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RURAL SOCIOLOGY

Effects of villagers' socio-economic and resource backgrounds on the perception of cultural landscape values of Linpan agricultural settlements: The case of Dujiangyan City

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ABSTRACT: The Linpan cultural landscape has been a masterpiece of harmonious coexistence between humans and nature since the Dujiangyan Hydraulic Engineering more than 2,300 years ago. With the rapid urbanization of the Chengdu Plain over the past thirty years, Linpan has gradually declined and faced a disappearance crisis. The protection and utilization of Linpan have become an urgent public demand. Our case study area was in Dujiangyan City. We used detailed field investigations, questionnaires, and unstructured interviews to understand the villagers' perceptions of the Linpan and explore how their socioeconomic and resource backgrounds affected their landscape perceptions. The study revealed typical population loss and aging trends in Linpan settlements, and it found that the villagers recognized Linpan as a "joint masterpiece of man and nature" and that most villagers supported the utilization in Linpan rural areas. This study further revealed that villagers' socioeconomic and resource background factors had complex and selective impacts on their landscape perceptions. It also found that economic factor, especially monthly income, was the key variables affecting villagers' landscape perceptions. The study enriched the perception study of Linpan, a unique agro-cultural landscape in the Chengdu Plain. It provided an essential reference for the subsequent sustainable development of Linpan based on villagers' participation.
Key words: Linpan, Cultural landscape of agricultural settlements, Landscape perceptions, Socioeconomic and resource background.

Efeitos das origens socioeconômicas e de recursos dos aldeões na percepção dos valores da paisagem cultural dos assentamentos agrícolas de Linpan: o caso da cidade de Dujiangyan

RESUMO: A paisagem cultural de Linpan tem sido uma obra-prima de coexistência harmoniosa entre humanos e natureza desde a Engenharia Hidráulica de Dujiangyan, há mais de 2.300 anos. Com a rápida urbanização da planície de Chengdu nos últimos trinta anos, Linpan declinou gradualmente e enfrentou uma crise de desaparecimento. A proteção e utilização do Linpan tornaram-se uma demanda pública urgente. Nossa área de estudo de caso foi na cidade de Dujiangyan. Utilizamos investigações de campo detalhadas, questionários e entrevistas não estruturadas para compreender as percepções dos aldeões sobre o Linpan e explorar como os seus antecedentes socioeconômicos e de recursos afetaram as suas percepções da paisagem. O estudo revelou tendências típicas de perda populacional e envelhecimento nos assentamentos de Linpan, e descobriu que os moradores reconheciam Linpan como uma "obra-prima conjunta do homem e da natureza" e que a maioria dos moradores apoiava a utilização nas áreas rurais de Linpan. Este estudo revelou ainda que os fatores socioeconômicos e de recursos dos habitantes das aldeias tiveram impactos complexos e seletivo nas suas percepções da paisagem. Descobriu também que o fator econômico, especialmente o rendimento mensal, era a variável chave que afetada as percepções paisagísticas dos aldeões. O estudo enriqueceu o estudo da percepção de Linpan, uma paisagem agro cultural única na planície de Chengdu. Forneceu uma referência essencial para o subsequente desenvolvimento sustentável de Linpan com base na participação dos moradores.
Palavras-chave: Linpan, paisagem cultural de assentamentos agrícolas, percepções da paisagem, Contexto socioeconômico e de recursos.

INTRODUCTION

The Linpan settlements of the Chengdu Plain in China's Sichuan Province comprise a cultural landscape of agricultural settlements and natural elements with unique local characteristics. The traditional rural communities rely on the Dujiangyan Irrigation System, a large-scale water conservancy project built around 256 BC for irrigation and flood control. The dense network of irrigation canals became the basis for developing the Linpan cultural landscape.

The main elements of the Linpan landscape are irrigation water systems, woodland, dwellings and courtyards, farmland, and paths. However, the traditional rural landscape has undergone tremendous changes over the past few decades. As the cities have expanded and spread to the suburbs and into the rural areas, significant quantities of farmland have been abandoned and the vegetation destroyed, accompanied by the exodus of the population, aging, and low efficiency of agriculture. As these socioeconomic and ecological problems increased, the Linpan landscape faced a disappearance crisis.

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Since 2017, Sichuan Province and Chengdu City have formulated and implemented a series of public policies to preserve and restore the cultural landscape of the Linpan agricultural settlements through the national strategy for rural revitalization. Especially 'The Action Plan for the Construction of Characteristic Towns and the Protection and Restoration of Linpan in Chengdu Plain' launched by the Chengdu Municipal Government; it specifies the main tasks of compiling technical guidelines and planning for the conservation and restoration of the Linpan landscape, which aims to promote the characteristic and high-quality development of Linpan settlements based on the protection of their original features (Chengdu Characteristic Town Construction Leading Group, 2019). The policy also emphasizes the need to encourage the villagers' participation and respect their interests in the development process.

The increasingly urgent need to preserve and protect the Linpan settlements has prompted a corresponding increase in the research on the cultural landscape of Linpan agricultural settlements, focusing primarily on its value connotations, spatial characteristics, settlement architecture, ecology, the landscape, botany, and land use (LI & CAO, 2019; LI, et al., 2019; SHI & ISHIKAWA, 2012; SUN et al., 2011; XUE & ZHU, 2013). However, few studies have explored the preservation and usage of the Linpan landscape from the perspective of landscape perceptions, even though the study of landscape perception has become an essential part of today's landscape research. Some scholars have explored the different perceptions of landscapes held by various stakeholders, such as the public (residents and nonresidents), villagers living in other villages, landscape experts, and government officials. The studies' conclusions have contributed to land-use decision-making and landscape planning. For example, RUSKULE et al. (2013) found that residents and experts in Latvia reached a consensus regarding the landscape (visual) and biodiversity value and usage potential of four patterns of afforestation of abandoned agricultural land. They also found that people could also reach a consensus on management strategies. KUPIDURA et al. (2014) argued that policymakers and others involved in the land consolidation process should consult with affected farmers and visitors to rural areas in Poland because the participatory approach could reduce injustices and increase acceptance.

Other studies have explored the factors that influence landscape perceptions. These mainly have had one of two focuses: (1) how people's backgrounds affect their landscape perceptions; or (2) how landscape elements and their features influence people's landscape perceptions. Among those focusing on people's backgrounds were LE LAY et al. (2013), who found that people's landscape preferences for the Magra River in Italy were influenced by their values, beliefs, social experiences, personalities, socioeconomic status (SES), professions, experiences with environmental management, and familiarity with the particular environment.

SANTORO et al. (2021) compared the differences in the perception of the Cinque Terre and Porto Venere terraced landscapes by two social groups, local farmers and residents, suggesting key issues that must be dealt with differently in complex areas of cultural landscapes due to diverse social and economic structures. VAN DEN BERG & KOOLE (2006) found that people's backgrounds (e.g., rural vs. urban, SES, political views, and recreational choices) strongly influenced their landscape perceptions. RUSKULE et al. (2013) argued that people who lived in their study areas in Latvia but had no agricultural land were more critical of the changes to abandoned agricultural land than those who owned agricultural land but did not engage in agriculture.

Among those focusing on how landscape elements and their features influence perceptions was TEMPESTA (2010), who found that the villas and traditional farm buildings in a historical landscape could increase people's favorable perceptions of the landscape. Similarly, SOLECKA et al. (2022) reported that external aesthetics significantly influenced people's evaluation of agricultural landscapes in Wrocław, Poland. LI et al. (2022) found that land-use context, surrounding woody and herbaceous plants, and basin slopes contributed to positive perceptions of the landscape.

However, current studies on the perception of the Linpan landscape only involve the second level--how the landscape elements and features affect people's perception of Linpan (LUO et al., 2021), and there is a lack of research on "the influence of people's socio-economic and other background factors on the perception of the cultural landscape of Linpan landscape".

This study builds on the decade-long study by ISHIKAWA et al. (2020) on the cultural landscape of Linpan agricultural settlements; the previous study has identified the value of Linpan landscape and classified the Linpan settlements according to their spatial and socio-economic characteristics and proposed basic objectives and guidelines for their protection and regeneration. However, in the

process of long-term field detailed investigation and interviews with villagers, we found that local villagers may have defective cognition of Linpan, and their views are crucial or even fundamental to Linpans' protection and utilization, which means failing to fully involve and survey villagers about their views on Linpan can hinder their acceptance of the government's preservation and restoration policies. Moreover, their backgrounds and interests might influence their perceptions of the Linpan landscape, leading to social contradictions and conflicts in the landscape policy implementation.

Therefore, this study seeks to understand villagers' perceptions of Linpan landscape and the factors that influence their perceptions-the villagers' social, economic, and resource backgrounds-which can help provide villagers' participatory views for the subsequent development of the conservation and utilization of Linpan and is an important foundation for ensuring the sustainable development of Linpan rural area.

Based on the above discussion, the specific research questions for this study are as follows.

(1) Villagers' background-what are the Linpan villagers' socioeconomic and resource backgrounds (mainly land ownership, including arable land, woodlands, and homesteads)?

(2) Landscape perception-how do the local villagers view the cultural landscape of the Linpan agricultural settlements (including perceptions of the overall landscape and landscape elements)?

(3) Influence of background factors on landscape perception-how do the villagers' socioeconomic and resource backgrounds affect their landscape perceptions?

MATERIALS AND METHODS

Study area

Dujiangyan City is a county-level city (directly affiliated with Chengdu City) located in the Chengdu Plain in southwestern China. Its main landscape elements of "water," "mountain," "field," "forest," and "town" jointly shape the skeleton of Dujiangyan City. The Linpan traditional agricultural settlement is the leading carrier of its landscape conservation (Figure 1). As of December 2021, Dujiangyan had an area of 1,208 km^2, a permanent population of 717,400, and an urbanization rate of 62.3%. Dujiangyan is a "Three Heritage City" with World Cultural Heritage, World Natural Heritage, and World Irrigation Engineering Heritage city titles (UNESCO WORLD HERITAGE CONVENTION, 2022; INTERNATIONAL COMMISSION ON IRRIGATION & DRAINAGE, 2022); tourism is its main industry.

The Linpan settlements in Dujiangyan City are concentrated in the rural planning area southeast of downtown (Figure 1). According to Dujiangyan City's master plan, Linpan is a critical part of Dujiangyan City becoming an "Eco-city" because it embodies Tianfu's farming culture. As of 2017, there were 3,824 Linpan settlements in Dujiangyan City, covering a total area of 332.97km^2, accounting for 27.56% of the city's area. The Linpan in Dujiangyan City has about 250,000 people, about 36% of the city's population. According to a recent satellite image, the Linpan's average area within Dujiangyan City was 10,617.6m^2, of which the largest Linpan area exceeded 30,000 m^2 and the smallest less than 2,000 m^2. The Linpan settlement units are usually based on a surname (clan), so the Linpan settlements are often identified by a family name, with the most common being Yang, Dang, Song, and Guo. There might be only a few households in a small Linpan settlement but hundreds in a large one. We found that most of the households were small (3–5 people), but there were some large families (6–9 people); the largest had ten people.

The survey

Building on the previous research, we developed and administered a questionnaire to investigate the local villagers' perceptions of the Linpan. We chose this method because it allowed the respondents to provide simple, structured responses to our questions and could support a large sample size.

Our detailed survey area was Juyuan Town (Figure 1), involving three traditional Linpan settlements: Dahe Village (3.82 km^2; population 4,384), Jinji Village (1.89 km^2; population 2,890), and Yingxiang Village (3.21 km^2; population 5,320). There were 374 Linpan settlements in the three villages; usually 2–5 was concentrated along roads and waterways. The average distance between them was small (about 300 m), so the overall layout was relatively concentrated. We selected this area because we had conducted detailed investigations and research in the three villages over the past 14 years. We analyzed the macro-scale spatial distribution characteristics of the Linpan settlements using satellite images, and also conducted a detailed micro-scale survey of each Linpan settlement (Figure 2, Figure 3). Based on this, we divided the Linpan cultural landscape into the following five main landscape elements: water system landscape (W), vegetation landscape (V), farmland landscape (F), dwellings and courtyards

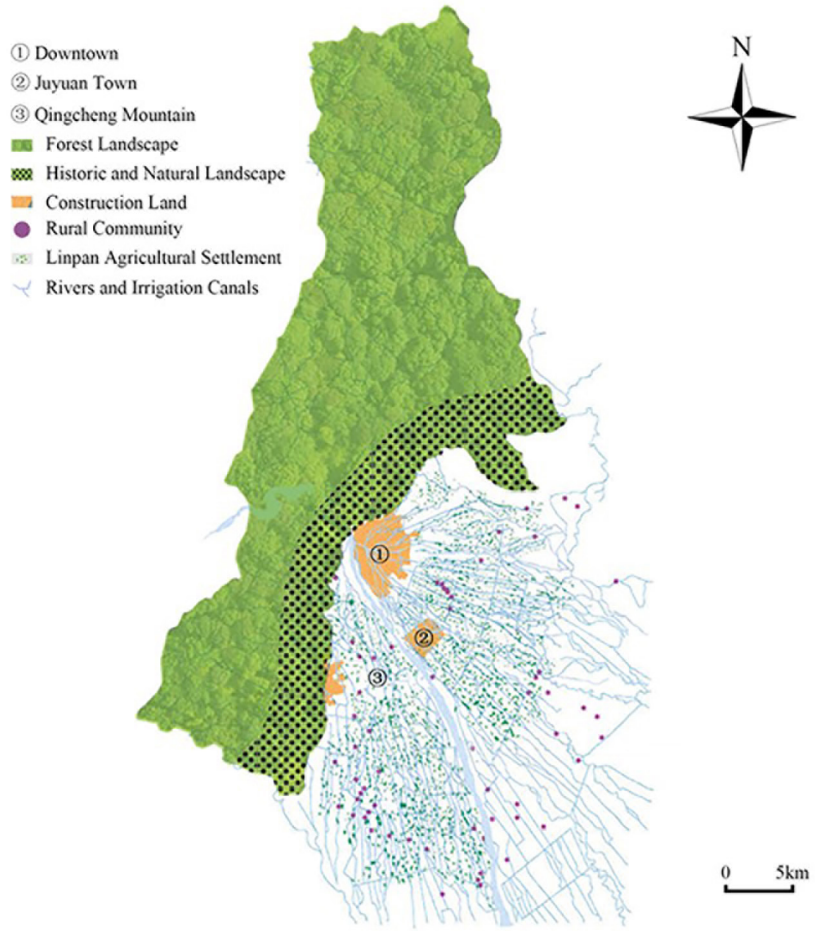

Figure 1 - Distribution of the main landscape elements in the Dujiangyan city area. Source: authors.

landscape (D), and path landscape (P). Furthermore, surveyed and mapped the water networks, we found that the water system mainly comprised irrigation canals (W1), rivers and ditches (W2), natural ponds and springs (W3), and paleochannels (W4), and we divided the irrigation canal by width and purpose into main canals (W1,1), branch canals (W1,2), medium canals (W1,3), farmland canals (W1,4), and capillary canals (W1,5). Our investigation of each tree in the Linpans revealed a rich and diverse collection of vegetation and native tree species. We found 28 main tree species in Linpan areas, and based on the classification method for ornamental tree species characteristics, we divided the vegetation landscape into four categories: flowering vegetation (VA), tree-shaped-effect vegetation (VB), foliage vegetation (VC), and fruiting vegetation (VD). The flowering vegetations include *Bretschneidera sinensis* (Bre), *Padus racemose* (Pad), *Lagerstroemia indica* (La), *Erythrina variegate* (Er), *Broussonetia papyrifera* (Bro), *Styphnolobium japonicum* (St), *Prunus salicina* (Pr), *Paulownia* (Pau), *Ligustrum lucidum* (Lig), *Dalbergia hupeana* (Da), *Ailanthus* (Ai), and *Robinia* (Ro); the tree-shaped-effect vegetations include *Castanea mollissima* (Cas), *Juglans* (Ju), *Lindera megaphylla* (Lin), *Phoebe zhennan* (Ph), *Camptotheca acuminate* (Cam), *Cinnamomum camphora* (Ci), and bamboo (Ba); the foliage vegetations include *Pterocarya stenoptera* (Pt), *Picrasma quassioides* (Pi), *Celtis sinensis* (Ce), *Metasequoia glyptostroboides* (Me), *Firmiana simplex* (Fi), *Ginkgo biloba* (Gi), and *Gleditsia sinensis* (Gs); the fruiting vegetations include *Diospyros cathayensis* (Di) and *Hovenia acerba* (Ho). According to long-term investigations of the main crops planted in the Linpan settlements in different seasons and the resulting farmland landscapes, we found the farmlands in Linpan areas are mainly rice

Figure 2 - Schematic diagram of the landscape elevation of Yangjia Linpan in Jinji village. Source: authors.

fields (F1), wheat fields (F2), rapeseed fields (F3), nurseries or orchards (F4), and vegetable fields (F5). Our surveys of the traditional dwellings and courtyards revealed that elements of them are made up with architectural layout of the single Linpan (D1), traditional dwellings in Chengdu Plain (D2), courtyards (D3), and dwelling and courtyard layouts in a household (D4). Moreover, we understood the traditional dwellings in Chengdu Plain based on three main aspects: the architectural shape (D2,1), architectural structure (D2,2), and colors and materials (D2,3). Finally, we identified four road components: field paths (P1), trails built along the water (P2), other internal paths of Linpan (P3), and the connecting road between the Linpan and the main road (P4).

We selected the respondents through random sampling, which allows researchers to obtain maximum diversity and randomness (CHIESURA, 2004). We sent 1,100 questionnaires over a three-month period (spring–summer 2022) to villagers from all socioeconomic and resource backgrounds. Seven professionals (professors, graduate students, and undergraduates) distributed the questionnaires, some with the assistance of the local village committee. The average completion time for each questionnaire was 20 minutes. We received 1,032 completed questionnaires for a total response rate of 93.8%; after excluding those that were incomplete or otherwise inapplicable, we had 915 valid questionnaires, a sufficient sample size.

We developed the content of the questionnaire from the research questions. To address the first research question, we collected three social background variables (age, gender, and education level), two economic background variables (income source and monthly income), and three resources variables (households' arable land area, woodlands area, and homestead area).

To address the second research question, we deconstructed the problem from two dimensions: (1) perceptions of the overall landscape and (2) perceptions of landscape elements. For the first, we asked the respondents about their overall perceptions through seven multiple-choice questions (Table 1) on seven dimensions of Linpan: individual/system, humans/nature, representativeness, major changes, value, value connotations, and attitudes toward preservation and use. For the second, we asked respondents to rank their perceptions of the value of the landscape elements using a 5-point Likert scale.

In addressing the third research question, as space constraints, we mainly explore the impact of villagers' background variables on three issues: their perceptions of the overall landscape value (Q5), their attitudes toward preservation and use (Q7), and their perceptions of the landscape elements' value. We selected all eight variables for analysis to assess the impact of the villagers' background variables (Q5 and Q7). To analyze the correlation between the influencing variables and the value perception of landscape elements, we selected only five ordered categorical variables (age, education level, monthly income, household arable land area, and household homestead area) due to the limitation of the definition of the data attributes.

Data analysis

We analyzed the questionnaire survey data using SPSS 26.0, conducting various statistical analyses. Firstly, this study used frequency descriptive statistics to analyze and interpret the results of scoring the seven multiple-choice questions and landscape element values. Since the data on the villagers' perceptions of the landscape elements' value came from a 5-point Likert scale, a continuous numerical variable,

Figure 3 - Photographs taken in the Linpan study area. Source: authors.

we needed to conduct reliability, validity, and normality tests before analysis. Moreover, because the results of all the scale items did not obey a normal distribution, we chose to report the median rather than the mean.

Second, we conducted a chi-square test to determine the impact of the villagers' background variables on their overall landscape value perceptions and attitudes toward preservation and use. When we

Table 1 - Multiple-choice question content and corresponding research questions.

Research questions	Number	----------Question----------
(2)	Q1	Do you think Linpan comprises individual units or is a system?
(2)	Q2	Do you think Linpan belongs to human engineering or the creation of nature?
(2)	Q3	Do you think Linpan is representative of the geographical and cultural areas of the Chengdu Plain?
(2)	Q4	What major changes do you think have taken place in Linpan since the 1990s?
(2)(3)	Q5	Do you think Linpan is valuable?
(2)	Q6	What do you think are the values of Linpan?
(2)(3)	Q7	What is your attitude toward preserving and using Linpan?

found that all the explanatory variables had significant effects on the two response variables, we calculated the contingency coefficients to find explanatory variables with a more significant impact.

Finally, we used Spearman's coefficient to calculate the correlation and positive and negative directions between the five ordinal categorical variables (age, education level, monthly income, household arable land area, and household homestead area) and the villagers' value perceptions of the landscape elements.

RESULTS AND DISCUSSION

Villagers' characteristics

Most (33.2%) of the villagers were aged 41–50 (Table 2), 19.7% were over 60 years old, in line with the aging population (according to international practice). Only 7.2% were aged 18–30, in line with the worrisome decline in the youth population. Most of the villagers were men. The overall education level of the villagers was relatively low. The largest group (42.5%) had only a junior high school education. The proportion having a university education or above was just 11.7%.

Only 10.6% of the villagers were engaged in agriculture. Most (61.4%) of the young and middle-aged people chose to work in cities. The fragmentation of arable land in the Linpan settlements and the challenges associated with conventional agricultural production techniques and crops have made traditional agriculture insufficient for sustaining livelihoods and meeting higher social needs. The area's primary agricultural products were rice and rape, followed by wheat, corn, and vegetables. Some villagers raised chickens, ducks, and livestock at home.

The proportion of retirees among the villagers was 16%. A significant proportion (28%) of villagers fell into the monthly income bracket RMB 2000–3000, which was higher than the national average (RMB 1,577) and comparable to the Chengdu average (RMB 2,427) (CUI, 2022; YUAN, 2022). A significant percentage (21.9%) of the villagers had a monthly income of RMB 3000–4000.

Most villagers' household arable land area was 2–4 mu (1,333.3 m^2 2,666.7 m^2), accounting for 56.5%. The average (2.77 mu) and median (3 mu) household arable land area were much less than the average household arable land area of villagers in China (7.8 mu) (WENJING & JUN, 2019), which means that most farmers are smallholders. Only 15% of the villagers owned woodlands but less than 1 mu; the vast majority owned no woodland. Most of the villagers' household homestead areas were 200–400m^2 (38.7 %), with an average of 314.92 m^2 and a median of 300 m^2, less than the average household homestead area in China (389.6 m^2) (REN et al., 2020).

Landscape perceptions

Perceptions of the overall landscape

The statistics results of Q1 (Figure 4) showed that most villagers saw the Linpan area as individual settlements rather than a system. This was inconsistent with previous research - from the whole point of view of the landscape, Linpan is a historical agricultural settlement system formed by the mutual adaptation and interaction of the constituent elements of the house, woodlands, water system, fields, and paths (ISHIKAWA et al., 2020); LIU et al. (2018) also described Linpan as a composite ecosystem from an ecological point of view. This result led many villagers to think only in terms of the single Linpan cell in which they lived rather than in terms of the entire Western Sichuan Linpan settlement system. However, the government's overall preservation and restoration plans for the Linpan area often start from a macro perspective, which might increase the difficulty of villagers' coordination between different Linpan settlements.

Table 2 - Basic information statistics.

Variables		Groups	Number	%
Social background	Age	aged 18–30	66	7.2
		aged 31–40	203	22.2
		aged 41–50	304	33.2
		aged 51–60	162	17.7
		aged 61 and older	180	19.7
	Gender	male	569	62.2
		female	346	37.8
	Education	primary school	196	21.4
		junior high school	389	42.5
		senior high school	210	23
		university and above	107	11.7
		no education	13	1.4
Economic background	Income source	agriculture	97	10.6
		family business	72	7.9
		work in the city	562	61.4
		no income	37	4
		retired	147	16.1
	Monthly income	< 1000 RMB	134	14.6
		1,000–2,000 RMB	188	20.5
		2,000–3,000 RMB	256	28
		3,000–4000 RMB	200	21.9
		> 4000 RMB	137	15
Resource background	Household arable land area	no arable land	98	10.7
		0–2 mu	171	18.7
		2–4 mu	517	56.5
		4–6 mu	103	11.3
		> 6 mu	26	2.8
	Household woodland area	no woodland	777	84.9
		0–1 mu	138	15.1
	Household homestead area	no homestead	163	17.8
		0–200 m^2	158	17.3
		200–400 m^2	354	38.7
		400–600 m^2	176	19.2
		600–800 m^2	48	5.2
		> 800 m^2	16	1.7

Note: One mu is approximately 666.67 square meters.

The statistics results of Q2 showed that 69% of the villagers believed the Linpan cultural landscape was a common masterpiece of human beings and nature. This was consistent with the definition of cultural landscape in the World Heritage Convention (MITCHELL et al., 2009; UNESCO World Heritage Convention, 2008) and the viewpoints of previous studies (ISHIKAWA et al., 2020). This indicates that the villagers realized that the land they lived on was the product of the mutual adaptation and interaction between humans and the environment, which helps to promote environmental protection awareness among them and create a sustainable environment in which people and nature coexist harmoniously.

The statistical results of Q3 showed that the vast majority (84%) agreed that the Linpan was representative of the geographical and cultural characteristics of the Chengdu Plain. This finding was in line with most people's perception of the Linpan and the Shu (traditional name of Sichuan area), water, and immigrant cultures it represents, as well as the cultural value and civilization spirit embodied in the unique production, life, and ecological adaptations—all symbols of this area.

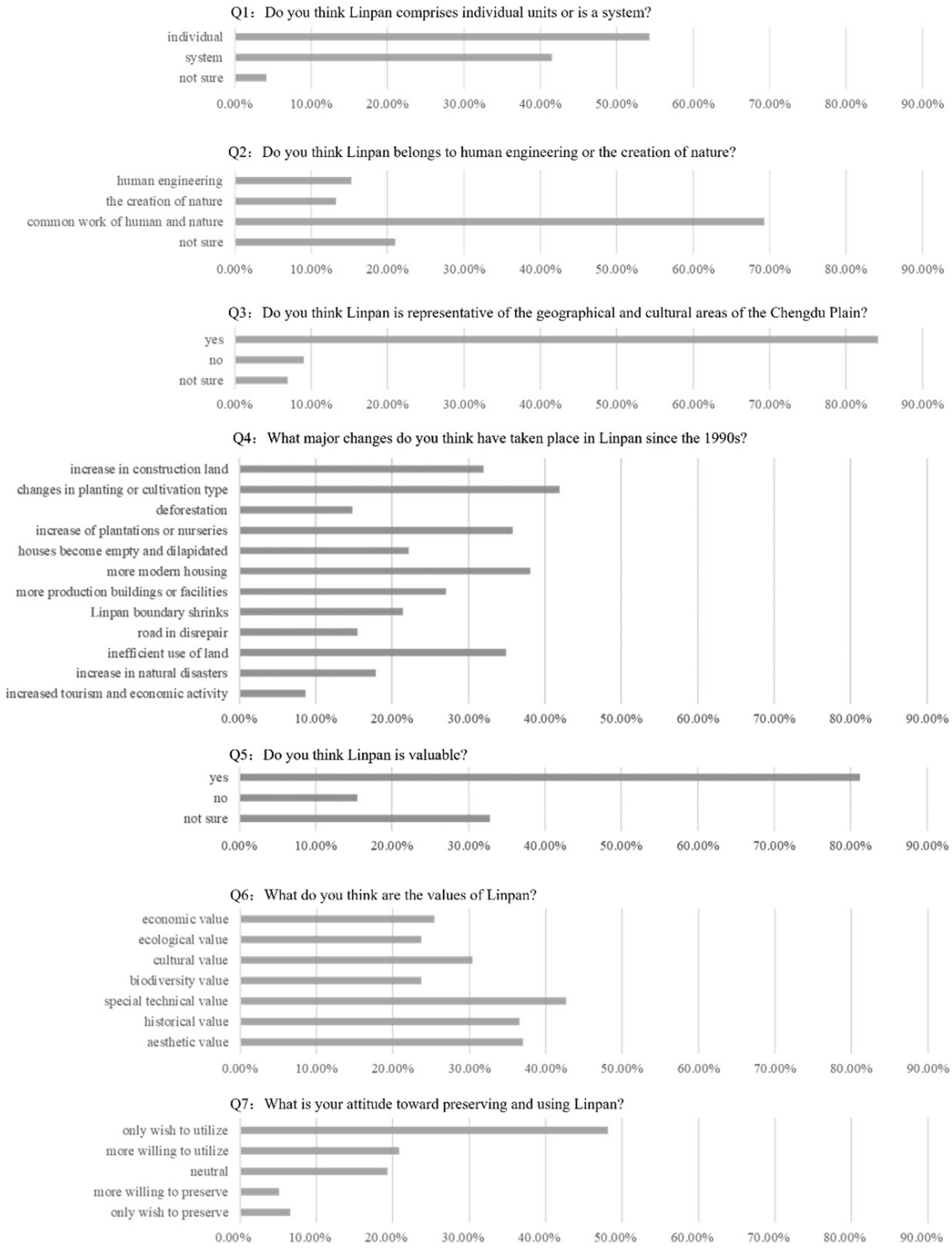

Figure 4 - Descriptive frequency statistics results of seven choice questions (% of respondents).

This will directly increase villagers' acceptance of Linpan preservation and restoration policies, especially when more local representative cultural elements are incorporated into future landscape planning strategies.

The statistical results of Q4 showed that changes in planting or cultivation type were seen as the most typical trend in landscape change since the 1990s by villagers. More modern housing (38%), growing plantations or nurseries (36%), and inefficient land use (35%) were among the more significant changes cited by villagers. Since China's reform and opening up, implementing the market economy has enabled most of the farmland in Linpan to be transferred, separating the direct production relationship between the villagers and the farmland (ANTROP, 2005). In the three decades following the reforms, city development increased the market demand for crops other than grain, motivating more villagers to grow more lucrative cash crops, such as rapeseed, corn, and flowers. So changes in planting or cultivation types are not difficult to explain. Our interviews and field visits revealed that many Linpan villagers cultivated Ginkgo biloba and sweet-scented osmanthus trees, which could explain the increase in plantations and nurseries. And with the rise in villagers' income and the stimulating effect of the National Rural Revitalization Strategy, the investment in rural construction in the Chengdu Plain has grown at a high rate, and two- or three-storey modern-style houses have gradually replaced the traditional residential houses in Linpan, which explains the change in the emergence of the new-style houses. Our on-site interviews also revealed that the villagers did not consider agricultural production sufficient to sustain their livelihoods, so many abandoned their farmland to work in the cities, resulting in substantial waste and inefficient use of rural land.

The statistical results of Q5 showed that 81% of the villagers agreed that the Linpan was valuable, which provides strong support for its conservation and restoration. Furthermore, the statistical results of Q6 showed that nearly half (43%) believed the Linpan had special technical value (technical performance related to agricultural production and land use), indicating that they paid significant attention to the technical performance related to agricultural production and land use. About a third valued its aesthetic (37%) and historical values (36.6%), suggesting the need for planners to pay attention to its spatial layout and external appearance and emphasize its long history and culture. Few villagers highlighted the Linpan's well-documented ecological value and biodiversity, suggesting the need for more education on these matters by the government and experts-extensive research has proved that Linpan has a very high ecological and biodiversity value (ISHIKAWA et al., 2020; SHI & ISHIKAWA, 2012).

The statistical results of Q7 showed that most villagers (48%) wanted to use the Linpan, only 12% wanted to preserve it, and 19% were neutral. The interviews revealed that many villagers were dissatisfied with the status quo, given that current agricultural production could not improve their income or meet their social and economic development needs. Thus, they were willing to give up farmland and agricultural production to introduce leisure tourism—including hotels, bed-andbreakfasts (B&Bs)—and other industries and cooperate with the government and developers to improve their economic income. However, the interviews also revealed the villagers' lack of awareness of Linpan preservation. A few villagers with preservation awareness mentioned food security issues and basic farmland protections, saying that farmland must be protected. This result supports increased development and nonagricultural use in the Linpan, suggesting the need to promote protection awareness.

Perceptions of landscape elements

Table 3 shows the reliability test results of the scale questions on the value perception of landscape elements. The Cronbach's alpha coefficient was greater than 0.9, indicating that the data's reliability was extremely high. Table 4 shows the validity test results. The Kaiser–Meyer–Olkin (KMO) index was greater than 0.9 and $P < 0.05$, indicating that the data's validity was also high.

The value scores for the landscape elements were all 5, except for flowering trees, tree shape, and foliage vegetation, for which the median score was 4, indicating that the villagers generally valued each landscape constituent highly. Future preservation and restoration plans for

Table 3 - Scale question reliability test.

Reliability statistics	
Cronbach' alpha coefficient	0.987
Number of items	63

Table 4 - Questionnaire validity test.

KMO and Bartlett's test	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.972
Sig.	0.000*
"*" means P < 0.05	

the Linpan should pay attention to these specific landscape elements and refine the management and maintenance measures. They should formulate different precise strategies according to the characteristics of the constituent landscape elements such as form, layout, function, ecology, diversity, and observation horizon.

Influence of villagers' background factors on landscape perception

The influence of villagers' socioeconomic and resource backgrounds on their perceptions of the overall landscape

The chi-square test showed that all eight background explanatory variables significantly affected the two response variables: overall landscape value perceptions and attitudes toward preservation and use (Table 5). By further calculating the contingency coefficient, we determined that the explanatory variable with the most robust relationship with the two response variables was the economic variable of monthly income, and the contingency coefficients were 0.315 (overall landscape value perceptions) and 0.427 (attitudes toward preservation and use). Villagers with high incomes were often the beneficiaries of Linpan and naturally considered the Linpan valuable. In contrast, villagers with lower incomes were more willing to ignore the Linpan's value because they wanted to give up their farmland, believing it could no longer improve their lives. In all five income groups, the proportions supporting using it were higher than those supporting preserving it, but villagers in higher income groups tended to have higher proportions of using it, while villagers in lower income groups tended to have higher proportions of preserving it and neutral attitude. Therefore, whether it is a group with a lower monthly income or a group with a higher monthly income, they may choose to support using because of their hopes to increase income, but the degree of support for using is stronger in the high-income group which may be largely due to the fact that they have gained more economic interests in the utilization and development of Linpan.

The influence of villagers' socioeconomic and resource backgrounds on their perceptions of landscape elements

We found almost no correlation between the villagers' perceptions of the value of landscape elements and age and only a slight correlation with education level (Table 6, Table 7, Table 8, Table 9, Table 10, and Table 11). Two variables (monthly income and household arable land) were positively correlated with the value perception of all landscape elements. There was also a correlation between the family homestead area and the value perception of most landscape elements. We discuss the correlations below.

Table 5 - Chi-square test results of the effect of differences in villagers' backgrounds on the perceptions of overall landscape value and attitudes toward conservation and usage.

	----------SER→OVP----------					----------SER→PUA----------				
	χ^2 value	df	Sig.	Contingency coefficient	Sig.	χ^2 value	df	Sig.	Contingency coefficient	Sig.
S1	56.027	8	0.000*	0.24	0.000*	71.698	16	0.000*	0.27	0.000*
S2	8.403	2	0.015*	0.095	0.015*	23.165	4	0.000*	0.157	0.000*
S3	42.065	8	0.000**	0.21	0.000*	39.764	16	0.001*	0.204	0.001*
E1	56.399	8	0.000*	0.241	0.000*	87.141	16	0.001*	0.295	0.000*
E2	101.05	8	0.000*	0.315	0.000*	203.53	16	0.001*	0.427	0.000*
R1	46.408	8	0.000*	0.145	0.000*	103.6	16	0.001*	0.319	0.000*
R2	31.066	10	0.001*	0.181	0.001*	88.103	20	0.000**	0.296	0.000**
R3	19.628	2	0.000*	0.145	0.000*	45.926	4	0.001*	0.219	0.000*

Note: "*" means P <0.05 (progressive method), "**" means P < 0.01 (Monte Carlo method). We use the following codes for the different variables: SER (villagers' socioeconomic and resource background), OVP (overall landscape value perception), PUA (attitudes toward preservation and use), S1 (age), S2 (gender), S3 (education), E1 (income source), E2 (monthly income), R1 (household arable land area), R2 (household woodland area), R3 (household homestead area).

Table 6 - Correlation between the SER and perceptions of the water system's value (W).

	W	W1	W2	W3	W4	W1,1	W1,2	W1,3	W1,4	W1,5
S1	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s
S3	$+^{*}$	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s
E2	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$
R1	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$
R3	$+^{**}$	$+^{**}$	$+^{**}$	n.s	$+^{*}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$

Notes: "n.s." means no significant correlation; "+" means positive correlation; "-" means negative correlation; "*" means $P < 0.05$; "**" means $P < 0.01$ (same for table 7 to table 11).

Age only affected the perception of the value of the architectural shape. There was a significant negative correlation, which means that older villagers were more likely to place a low value on the architectural shape of the traditional dwellings in Chengdu Plain, perhaps because they were less likely to have access (e.g., internet use) to information about the building's shape or history. However, age was not significantly correlated with the villagers' value perceptions of other landscape elements. This is more because young people have more access to and ability to acquire information about architectural shapes. Therefore, although age is not related to the perception of the value of most landscape components, attention should be paid to increasing the knowledge and dissemination of traditional architectural values, especially among the older population.

Education level had a significant positive correlation with villagers' value perceptions of the water system overall, farmland landscape and its five sub-elements. However, education level had a significant negative correlation with the value perceptions of *Bretschneidera sinensis*, *Padus racemosa*, *Lagerstroemia indica*, *Erythrina variegata*, *Broussonetia papyrifera*, *Styphnolobium japonicum*, *Prunus salicina*, *Paulownia*, and *Ligustrum lucidum* among the flowering vegetation, and *Pterocarya stenoptera*, *Picrasma quassioides*, *Celtis sinensis*, *Metasequoia glyptostroboides*, and *Firmiana simplex* among the foliage vegetation. With regard to the water system, the result probably dues to the higher popularity of the Dujiangyan Water Conservancy Project among higher educated people. For the relationship between educational level and perception of the field's value, it is likely to be related to their deep understanding and importance of the national farmland protection policy and food security. And the negative correlation between education level and the perception of value in some vegetation somehow explains the lack of knowledge of Linpan vegetations among people with higher education level. Therefore, the difference in perception between people with different education levels should be moderated through the popularization of landscape knowledge, and there is a particular need to promote botanical knowledge to the general public to enhance the perception of the value of vegetation.

A significant positive correlation existed between monthly income and the villagers' value perceptions of all landscape elements. This aligns with our previous finding that higher-income villagers

Table 7 - Correlation between the SER and perceptions of the vegetations' value (V-1).

	V	Bre	Pad	La	Er	Bro	St	Pr	Pau	Lig	Da	Ai	Ro
S1	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s
S3	n.s	$-^{**}$	$-^{**}$	$-^{**}$	$-^{**}$	$-^{**}$	$-^{**}$	$-^{**}$	$-^{**}$	$-^{**}$	n.s	n.s	n.s
E2	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$
R1	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$
R3	n.s.	n.s.	n.s.	$-^{*}$	$-^{**}$	$-^{**}$	$-^{**}$	$-^{*}$	$-^{**}$	n.s.	n.s.	n.s.	$-^{**}$

Table 8 - Correlation between the SER and perceptions of the vegetations' value (V-2).

	Cas	Ju	Lin	Ph	Cam	Ci	Ba	Pt	Pi	Ce	Me	Fi	Gi	Gs	Di	Ho
S1	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
S3	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	$-^{**}$	$-^{**}$	$-^{**}$	$-^{*}$	$-^{**}$	n.s	n.s.	n.s.	n.s.
E2	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$
R1	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$
R3	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	$-^{**}$	n.s.	n.s.	$+^{**}$	$+^{**}$

were more willing to consider the Linpan valuable. Households' arable land area also had a significant positive correlation with the villagers' value perceptions of all landscape elements. Large-scale farmers with more arable land resources tend to be more conducive to intensive agricultural production, making them more likely to profit from agriculture. Their production and life are more closely related to their living environment. Whether it is the water system, the fields, the vegetation, the house, or the path, they are inseparable from their production and life. As a result, they will place a higher value on each of the landscape components of Linpan.

Household homestead area had a significant positive correlation with the villagers' value perceptions of the water system and its three sub-elements (irrigation canals and its five types, rivers and ditches, and paleochannels), farmland landscapes and its five sub-elements, fruiting vegetation (*Diospyros cathayensis* and *Hovenia acerba*), and field paths. It had a significant negative correlation with the value perception of some flowering vegetation (*Lagerstroemia indica*, *Erythrina variegata*, *Broussonetia papyrifera*, *Styphnolobium japonicum*, *Prunus salicina*, *Paulownia*, and *Robinia)*, and the foliage vegetation *Firmiana simplex*. Often, the larger the family homestead area, the greater the benefits of land transfer and the higher the villagers' expectations for the future implantation of homestay vacations, agrotourism, sightseeing, and leisure industries. The various water system elements are necessary not only for production and life but to support nonagricultural uses like cultural tourism and the leisure industry. Large-scale homesteads are often surrounded by peripheral farmland, and these farmland landscapes are also necessary for tourism, including field roads. And field sightseeing could just as well be combined with the B&B vacation industry in the large homesteads they own. Many large residential households plant fruiting vegetation in their courtyards and sell the ripe fruit to increase their income; villagers with smaller residential area rarely have enough planting space to do this, which might be why household homestead area affected the villagers' valuations of fruiting vegetation. Flowering and foliage vegetations are often decorative, which affects an area's aesthetics. However, vegetation that grows too fast or high can block natural lighting or affect the balance of landscape colors. Residents' views, travel, and safety could also be affected by these two types of vegetation, especially foliage vegetation. Therefore, for the expected future development of tourism such as lodging, large householders may also take into account the impact of the above factors and be reluctant to assign high scores to the value of flowering and foliage vegetations.

Table 9 - Correlation between the SER and perceptions of the farmland's value (F).

	F	F1	F2	F3	F4	F5
S1	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
S3	$+^{*}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$
E2	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$
R1	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$
R3	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$	$+^{**}$

Table 10 - Correlation between the SER and perceptions of the dwellings and courtyards' value (D).

	D	D1	D2	D3	D4	D2,1	D2,2	D2,3
S1	n.s	n.s	n.s	n.s	n.s	-*	n.s	n.s
S3	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s
E2	+**	+**	+**	+**	+**	+**	+**	+**
R1	+**	+**	+**	+**	+**	+**	+**	+**
R3	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s

CONCLUSION

For the villagers' socioeconomic and resource backgrounds in the Linpan rural area, the study verified its typical trend of population loss and aging as well as facing the status of low per capita arable land and the abandonment of land resources, which is negatively affecting the revitalization of the Linpan cultural landscape. It should be emphasized that the diversified characteristics of the indigenous villagers in Linpan are the basis for promoting the diversified development of the cultural landscape. Policymakers should thoroughly survey the villagers at the social, economic and resource levels, and promote the protection and utilization of the cultural landscape based on understanding the characteristics of the region's population.

Regarding the landscape perception of Linpan, the main finding of this study is that the villagers' perception of the positioning of Linpan - "a joint masterpiece between humans and nature" - is consistent with UNESCO's definition of the cultural landscape. Therefore, there is a need for more in-depth research on the attributes of the cultural landscape of Linpan in future studies. In addition, the study found that most villagers believed that the Linpan was valuable and supported its utilization and that the majority needed more conservation awareness. Such results provide a basis for villagers' participation in implementing subsequent conservation and utilization planning for Linpan settlements.

Finally, the study reveals that villagers' socio-economic and resource background factors have complex and selective effects on their landscape perceptions. However, the study also found that villagers' economic background factors, especially monthly income, are always the key variables affecting their landscape perceptions. This critical point needs to be considered in formulating landscape conservation and utilization policies and sustainable land development. Policymakers can use government subsidies and other policy tools to adjust the perception differences between villagers with different incomes and reduce unnecessary conflicts.

Understanding the villagers' landscape perceptions can help ensure that future preservation and restoration planning for the cultural landscape of the Linpan agricultural settlements in Chengdu Plain will fully respect the villagers' interests and ensure their participation. This will help the government make reasonable adjustments to relevant land-use policies and achieve equity among villagers with different economic, social, and resource backgrounds, which lays the foundation for the sustainable development of local rural areas.

Future research will concentrate on exploring perception differences among different groups of villagers, government officials, experts,

Table 11 - Correlation between the SER and perception of the paths' value (P).

	P	P1	P2	P3	P4
S1	n.s.	n.s.	n.s.	n.s.	n.s.
S3	n.s.	n.s.	n.s.	n.s.	n.s.
E2	+**	+**	+**	+**	+**
R1	+**	+**	+**	+**	+**
R3	n.s.	+*	n.s.	n.s.	n.s.

and developers and propose sustainable planning strategies from the perspective of villagers' participation in Linpan preservation and restoration.

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BIOETHICS AND BIOSECURITY COMMITTEE APPROVAL

We authors of the article entitled "Effects of villagers' socio-economic and resource backgrounds on the perception of cultural landscape values of Linpan agricultural settlements: The case of Dujiangyan City" declared, for all due purposes, the project that gave rise to the present data of the same has not been submitted for evaluation to the Ethics Committee of the University/Research Institute "Universidade Federal de Santa Maria", but we are aware of the contents of Resolution No. 466, of December 12, 2012 of the Brazilian National Health Council "http://conselho.saude.gov.br/resolucoes/2012/Reso466.pdf" if it involves human.

Thus, the authors assume full responsibility for the presented data and are available for possible questions, should they be required by the competent authorities

DECLARATION OF CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHORS' CONTRIBUTIONS

Conceptualization, PZ and KU; design of methodology and data analysis, PZ; visualization, PZ and YL; investigation, PZ, KU, YL, MI and LY; resources, PZ, KU and LY; writing—original draft preparation, PZ; writing—review and editing, PZ and KU; supervision, KU and MI. All authors critically revised the manuscript and approved of the final version.

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