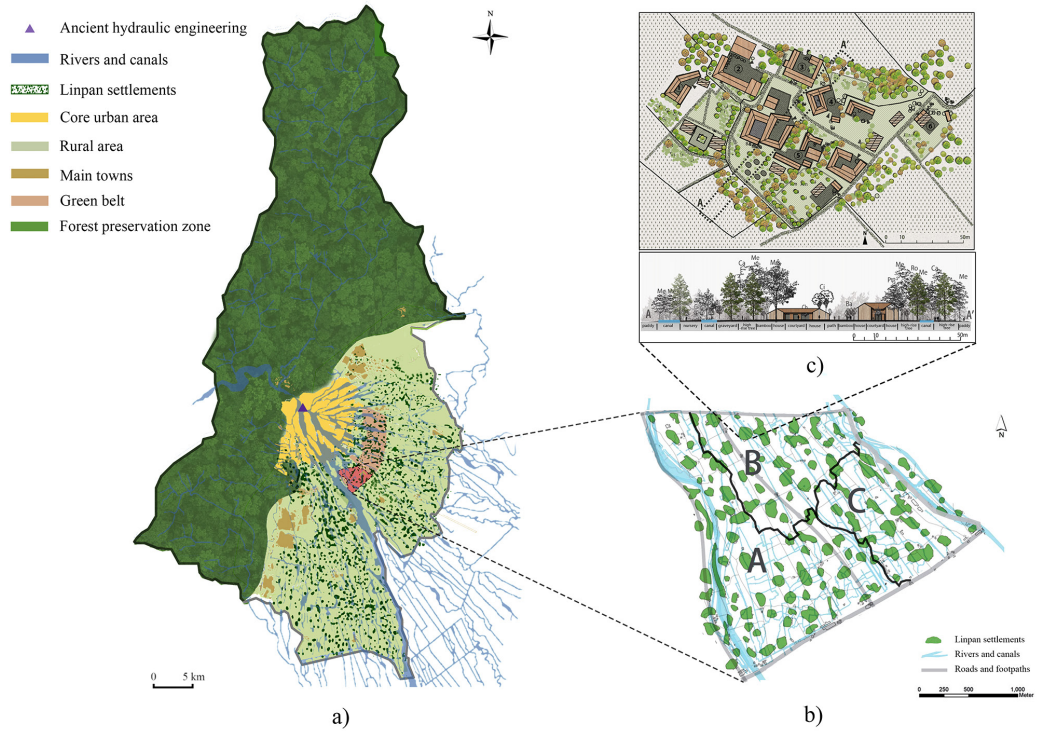

Figure 1. Diagram of the study area and the survey area: a) Dujiangyan City urban-rural spatial layout; b) Schematic map of the survey area, A, B, and C are respectively Dahe, Jinji, and Yingxiang Villages; c) Top view (upper map) and section (lower map) of a typical Linpan in Jinji Village

ing the whole field, forest protection; water management; yard improvement; industry planting; greenway tandem on the natural substrate of green fields and ecological Linpan; and paying attention to the improvement of rural culture and supporting facilities.

2.2. The survey

In this study, a questionnaire survey was conducted to understand the villagers' opinions on the conservation and utilization of Linpan. The survey area was in three villiges in the green belt of Dujiangyan City Master Plan, Dahe Village, Jinji Village and Yingxiang Village, with an area of 5.62 km^2 and a population of 4,255 inhabitants (Figure 1b). This area is highly representative. Firstly, the green belt where the area is located is an urban-rural buffer zone immediately southeast of the core urban area of Dujiangyan, assuming the essential functions of restricting the unlimited sprawl of the city and protecting the farmland and ecological landscape at the same time, it is also the first place of the Dujiangyan hydraulic engineering's irrigation in the downstream and is the origin of agricultural settlements in the whole Chengdu Plain. Secondly, the Conservation Plan of Dujiangyan Historical City (2016–2035) designates this area as the core display area for the agricultural history and cultural landscape of the Dujiangyan Irrigation District. It proposes the development goal of building the "Farming Civilization Heritage Park". Finally, the number of existing Linpan in the three villages is 143, the total area of Linpan is about 1.7 km^2, and the density of Linpan reaches 25.4/km^2, which is much higher than the average level in the whole Dujiangyan City (8.31/km^2), which determines that the survey has significant reference value (Figure 2).

The respondents were selected using a random sampling method. Seven professionals, including professors and students, sent out 980 questionnaires from June to August 2022, and 812 questionnaires were returned, with a total response rate of 82.8%. There were 725 valid responses in total, including 267 from Dahe village, 232 from Jinji village, and 226 from Yingxiang village (Figure 3). Field surveys and unstructured interviews were also essential data collection methods for this process.

The questionnaire consists of three parts. The first is to understand the current characteristics of villagers, including social characteristics–age, gender, education level; financial characteristics–income sources and monthly income; and resource characteristics–household homestead area, household arable land area, household woodland area, and the villagers' living space. The second is the perception of Linpan conservation, including the perception of the overall conservation of Linpan (Q1) and the perception of spatial elements conservation in Linpan (Q2-Q6); due to the importance of irrigation canals in water systems and traditional residential houses in residence, these two were assessed separately as Q2-2 and Q5-2, respectively. The third is the perception of Linpan utilization, including villagers' perception of government actions (Q7-Q10) and implantation of industries (Q11). Each question included predefined answer options, except for Q7-Q9, which were single-choice questions, and the rest were multiple-choice questions. The survey questionnaire database was constructed using SPSS 26.0 and analyzed quantitatively. We used descriptive frequency statistics to investigate the overall perception characteristics of the villagers regarding the conservation and utilization of Linpan. In addition, to investigate the influence of villagers' characteristics on their perceptions, their places of residence were selected as the independent variable, and villagers' perceptions were considered the dependent variable. The reason for doing so is that villagers' characteristics show typical village-to-village differences that vary by geographic area. We used a cross-tabulation chi-square test and a multiple response chi-square test to explore the effect of the independent variables on the dependent variable. The chi-square value (χ^2) in the chi-square test is a statistic in the non-parametric test, and its function is to test the correlation of the data; if the *p*-value is less than 0.05, the two variables are significantly correlated.

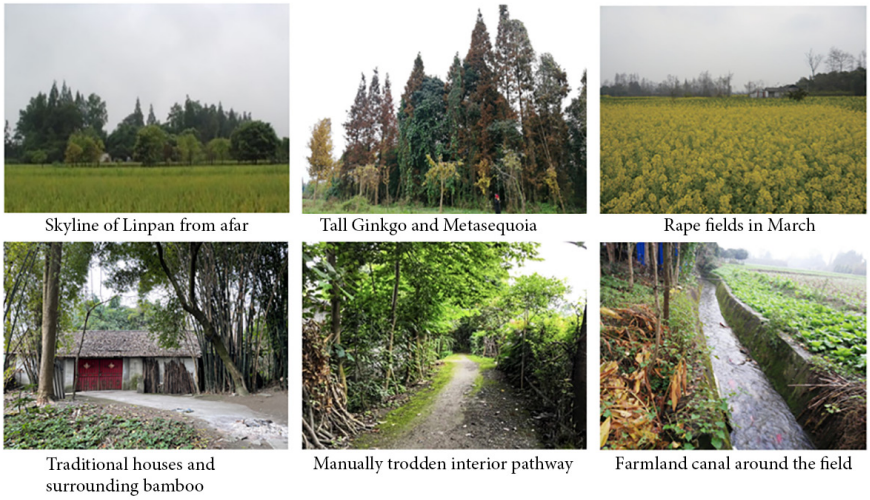

Figure 2. Actual photo of the Linpan in the study area (taken by authors)

3. Results and analysis

3.1. Analysis of the characteristics of the indigenous villagers in Linpan settlements

In terms of social characteristics, the age of villagers in Linpan settlements is between 41 and 50 years (Table 1), and the proportion of older people over 60 is about 21%, which indicates that this is a highly aging society. The loss of young people is severe, with only 7.2% of those aged 18–30. There are more male villagers than female villagers, and the education level of males is generally low, only a small part having been educated at the university and beyond (12.30%).

Regarding economic characteristics, approximately 12% of the people in Linpan are engaged in agriculture; most villagers give up agriculture and choose to work in the city (58.80%). The percentage of retired people in Linpan has reached approximately 17%, and the monthly income of villagers is between 2,000 and 3,000 RMB, accounting for 26.20%, which is generally higher than the national average (1,577 RMB) and in line with the average level of Chengdu city (2,427 RMB) (National Bureau of Statistics of China [NBSC], 2022).

As for resource characteristics, villagers' household homestead areas in Linpan are mainly concentrated in the range of 200–400 m^2, with a mean of 305 m^2 and a median of 300 m^2, which is smaller than the national average household homestead area (389.6 m^2). Villagers' household arable land areas are mainly concentrated in the range of 2–4 Mu, accounting for 56.7%, with a mean of 2.65 Mu and a median of 3 Mu, which is smaller than the national average household arable land area of villagers (7.8 Mu; NBSC, 2022). This indicates that most local households are small farmers, mainly because of scattered

Table 1. Socio-economic and resource characteristics of indigenous villagers in Linpan settlements

Variable		Group	Villagers' location						Total	
			Dahe		Jinji		Yingxiang			
			Number	%	Number	%	Number	%	Number	%
Social characteristics	Gender	Male	189	70.8	126	54.3	120	53.1	435	60
		Female	78	29.2	106	45.7	106	46.9	290	40
	Age	18–30 years	8	3	22	9.5	22	9.7	52	7.2
		31–40 years	71	26.6	58	25	43	19	172	23.7
		41–50 years	90	33.7	71	30.6	59	26.1	220	30.3
		51–60 years	41	15.4	37	16	52	23	130	17.9
		>60 years	57	21.4	44	19	50	22.1	151	20.8
	Education level	No education	1	0.4	4	1.7	6	2.7	11	15
		Primary school	60	22.5	29	12.5	69	30.5	158	21.8
		Junior high school	135	50.6	91	39.2	73	32.3	299	41.2
		Senior high school	46	17.2	74	31.9	48	21.2	168	23.2
		University or above	25	9.4	34	14.7	30	13.3	89	12.3
Economy characteristics	Source of income	Agriculture	11	4.1	43	18.5	34	15	88	12.1
		Family business	16	6	17	7.3	25	11.1	58	8
		Work in cities	178	66.7	133	57.3	115	50.9	426	58.8
		No income	4	1.5	17	7.3	11	4.9	32	44
		Retire	58	21.7	22	9.5	41	18.1	121	16.7
	Monthly income	<1000 RMB	16	6	60	25.9	40	17.7	116	16
		1001–2000 RMB	69	25.8	32	13.8	53	23.5	154	21.2
		2001–3000 RMB	93	34.8	27	11.6	70	31	190	26.2
		3001–4000 RMB	62	23.2	52	22.4	38	16.8	152	21
		>4000 RMB	27	10.1	61	26.3	25	11.1	113	15.6
Resource characteristics	Household homestead area	No homestead	32	12	32	13.8	68	30.1	132	18.2
		1–200 m^2	30	11.2	41	17.7	65	28.8	136	18.8
		201–400 m^2	151	56.6	64	27.6	49	21.7	264	36.4
		401–600 m^2	41	15.4	78	33.6	19	8.4	138	19
		601–800 m^2	10	3.8	16	6.9	16	7.1	42	5.8
		>800 m^2	3	1.1	1	0.4	9	4	13	1.8
	Household arable land area	No arable land	36	13.5	11	4.7	29	12.8	76	10.5
		0.1–2.0 Mu	18	6.7	61	26.3	74	32.7	153	21.1
		2.1–4.0 Mu	157	58.8	137	59.1	117	51.8	411	56.7
		4.1–6.0 Mu	45	16.9	23	9.9	6	2.7	74	10.2
		>6.0 Mu	11	4.1	0	0	0	0	11	1.5
	Household woodland area	No woodland	266	99.6	221	95.3	108	47.8	595	82.1
		0–1 Mu	1	0.4	11	4.7	118	52.2	130	17.9

Note: Mu is a unit of area in China, and one Mu is approximately equal to 666.67 square meters.

plots of land. Most villagers do not own woodlands; only 18% own them, and all of them are less than 1 Mu in size.

The villagers' characteristics in the three villages show relatively apparent differences. In terms of socioeconomic characteristics, Dahe village has the highest proportion of young and middle-aged people; the most significant number of people working in urban areas, the higher the monthly income of villagers, and according to the interviews, there are a few wealthy sections in the local population. Jinji village has experienced the most significant youth population loss, and most of the remaining villagers are retired and elderly, with traditional agricultural production as their primary source of livelihood. Jinji village has the most significant proportion of villagers with less than 1,000 RMB and overall low income. Yingxiang village has the largest population over 50 years of age and the highest proportion of villagers engaged in the family business. The education level of villagers in all three villages is concentrated in junior high school or below; however, Jinji has the highest percentage of people with senior high school education or above, but these people are mainly city workers. Regarding resource characteristics, Dahe village has the highest average household arable land area, and a certain proportion of remaining farmers are large growers (a household arable land area greater than six Mu); the average household homestead area is also relatively high. The villagers of Jinji have the highest average household homestead area with spacious yards, but the environment can be better utilized. The average household arable land area in Jinji is relatively high. Yingxiang Village, due to its proximity to the town, is the most affected by urbanization and has the highest conversion of agricultural land into urban residential communities, resulting in the smallest average household arable land area; however, for the most significant number of households with large homesteads (with a household homestead area greater than 800 m^2), the average household homestead area is small because many villagers have moved into nearby townships, resulting in more homesteads vacated within Linpan.

3.2. Analysis of perceptions of Linpan conservation

3.2.1. Perception of overall Linpan conservation

The statistical results of Q1 (Figure 3) show that the most significant proportions of villagers, 54% and 49%, want to protect the fields and water systems in Linpan, respectively, which supports the approach of the government and experts to give priority and overall protection to these two spatial elements of Linpan. On the one hand, farmland is the most basic faceted substrate of the Linpan landscape and the spatial carrier of agricultural production. On the other hand, the well-developed water system of Linpan benefits from the maintenance carried out by the Dujiangyan hydraulic engineering. It also reflects the long history of agricultural civilization in the irrigated areas; therefore, the water system and fields should be included in the core protection scope of the Linpan Landscape System for overall protection.

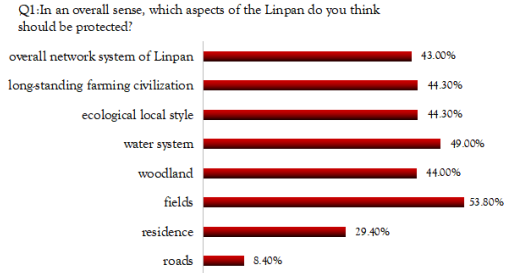

Figure 3. Analysis chart of the overall conservation perception of Linpan (percentage of cases, the same below)

3.2.2. Perception of Linpan space elements' conservation

The statistical results of Q2-1 (Figure 4) show that most (83%) villagers consider irrigation canals as the most crucial element of the water system to be protected in the landscape. This provides sufficient evidence that villagers value the water system with irrigation canals as the core, which is the basis of villagers' agricultural production and life in Linpan as well as the core of the Linpan ecosystem.

The statistical results of Q2-2 (Figure 4) show that more than 80% of the villagers believe that main canals, branch canals, medium canals, and farmland canals should be protected. In contrast, the willingness to protect capillary canals is relatively low. Capillary canals are found at the extremes of the irrigation system and can be modified and used by villagers according to their production and living needs. In contrast, the other four types of canals form the backbone of the water system in Linpan, which is the focus of water system protection.

The statistical results of Q3 (Figure 5) show that the vegetation that villagers are most inclined to protect include Di, Cas, and Ju, all of which are edible and have high economic value. Therefore, the allocation of such vegetation can be encouraged to ensure landscape color coordination.

The statistical results of Q4 (Figure 6) show that paddy is the type of fields that villagers think should be protected the most (85%), followed by wheat fields (79%), suggesting that the security of grain crops is important to the villagers as well as their concordance with the national requirement of protecting farmland.

The statistical results of Q5-1 (Figure 6) show that most villagers attach importance to protecting traditional

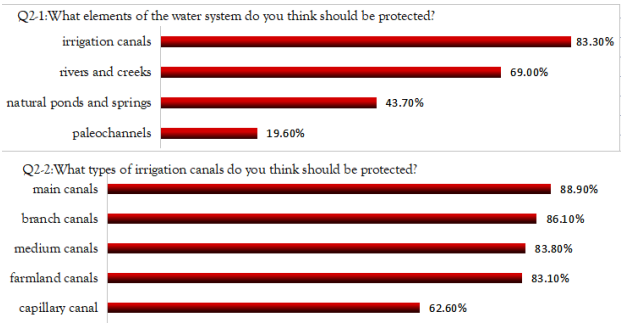

Figure 4. Analysis chart of perception of water system and irrigation canal protection

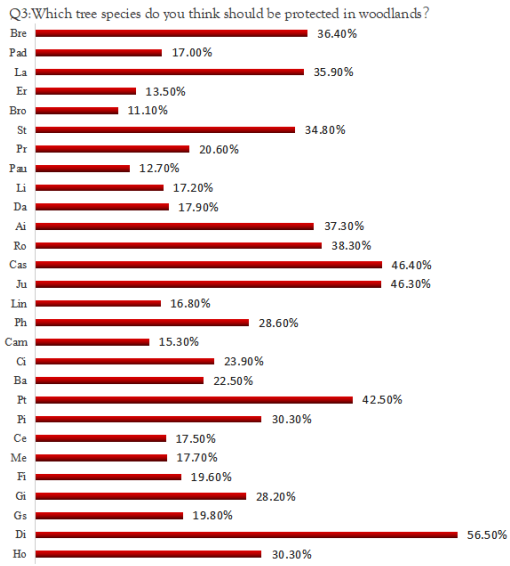

Figure 5. Analysis chart of the perception of woodland conservation[1]

residential houses (76%) and the layouts of building groups (75%). For traditional residential houses, some of the better quality and preserved traditional residential houses in Linpan have been the focus of protection in government planning, and is an essential carrier of Linpan's culture. Residential houses can also play a role in the future introduction of functions, such as rural vacations, and generate economic value. Some newly built modern buildings can be renovated to restore the traditional architectural style when conditions allow to better highlight the regional characteristics of Linpan. The layout of building groups is an essential reflection of the development intensity and density of Linpan and is the basis for the formation of Linpan settlements. Attention should be paid to the preservation of traditional building layouts, adoption of reasonable layout arrangements, and creation of efficient building utilization patterns.

The statistical results of Q5-2 (Figure 6) show that 86% of the villagers value the preservation of the architectural structure of traditional houses and believe that their through-drawer frame–a form of ancient Chinese architectural wood frame–has high cultural value; hence they are a priority for government protection.

The statistical results of Q6 (Figure 6) show that most villagers (76%) believe that field paths should be protected as they determine the accessibility between agricultural production and living settlements. At the same time, these field paths are also closely related to the rural tourism industry, which may be introduced in the future and can be integrated into the unified restoration and management of the future slow transport system of Linpan; this should focus on replacing the road material and moderately widening the width to make it suitable for walking.

3.3. Analysis of the perception of Linpan utilization

3.3.1. Perceptions of government actions

The results of Q7 (Figure 7) show that the majority (89%) of the villagers agree with the government's plan for the conservation and utilization of the Linpan, and the results of Q8 (Figure 7) show that most of them (77%) are willing to participate in its land utilization; as indicated by the interviews, this is mainly motivated by the need to increase economic income and improve the quality of the living environment.

The statistical results of Q9 (Figure 7) show that 44% of the villagers would like to use market-based land transfer and transfer the use rights to developers when they can see more employment opportunities and obtain more income as practitioners of developed industries. In addition, 31% of villagers are willing to operate related industries on their own under the government's guidance, such as operating agrotourism projects to improve their income.

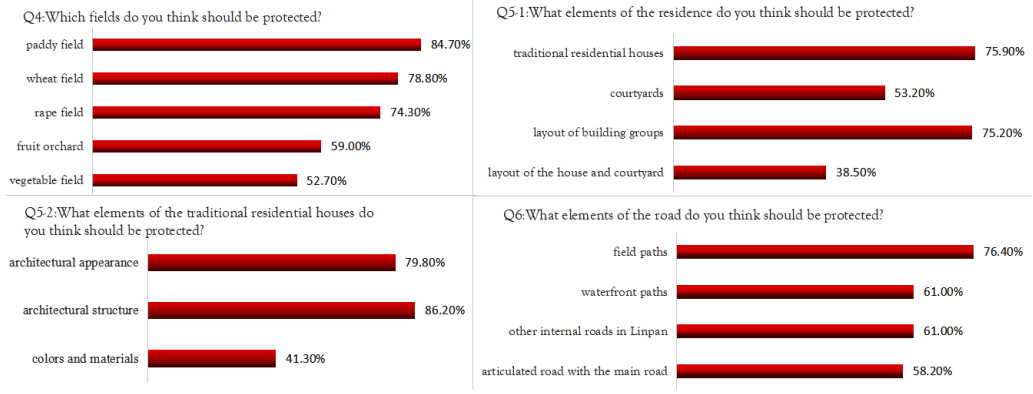

Figure 6. Analysis chart of perceptions of protection of fields, residence, traditional residential houses, and roads

[1] Since January 2022, we have conducted a detailed survey of the vegetation in the three villages with a diameter at breast height ≥25 cm and found 28 major tree species: Bretschneidera sinensis (Bre), Padus racemose (Pad), Lagerstroemia indica (La), Erythrina variegata (Er), Broussonetia papyrifera (Bro), Styphnolobium japonicum (St), Prunus salicina (Pr), Paulownia (Pau), Ligustrum lucidum (Lig), Dalbergia hupeana (Da), Ailanthus (Ai), Robina (Ro), Castanea mollissima (Cas), Juglans (Ju), Lindera mesophyll (Lin), Phoebe Chennai (Ph), Camptotheca acuminate (Cam), Cinnamomum camphora (Ci), Bamboo (Ba), Pterocarya Hymenoptera (Pt), Picrasma quassinoids (Pi), Celtis sinensis (Ce), Metasequoia glyptostroboides (Me), Firmiana simplex (Fi), Ginkgo biloba (Gi), Gleditsia sinensis (Gs), Diospyros catharsis (Di), and Hovenia acerba (Ho).

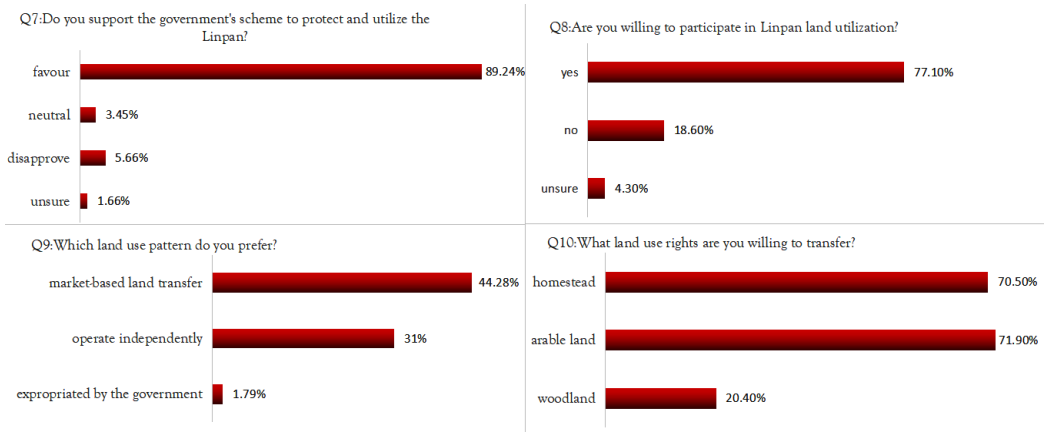

Figure 7. Analysis chart of government action perception

Q10's statistical results (Figure 7) show that more than 70% of villagers are willing to transfer their homesteads and arable land, which corroborates the phenomenon that many villagers are willing to abandon agricultural production to enjoy urban life, as is evident from the interviews. In summary, the government can encourage market-based land transfer through policy tools such as increasing subsidies for farmers who transfer land for development and allowing farmers to participate in cooperatives or market owners in the form of land shares.

3.3.2. Perception of implantation of industries

The statistical results of Q11 (Figure 8) show that most villagers believe that the Linpan should introduce vacation industries (74%), followed by health and wellness (42%), and farmland leisure and sightseeing (38%). These functions are closely related to the villagers' production and mode of living. The vacation industry primarily uses residential houses and surrounding fields, to run B&B ventures, and villagers can use their residential houses to profit from the operation. The government encourages the development of the wellness industry, such as nursing homes and medical care. It requires government and social capital investment, but the output is more extensive and can also radiate toward the surrounding industries and regions. Farmland leisure and sightseeing can involve orchard tours, agricultural science, building a farming culture museum to develop educational camps and experience communities, or combining different farming times to hold plucking festivals, idyllic music festivals, and other forms to promote farming culture.

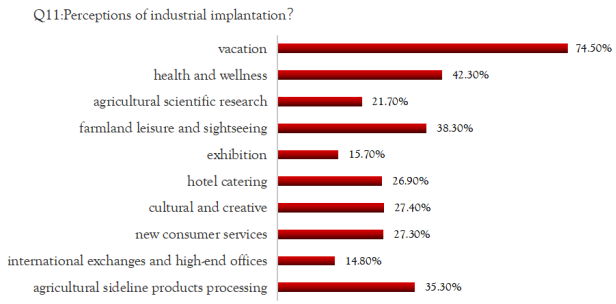

Figure 8. Analysis chart of perception of implantation of industries

3.4. Impact of differences in villagers' characteristics on the perception of Linpan conservation

According to Table 2, villagers in the three villages differ significantly in their choice of overall Linpan conservation (Q1) and in their perceptions of the conservation of water system (Q2-1), woodland (Q3), residence (Q5-1), traditional residential houses (Q5-2) and road (Q6) elements. The statistically significant difference items for the perceptions of Linpan conservation are detailed in Table 3, and the specific manifestations of these differences are analyzed in detail below. However, no significant difference was found in the villagers' perceptions of the protection of irrigation canals (Q2-2) and fields (Q4). This indicates that irrigation canals and fields, which are the core of the water system, are recognized by villagers as priority objects for protection.

Table 2. Results of the chi-square test for the effect of differences in villagers' characteristics on the perception of Linpan conservation and utilization

Variable	χ^2 value	df	Sig.
Q1	153.16	14	0.000*
Q2-1	94.908	6	0.000*
Q2-2	15.36	8	0.053
Q3	572.957	54	0.001*
Q4	11.547	8	0.173
Q5-1	34.399	6	0.000*
Q5-2	10.937	4	0.027*
Q6	66.64	6	0.000*
Q7	4.935	6	0.552
Q8	122.153	4	0.000*
Q9	82.805	4	0.000**
Q10	75.254	4	0.000*
Q11	184.056	20	0.000*

Note: *$p < 0.05$ (progressive method), **$p < 0.01$ (Monte Carlo method).

Table 3. Differences in perceptions of Linpan's conservation and utilization among villagers in three villages

Items with differences	Comparison of the three villages		
	Dahe	Jinji	Yingxiang
Q1-1	□	–	□
Q1-2	–	□	□
Q1-4	□	+	–
Q1-7	□	–	□
Q2-1-2	□	□	–
Q2-1-3	□	+	□
Q2-1-4	□	+	□
Q3-1	□	□	–
Q3-6	+	□	□
Q3-8	–	□	□
Q3-9	□	□	+
Q3-11	+	□	□
Q3-12	+	□	□
Q3-13	+	□	□
Q3-16	–	□	□
Q3-19	□	+	□
Q3-20	+	□	□
Q3-21	+	□	□
Q3-24	□	□	+
Q3-28	□	+	□
Q5-1-1	□	□	+
Q5-1-4	□	□	–
Q5-2-1	□	□	+
Q5-2-3	–	+	□
Q6-2	□	–	□
Q6-4	□	+	□
Q8-2	+	□	□
Q9-1	□	□	+
Q9-2	+	□	□
Q10-1	–	□	+
Q10-2	+	□	–
Q11-1	□	□	–
Q11-4	□	□	–
Q11-6	□	+	□
Q11-9	+	□	□

Notes: Q1-1, Q1-2, Q1-4, and Q1-7 correspond to the 1st, 2nd, 4th, and 7th answer items (top-to-bottom ordered) respectively in Figure 3, and so on for the rest; "+" indicates that villagers in the corresponding village significantly favor this item more than those in the other two villages; "–" indicates that villagers in the corresponding village significantly favor this item less than those in the other two villages; "□" indicates villagers in the corresponding village do not have a significantly higher or lower favor for the item compared to those in the other two villages.

3.4.1. Differences in the perception of overall Linpan conservation

There is less consensus among villagers in Jinji regarding the preservation of the overall network system of Linpan. As villages that retain traditional agriculture, they are more conservative. They have less contact with the outside world; therefore, they are less aware of the connections between the individual Linpan in which they live and other Linpans and the surrounding environment. The Dahe villagers have a lower propensity to agree to the preservation of the faming civilization of Linpan owing to the relatively young demographic structure of Dahe village and relatively high monthly income of the villagers, which, to a certain extent, impacted the villagers' respect for the farming civilization. This suggests the need to strengthen conservation awareness and knowledge of history and culture among the villagers in Dahe. The tendency of villagers in Jinji to protect the water system is higher, while the opposite is true for Yingxiang villagers; this is also owing to the high proportion of the agricultural population in Jinji. In contrast, Yingxiang is adjacent to the town and has a wide range of residential land. Moreover, a high proportion of residents have moved to the town; therefore, their production and lifestyles are less dependent on the water system. As for the conservation of the residences, the villagers in Jinji have a lower agreement. As villagers who have been engaged in agriculture for a long time, their residential buildings are long-lasting; there are many old and temporary buildings with poor construction quality, so they consider these buildings unnecessary to be protected. In addition, the average household homestead area in Jinji is high. According to field research, the courtyard areas in Jinji residences are generally more prominent, but they are old and dilapidated, which is why villagers are reluctant to protect them. Therefore, Jinji village should pay attention to the restoration of old buildings and the rational use of courtyard spaces–especially taking advantage of more homestead areas that can be used to develop the courtyard economy–and developing vacation sites.

3.4.2. Differences in the perception of spatial elements conservation of Linpan

3.4.2.1. Differences in perceptions of water system protection

Villagers in Yingxiang are less inclined to protect rivers and creeks. Since many Yingxiang villagers have moved to urban areas and their living environment has changed, the density of urban's natural rivers is much less than that of rural areas; thus, many people have forgotten their value.

Jinji villagers have a higher consensus in wanting to protect natural ponds, springs, and paleochannels. The only spring in the region is in Jinji, which is surrounded by high-quality water and several naturally formed ponds. During the interviews, we learned that, because the village committee wants to create a tourist site around the spring in the future, there is much publicity about it, and the local villagers are more aware of it and think it needs to be protected. Long-term fieldwork shows several traces of ancient waterways in Jinji Village 10 years ago, which, however, have disappeared today. The restoration of paleochannels can provide a more stable source of agriculture, which is critical for villagers who depend on agriculture as their main livelihood and have a low income.

3.4.2.2. Differences in perceptions of woodland protection

Dahe villagers have a higher propensity to protect St, Ai, Ro, Cas, Pt, and Pi and a significantly lower propensity to protect Pau and Ph. This is because villagers with higher income give greater weight to the economic value of vegetation or the role of enriching the landscape. Ai is a common edible plant in China, and Cas can be sold at high prices. St, Ro, Pt, and Pi each have advantages in terms of odor, flower color, and the ornamental nature of their leaves. Moreover, according to the per-wood survey of tree species in Linpan, Pau, and Ph are more frequently found in Dahe, with low rarity and low practical value, which would reduce the local villagers' attitude toward their conservation. Jinji villagers have a higher tendency to protect Ba and Ho. Because Jinji village has the highest proportion of villagers engaged in agriculture and bamboo has the best utility for agricultural production and life and can provide materials for many agricultural tools. It can also be used as material for brooms, tables, chairs, and other daily necessities. Ho wood is delicate and complex and can provide good material for construction and joinery and making agricultural tools. The proportion of villagers in Yingxiang who think Bre should be protected is lower; they prefer to protect Lig and Fi, the two common urban street trees, which are seen more frequently by many villagers who have moved into the town. These two trees provide a place for these new urban citizens to rest and socialize under the trees. The lower tendency to protect Bre is because it needs to grow under broad-leaved forests inside Linpan and needs to grow slowly. However, Yingxiang villagers living in urban–rural border areas rarely see such trees and do not understand their value.

3.4.2.3. Differences in perceptions of residence protection

Yingxiang villagers have a higher tendency to protect traditional residential houses, while they have a lower tendency to protect the layout of the houses and courtyards in Linpan. According to a field survey, Yingxiang has some historical and cultural relics, such as ancient buildings and temples, and it also has the largest population over 50 years old, which raises its villagers' awareness of the protection of traditional houses. In addition, 30% of Yingxiang villagers have already relinquished their homestead and live in high-rise apartments or government resettlement houses in the nearby urban community; therefore, they are naturally less concerned about protecting the layout of the houses and courtyards in Linpan.

3.4.2.4. Differences in perceptions of traditional residential houses protection

Villagers in Dahe tend to preserve the appearance of buildings. This is because several modern three- to five-story buildings and even European-style villas have been built by the high-property class in Dahe, which have destroyed the traditional architectural appearance to some extent; thus, locals think that buildings should be protected more. Regarding preserving colors and materials, villagers in Jinji have a higher inclination, while the opposite is true for those in Dahe. As a traditional agricultural village, the colors and materials of the buildings in Jinji integrate the culture and values of local people and embody the agricultural culture; therefore, only the villagers of Jinji can feel their importance. In contrast, the villagers of Dahe, due to their relative affluence, lack attention to the color and material of the building that carries the material elements of culture; moreover, the fact that villas have been built also destroys the color and material of the traditional buildings' extensions.

3.4.2.5. Differences in perceptions of road protection

The tendency of Jinji villagers to protect waterfront paths is lower. The waterfront road in Linpan is mainly a road for villagers to travel, while the villagers in Jinji stick to their traditional farming life and travel less; thus, the frequency of using the waterfront road is low. For the protection of the articulated road between Linpan and the main road, the tendency of Jinji villagers is higher. According to a field survey, many Jinji villagers sell their harvested crops directly on the outer roads of Linpan or next to the main road north of the village and hope that these roads will be better repaired to ensure pedestrian safety and accessibility.

3.5. Impact of differences in villagers' characteristics on the perception of Linpan utilization

According to Table 2, villagers in the three villages differ significantly in their willingness to use land (Q8) as well as in land-use patterns (Q9), support for transferring land-use rights (Q10), and perceptions of implantation of industries (Q11). The statistically significant difference items for the perceptions of Linpan utilization are detailed in Table 3, and the specific manifestations of these differences are analyzed in detail below. However, no significant differences are found in the villagers' attitudes toward the government's conservation and utilization planning schemes concerning Linpan (Q7).

3.5.1. Differences in perceptions of government actions

In terms of willingness to participate in land use, Dahe villagers tend to oppose it. As many villagers with higher incomes have already profited from land development activities, they are reluctant to lose interest and maintain the current status of the land. In addition, there are many large growers in Dahe, and large areas of arable land are more productive than fragmented arable land; thus, villagers are reluctant to give up these contiguous pieces of land. In terms of future land use patterns, a significantly higher proportion of villagers in Dahe choose to operate independently, while a higher proportion of villagers in Yingxiang support market-based land transfer. Villagers with higher incomes have the potential to run their businesses, which indicates that the government can support villagers in a position to operate relevant industries independently under the guidance of the policy. While many villagers

in Yingxiang have already transferred their homesteads to live in the city, and local homesteads have been widely used for market exploitation after the transfer. Farmers can obtain more income through land-share dividends. Regarding the transfer of land use rights, villagers in Dahe are very willing to support the transfer of arable land and not very willing to transfer homestead sites. In contrast, Yingxiang villagers are very willing to transfer homesteads and not very willing to transfer arable land. This is because the resource structure of villagers in the two villages has the highest average household arable land area and more giant planters, and the smallest average household arable land area and more large households on homesteads, respectively. Therefore, these two villages have apparent advantages in transferring arable land and homesteads. In summary, the government can provide differentiated subsidies for the types of Linpan land that different villagers either want to relinquish or develop large-scale agricultural production bases in the cooperation of large growers to improve agricultural returns.

3.5.2. Differences in perceptions of implantation of industries

Yingxiang villagers have a lower propensity to develop vacation, farmland leisure, and sightseeing industries. As many villagers in Yingxiang no longer have homesteads, there is no space carrier for developing rural vacations or leisure industries. Yingxiang villagers are more willing to develop agricultural scientific research and the exhibition industry. Scientific research needs to rely on the city's educational resources and the exhibition industry, such as museums and art galleries, are therefore part of the city's cultural public service resources; these are the benefits and advantages that many Yingxiang villagers who have moved into the city have experienced. The villagers of Jinji have a higher inclination to want the development of the hotel catering industry. They also have a high average family homestead area, with spacious yards and dams; these spaces are suitable for cafés, barbecue grills, farmhouse meals, and other special catering services. The villagers of Dahe have a higher inclination for wanting international exchanges and high-end offices. In the government's scheme, an area with a concentration of residential houses in the central area of Dahe will be planned as a World Heritage IT Valley, and the local government's promotion policy is in place. Moreover, Dahe has relatively more young and middle-aged people, which affects the villagers' overall acceptance of cutting-edge industries.

4. Conclusions

First, the socioeconomic and resource characteristics of the indigenous inhabitants of cultural landscape areas are essential indicators of the rise and fall of landscape change; thus, investigating and understanding the current attributes of indigenous villagers is a preliminary step in developing Linpan conservation and utilization policies. The contemporary characteristics of the villagers in Linpan reflect the signs of Linpan's decline, suggesting that policymakers should pay full attention to this trend and take action accordingly. For example, attracting the labour force back by improving the living environment, infrastructure, and industrial vitality; focusing on the education and training of villagers; integrating fragmented arable land to increase the per capita area of arable land, and promoting the centralized and intensive use of scattered and unused construction land in the countryside; increasing the labour productivity of the farmers through the application of new agricultural technologies to promote the traditional agrarian regeneration.

Second, in the survey, villagers proposed elements of the Linpan landscape that they preferred to protect and the types of industries they wished to develop, and expressed their willingness to participate in land use, their preferred form of use, and the objects of land transfer, providing a reference for the formulation of Linpan conservation and utilization policies from the villagers' perspective. This suggests that policymakers and land policy process stakeholders should consult affected populations and respect villagers' autonomous choices in their plans and actions, which involves proposing a framework for the categorized conservation and utilization of the Linpan cultural landscape considering the overall and elemental conservation of Linpan, as well as its overall industrial development orientation and land use policy, and taking into account the villagers' willingness to transfer their land, promoting diversified community building methods such as staying in the countryside scattered, establishing a clustered rural community, and flowing into cities. This participatory approach reduces injustice in the resource allocation process (Kapidura et al., 2014), takes advantage of villagers as holders of information on cultural landscapes safeguards the rights and interests of villagers collectively as landowners, and provides a social basis for implementing plans.

Third, villagers in different settlements view the conservation and use of Linpan differently, wish to protect different landscape elements, and differ in their potential land use choices. This is mainly due to the differences in their social, economic, and resource characteristics. It shows that villagers' characteristic factors have a complex influence on their understanding and perception of cultural landscapes. This implies that policies and actions for the conservation and use of Linpan should conduct necessary investigations among different villages regarding the understanding and perceptions, combining the subjective perceptions for the local expression of the Linpan cultural landscape area, which will help to diversify the conservation of Linpan, respect the social genes and human characteristics of the different villages, and make use of their respective resource advantages. Necessary communication between villages should also be carried out, and the government's role in publicity and guidance in landscape conservation and utilization should be brought into play to negotiate a sustainable model of the rural cultural landscape that combines the expression of characteristics and unity.

This study helps to understand villagers' perceptions of the conservation and utilization of the Linpan landscape,

which will contribute to the social and spatial diversification of the landscape based on villagers' participation in the sustainable development of the rural areas. It also enriches the academic research on the perception of Linpan, a unique cultural landscape in the Chengdu Plain, and the research on the conservation and utilization of cultural landscape heritage.

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