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Monetized Evaluation of Landscape Resources of National Parks Based on the Willingness to Pay of Multiple Interest Groups

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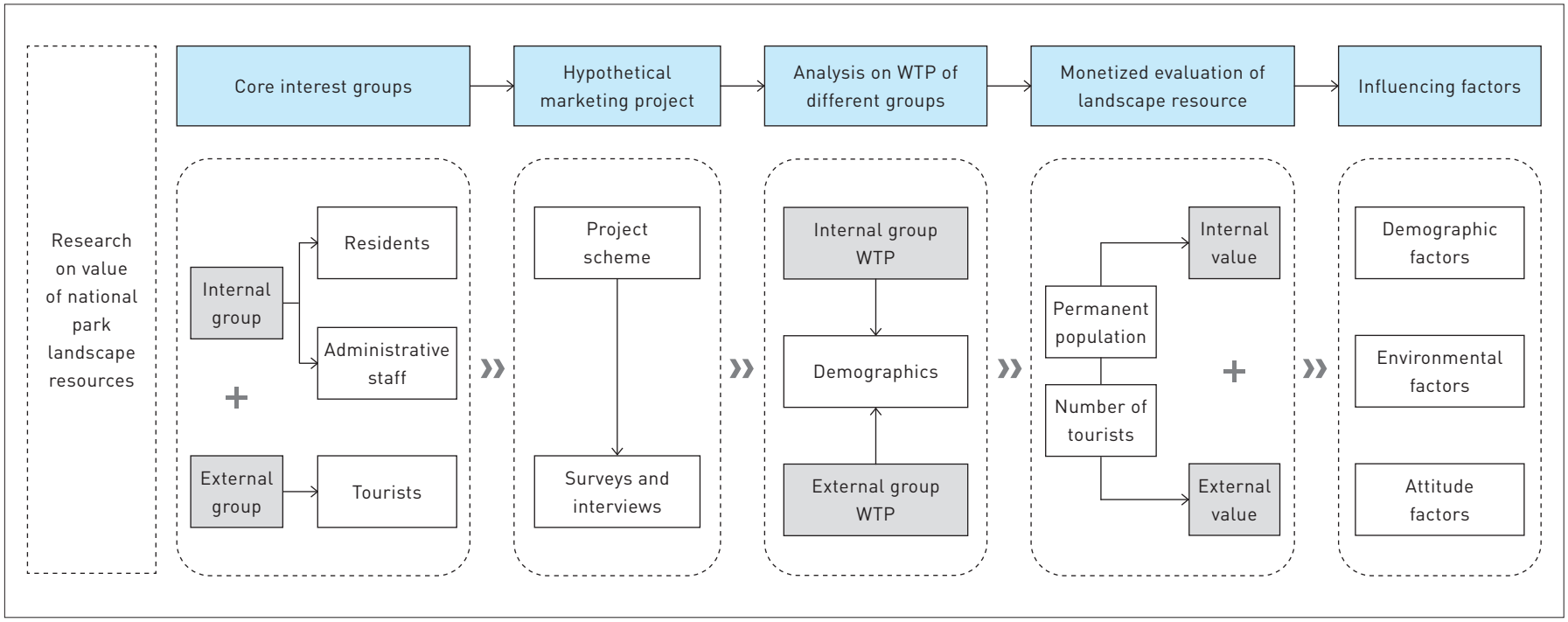
GRAPHICAL ABSTRACT



HIGHLIGHTS

- Constructs an exploratory method for monetized evaluation on landscape resources value of national parks
- Analyzes the willingness to pay of internal and external groups through a hypothetical market project
- Analyzes the impacts of demographic, environmental, and attitude factors on the monetized evaluation of landscape resources value of national parks and people's willingness to pay for them

KEYWORDS

National Park;
Landscape Resources Value;
Monetized Evaluation;
Willingness to Pay;
Multiple Interest Groups

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ABSTRACT

In China, national parks represent the country's most unique natural landscapes. Scientific evaluation of landscape resources is significant for preserving the authenticity and integrity of national parks. Taking Qianjiangyuan National Park System Pilot Zone as an example, this research investigated the willingness of internal group (residents and administrative staff) and external group (tourists) to pay for a hypothetical market project based on the pilot zone via Contingent Valuation Method to acquire the monetized value of landscape resources in the national park, and applied Logistic Regression to analyze the influencing factors. The results show that the payment rate of external group is higher than that of internal group, and people with different demographics have different payment rates. Both internal and external groups are willing to pay to improve ecological environment, but there are significant differences on reasons for refusal—having a low income is the main reason for the internal group, and the external respondents refuse mainly because of the belief that the payment is owed to government finance. The total monetized value of the research area is 135 million yuan, of which the external value is much higher than internal value. The attitude factors influence landscape resource value more significantly than demographic and environmental factors. The assessment of landscape resource value of national parks is affected by perceptions and demands of multiple interest groups. This research suggests accelerating the construction of a standardized assessment technical system to support the establishment of national park system in China.

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1 Introduction

National parks cover the most essential part of natural ecosystems in China, featured with the most unique natural landscape, the most essential natural heritage, and the most abundant biodiversity[1]. Many issues on national parks, including human-animal conflict, population protection, ecological restoration, and biodiversity have been deeply studied[2]~[6], but few on natural landscape and heritage. According to such documents as the Guidance to Establish a Nature Reserve System Based on National Parks and the General Plan for Establishing National Park System issued by the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council, national parks, representing China's most unique natural landscape, bear irreplaceable value in enhancing the country's global role, national symbols, and citizens' identities. Therefore, it urgently calls for scientific evaluation and monetization research on the landscape resources in the construction of China's unique national park system.

The value of landscape resources of national parks can be understood as the products and services for humans provided by national parks landscape[7][8], involving aesthetic, recreational, and ecological values. According to theories of macroeconomics and management, the asset value of landscape resources can be measured through monetized evaluation.[8][9] Given that landscape is a complex system with dynamic resources and various recognitions from human, there has not been a recognized and comprehensive approach to assess the value of landscape resources. Early scholars assessed the value of landscape resources indirectly by studying the public's perception, and proposed approaches including Scenic Beauty Evaluation and Law of Comparative Judgement[10][11]. Recently, an increasing number of scholars have quantified landscape perceptions from multiple perspectives, and introduced new technologies such as eye tracking, digital projection images, and geographic information systems to quantify landscape values with statistical models[12]~[15]. Overall, existing studies focus more on functions rather than values of landscape, but still support the monetized evaluation of the landscape resources of national parks. Currently, domestic and foreign scholars have begun to quantify landscape perception based

on methodologies from forestry economics, ecological management, and other disciplines, e.g., the Contingent Valuation Method[16], the Travel Cost Method[16][17], and the Hedonic Price Method[18], so as to monetize the value of landscape resources. The Contingent Valuation Method (CVM) investigates the respondents' willingness to pay (WTP), i.e., the highest price they would like to pay for visiting or participating in nature preservation. It has been widely applied in economic and ecological evaluation of nature reserves, but most only targets tourists[19][20], failing to consider the local residents, decision makers, and other relevant interest groups, and thus results in bias.

In 2013, China proposed to establish a national park system for the first time; in 2017 and 2019, the General Plan for Establishing National Park System and The Guidance on the Establishment of a Nature Reserve System with National Parks as the Mainstay were issued respectively; by 2022 when 49 candidate sites for national parks were selected in the National Parks Layout Plan, China has achieved a milestone in the top-level design of national park system. However, the quantitative research on functions and values of landscape resources of national parks in China still lacks well-developed theories and methodologies. Such lacks thus lead to a misunderstanding that the values of landscape resources of national parks only relates to tourism industry, depending on the number of tourists and ticket revenues, which implies a wrong dichotomy between ecological and landscape values. Therefore, a scientific evaluation system for landscape resources of national parks is significant for the construction of the national park system in China.

This paper takes the Qianjiangyuan National Park System Pilot Zone, China as an example, investigating the WTP of the core interest groups—residents and administrative staff (internal group), and tourists (external group) to assess the internal and external monetized value of landscape resources in the pilot zone and analyze the influencing factors. This research aims to address the monetized evaluation of landscape resources of national parks, and to provide a reference to integrate landscape resources values into ecosystem evaluation of national parks.

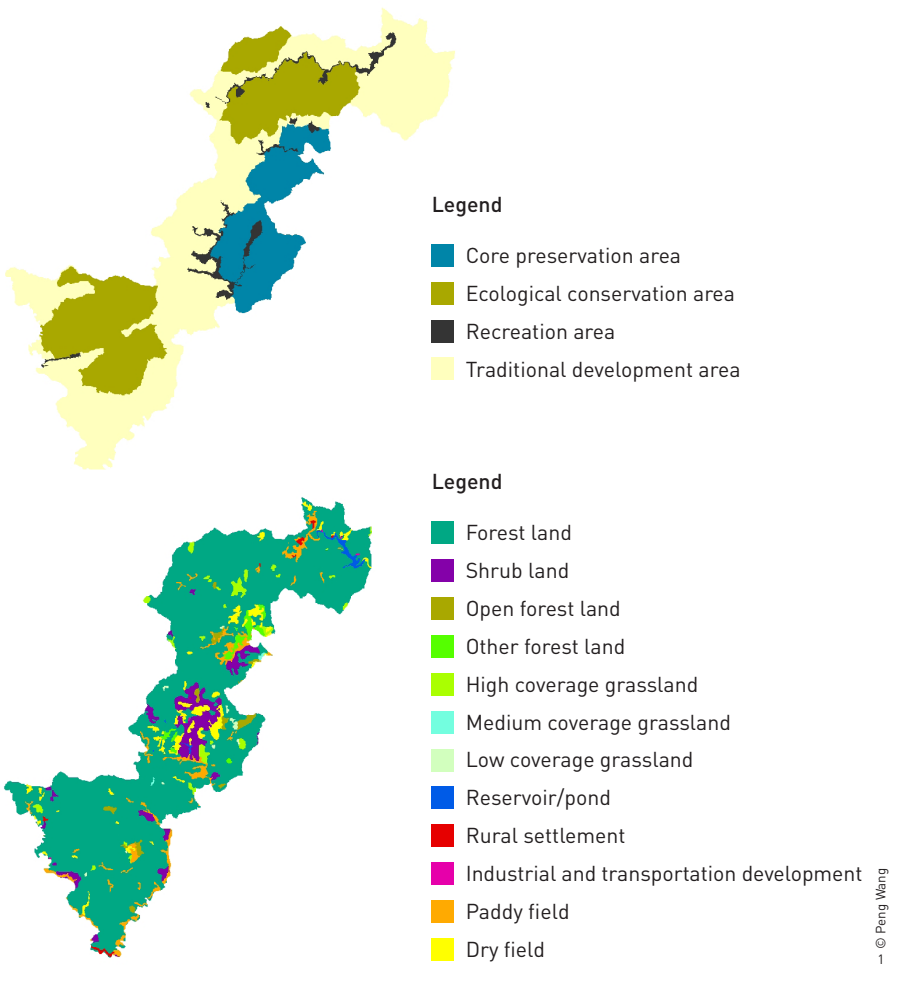
2 Study Area and Research Methods

2.1 Study Area

Qianjiangyuan National Park System Pilot Zone ("Qianjiangyuan Pilot Zone" hereafter) is one of the first 10 pilot zones established in 2015, also one of the formal candidate zones proposed in the General Plan for Establishing National Park System. It is located in the western part of Zhejiang Province, bordered with Jiangxi and Anhui Provinces, with an area of about 252 km^2. According to the pilot scheme and the overall plan, Qianjiangyuan Pilot Zone, consisting of Mount Gutian National Nature Reserve, Qianjiangyuan National Forest Park, and Qianjiangyuan Provincial Scenic Area, includes two regulation zones, i.e., critical protection zone and general control zone, and four function areas (Fig. 1), i.e., core preservation area (72.33 km^2), ecological conservation area (135.80 km^2), recreation area (8.12 km^2), and traditional development area (36.13 km^2). The land ownerships within the Qianjiangyuan Pilot Zone are complicated: the state ownership covers 48.64 km^2 (19.30% of the total area), including Qixi and Suzhuang Sub-Farms of Kaihua Forest Farm, and Mount Gutian National Nature Reserve; and the collective ownership covers 203.52 km^2 (80.70% of the total area).

According to The Overall Plan of Qianjiangyuan National Park System Pilot Zone (2016–2025) and the statistics from the

1. Function zoning and current land use of Qianjiangyuan National Park System Pilot Zone



Qianjiangyuan National Park Administration, the scope of the Qianjiangyuan Pilot Zone covers Suzhuang Town (1,030 people and 383 households), Changhong Village (3,825 people and 1,044 households), Hetian Village (2,068 people and 587 households), and Qixi Town (2,621 people and 659 households), with a total population of 9,544. The industrial structure in Qianjiangyuan Pilot Zone is simple and the residents' income primarily comes from local agriculture and forestry or as migrant workers; the main agricultural crops are rice and corn, while the primary economic forest is *Camellia oleifera*. Although the tourism is still an emerging industry mainly running spontaneously, the number of tourists to Qianjiangyuan Pilot Zone reached 1,202,400 in 2020, making tourism an important source of local economy.

The study area is also the only national park system pilot zone of the Yangtze River Delta region, so this research should address how to assess and monetize the value of landscape resources of a region with developed economy, dense population, and complex ownerships of natural resources (with large amount of collective-owned forests and economic forests). At the same time, this research can provide reference in dealing with problems such as the unclear inventory, the difficulties in measurements, and challenges in utilizing the resources in the areas where multiple types of nature reserves are gathered.

2.2 Research Methods

2.2.1 Contingent Valuation Method

(1) WTP survey

To avoid the bias caused by single-group evaluation, and to enhance the generalizability of the results, this research surveyed three core interest groups—residents, administrative staff, and tourists. A random questionnaire survey was conducted from September to November in 2020. Before the formal research, three pre-surveys were conducted in August to September, 2020. The pre-surveys found it difficult for the non-professional groups to fully understand the meaning of "landscape," which is comprehensive and integrative. Therefore, this research adopted the narrow definition of landscape—the scenery of aesthetic values. As for the interest groups, this research surveyed the residents in all four townships and 19 villages; the administrative staff from the Qianjiangyuan National Park Administration, law enforcement officials from the towns/villages, township government staff, and village cadres; and the tourists encountered around the service center and the surrounding scenic attractions in the study area. Based on the previous community investigations about agroforestry economic management, the questionnaire mainly included basic personal information and willingness to pay.

Currently, there are two major methods for assessing the value of public goods—revealed preference approach and stated preference approach[21][22]. CVM, as a typical stated preference approach, is the most widely applied method with most influences in non-market value assessment[23][24]. By constructing a hypothetical market, this method investigates people's WTP or willingness to accept compensation (WTA) to assess the value of ecological products or services[25][26]. Although both WTP and WTA can reveal changes in consumer surplus[27], the result of WTA is usually higher than that of WTP, while the latter is closer to the actual market value[28][29]. CVM has been adopted by an increasing number of researchers in landscape resource evaluation[30]~[32].

As a type of public goods, national parks are of scarcity, thus non-tradable nor substitutable. Referring to the existing research on CVM[33][34], the research team proposed to construct a hypothetical market project. All the investigators in this project are professionals with long-years' experience of fieldwork and CVM training. After three rounds of pre-surveys, repeated questionnaire revisions, and expert consultations, the research team finally developed the hypothetical market project scheme on participation and payment of membership fees to a public ecological preservation welfare association to investigate people's WTP (Table 1).

Relevant research shows that the setting of the bid amounts (payment amounts) for hypothetical market projects may cause bias in the results, and the options of WTP offered to the respondents should be affordable to them and not affect the household food expenditures[33]. As the residents and administrative staff are mainly rural and urban residents from Kaihua County, the research team obtained per capita disposable income and Engel coefficient from Kaihua County Bureau of Statistics to determine the payment amount options. The per capita disposable income of Kaihua County in 2019 was 26,857 yuan (37,762 yuan for urban residents, 19,001 yuan for rural residents), and the Engel coefficient was 31%; combined with the expert opinions, the maximum payment amount in this study was set up to 1,500 yuan, with the other options set proportionally. In addition, to address the difficulties in payment selection in pre-surveys, the research team reduced the number of options following the experts' opinions: five payment options for the internal group (5 yuan, 15 yuan, 50 yuan, 150 yuan, 1,500 yuan) and four payment options for the external group (5 yuan, 15 yuan, 150 yuan, 1,500 yuan).

Table 1: Hypothetical market project scheme

Project name	Grand Qianjiangyuan—Demonstration Welfare Project of National Park Landscape Preservation and Restoration
Implementing agency	A public welfare association composed of experts in forestry, ecology, landscape architecture, and agroforestry economics
Project objective	To protect the natural landscape and local cultural landscape of the national park
Project site	Qianjiangyuan National Park Pilot Zone
Project content	1) To investigate and monitor natural and cultural landscape; 2) To carry out popularization of plant science and nature education; 3) To develop a protective planning for the pilot zone about forest transformation, local landscape preservation and restoration, etc.

(2) Evaluation measurement

This research combines survey and interview to obtain the WTP of landscape resources in Qianjiangyuan Pilot Zone, indicated by the average of the result, which can be obtained by the mathematical expectation of discrete variables[22]. The equation is as follows:

$$E(\mathrm{WTP}) = \sum_{i=1} A_i P_i , \quad (1)$$

where E(WTP) is the average WTP of the respondents, A_i is a certain amount willing to pay, P_i is the probability of choosing the certain A_i, and n is the number of set payment amount options.

Since the samples contain the zero WTP (i.e., refusal to pay), the more accurate average WTP requires econometric adjustment (Spike Model)[35]. The revised equation for the groups' WTP in this research is:

$$E(\mathrm{WTP})_{\mathrm{nonnegative}} = (1 - P_{\mathrm{total}}) \times E(\mathrm{WTP})_{\mathrm{positive}} = (1 - P_i) \sum_{i=1}^{n} A_i P_i , \quad (2)$$

where $E(\mathrm{WTP})_{\mathrm{nonnegative}}$ is the respondents' average WTP including zero WTP; $E(\mathrm{WTP})_{\mathrm{positive}}$ is the average WTP, P_{total} is the total probability to pay, A_i is the amount willing to pay, and P_i is the probability of choosing a certain amount to pay.

The landscape resource value of Qianjiangyuan Pilot Zone is composed of its internal value and external value. Because the study area covers several natural reserves that do not have defined tourism management boundaries (i.e., access for ticketed visitors), it is difficult to count the number of tourists throughout the national park. Informed by the local management department, most tourists coming to Kaihua County would visit the Qianjiangyuan National Park, the most famous scenic spot in this county. Thus, this research took the total number of tourists in Kaihua County to calculate the external value. Based on the resident population and tourists figures in 2020 from *Kaihua County Statistical Yearbook 2021*, the internal value and external value were calculated respectively to obtain the total landscape resources value. The equation is as follows:

$$\begin{aligned} V_{\mathrm{total}} &= V_{\mathrm{in}} + V_{\mathrm{ex}} \\ &= E(\mathrm{WTP})_{\mathrm{in\ nonnegative}} \times N_{\mathrm{r}} \times R_{\mathrm{in}} + E(\mathrm{WTP})_{\mathrm{ex\ nonnegative}} \times N_{\mathrm{t}} \times R_{\mathrm{ex}}, \end{aligned} \quad (3)$$

where V_{in} is the internal value of Qianjiangyuan Pilot Zone, V_{ex} is the external value of Qianjiangyuan Pilot Zone, $E(\mathrm{WTP})_{\mathrm{in\ nonnegative}}$ is the average WTP (including zero WTP) of internal group, N_{r} is the population of Kaihua County, R_{in} is the internal payment rate, $E(\mathrm{WTP})_{\mathrm{ex\ nonnegative}}$ is the average WTP (including zero WTP) of external group, N_{t} is the total number of tourists, and R_{ex} is the external payment rate.

2.2.2 Logistic Regression Model

(1) Selection and definition of the variables

Integrating the research hypotheses and the opinions from experts, the research team selected demographic, environmental, and attitude factors that may influence different groups' WTP for membership of the public welfare association (Table 2). In this research, the dependent variable is the respondents' (both internal and external groups) choice to the question "willing to pay for

Table 2: Variables and their meanings

Variables			Code	Meaning
Dependent variable	Willing to pay for membership of the public welfare association or not		Y	1 = yes; 0 = no
Independent variable				
Demographic factors	Gender		X_1	1 = male; 0 = female
	Age		X_2	actual age
	Education level	Higher education	X_3	1 = yes; 0 = no
		Compulsory education only	X_4	1 = yes; 0 = no
	Occupation	Farmer	X_5	1 = yes; 0 = no
		Self-employed	X_6	1 = yes; 0 = no
		Civil servant/ public service staff/ village cadre	X_7	1 = yes; 0 = no
		Enterprise staff	X_8	1 = yes; 0 = no
		Student	X_9	1 = yes; 0 = no
	Average annual income (yuan)	< 30,000	X_{10}	1 = yes; 0 = no
		[30,000, 60,000)	X_{11}	1 = yes; 0 = no
		[60,000, 160,000)	X_{12}	1 = yes; 0 = no
		[160,000, 310,000)	X_{13}	1 = yes; 0 = no
		[310,000, 510,000)	X_{14}	1 = yes; 0 = no
		≥ 510,000	X_{15}	1 = yes; 0 = no
Environmental factors	Residency	Suzhuang Town	X_{16}	1 = yes; 0 = no
		Changhong Village	X_{17}	1 = yes; 0 = no
		Hetian Village	X_{18}	1 = yes; 0 = no
		Qixi Town	X_{19}	1 = yes; 0 = no
		Town of Kaihua County	X_{20}	1 = yes; 0 = no
	Workplace	Kaihua County	X_{21}	1 = yes; 0 = no
		Zhejiang Province	X_{22}	1 = yes; 0 = no
		Yangtze River Delta (except Zhejiang Province)	X_{23}	1 = yes; 0 = no
		Others	X_{24}	1 = yes; 0 = no
Attitude factors	Attitude on natural scenery		X_{25}	1 = low; 2 = moderate; 3 = high
	Attitude on ecological environment		X_{26}	1 = low; 2 = moderate; 3 = high
	Attitude on environmental protection		X_{27}	1 = low; 2 = moderate; 3 = high
	Attitude on ecological culture		X_{28}	1 = low; 2 = moderate; 3 = high
	Attitude on aesthetic and functions		X_{29}	1 = low; 2 = moderate; 3 = high

NOTE
In this research, all variables are categorical, except for age as continuous variable.

membership of the public welfare association or not". The value of 1 means "yes" and 0 means "no."

(2) Research model

Referring to the existing research[36], this research applied Binary Logistic Regression to analyze the influencing factors. Binary Logistic Regression is usually used to predict the occurrence probability of an event, where the dependent variable *Y* has only two values, 1 and 0. Set the overall probability of $Y = 1$ as $P(Y = 1)$,

and the n independent variables as x_1, x_2, ..., x_n, the corresponding logistic regression model is:

$$P(Y=1)=\frac{\exp(b_0+b_1x_1+b_2x_2+\cdots+b_nx_n)}{1+\exp(b_0+b_1x_1+b_2x_2+\cdots+b_nx_n)}$$
$$=\frac{1}{1+\exp\left[-(b_0+b_1x_1+b_2x_2+\cdots+b_nx_n)\right]}, \quad (4)$$

or:

$$\text{logit}\,P(Y=1)=\text{Ln}\left[\frac{P(Y=1)}{1-P(Y=1)}\right]=b_0+b_1x_1+b_2x_2+\cdots+b_nx_n, \quad (5)$$

where b_0 is a constant, indicating the natural logarithmic value of the ratio of the probability of Y = 1 to that of Y = 0 when all independent variables are set as 0; b_i is the regression coefficient of a certain independent variable x_i, indicating that a one-unit change in x_i changes the corresponding dominance ratio of the dependent variable by an average of exp(b_i) units, holding the other independent variables constant.

3 Results and Analyses

3.1 Sample Statistics

3.1.1 Residents

The research distributed 531 questionnaires to the residents and collected 457 valid samples, accounting for 86.06% of the total. Among the valid samples, 145 were from Suzhuang Town, 79 from Changhong Village, 124 from Hetian Village, and 109 from Qixi Town (Table 3). The collected data were analyzed with IBM SPSS for reliability and validity tests. The results show that the Cronbach's alpha is 0.805 (> 0.8) and KMO is 0.873 (0.8, 0.9], indicating good internal consistency and construct validity of the data from resident samples.

Table 3: Valid samples of residents

Township	Number of households	Population	Valid sample size
Suzhuang Town	383	1,030	145
Changhong Village	1,044	3,825	79
Hetian Village	587	2,068	124
Qixi Town	659	2,621	109
Total	2,673	9,544	457

3.1.2 Administrative staff

The research distributed 79 questionnaires to the administrative staff and collected 74 valid samples, accounting for 96.67% of the total. The reliability and validity tests show that the Cronbach's alpha is 0.856 (> 0.8) and KMO is 0.823 (0.8, 0.9], indicating good internal consistency and construct of validity of the data from administrative staff samples.

3.1.3 Tourists

The research distributed 616 questionnaires to the tourists and collected 542 valid samples, accounting for 87.99% of the total. The reliability and validity tests show that the Cronbach's alpha is 0.716 (0.6, 0.8] and KMO is 0.823 (0.8, 0.9], indicating good internal consistency and construct validity of the data from tourist samples.

3.2 WTP

In total, this research obtained 531 valid samples from the internal group (residents and administrative staff) and 542 valid samples from the external group (tourists) (Table 4). The payment rate of internal group is 70.06% with a total payment of 52,055 yuan, while the payment rate of external group is 79.15% with a total payment of 43,005 yuan.

Table 4: Statistics on samples of internal and external groups

Group	Valid sample size	Number of willing to pay	Number of unwilling to pay	Payment rate (%)	Total payment (yuan)
Internal	531	372	159	70.06	52,055
External	542	429	113	79.15	43,005
Total	1,073	801	272	74.65	95,060

NOTE
The total payment rate is the percentage of total number of willing to pay to the total valid samples.

Table 5: Payment rate and demographics of internal group

Demographics		Number of willing to pay	Payment rate (%)
Gender	Male	201	71.79
	Female	171	68.13
Age	18 ~ 25	22	91.67
	26 ~ 40	70	79.55
	41 ~ 55	154	76.24
	56 ~ 70	90	56.25
	≥ 71	36	53.73
Education level	Junior high school or below	252	66.67
	High school/specialized secondary school	57	74.03
	Vocational and technical college	28	80.00
	Undergraduate education or above	35	85.37
Occupation	Farmer	179	62.59
	Self-employed	74	79.57
	Civil servant/public service staff/village cadre	62	83.78
	Enterprise staff	49	70.00
	Student	8	100.00
Average annual income (yuan)	< 30,000	113	57.95
	[30,000, 60,000)	132	75.86
	[60,000, 160,000)	88	75.21
	[160,000, 310,000)	33	94.29
	≥ 310,000	6	60.00

3.2.1 WTP of Internal Group

This research analyzed the demographics of the internal respondents who are willing to participate in the preservation association and pay for the membership (Table 5). The results show that, regarding gender, the payment rate of males (71.79%) is higher than females (68.13%); in terms of age, the payment rate of those aged 18 ~ 25 years old is the highest (91.67%), and that of those aged 71 years old and above is the lowest (53.73%). As for education level, higher level of education shows a higher payment rate. In terms of occupation, the students, civil servants, public service staff, and village cadres have higher payment rates overall, while farmers have the lowest payment rate (62.59%). Regarding average annual income, the respondents with an average annual income of [160,000, 310,000) yuan have the highest payment rate (94.29%), and those below 30,000 yuan have the lowest payment rate (57.95%).

Based on the survey results, the research team analyzed the reasons to participate the preservation association and pay for the membership of the 372 internal respondents (Fig. 2). The results reveal that 48.92% of the respondents would pay “to improve ecological environment”; 22.85% of them would pay to “revitalize rural culture”; 19.09% of them chose “I will join if others do”; and 9.14% of them would pay “if required by the government.”

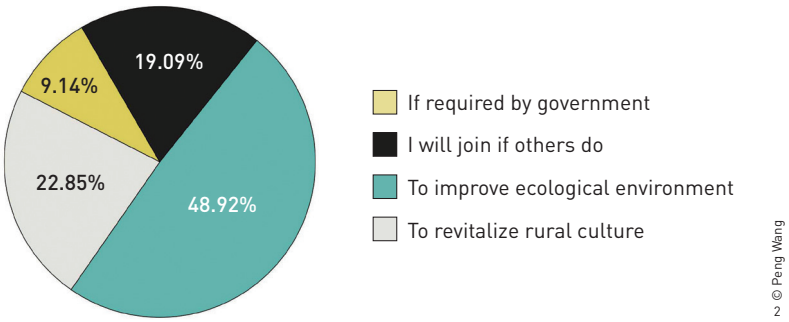
3.2.2 WTP of External Group

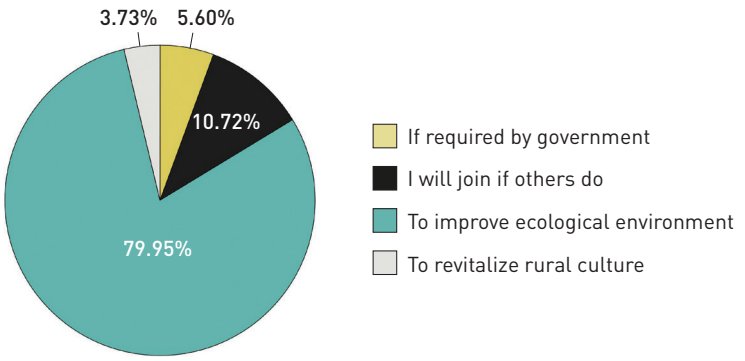
The demographics analysis of the external respondents who are willing to pay for the membership (Table 6) reveals that, regarding gender, the payment rate of males (79.48%) is slightly higher than females (78.72%), which is consistent with the results of the internal group. As for age, the payment rate of those aged 56 ~ 70 years old is the highest (84.50%), and that of those aged 18 ~ 25 years old is the lowest (69.42%). In terms of education level, those who had undergraduate education or above have the highest payment rate (82.25%). In terms of occupation, the self-employed have the highest payment rate (89.66%) and the students have the lowest (61.76%). Considering average annual income, respondents earning [160,000, 310,000) yuan annually have the highest payment rate (89.57%), while those earning less than 30,000 yuan, [30,000, 60,000) yuan, and not less than 510,000 yuan annually had lower payment rates of 65.22%, 62.22%, and 57.14%, respectively.

Based on survey of the reasons to pay of the 429 willing external respondents (Fig. 3), 79.95% of the respondents selected “to improve ecological environment”; 10.72% of them chose “I will join if others do”; 5.60% of them voted “if required by the government”; and 3.73% of them would pay “to revitalize rural culture.”

Table 6: Payment rate and demographics of external group

Demographics		Number of willing to pay	Payment rate (%)
Gender	Male	244	79.48
	Female	185	78.72
Age	18 ~ 25	84	69.42
	26 ~ 40	114	82.01
	41 ~ 55	122	79.74
	56 ~ 70	109	84.50
Education level	Junior high school or below	1	25.00
	High school/secondary specialized school	129	75.44
	Vocational and technical college	71	78.02
	Undergraduate education or above	227	82.25
Occupation	Self-employed	26	89.66
	Civil servant/public service staff/village cadre	60	86.96
	Enterprise staff	301	80.05
	Student	42	61.76
Average annual income (yuan)	< 30,000	45	65.22
	[30,000, 60,000)	28	62.22
	[60,000, 160,000)	229	81.21
	[160,000, 310,000)	103	89.57
	[310,000, 510,000)	20	83.33
	≥ 510,000	4	57.14





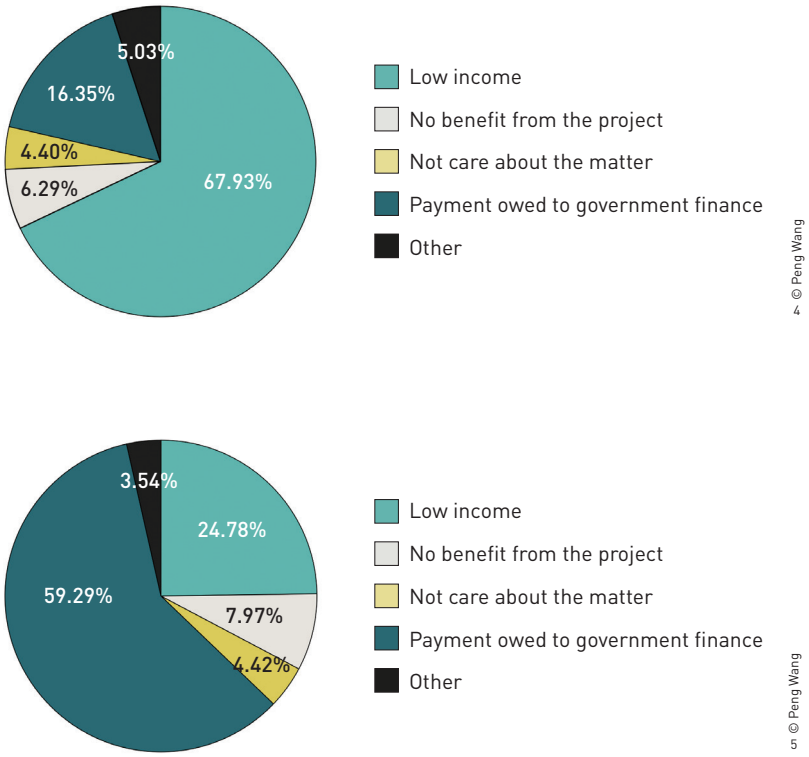
3.3 Analysis of Zero WTP

This research surveyed why 159 respondents in the internal group refused to pay (Fig. 4): 67.93% of them refused to pay because of low income; 16.35% of them thought the payment owed to government finance; 6.29% of them thought they would not benefit from the project; 5.03% of them had other reasons, and as explained through further interviews, they believed this welfare project has little significance; and 4.40% of them little cared about this matter.

The refusal reasons of the 113 unwilling external respondents (Fig. 5) include that 59.29% of them thought the payment owed to government finance; 24.78% of them thought they were unaffordable; 7.97% of them thought they would not benefit from the project; 4.42% of them did not care about this matter; and 3.54% had other reasons.

3.4 Monetized Evaluation of Landscape Resource Value

The research used CVM to estimate the total WTP and work out the monetized value of the landscape resources in Qianjiangyuan Pilot Zone. In particular, the internal value is the monetized evaluation of WTP by local people of Kaihua County, i.e., the sum of payment by all the residents and administrative staff; the external value is the WTP of tourists, i.e. the sum of the payments by them for the landscape resources in Qianjiangyuan Pilot Zone.



2. Reasons to pay of the internal group
3. Reasons to pay of the external group
4. Reasons for refusal to pay of the internal group
5. Reasons for refusal to pay of the external group

3.4.1 Internal Value

The internal WTP distribution (the amount of money each person is willing to pay per year) was obtained from the payments of the 531 willing internal respondents (Table 7). Based on equation (2), the average internal WTP is 98.03 yuan, and the average internal WTP (including zero WTP) is 68.68 yuan.

3.4.2 External Value

The external WTP distribution (the amount of money each person is willing to pay per year) was obtained from the payments of the 542 willing external respondents (Table 8). Based on equation (2), the average external WTP is 156.56 yuan, and the average external WTP (including zero WTP) is 123.92 yuan.

3.4.3 Total Landscape Resources Value

Based on the population of permanent residents (360,600) and the total number of tourists (1,202,400) of Kaihua County in 2020, the value of landscape resources of the Qianjiangyuan Pilot Zone in 2020 is 135 million yuan: the internal value is 17 million yuan and the external value is 118 million yuan.

3.5 Influencing Factors of Landscape Resource Value

Binary Logistic Regression analysis on the main influencing factors of landscape resources value in Qianjiangyuan Pilot Zone show that, when there is only constant without any independent variable, the model's correct predicting rate is 74.70%, with a

Table 7: WTP distribution of the internal group

Monetized WTP (yuan per year)	Number of samples	Frequency of positive WTP (%)	Cumulative frequency of positive WTP (%)	Total frequency of WTP (%)	Cumulative frequency of WTP (%)
0.00	159	–	–	29.94	29.94
5.00	11	2.96	2.96	2.07	32.01
15.00	170	45.70	48.66	32.02	64.03
50.00	8	2.15	50.81	1.51	65.54
150.00	167	44.89	95.70	31.45	96.99
1,500.00	16	4.30	100	3.01	100
Total	531	100	–	100	–

Table 8: WTP distribution of the external group

Monetized WTP (yuan per year)	Number of samples	Frequency of positive WTP (%)	Cumulative frequency of positive WTP (%)	Total frequency of WTP (%)	Cumulative frequency of WTP (%)
0.00	113	–	–	20.85	20.85
5.00	15	3.50	3.50	2.77	23.62
15.00	142	33.10	36.60	26.20	49.82
150.00	241	56.18	92.78	44.46	94.28
1,500.00	31	7.22	100	5.72	100
Total	542	100	–	100	–

regression coefficient of 1.080 (p = 0.000, Wald = 236.863).

The score test was conducted to examine the correlations between the independent and dependent variables (Table 9). The result shows that, at the significance level of 5%, 10 demographic factors are significantly correlated with the dependent variable: age (X_2), higher education (X_3), compulsory education only (X_4), farmer (X_5), self-employed (X_6), civil servant/public service staff/village cadre (X_7), enterprise staff (X_8), average annual income below 30,000 yuan (X_{10}), [60,000, 160,000) yuan (X_{12}), and [160,000, 310,000) yuan (X_{13}). There are four environmental factors significantly correlated with the dependent variables: living in Qixi Town (X_{19}), living in town of Kaihua County (X_{20}), working in Kaihua County (X_{21}), and working in Zhejiang Province (X_{22}). All five attitude factors are significantly correlated with dependent variable. Although the score test suggests some variables are not significantly correlated with the dependent variable, it does not mean that there is no effect from these variables; the effect of each variable should be examined by the Logistic regression model.[36]

Besides, Hosmer-Lemeshow test was adopted to examine the goodness of fit for the logistic regression model: the p value is 0.493 (> 0.05), indicating a good fit of the model. There is no significant difference between the observed and expected values of the model. Also, the correct rate of prediction is 78.8%, indicating a high accuracy of predicting.

According to the results of Logistic regression (Table 10), finally 24 independent variables were included in the fitted model (except for X_9, X_{15}, X_{20}, X_{21}, and X_{24}). Self-employed (p = 0.015), civil servant/public service staff/village cadre (p = 0.049), the average annual income of [160,000, 310,000) yuan (p = 0.039), and living in Changhong Village (p = 0.024) are significantly correlated with the willingness to participate in the welfare preservation association and pay for the membership. Attitudes on natural scenery, ecological environment, and ecological culture are all significantly correlated with the dependent variable at the significance level of both 1% and 5%; attitudes on aesthetics and functions are significantly correlated with the dependent variable at the significance level of 10%. The attitude factors that are significantly correlated with the willingness including low (p = 0.005), moderate (p = 0.015), and high (p = 0.001) attitudes on natural scenery; low (p = 0.000), moderate (p = 0.001), and high (p = 0.000) attitudes on environmental protection; low (p = 0.000), moderate (p = 0.00), and high (p = 0.002) attitudes on ecological culture; and low (p = 0.008) and high (p =0.002) attitudes on aesthetics and functions. Overall, the proportion of attitude factors that passed the test at the significance level of 5% is higher than that of demographic and environmental factors, which suggests a greater impact of attitude factors on WTP.

4 Conclusions and Discussion

4.1 Conclusions

In response to the insufficient investigation of landscape resources in national parks in China and the lack of well-developed

Table 9: Score test of independent variables

Code	Score	Sig.	Code	Score	Sig.
X_1	0.919	0.338	X_{21}	11.724	0.001
X_2	9.796	0.002	X_{22}	6.375	0.012
X_3	18.650	0.000	X_{23}	3.748	0.053
X_4	20.864	0.000	X_{24}	0.044	0.834
X_5	29.985	0.000	X_{25}	32.785	0.000
X_6	3.894	0.048		0.488	0.485
X_7	9.915	0.002		12.004	0.001
X_8	5.900	0.015	X_{26}	11.921	0.003
X_9	3.394	0.065		0.024	0.877
X_{10}	40.541	0.000		2.452	0.117
X_{11}	0.368	0.544	X_{27}	43.060	0.000
X_{12}	7.728	0.005		0.177	0.674
X_{13}	23.638	0.000		31.161	0.000
X_{14}	0.061	0.804	X_{28}	52.472	0.000
X_{15}	1.141	0.285		15.997	0.000
X_{16}	0.363	0.547		9.534	0.002
X_{17}	2.828	0.093	X_{29}	58.914	0.000
X_{18}	0.218	0.640		0.042	0.837
X_{19}	12.370	0.000		26.429	0.000
X_{20}	11.724	0.001			

assessment techniques and methods, this research took the Qianjiangyuan National Park Pilot Zone as an example, constructed a hypothetical market project to survey WTP of the internal and external groups of the pilot zone, evaluated the monetized value of landscape resources, and explored the influencing factors of the willingness. The research draws the following conclusions.

1) There is a significant difference of WTP between different groups. The payment rate of external group (79.15%) is higher than that of internal group (70.06%), but the total amount of payment of internal group (52,055 yuan) is higher than that of external group (43,005 yuan).

2) People with different demographics have different payment rates. Overall, males, having undergraduate education or above and an average income of [160,000, 310,000) yuan relate to a higher payment rate. For internal group, the payment rate declines as age increases; in external group, however, the youngest people (aged 18 ~ 25 years old) have the lowest payment rate while the eldest people (aged 56 ~ 70 years old) have the highest. In terms of occupation, students have the highest payment rate in internal group, but lowest in external group.

3) There is a disparity of the reasons for willing to participate in the hypothetical market project or not. Different groups share "to improve ecological environment" as a common and primary reason of willingness, but show significant differences on reasons of refusal: having a low income is the main reason for the internal group (67.93%), and the external respondents mainly refuse because of the belief that the payment owed to government finance (59.29%).

And 4) the total monetized value of the Qianjiangyuan Pilot Zone is 135 million yuan, of which the external value (118 million yuan) is higher than internal value (17 million yuan). People's WTP can be influenced by multiple factors, among which the proportion of attitude factors passing significance test at the level of 5% is higher than that of demographic and environmental factors, suggesting that attitude factors are more influential.

4.2 Discussion

Through the analyses of WTP of internal and external groups of the national park, this research finds no significant differences of the impact by gender, average annual income, and education level on WTP among both internal and external groups. Overall, the respondents with higher education level are more willing to pay. This proves the findings of landscape recreational value by Yutong Sun et al.[37] and Zhengbing He et al.[38] The research by Tianyao Zhao et al.[39] also indicates that education level is significantly

Table 10: Results of Logistic regression

Independent variables		Code	B	S.E.	Wald	df	Sig.	Exp(B)
Gender		X_1	0.062	0.160	0.147	1	0.701	1.063
Age		X_2	–0.007	0.007	1.003	1	0.317	0.993
Education level	Higher education	X_3	0.315	0.218	2.087	1	0.149	1.370
	Compulsory education only	X_4	–0.273	0.298	0.839	1	0.360	0.761
Occupation	Farmer	X_5	0.406	0.462	0.772	1	0.380	1.501
	Self-employed	X_6	1.186	0.489	5.877	1	0.015	3.274
	Civil servant/public service staff/ village cadre	X_7	0.915	0.464	3.880	1	0.049	2.496
	Enterprise staff	X_8	0.388	0.389	0.992	1	0.319	1.474
Average annual income	< 30,000	X_{10}	0.406	0.884	0.211	1	0.646	1.500
	[30,000, 60,000)	X_{11}	0.709	0.882	0.646	1	0.422	2.032
	[60,000, 160,000)	X_{12}	0.958	0.863	1.232	1	0.267	2.606
	[160,000, 310,000)	X_{13}	1.856	0.899	4.259	1	0.039	6.398
	[310,000, 510,000)	X_{14}	0.967	0.955	1.026	1	0.311	2.630
Residency	Suzhuang Town	X_{16}	0.164	0.391	0.177	1	0.674	1.179
	Changhong Village	X_{17}	–0.867	0.383	5.121	1	0.024	0.420
	Hetian Village	X_{18}	0.325	0.415	0.616	1	0.433	1.384
	Qixi Town	X_{19}	–0.390	0.395	0.978	1	0.323	0.677
Workplace	Zhejiang Province	X_{22}	0.273	0.329	0.689	1	0.407	1.314
	Yangtze River Delta (except Zhejiang Province)	X_{23}	0.125	0.263	0.226	1	0.634	1.133
Attitude on natural scenery	Low	X_{25}	–	–	10.445	2	0.005	–
	Moderate		0.758	0.312	5.888	1	0.015	2.134
	High		1.020	0.319	10.235	1	0.001	2.773

Continued

Table 10: Results of Logistic regression

Independent variables		Code	B	S.E.	Wald	df	Sig.	Exp(B)
Attitude on ecological environment	Low	X_{26}	–	–	5.847	2	0.054	–
	Moderate		0.015	0.310	0.002	1	0.961	1.015
	High		–0.411	0.322	1.630	1	0.202	0.663
Attitude on environmental protection	Low	X_{27}	–	–	23.115	2	0.000	–
	Moderate		0.625	0.193	10.497	1	0.001	1.868
	High		1.030	0.219	22.111	1	0.000	2.802
Attitude on ecological culture	Low	X_{28}	–	–	19.046	2	0.000	–
	Moderate		0.716	0.175	16.671	1	0.000	2.046
	High		0.785	0.249	9.959	1	0.002	2.192
Attitude on aesthetics and functions	Low	X_{29}	–	–	9.733	2	0.008	–
	Moderate		0.433	0.225	3.703	1	0.054	1.542
	High		0.797	0.257	9.624	1	0.002	2.218
Constant			–2.060	1.052	3.837	1	0.050	0.127

correlated with WTP, because increased literacy brings about an improvement of individual cognition and promotes the spiritual and cultural consumption. In addition, the respondents aged 56 ~ 70 years old in the external group, and those aged 18 ~ 25 years old in the internal group have the highest payment rate. For elder tourists with relatively free schedule and adequate savings, their main demand for landscape resources in national parks is sight-seeing, so they are more willing to pay for the enhancement of landscape value of recreational places[26][34]. In contrast, the main demand of the internal group is about daily recreation and entertainment that will not cause consumptions, so their WTP depends on the awareness of the sustainable development of national parks. As a result, the payment rate of older tourists who have more savings is higher than that of local young people with higher level of awareness.

Referring to the research of different interest groups participating in hypothetical market projects by Zhengbing He et al.[38] and Chunla Liu et al.[40], this research finds that people's WTP for the preservation of landscape resources is not limited by interests such as individual wealth or social status, but is more driven by the landscape ecological benefits than other reasons. In terms of revitalizing rural culture, the internal group shows higher enthusiasm, reflecting the willingness of residents and administrative staff to protect both natural and cultural resources. Therefore, it is necessary to survey and discuss internal and external groups separately. Meanwhile, the reasons analysis of refusal to pay reveals that the public's income influences a lot on their choice.

This research proposes the following reasons why the external value of landscape resources is obviously higher than internal value. First, Kaihua County is located in the mountainous area which is close to the border of Zhejiang Province, and the tourists mainly come from other more developed areas in the Yangtze River Delta with higher standard of living and ability to pay. In addition, the tourists have higher level education than the internal group, thus have deeper understanding of the connotation and importance of landscape resources, and more recognition on their values. Cheng Cheng et al.[16] explained the landscape resources value of scenic spots according to time and transportation cost. They held the idea that tourists are a group of people with relatively stable incomes and tend to pay a certain amount of money for tourism. Their transportation costs would increase with the distance to scenic spot, and the costs of lodging and meals increase with the duration of trip, which in turn raises the external value of landscape and makes it reasonable more than internal value.

Through analyses on influencing factors of landscape resources value, the research finds that people's attitudes on natural scenery, ecological protection, ecological culture, and aesthetics and functions are all significantly correlated with whether willing to pay for landscape resources or not. This may be related to the level of perceived value of the landscape by internal and external groups; the higher the level of perception, the correspondingly higher amount willing to pay. Yongle Li et al.[41] also proved that there is a significant positive correlation between the perceived value of landscape resources and the willingness to protect and local identity. Among demographic factors, self-employed, civil servant/public service staff/village cadre, and average annual income of [160,000, 310,000) yuan have a certain impact on WTP. Further reason analysis suggests that people with higher education level, stable jobs, and higher incomes also have relatively more demands and investments in landscape, which supports the findings of Zhenhua Bing et al.[42] Among the environmental factors, only living in Changhong Village is correlated with WTP options, which is probably related to the landscape characteristics of Changhong Village—It is mostly located in the traditional development area with more agricultural landscape resources than the other townships, which in turn affects the livelihoods and incomes of the residents and leads to different assessed landscape values. The research results of Pei Luo et al.[43] and Bohua Li et al.[44] also proved that the value of landscape resources is influenced by their locations and functions.

China's national parks cover wide areas, involve various interest agents with complex relationships, and face many challenges in monetizing the value of landscape resources due to varied demands and interest drives. Considering the respondents are non-professionals, the difficulties of the survey, and other limitations, this research mainly focuses on the narrow definition of landscape at the aesthetic level, failing to realize a multi-dimensional assessment based on a comprehensive definition of landscape resources. In addition, how landscape resources are perceived by the public, how to affect public perceptions, and how to promote scientific management and decision-making of national parks through the evaluation of landscape resource value also need to be further explored. In future pilot construction of national park system, it is urgent to develop measurement models and calculation techniques for multi-dimensional values of recreation, aesthetics, and ecology, and to establish replicable standards and regulations that can be generalized on multiple categories of landscape resources including forests, wetlands, grasslands, and cultivated land.

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REFERENCES

[1] Xinhua News Agency. (2019, June 26). *General Office of the CPC Central Committee and the General Office of State Council Issued the Guidance to Establish a Nature Reserve System Based on National Parks*.

[2] Su, K., Ren, J., Huang, Y., Yang, J., & Wen, Y. (2022). Current status, challenges and advices of human wildlife conflict management in protected areas. *Chinese Journal of Wildlife*, 43(1), 259–265.

[3] Wang, T., Gao, F., Wang, B., Wang, P., Wang, Q., Song, H., & Yin, C. (2017). Status and suggestions on ecological protection and restoration of Qilian Mountains. *Journal of Glaciology and Geocryology*, 39(2), 229–234.

[4] Li, Y. (2019). Discussion on the protection and management of Sanjiangyuan National Park. *Forestry Economics*, 41(6), 34–39.

[5] Fu, J., Cao, G., & Guo, W. (2021). Spatial-temporal differentiation of mountain-water-forest-farmland-lake-grass system in Qinghai area of the Qilian Mountain National Park, China. *Chinese Journal of Applied Ecology*, 32(8), 2866–2874.

[6] Zou, Y., & Wei, Y. (2023). Review of the current situation, hotspots and contents of research on sustainable development of national parks in China—Based on CiteSpace visualization and analysis. *Management and Administration*, 1–12.

[7] Xu, L., & Yu, H. (2022). Research progress of international landscape evaluation, protection, and utilization of national parks and implications to China. *Resources Science*, 44(7), 1520–1532.

[8] Li, Y. (2014). Connotation, basic issues and research methods of landscape economics. *Areal Research and Development*, 33(6), 51–55.

[9] Xie, X. (2021). *Valuation of Forest Landscape Resources Assets in Beiluoxiao National Forest Park* [Unpublished master's thesis]. Central South University of Forestry & Technology.

[10] Linton, D. L. (1968). The assessment of scenery as a natural resource. *Scottish Geographical Magazine*, 84(3), 219–238.

[11] Bruce Hull, R., & Buhyoff, G. J. (1981). On the Law of Comparative Judgment: Scaling with intransitive observers and multidimensional stimuli. *Educational and Psychological Measurement*, 41(4), 1083–1089.

[12] Aoki, Y. (1999). Trends in the study of the psychological evaluation of landscape. *Landscape Research*, 24(1), 85–94.

[13] Wang, P., Yang, W., Wang, D., & He, Y. (2021). Insights into public visual behaviors through eye-tracking tests: A study based on National Park System Pilot Area landscapes. *Land*, (10), 497.

[14] Harding, S. P., Burch, S. E., & Wemelsfelder, F. (2017). The assessment of landscape expressivity: A free choice profiling approach. *PLoS ONE*, 12(1), e0169507.

[15] Nekhay, O., Arriaza, M. (2016). How attractive is upland olive groves landscape? Application of the analytic hierarchy process and GIS in Southern Spain. *Sustainability*, (8), 1160.

[16] Cheng, C., Xiao, Y., Ouyang, Z., & Rao, E. (2013). Natural landscape valuation of Wulingyuan Scenic Area in Zhangjiajie City. *Acta Ecologica Sinica*, 33(3), 771–779.

[17] Zhu, Y., Li, J., Fei, Y., Li, X., & Wang, J. (2009). An assessment on the ecosystem services value of landscape for Kunming Daguan Park with travel cost method. *Journal of Yunnan University*, 31(S2), 528–533.

[18] Tong, L., Wei, X., Song, X., Mao, X., Jin, X., Jin, Y., & Ji, H., & Tang, W. (2022). A Hedonic-Price and Structural-Equation Model based value assessment and factors of ecosystem services of urban wetlands in Xining City. *Acta Ecologica Sinica*, 42(11), 4630–4639.

[19] Cao, H., & Lan, S. (2002). Application of CVM method in forest landscape asset evaluation. *World Forestry Research*, 15(3), 32–36.

[20] Mou, Z., & Yang, G. (2014). Forest landscape valuation of Libo World Natural Heritage Site. *Ecological Economy*, 30(9), 135–140.

[21] Zhang, Y., Tian, X., & Liu, M. (2017). Review of the evaluation methods on urban forests. *Forestry Economics*, 39(3), 64–72.

[22] Zhang, M. (2011). *Study on the Compensation for Ecological Forest by the Contingent Valuation Method—Based on the Urban Residents' Willingness to Pay in Guangzhou, Fuzhou, Kunming Cities* [Doctoral dissertation]. Fujian Agriculture and Forestry University.

[23] Han, L., & Wang, P. (2019). Study on the uncertainty influencing factors and the treatment in contingent value method—A case study of Hulunbeier grassland. *Journal of Arid Land Resources and Environment*, 33(5), 19–24.

[24] Wu, Z. (2022). Application of contingent valuation method in resources and environmental value assessment in China. *China Environmental Science*, 42(10), 4931–4938.

[25] Jiang, S. (2015). *Based on the Contingent Valuation Method to Erhai Lake Environmental Value Evaluation* [Doctoral dissertation]. Yunnan University.

[26] Zha, A., & Qiu, J. (2016). Validity test in assessing recreational value of tourism resource using contingent valuation method: A case study of Hangzhou West Lake scenic spot. *Human Geography*, 31(1), 154–160.

[27] Zhao, J., Yang, K., Liu, L., & Chen, T. (2007). The WTA/WTP disparity in environmental and ecosystem services valuation. *Acta Scientiae Circumstantiae*, 27(5), 854–860.

[28] Liu, Y., Jin, J., Zhou, W., & He, X. (2015). Measurement and analysis of asymmetry between WTP and WTA values in the evaluation of environmental value: The case of coastal environmental protection in the Guangxi Beibu Gulf Economic Zone. *Acta Ecologica Sinica*, 35(9), 2870–2879.

[29] Zong, J. (2014). Choice of value estimation tools: Willingness to pay or willingness to accept—An review of experiment research

frontier. *Foreign Economics & Management,* 36(7), 44–52.
[30] Jahandideh-Kodehi, G., Kavoosi-Kalashami, M., & Motamed, M. K. (2021). Landscape valuation of historical tourism site in Northern Iran: A case study from Sheikh-Zahed Tomb. *GeoScape*, 15(1), 79–89.
[31] Liu, Y., Zhang, Y., Zhang, L., & Chen, J. (2017). Research on aesthetic value of ecological system based on AHP and CVM—An example of Qinghai Beishan National Forest Park. *Forestry Economics*, 39(7), 95–102.
[32] Molina, J. R., Moreno, R., Castillo, M., & y Silva, F. R. (2018). Economic susceptibility of fire-prone landscapes in natural protected areas of the southern Andean Range. *Science of The Total Environment*, (619–620), 1557–1565.
[33] Cai, Z., Du, L., & Jiang, Z. (2011). Improving validity and reliability of contingent valuation method through reducing biases and errors: Theory, method and application. *Acta Ecologica Sinica*, 31(10), 2915–2923.
[34] Chen, H., Wang, Q., & Li, C. (2014). WTP guidance technology: A comparison of payment card, single-bounded and double-bounded dichotomous formats for evaluating non-use values of Sanjiang Plain ecotourism water resources. *Chinese Journal of Applied Ecology*, 25(9), 2709–2715.
[35] Kriström, B. (1997). Spike models in contingent valuation. *American Journal of Agricultural Economics*, 79(3), 1013–1023.
[36] Li, Z., & Pan, W. (2015). *Econometric*s. Higher Education Press.
[37] Sun, Y., Wang, W., Fang, S., & Wang, Y. (2014). An empirical analysis on influencing factors of residents' environment willingness to pay under the background of the plains afforestation project—Taking Beijing as an example. *Forestry Economics*, 36(6), 114–118.
[38] He, Z., Ji, W., Hu, S., & Li, W. (2008). Evaluation on recreation value of landscape based on contingent valuation method—A case study on Taibai Mountain Forest Park. *Journal of Northwest Forestry University*, 23(5), 213–217.
[39] Zhao, T., Cao, P., Liu, Z., Jiang, Z., & Jin, T. (2015). Evaluation of landscape, leisure and tourism value of paddy field in Jingzhou by the contingent valuation method. *Resources and Environment in the Yangtze Basin*, 24(3), 498–503.
[40] Liu, C., Shen, X., Tang, C., & Wang, P. (2014). Assessment of traditional settlements landscape's low carbon value based on CVM—A case of Shanggantang Village in Hunan Province. *Resource Development & Market*, 30(4), 413–416, 461.
[41] Li, Y., Xiao, L., Yang, J., Wang, K., & Cheng, S. (2022). On the influence of perception of the Grand Canal landscape value on tourists' willingness to protect heritage: A case study of Qingming Bridge Historical and Cultural District, Wuxi. *Journal of Arid Land Resources and Environment*, 36(2), 202–208.
[42] Bing, Z., & Gao, J. (2016). An assessment of the Jiuzhaigou landscape recreational value and spatial variation. *Acta Ecologica Sinica*, 36(14), 4298–4306.
[43] Luo, P., Zhang, L., Wu, Y., Xu, F., & Wang, G. (2020). Evaluation of tourism value of landscape resources of Guangwushan·Nuoshuihe World Geopark based on multi-scenic. *Journal of Shanxi Normal University (Natural Science Edition)*, 34(2), 106–113.
[44] Li, B., Yang, J., Liu, P., Chen, C., & Liu, Y. (2018). Landscape value perception and evaluation of residents on traditional villages—A case study of Zhangguying Village. *Journal of Central China Normal University (Natural Sciences)*, 52(2), 248–255.

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基于多元利益群体支付意愿的国家公园景观资源价值货币化核算评估

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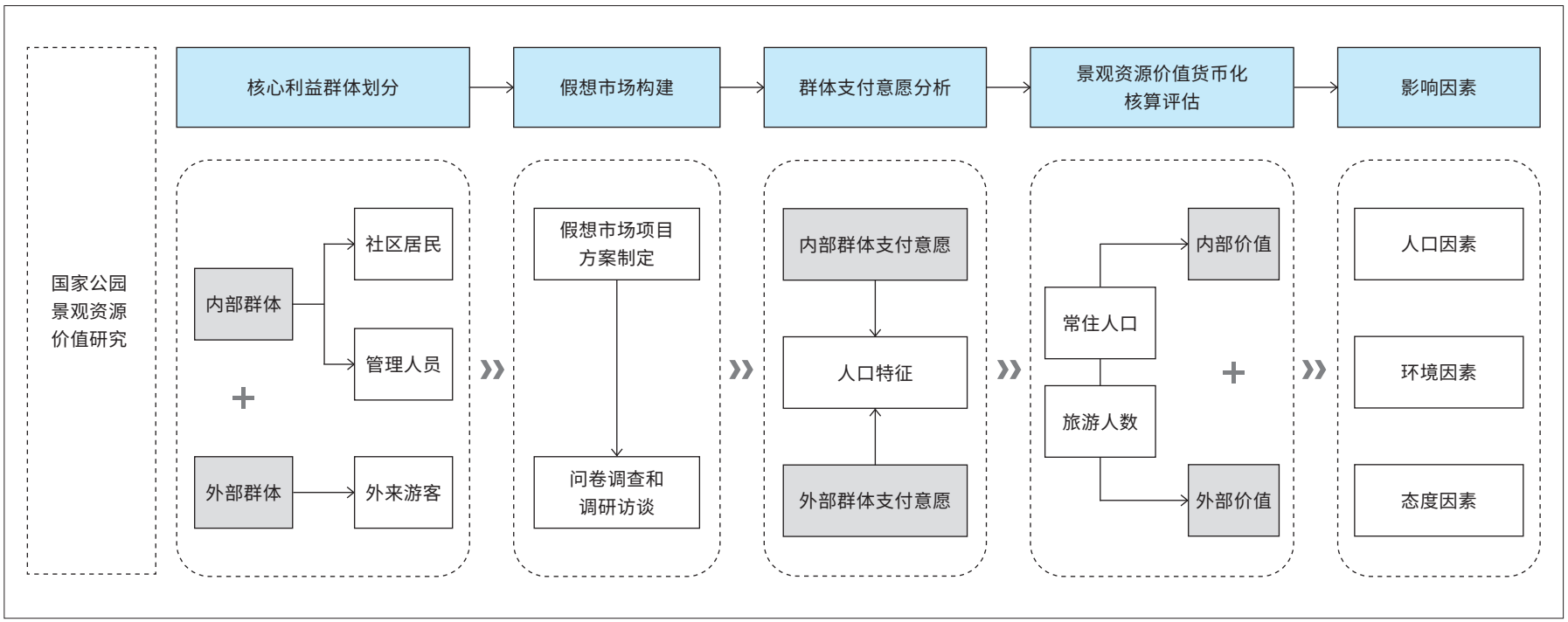
图文摘要



文章亮点

- 探索性构建了国家公园景观资源价值的货币化核算评估方法
- 通过设定假想市场项目，对国家公园内部群体与外部群体的支付意愿进行了分析
- 从人口、环境、态度三方面探索了景观资源价值和支付意愿的影响因素

关键词

国家公园；
景观资源价值；
货币化核算评估；
支付意愿；
多元利益群体

摘要

国家公园是我国自然景观最独特的国土空间之一。科学评估景观资源价值对于实现国家公园原真性与完整性的保护具有重要作用。本文以钱江源国家公园体制试点区为例，采用条件价值法，通过调研内部群体（社区居民与管理人员）和外部群体（外来游客）对假想市场项目的支付意愿，对该国家公园景观资源价值进行货币化核算评估，并在此基础上采用Logistic回归模型分析影响景观资源价值的关键因素。结果显示，外部群体支

付率高于内部群体，且不同特征的人群具有不同的支付率。改善生态环境是不同群体愿意为假想市场项目进行支付的主要原因，但拒绝支付的原因存在明显差异，自身收入低是导致内部群体拒绝支付的主要原因，认为假想市场项目应由财政支付是外部群体拒绝支付的主要原因。研究区域景观资源价值为1.35亿元，其中，外部价值明显高于内部价值，而态度因素比人口和环境因素对景观资源价值的影响更大。国家公园景观资源价值受到多元利益群体的认知、诉求和利益驱动的影响，研究建议加快构建标准化核算评估技术体系，为中国的国家公园体系建设提供支撑。

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1 引言

国家公园是中国自然生态系统中最重要、自然景观最独特、自然遗产最精华、生物多样性最富集的部分[1]。目前，众多学者从人兽冲突与种群保护、生态修复和生物多样性等角度深入研究了国家公园相关科学问题[2]~[6]，但是鲜少看到自然景观与遗产等角度的相关研究。根据中共中央办公厅、国务院办公厅颁布的《关于建立以国家公园为主体的自然保护地体系的指导意见》《建立国家公园体制总体方案》等顶层设计文件，国家公园在体现全球价值、国家象征与国民认同度方面具有不可替代的作用。因此，如何科学评估国家公园景观资源价值并核算其货币价值，已成为中国特色国家公园体制建设亟需解决的重要问题。

国家公园景观资源价值可以理解为国家公园景观资源为人类提供的产品与服务[7][8]，涉及美学、游憩、生态等方面。综合宏观经济与管理学等学科理论，景观资源的资产价值可以通过货币化评估实现[8][9]。由于景观系统的复杂性、资源的动态性，以及对其认知的差异性，目前学术界尚未形成公认且较为完善的景观资源价值核算方法和评估技术。早期学者多通过研究公众对景观资源的主观感受来间接评估景观资源价值，并提出了美景度评估法、比较评判法等技术方法[10][11]。近年来，越来越多的学者从多维角度分解量化受访者的景观感受，并相继引入眼动跟踪、数字投影图像和地理信息系统等新技术，通过建立相应的统计模型计算景观价值[12]~[15]。整体而言，现有研究侧重于景观资源的功能评估，对其价值核算较少，但上述研究都为国家公园景观资源价值货币化核算提供了坚实的技术支撑。当前，国内外学者逐渐开始结合林业经济、生态管理等计量学科，采用条件价值法[16]、旅行费用法[16][17]和享乐价格法[18]等方法量化景观感知数据，从而进行价值估算。其中，条件价值法为通过调查受访者支付意愿（willingness to pay）（即受访者为参观或参与自然保护地活动而愿意支付的最高价格）进行价值评估，在自然保护地资源经济与生态价值评估等领域应用较广泛，但现有相关研究多局限在游客群体[19][20]，较少考虑当地社区居民、管理决策者等其他相关利益群体，导致评估结果常常存在一定偏差。

从2013年我国首次提出创建国家公园体制起，到2017年《建立国家公园体制总体方案》和2019年《关于建立以国家公园为主体的自然保护地体系的指导意见》的印发，直至2022年《国家公园空间布局方案》正式遴选出49个国家公园候选区，我国已初步完成国家公园顶层设计，取得了重要阶段性成果。但在我国国家公园体制建设进程中，对国家公园景观资源功能与价值的量化研究整体还处于起步阶段，在理论与方法方面的积累都相对匮乏。受相关研究广度与深度不足的影响，对国家公园景观资源的认识存在一定误区——仅仅将景观价值与旅游产业发展挂钩，使得对景观资源价值的评价取决于其吸引游客的数量与门票收益，从而形成生态价值与景观价值二元对立的错误认识。因此，建立科学合理的国家公园景观资源评价体系将对创建具有中国特色的国家公园体制具有重要意义。

本文以钱江源国家公园体制试点区为研究对象，选取当地社区居民和管理人员（内部群体）与外来游客（外部群体）为核心利益群体，通过分别调查其支付意愿，来评估国家公园内部与外部的景观资源货币化价值，并分析其影响因素。本研究旨在探索解决国家公园景观资源价值的评估核算难题，为推动景观资源价值纳入国家公园生态系统评估体系提供参考。

2 研究区域与方法

2.1 研究区域

钱江源国家公园体制试点区（以下简称“钱江源试点区”）是2015年首批设立的10个体制试点之一，也是2022年《国家公园空间布局方案》正式遴选出的候选区之一，位于浙江省西部与江西省、安徽省的交界地带，面积约252km^2。根据体制试点方案与总体规划，钱江源试点区是由古田山国家级自然保护区、钱江源国家森林公园、钱江源省级风景名胜区三处自然保护地整合而成，包括核心保护区、一般控制区两个管控分区，并被划分为核心保护区（72.33km^2）、生态保育区（135.80km^2）、游憩展示区（8.12km^2）、传统利用区（36.13km^2）四个

功能分区（图1）。钱江源试点区土地资源权属复杂，其中国有土地为48.64km^2，占总面积的19.30%，主要包括开化林场齐溪分场、苏庄分场和古田山国家级自然保护区等区域；集体土地为203.52km^2，占总面积的80.70%。

根据《钱江源国家公园体制试点区总体规划（2016—2025）》及钱江源国家公园管理局统计数据，钱江源试点区范围涉及开化县苏庄镇、齐溪镇、何田乡和长虹乡4个乡镇，人口共计9 544人。其中，苏庄镇1 030人、383户；长虹乡3 825人、1 044户；何田乡2 068人、587户；齐溪镇2 621人、659户。钱江源试点区内产业结构相对单一，居民经济收入主要来自农林产业和外出打工，农业生产以稻谷和玉米等作物为主、经济林种植以油茶（*Camellia oleifera*）为主；旅游产业处于起步阶段，以自发经营为主。2020年旅游人数达120.24万人，旅游收入成为地方重要的经济来源之一。

研究区域作为长江三角洲地区唯一的国家公园体制试点区，如何在经济社会发达、人口相对稠密且自然资源权属关系复杂（集体林与经济林占比高）的地区，对其景观资源价值进行科学评估及货币化核算是国家公园体制试点阶段面临的重要科学问题。同时，本研究对于破解多类型自然保护地集中地区景观资源资产本底不明、度量难度大、资源利用渠道不畅等现实难题也具有十分重要借鉴意义。

2.2 研究方法

2.2.1 条件价值法

（1）支付意愿调查

为避免单一群体评价造成的结果偏差，并加强评价结果的普适性，本研究选择三个核心利益群体——社区居民、管理人员和外来游客作为调查对象。研究团队在正式调研之前开展了三次预调研（2020年8~9月），并根据调研情况完成问卷修订。随后，以随机发放的形式，在2020年9~11月展开正式调研。预调查发现，由于景观概念具有一定的综合性与集成性，本研究中受访的非专业人士难以全面理解对景观的定义，因此，本研究主要基于狭义层面的景观展开，即美学层面的风景。在社区居民层面，对4个乡镇、19个行政村的居民都进行了实地调研；在管理人员层面，选取钱江源国家公园管理局、乡镇执法所、乡镇政府工作人员和村干部等管理人员进行调研；在游客层面，选取研究区域内游客服务中心和主要景点周边进行调研。基于过去的社区调研等相关农林经济管理研究经验，问卷主要包括个人基本情况与支付意愿等内容。

目前，对公共物品价值的评估主要有揭示偏好和陈述偏好两种方法[21][22]。条件价值法（Contingent Valuation Method，CVM）作为典型的陈述偏好方法，是非市场价值评估中应用范围及影响最广泛的技术方法[23][24]。通过构建假想市场，调查询问人们对生态产品或服务的支付意愿或接受赔偿意愿（willingness to accept），以此进行价值评估[25][26]。虽然支付意愿和接受赔偿意愿都能反映消费者剩余的变化[27]，但通常接受赔偿意愿值会高于支付意愿值，而支付意愿值更接近市场价值[28][29]。当前，已有越来越多的研究者将条件价值法运用于景观资源价值评估[30]~[32]。

因为国家公园具有公共物品属性和稀缺性，无法进行市场交易，也难以找到合适的替代品进行价值评估，结合对条件价值法的研究[33][34]，研究团队认为构建假想市场是最为方便有效的方式之一。本项目中的调查人员都是拥有多年田野调查经验并接受过CVM培训的专业人员。经过三轮预调研、反复的问卷调整和专家咨询，研究团队最终确定了参与公益生态保护协会并缴纳会费的假想市场项目方案，以此调查人们的支付意愿（表1）。

相关研究表明，问卷中假想市场项目的支付投标值（支付金额）的设置可能会对结果带来偏差，且受访者的个人支付意愿应在其可支配收入范围内，并不能影响家庭食物支出[33]。项目研究区位于开化县，涉及的社区居民与管理人员多是开化县的农村居民与城镇居民，因此，研究团队从开化县统计局获取县域人均可支配收入与恩格尔系数，并对支付金额进行设置。其中，2019年人均可支配收入26 857元（城镇居民与农村居民人均可支配收入分别为37 762元、19 001元）、恩格尔系数为31%。结合对相关专家的咨询，最终将问卷中的最高支付金额确定为1 500元，其余支付金额根据1 500元的倍数进行相应调整。另外，在预调研现场发现支付选择困难问题，研究结合专家意见减少了支付金额数量设置。最终，对内部群体设置5个支付金额（5元、15元、50元、150元、1 500元），外部群体设置4个支付金额（5元、15元、150元、1 500元）。

表1：假想市场项目方案

项目名称	大美钱江源——国家公园景观保护与恢复示范公益项目
实施机构	林学、生态学、风景园林学、农林经济学专家组成的公益协会
项目目标	保护国家公园自然景观与地域文化景观
项目地点	钱江源国家公园体制试点区
项目内容	1）对自然景观与人文景观进行调查和监测； 2）开展植物科普和自然教育活动； 3）开展保护性规划编制，在重要观景区进行林相改造，保护并恢复地域性乡土景观等

（2）价值计量

本研究采用问卷调查和调研访谈结合的方法获取受访者对于钱江源试点区景观资源价值的支付意愿，支付意愿的价值计量即为数学平均值，可通过离散变量的数学期望公式得到[22]。计算公式为：

$$E(\mathrm{WTP})=\sum_{i=1}^{n}A_iP_i\ , \qquad (1)$$

式中，E(WTP)是受访者愿意支付的平均支付意愿，A_i为愿意支付的金额，P_i为受访者选取某一金额的概率，n为设定的支付金额选项数量。

由于调查样本中包含零支付意愿（即拒绝支付），获取更精确的平均支付意愿需要经过一定的计量经济学（Spike模型）[35]调整，本研究中群体支付意愿的计算公式为：

$$E(\mathrm{WTP})_{\mathrm{nonnegative}}=(1-P_{\mathrm{total}})\times E(\mathrm{WTP})_{\mathrm{positive}}=(1-P_i)\sum_{i=1}^{n}A_iP_i\ , \qquad (2)$$

式中，$E(\mathrm{WTP})_{\mathrm{nonnegative}}$是包含零支付意愿的受访者的平均支付意愿，$E(\mathrm{WTP})_{\mathrm{positive}}$是愿意支付的受访者的平均支付意愿，$P_{\mathrm{total}}$为受访者的总支付概率，$A_i$为愿意支付的金额，$P_i$为受访者选取某一金额的概率，$n$为设定的支付金额选项数量。

钱江源试点区景观资源价值由内部价值与外部价值构成。因研究区是由多个保护地整合而成，且没有明确的旅游管理边界（即需刷卡、买票等才能进入的边界），难以具体统计整个国家公园的相关旅游人数。从当地管理部门得知，作为开化县最著名的“景区”，前往开化县的游客大多都会前往钱江源国家公园，因而本研究使用开化县总旅游人数对外部价值进行统计。基于《2021年开化县统计年鉴》中2020年开化县县域人口数和总旅游人数，分别对内部价值与外部价值进行核算，并得到景观资源价值总值。计算公式为：

$$\begin{aligned}V_{\mathrm{total}}&=V_{\mathrm{in}}+V_{\mathrm{ex}}\\&=E(\mathrm{WTP})_{\mathrm{in\ nonnegative}}\times N_{\mathrm{r}}\times R_{\mathrm{in}}+E(\mathrm{WTP})_{\mathrm{ex\ nonnegative}}\times N_{\mathrm{t}}\times R_{\mathrm{ex}}\ ,\end{aligned} \qquad (3)$$

式中，V_{in}为钱江源试点区内部价值，V_{ex}为钱江源试点区外部价值，$E(\mathrm{WTP})_{\mathrm{in\ nonnegative}}$为内部群体平均支付意愿，$N_{\mathrm{r}}$为开化县县域人口数，$R_{\mathrm{in}}$为内部群体支付率；$E(\mathrm{WTP})_{\mathrm{ex\ nonnegative}}$为外部群体平均支付意愿，$N_{\mathrm{t}}$为开化县县域总旅游人数，$R_{\mathrm{ex}}$为外部群体支付率。

2.2.2 Logistic回归模型

（1）变量选取与释义

结合研究假设和专家咨询结果，研究团队针对人口因素、环境因素和态度因素选取了可能对不同群体参与公益协会并缴纳会费的意愿产生影响的指标（表2）。本研究中，因变量为受访者（内部和外部群体）是否愿意参与公益保护协会并缴纳会费，在“您是否愿意加入公益保护协会参与该项目活动，并每年支付一定会费？”的问题下，设有两个选项，并分别赋值为1（愿意）和0（不愿意）。

（2）研究模型

参考现有研究成果[36]，本研究采用二元Logistic回归模型进行影响因素分析。二元Logistic回归通常用来预测某一事件的发生概率，且因变量Y仅有两个分类，通常取值1和0。令Y=1的总体概率为$P(Y=1)$，n个自变量分别为x_1，x_2，…，x_n，那么对应的Logistic回归模型为：

$$\begin{aligned}P(Y=1)&=\frac{\exp(b_0+b_1x_1+b_2x_2+\cdots+b_nx_n)}{1+\exp(b_0+b_1x_1+b_2x_2+\cdots+b_nx_n)}\\&=\frac{1}{1+\exp[-(b_0+b_1x_1+b_2x_2+\cdots+b_nx_n)]}\ ,\end{aligned} \qquad (4)$$

或：

$$\mathrm{logit}\,P(Y=1)=\mathrm{Ln}\left[\frac{P(Y=1)}{1-P(Y=1)}\right]=b_0+b_1x_1+b_2x_2+\cdots+b_nx_n\ , \qquad (5)$$

式中，b_0为常数项，表示自变量全部取值为0时，Y=1与Y=0的概率之比的自然对数值；b_i为相应自变量x_i的回归系数，表示在其余自变量不变情况下，自变量x_i改变一个单位，因变量对应的优势比平均改变exp(b_i)个单位。

3 结果与分析

3.1 样本统计

3.1.1 社区居民

研究共向社区居民发放问卷531份，回收有效问卷457份，有效问卷回收率为86.06%。其中，苏庄镇145份、长虹乡79份、何田乡124份、齐溪镇109份（表3）。采用IBM SPSS对量表数据进行信度与效度分析。经计算得知，克隆巴赫系数为0.805，大于0.8；KMO为0.873，介于0.8～0.9之间。参考信度和效度评价标准，钱江源试点区社区居民问卷数据的内部一致性和结构效度均较好。

3.1.2 管理人员

研究共向管理人员发放问卷79份，回收有效问卷74份，有效问卷回收率为96.67%。由信度与效度分析得知，克隆巴赫系数为0.856，大于0.8；KMO为0.823，介于0.8～0.9之间。参考信度和效度标准，

表 2：变量选择与定义

变量			代码	变量含义
因变量	是否愿意加入公益保护协会并缴纳会费		Y	1= 愿意；0= 不愿意
自变量				
人口因素	性别		X_1	1= 男；0= 女
	年龄		X_2	实际年龄
	受教育程度	受过高等教育	X_3	1= 高等教育；0= 非高等教育
		仅受过义务教育	X_4	1= 完成义务教育；0= 未完成义务教育
	职业类型	务农	X_5	1= 是；0= 不是
		个体经营	X_6	1= 是；0= 不是
		公务员 / 事业单位人员 / 村干部	X_7	1= 是；0= 不是
		企业员工	X_8	1= 是；0= 不是
		学生	X_9	1= 是；0= 不是
	年均收入（元）	<30 000	X_{10}	1= 是；0= 不是
		[30 000, 60 000)	X_{11}	1= 是；0= 不是
		[60 000, 160 000)	X_{12}	1= 是；0= 不是
		[160 000, 310 000)	X_{13}	1= 是；0= 不是
		[310 000, 510 000)	X_{14}	1= 是；0= 不是
		⩾ 510 000	X_{15}	1= 是；0= 不是

变量			代码	变量含义
自变量				
环境因素	居住地	苏庄镇	X_{16}	1= 是；0= 不是
		长虹乡	X_{17}	1= 是；0= 不是
		何田乡	X_{18}	1= 是；0= 不是
		齐溪镇	X_{19}	1= 是；0= 不是
		开化县城	X_{20}	1= 是；0= 不是
	工作地点	开化县域	X_{21}	1= 是；0= 不是
		浙江省	X_{22}	1= 是；0= 不是
		长江三角洲（浙江省以外）	X_{23}	1= 是；0= 不是
		其他	X_{24}	1= 是；0= 不是
态度因素	自然风景态度		X_{25}	1= 较低；2= 一般；3= 较高
	生态环境态度		X_{26}	1= 较低；2= 一般；3= 较高
	环保意识态度		X_{27}	1= 较低；2= 一般；3= 较高
	生态文化态度		X_{28}	1= 较低；2= 一般；3= 较高
	美学功能态度		X_{29}	1= 较低；2= 一般；3= 较高

注
本研究中除年龄为连续变量，其余变量均为分类变量。

说明钱江源试点区管理人员问卷数据的内部一致性和结构效度均较好。

3.1.3外来游客

研究共向外来游客发放问卷616份，回收有效问卷542份，有效问卷回收率为87.99%。信度与效度分析结果显示，克隆巴赫系数为0.716，介于0.6～0.8之间；KMO为0.823，介于0.8～0.9之间，说明钱江源试点区游客问卷数据的内部一致性和结构效度均较好。

3.2 支付意愿

研究共获取内部群体（社区居民、管理人员）有效样本531份，外部群体（外来游客）有效样本542份（表4）。其中，内部群体支付率为70.06%，支付总额为52 055元；外部群体支付率为79.15%，支付总额为43 005元。

3.2.1 内部群体支付意愿

通过对内部群体愿意参与保护协会并缴纳会费的受访者的人口特征进行分析发现（表5），在性别方面，男性的支付率（71.79%）高于女性（68.13%）；在年龄方面，18～25岁人群的支付率最高（91.67%），71岁以上受访者的支付率最低（53.73%）；在受教育程度方面，受教育程度越高的受访者，支付率也更高；在职业方面，学生、公务员和事业单位人员、村干部的支付率整体较高，务农的受访者支付率最低（62.59%）；在年均收入方面，收入为[16，31）万元的受访者支付率最高（94.29%），低于3万元的受访者支付率最低（57.95%）。

根据假想市场的问卷调查情况，对愿意参与保护协会并缴纳会费的372名内部群体受访者的支付原因进行统计（图2）。结果表明，48.92%的受访者表示为了改善生态环境，愿意加入生态保护公益协会；22.85%的受访者表示为了更好地繁荣乡村文化，愿意加入协会并缴纳会费；19.09%的受访者表示如果大家加入自己就加入；9.14%的受访者表示如果政府组织要求，则愿意加入协会并缴纳会费。

3.2.2 外部群体支付意愿

通过对外部群体愿意支付会费的受访者人口特征进行分析发现（表6），在性别方面，男性受访者的支付率略高于女性，分别为79.48%和78.72%，这与内部群体的统计结果一致；在年龄方面，56～70岁受访人群支付率最高（84.50%），18～25岁受访者支付率最低（69.42%）；在受教育程度方面，本科及以上受访者的支付率最高（82.25%）；在职业方面，个体经营者支付率最高，学生群体支付率最低，分别为89.66%和61.76%；年均收入在[16，31）万元的受访者支付率最高（89.57%），低于3万元、[3，6）万元、51万元及以上的受访者支付率较低，分别为65.22%、62.22%和57.14%。

表3：社区居民有效样本统计表

乡镇	户数	人口数	有效样本量
苏庄镇	383	1 030	145
长虹乡	1 044	3 825	79
何田乡	587	2 068	124
齐溪镇	659	2 621	109
总计	2 673	9 544	457

表4：内部群体和外部群体的样本统计

群体	有效样本数	愿意支付人数	拒绝支付人数	支付率（%）	支付总额（元）
内部群体	531	372	159	70.06	52 055
外部群体	542	429	113	79.15	43 005
总计	1 073	801	272	74.65	95 060

注
支付率的总计结果为愿意支付的总人数占全部有效样本数的百分比。

对愿意参加保护协会并缴纳会费的429名外部群体受访者的相关支付原因进行统计（图3），结果表明，79.95%的外部受访者表示愿意为了改善生态环境而加入生态保护协会；10.72%的外部受访者表示如果大家加入，自己就愿意加入；5.60%的外部受访者表示如果政府组织要求，则愿意加入保护协会并支付会费；3.73%的外部受访者表示愿意为了更好地繁荣乡村文化而加入生态保护协会。

3.3 零支付意愿分析

对内部群体中159位受访者拒绝支付（零支付意愿）的原因进行统计（图4），结果表明，其中67.93%的受访者因本身收入低而不愿加入保护

表 5：内部群体支付率与人口特征

人口特征		支付样本数量	支付率（%）
性别	男	201	71.79
	女	171	68.13
年龄（岁）	18 ～ 25	22	91.67
	26 ～ 40	70	79.55
	41 ～ 55	154	76.24
	56 ～ 70	90	56.25
	71 及以上	36	53.73
受教育程度	初中及以下	252	66.67
	高中 / 中等专业学校	57	74.03
	高等职业学院 / 高等专科学校	28	80.00
	本科及以上	35	85.37
职业	务农	179	62.59
	个体经营	74	79.57
	公务员 / 事业单位 / 村干部	62	83.78
	企业员工	49	70.00
	学生	8	100.00
年均收入（元）	<30 000	113	57.95
	[30 000, 60 000)	132	75.86
	[60 000, 160 000)	88	75.21
	[160 000, 310 000)	33	94.29
	⩾ 310 000	6	60.00

协会并支付会费；16.35%的受访者认为该公益项目应由政府负责并由财政支付相关资金；6.29%的受访者认为自身无法从中受益； 5.03%的受访者因其他原因不愿意加入协会，通过深度访谈得知，他们认为这一假想公益项目意义较小；4.40%的受访者对此事不关心，拒绝支付。

对外部群体中113位受访者拒绝支付的原因（图5）进行统计，其中59.29%的受访者认为公益项目应由政府负责并由财政支付相关资金；24.78%的受访者因本身收入低而不愿加入保护协会并缴纳会费；7.97%的受访者认为自身无法从中受益；4.42%的受访者对此事不关心；3.54%的受访者是因为其他原因不愿意加入并支付。

3.4 景观资源价值货币化评估

通过条件价值法进行支付意愿总值的估算，以获得钱江源试点区景观资源的货币化价值。其中，内部价值是开化县本地人员对景观资源价值总支付意愿，即社区居民与管理人员的支付值总和；外部价值指外地游客对钱江源试点区景观资源价值支付意愿，即游客的支付值总和。

3.4.1 内部价值

根据531名内部群体受访者的支付情况，得到钱江源试点区内部群体的支付意愿（每人每年愿意支付的金额）分布（表7）。根据公式（2）计算得到内部平均支付意愿为98.03元，而包含零支付意愿的内部平均支付意愿为68.68元。

3.4.2 外部价值

根据542名外部群体受访者的支付情况，得到钱江源试点区外部人群的支付意愿（每人每年愿意支付的金额）分布（表8）。根据公式（2）计算得到外部平均支付意愿为156.56元，而包含零支付意愿的外部平均支付意愿为123.92元。

3.4.3 景观资源总值

依据2020年开化县县域人常住口数（360 600人）和总旅游人数（1 202 400人），计算得出2020年钱江源试点区的景观资源价值为1.35亿元。其中，内部价值0.17亿元，外部价值1.18亿元。

3.5 景观资源价值影响因素分析

用二元Logistic回归模型对影响钱江源试点区景观资源价值的主要因素进行分析，结果显示，当只有常数项而无自变量时，模型预测正确率达到74.70%，这时回归系数为1.080，显著性p=0.000，Wald值为236.863。

采用得分检验方法对变量进行分析，检验自变量与因变量之间的相关性（表9）。结果显示，在5%的显著水平下，10个人口因素变量与因

表 6：外部群体支付率与人口特征

	人口特征	支付样本数量	支付率（%）
性别	男	244	79.48
	女	185	78.72
年龄（岁）	18 ～ 25	84	69.42
	26 ～ 40	114	82.01
	41 ～ 55	122	79.74
	56 ～ 70	109	84.50
受教育程度	初中及以下	1	25.00
	高中 / 中等专业学校	129	75.44
	高等职业学院 / 高等专科学校	71	78.02
	本科及以上	227	82.25
职业	个体经营	26	89.66
	公务 / 事业单位 / 村干部	60	86.96
	企业员工	301	80.05
	学生	42	61.76
年均收入（元）	<30 000	45	65.22
	[30 000, 60 000)	28	62.22
	[60 000, 160 000)	229	81.21
	[160 000, 310 000)	103	89.57
	[310 000, 510 000)	20	83.33
	⩾ 510 000	4	57.14

变量显著相关，包括：年龄（X_2）、受过高等教育（X_3）、仅受过义务教育（X_4）、务农（X_5）、个体经营（X_6）、公务员/事业单位人员/村干部（X_7）、企业员工（X_8），以及年均收入3万以下（X_{10}）、[6，16）万元（X_{12}）、[16，31）万元（X_{13}）；4个环境因素变量与因变量显著相关，包括：居住在齐溪镇（X_{19}）、居住在县城（X_{20}）、工作地点在县域（X_{21}）、工作地点在浙江省（X_{22}）；5个态度因素变量全部都与因变量显著相关。虽然得分检验显示部分自变量和因变量不具有显著相关性，但检验结果主要起验证性作用，并非表示对因变量没有影响，具体还需要在Logistic回归模型中检验变量在模型中的作用。[36]

同时，进行Hosmer-Lemeshow拟合优度检验，得到检验p值为0.493，大于0.05，说明模型拟合度较好。模型观测值与期望值之间无明显差异。同时，模型的预测结果正确率达到78.8%，预测效果较好。

Logistic回归结果显示（表10），最终有24个变量进入拟合方程（除X_9、X_{15}、X_{20}、X_{21}、X_{24}）。职业类别中个体经营（p=0.015）、公务员、事业单位人员和村干部（p=0.049），年均收入[16，31）万元（p=0.039），以及居住在长虹乡（p=0.024）均在5%的显著水平下和是否愿意加入公益保护协会并缴纳会费显著相关。自然风景态度、环保意识态度、生态文化态度均在1%、5%的显著水平下通过检验，美学功能态度在10%的显著水平下通过检验。其中，与是否愿意加入公益保护协会并缴纳会费呈显著相关的态度因素包括较低（p=0.005）、一般（p=0.015）、较高（p=0.001）的自然风景态度；较低（p=0.000）、一般（p=0.001）、较高（p=0.000）的环保意识态度；较低（p=0.000）、一般（p=0.00）、较高（p=0.002）的生态文化态度；较低（p=0.008）和较高（p=0.002）的美学功能态度。整体来看，态度因素在5%的显著水平下通过检验的自变量比例高于人口因素与环境因素，这说明态度因素的自变量对支付意愿影响更大。

4 结论与讨论

4.1 结论

针对我国国家公园景观资源资产本底不明、核算评估技术和方法体系不完善等问题，本研究以钱江源国家公园体制试点区为研究对象，基于内部与外部群体对假想市场项目的支付意愿调研，对该试点区的景观资源价值进行了货币化评估，并探究了愿意支付与否的主要影响因素。研究得到如下结论：

1）不同利益群体对假想市场的支付意愿存在明显差异。外部群体支付率（79.15%）高于内部群体（70.06%），但内部群体的支付总额（52 055元）高于内部群体（43 005元）。

2）不同特征的人群具有不同的支付率。整体而言，男性、本科及以上学历、年均收入[16，31）万元的人群有相对更高的支付率。在内部群

表 7：内部群体的支付意愿分布

支付意愿（元 / 年）	人数	正支付意愿频率（%）	正支付意愿累计频率（%）	支付意愿总频率（%）	支付意愿累计频率（%）
0.00	159	–	–	29.94	29.94
5.00	11	2.96	2.96	2.07	32.01
15.00	170	45.70	48.66	32.02	64.03
50.00	8	2.15	50.81	1.51	65.54
150.00	167	44.89	95.70	31.45	96.99
1 500.00	16	4.30	100	3.01	100
总计	531	100	–	100	–

表 8：外部群体的支付意愿分布

支付意愿（元 / 年）	人数	正支付意愿频率（%）	正支付意愿累计频率（%）	支付意愿总频率（%）	支付意愿累计频率（%）
0.00	113	–	–	20.85	20.85
5.00	15	3.50	3.50	2.77	23.62
15.00	142	33.10	36.60	26.20	49.82
150.00	241	56.18	92.78	44.46	94.28
1 500.00	31	7.22	100	5.72	100
总计	542	100	–	100	–

体中，受访者的支付率随年龄的增长而降低；在外部群体中，年龄最小的群体（18 ~ 25岁）支付率最低、年龄最大的群体（56 ~ 70岁）支付率最高。内部群体中的学生支付率最高，外部群体中的学生支付率最低。

3）不同利益群体是否愿意参与假想市场项目的原因存在差异。改善生态环境是不同群体愿意参与假想市场并缴纳会费的共同主要原因。但拒绝支付的原因存在明显差异，自身收入低是导致内部群体拒绝支付的主要原因（67.93%），认为假想市场项目应由财政支付费用是外部群体拒绝支付的主要原因（59.29%）。

4）钱江源试点区景观资源的货币化价值评估总值为1.35亿元，其中，外部价值（1.18亿元）高于内部价值（0.17亿元）。对景观资源的支付意愿受多种因素影响，态度因素在5%的显著水平下通过检验的自变量占比也整体最高，这说明态度因素比人口因素和环境因素的影响更大。

4.2 讨论

本研究通过对国家公园内部群体和外部群体的支付意愿进行分析，发现在内部群体和外部群体之间，性别、年均收入和受教育程度对支付意愿的影响没有明显差异；整体而言，受过高等教育的受访者支付意愿更高。这验证了孙宇彤等人[37]、贺征兵等人[38]关于景观游憩价值的研究结果。赵天瑶等人[39]研究也表明，文化程度与支付意愿呈显著相关关系，这是由于文化程度提升会带来个体认知水平的提高，并促进对精神文化消费的重视。此外，外部游客中56~70岁的被访者支付率最高、内部群体中18 ~ 25岁的被访者支付率最高。老年群体的游客对国家公园景观资源的主要需求是旅游观光，这一群体本身具有相对自由的时间以及储蓄收入，他们相应地更愿意为提升游憩地的景观价值支付费用[26][34]。而内部群体对国家公园景观资源的主要需求是日常休闲娱乐，并不会因此产生较多消费，其支付意愿依赖于人们对国家公园可持续发展的认知水平。因此，储蓄更多的外地年长游客和认知水平更高的本地年轻人的支付率更高。

结合贺征兵等人[38]、刘春腊等人[40]对不同利益群体参与假想市场的原因分析，研究发现，人们对景观资源的保护和成本付费的意愿不会受到金钱或所处地位等利益的限制，且基于景观生态效益保护所产生的支付意愿高于基于其他原因的支付意愿。若从繁荣乡村文化的角度来看，内部群体则表现出较高积极性，体现出社区居民和管理人员保护自然资源和文化资源的双重意愿。由此可见，划分内部和外部群体进行调研及讨论是有必要的。另外，结合拒绝支付的原因分析可知，公众是否愿意对国家公园景观资源进行支付，很大程度上取决于个体的经济收入。

研究发现，景观资源外部价值明显高于内部价值的主要原因如下：一方面，开化县整体处于山区且紧靠浙江省边界，而外部游客群体主要来自长江三角洲其他社会经济发展较发达的地区，相对而言人们的生活水平较高，因此具有相对更高的支付能力；另一方面，外来群体受访者的文化水平相较于内部群体更高，因而更加了解景观资源的内涵和重要性，对景观资源价值的认同度也更高。成程等人[16]从时间和交通成本角度，对风景名胜区景观资源价值作了相应的解释，他们认为外来游客是收入相对稳定、且倾向于为旅游付出一定成本的群体。他们在旅行中产生的交通成本会随着到景区距离的增加而提高，住宿费和餐饮费也会伴随旅游时间的延长而提高，进而提升了景观的外部价值，使其高于内部价值具有合理性。

通过研究影响景观资源价值的多种因素发现，态度因素中自然风景态度、环保意识态度、生态文化态度和美学功能态度对是否愿意为景观资源进行支付均有显著性影响，这可能与内部和外部群体对景观价值的认知水平有关，认知水平越高，其愿意支付的费用相应越多。李永乐等人[41]研究也证实，景观资源价值感知与保护意愿、地方认同都存在显著正相关关系。人口因素中个体经营、公务员、事业单位人员、村干部和年均收入[16，31）万元的特征对景观资源的支付意愿有一定影响，结合对原因的分析，说明具有较高文化程度、工作稳定和收入较高的人群，对景观价值的需求和投入也相对更多，这也验证了邴振华等人[42]的研究结果。环境因素中仅有居住地是否在长虹乡对是否愿意为景观资源进行

表 9：自变量得分检验

代码	得分	显著性值	代码	得分	显著性值
X_1	0.919	0.338	X_{21}	11.724	0.001
X_2	9.796	0.002	X_{22}	6.375	0.012
X_3	18.650	0.000	X_{23}	3.748	0.053
X_4	20.864	0.000	X_{24}	0.044	0.834
X_5	29.985	0.000	X_{25}	32.785	0.000
X_6	3.894	0.048		0.488	0.485
X_7	9.915	0.002		12.004	0.001
X_8	5.900	0.015	X_{26}	11.921	0.003
X_9	3.394	0.065		0.024	0.877
X_{10}	40.541	0.000		2.452	0.117
X_{11}	0.368	0.544	X_{27}	43.060	0.000
X_{12}	7.728	0.005		0.177	0.674
X_{13}	23.638	0.000		31.161	0.000
X_{14}	0.061	0.804	X_{28}	52.472	0.000
X_{15}	1.141	0.285		15.997	0.000
X_{16}	0.363	0.547		9.534	0.002
X_{17}	2.828	0.093	X_{29}	58.914	0.000
X_{18}	0.218	0.640		0.042	0.837
X_{19}	12.370	0.000		26.429	0.000
X_{20}	11.724	0.001			

支付有影响，这与长虹乡的景观特点有关，长虹乡大多位于传统利用功能区，农业景观资源相比其他乡镇更多，进而影响社区居民的生计与经济收入，从而对景观价值形成不同的评估。罗培等人[43]、李伯华等人[44]的研究结果也证实了这一点，即景观资源价值高低具有地域性,与景观所处功能区相关。

我国国家公园覆盖面积广、涉及的利益主体众多且关系复杂，多元化的诉求与利益驱动导致国家公园景观资源价值货币化核算面临诸多挑战。考虑到受访者专业水平、问卷难易程度等客观条件的限制，本研

表 10：Logistic 回归结果

自变量		代码	B	S.E.	Wald	df	Sig.	Exp(B)
性别		X_1	0.062	0.160	0.147	1	0.701	1.063
年龄		X_2	–0.007	0.007	1.003	1	0.317	0.993
受教育程度	受过高等教育	X_3	0.315	0.218	2.087	1	0.149	1.370
	仅受过义务教育	X_4	–0.273	0.298	0.839	1	0.360	0.761
职业类别	务农	X_5	0.406	0.462	0.772	1	0.380	1.501
	个体经营	X_6	1.186	0.489	5.877	1	0.015	3.274
	公务员 / 事业单位 / 村干部	X_7	0.915	0.464	3.880	1	0.049	2.496
	企业	X_8	0.388	0.389	0.992	1	0.319	1.474
年均收入（元）	<30 000	X_{10}	0.406	0.884	0.211	1	0.646	1.500
	[30 000, 60 000)	X_{11}	0.709	0.882	0.646	1	0.422	2.032
	[60 000, 160 000)	X_{12}	0.958	0.863	1.232	1	0.267	2.606
	[160 000, 310 000)	X_{13}	1.856	0.899	4.259	1	0.039	6.398
	[310 000, 510 000)	X_{14}	0.967	0.955	1.026	1	0.311	2.630
居住地	苏庄镇	X_{16}	0.164	0.391	0.177	1	0.674	1.179
	长虹乡	X_{17}	–0.867	0.383	5.121	1	0.024	0.420
	何田乡	X_{18}	0.325	0.415	0.616	1	0.433	1.384
	齐溪镇	X_{19}	–0.390	0.395	0.978	1	0.323	0.677
工作地点	浙江省	X_{22}	0.273	0.329	0.689	1	0.407	1.314
	长江三角洲（浙江省以外）	X_{23}	0.125	0.263	0.226	1	0.634	1.133

续表见下页

表 10：Logistic 回归结果

	自变量	代码	B	S.E.	Wald	df	Sig.	Exp(B)
自然风景态度	较低	X_{25}	–	–	10.445	2	0.005	–
	一般		0.758	0.312	5.888	1	0.015	2.134
	较高		1.020	0.319	10.235	1	0.001	2.773
生态环境态度	较低	X_{26}	–	–	5.847	2	0.054	–
	一般		0.015	0.310	0.002	1	0.961	1.015
	较高		–0.411	0.322	1.630	1	0.202	0.663
环保意识态度	较低	X_{27}	–	–	23.115	2	0.000	–
	一般		0.625	0.193	10.497	1	0.001	1.868
	较高		1.030	0.219	22.111	1	0.000	2.802
生态文化态度	较低	X_{28}	–	–	19.046	2	0.000	–
	一般		0.716	0.175	16.671	1	0.000	2.046
	较高		0.785	0.249	9.959	1	0.002	2.192
美学功能态度	较低	X_{29}	–	–	9.733	2	0.008	–
	一般		0.433	0.225	3.703	1	0.054	1.542
	较高		0.797	0.257	9.624	1	0.002	2.218
	常量		–2.060	1.052	3.837	1	0.050	0.127

究主要聚焦“美学层面上的风景”这一狭义的景观定义，在景观资源界定及其多维价值核算等方面还存在不足。此外，景观资源如何被公众感知、如何影响公众价值认知，以及如何通过景观资源价值评估促进国家公园管理决策等方面也还有待进一步探索。在未来国家公园体制试点建设过程中，从典型国家公园中的森林、湿地、草地、农田等景观资源入手，分类构建游憩、美学、生态等多维价值的计量模型与核算技术，形成可复制、可推广的资产价值评估标准和技术规程是亟需关注的重要议题。

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图 1. 钱江源国家公园体制试点区功能分区图及用地现状图
图 2. 内部群体受访者支付原因分析图
图 3. 外部群体受访者支付原因分析图
图 4. 内部群体拒绝支付原由分析
图 5. 外部群体拒绝支付原由分析