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Research Article

Natural attributes or aesthetic attributes: Which is more valuable in recreational ecosystem services of nature-based parks considering tourists' environmental knowledge and attitude impacts?

Ying Ge [a], Guoxing Xu [a], Qi Zhang [b,c], Xin Wang [a], Tan Li [a,*]

[a] College of Economics and Management, Anhui Agricultural University, Hefei, 230036, China
[b] Department of Geography, University of North Carolina at Chapel Hill, Chapel Hill, NC, 27599, USA
[c] Frederick S. Pardee Center for the Study of the Longer-Range Future, Frederick S. Pardee School of Global Studies, Boston University, MA, 02215, USA

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ABSTRACT

Nature-based tourism provides recreational ecosystem services for both local inhabitants and tourists being of considerable importance. Existing literature predominantly concentrates on the potential for environmental communication interventions to augment the public's willingness to pay (WTP) for nature-based recreational ecosystem services. However, scant attention has been paid to the impact of tourists' pre-existing environmental knowledge and attitudes on specific service attributes. In addressing this research gap, this study uses social surveys to design a choice experiment and employs mixed logit models to analyse tourists' preferences and WTP for recreational ecosystem services in the Yangtze River Delta, east China. The results reveal that tourists are more likely to pay for recreational ecosystem services attributes, with a stronger WTP for aesthetic attributes over natural ones. Tourists with more environmental knowledge and attitude are also more inclined to pay for reduced waste and lower tourist traffic. These findings suggest that environmental communication encourages trade-off considerations between natural and aesthetic attributes in determining WTP. Enhancing public education and promoting environmental protection awareness can effectively manage aesthetic services.

Management implications: Our results offer practical insights for improved natural resource management and planning for protected areas with nature-based tourism. We determined that tourists' environmental knowledge is significantly lower than actual inclinations towards environmental responsibility, particularly in waste classification, which significantly influences their environmental valuation and willingness to conserve nature. Encouraging waste classification awareness in parks and daily life can reinforce pro-environmental behaviour and promote the sustainable consumption of public goods. Furthermore, payment is strongly related to aesthetic attributes, with tourists demonstrating positive WTP for improved features. Planners can better regulate nature-based tourism by understanding which attributes tourists are willing to spend extra for, such as creating themed mini-zones with specific recreational attributes and controlling tourist flow. Administrators could also offer off-season volunteering opportunities for garbage collection, offering rewards such as discounted tickets. Finally, the lack of environmental knowledge among tourists highlights ecotourism's potential for driving change in the industry and daily life, emphasizing the need for a pro-environmental approach. Ecotourism managers can also leverage differences in tourist preference elasticity to reduce the total visitor numbers.

1. Introduction

In recent years, human consumption of ecosystem goods and services has accelerated at an alarming rate (Mudavanhu et al., 2017; Yin et al., 2013), making rapidly depleting natural resources even more valuable for human use. Protected areas have been established worldwide to preserve nature-based resources (Buongiorno & Intini, 2021; Lawrence et al., 2021). Among all forms of protected areas, nature-based tourism has increasingly gained attention due to its dual functions of supporting environmental conservation and maintaining economic development (He et al., 2018). Nature-based tourism primarily focus on conserving natural ecosystems, biodiversity and landscapes while providing

* Corresponding author.
E-mail address: litan@ahau.edu.cn (T. Li).

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opportunities for ecotourism, recreation and education (Mendoza-González et al., 2018; Nautiyal et al., 2023; Weaver, 2001). This form of tourism is endowed with natural resources that hold recreational value, which is a critically important aspect of ecosystem services (Tibesigwa et al., 2020).

The aim of quantifying the value of various recreational ecosystem services (RES) offered by nature-based tourism remains a pivotal challenge within the disciplines of applied economics and tourism research (Bartczak et al., 2008; Hermes et al., 2018; Tyrväinen et al., 2021). In response, environmental economists have proposed an array of theories and methodologies aimed at eliciting or estimating tourists' willingness to pay (WTP), representing crucial components in the appraisal of non-market values (Ateş, 2020; Liebe et al., 2011; Liu, Wu, & Che, 2019; Ojea & Loureiro, 2007). The suite of these empirical techniques prominently features the Travel Cost Method (TCM) (Hotelling, 1949), Hedonic Pricing Method (HPM) (Court, 1939, pp. 98–119), Contingent Valuation Method (CVM) (Davis, 1963), and Choice Experiments (CE) (Louviere & Woodworth, 1983). As posited by Costanza et al. (1997), the RES value derived from nature-based tourism should encapsulate a diverse spectrum of non-use values (Liu, Liu, et al., 2019). These include aesthetic and natural service values, thereby requiring trade-off and synergistic exploration in the field of RES research (Zhou et al., 2020).

It is widely accepted that human activities are predominantly the cause of most environmental problems (Ostrom et al., 1993; Ghazvini et al., 2020). Consequently, human environmental behaviour has come under public scrutiny (Brady, 1993; Kollock, 1998). Numerous social science research efforts have strived to understand the underlying motivators and predictors of pro-environmental behaviours (Steg & Vlek, 2009). Despite the extensive use of environmental attitude and knowledge in literature to explain different types of pro-environmental behaviours, their relationship with tourists' willingness to pay (WTP) remains ambiguous (Heimlich & Ardoin, 2008; Tam & Chan, 2018).

Furthermore, there has been a significant increase in environmental information in recent decades, which has not consistently translated into pro-environmental behaviour (Paço & Lavrador, 2017). Simply disseminating information about environmental problems appears to be insufficient (Kollmuss & Agyeman, 2002), especially when the target audience, already overloaded with information, perceives no need for additional information campaigns or leaflets (Mangachena et al., 2023; Tkaczynski et al., 2020). Hence, scholars have underscored the importance of identifying the types of environmental knowledge that promote pro-environmental behaviour for efficient information strategies (Frick et al., 2004).

The existing research literature presents two major gaps. Firstly, there is a lack of exploration regarding the influence of environmental knowledge and attitudes on the tourists' valuation of RES, and the heterogeneity of this impact (Ghazvini et al., 2020; Liu, Teng, & Han, 2020). Secondly, studies seldom integrate environmental knowledge and attitudes to comparatively assess the heterogeneity of tourists' preferences for RES when they possess positive environmental knowledge and attitudes (Gkargkavouzi et al., 2019; He & Filimonau, 2020). For instance, the preference divergence between aesthetic and natural attributes has not been thoroughly explored (Bachi et al., 2020; Johnson et al., 2019).

In this study, we conduct a choice experiment to investigate tourists' preferences and willingness to pay (WTP) for different environmental attributes of nature-based tourism in the Yangtze River Delta, China. The reason for employing the choice experiment method for investigation in this study can be attributed to several advantages. Firstly, the choice experiment method is proficient at assessing a multitude of attributes or characteristics inherent to a product or service, facilitating a comprehensive understanding of the individual components that contribute to its overall value (Lancaster & Tsushima, 1966). Moreover, the applicability of choice experiment methods extends across a diverse array of goods and services, testifying to its versatility and broad scope of utility (Ndunda & Mungatana, 2013; Tyrväinen et al., 2021). Finally, the predictive capability of the choice experiment method, particularly in terms of forecasting consumer behaviour in response to variations in attribute composition, is instrumental for the informed formulation of policy and strategic advancements (Mark & Swait, 2004; Pröbstl-Haider et al., 2020).

In 2019, the ecological scenic areas under study collectively attracted over 2.78 billion tourists, which is equivalent to 46.38% of the total number of domestic tourists in China. This brought the region a domestic tourism revenue of 3.77 trillion yuan or 0.54 trillion USD (1 USD = 6.8985 yuan in 2019), accounting for 65.79% of the total revenue in China (China National Bureau of Statistics). Understanding tourists' WTP for the recreational value of these natural landscapes and their preferences and priorities for various environmental attributes can offer critical insights for better management of nature-based tourism and harmonisation between environmental conservation and economic development.

This study aims to examine the hypothesis that both environmental knowledge and attitude have an impact on tourists' willingness to pay (WTP) for RES. Additionally, it investigates whether the WTP for aesthetic attributes offered by nature-based tourism surpasses that for natural attributes. We conducted surveys to assess environmental knowledge and attitude and subsequently analysed the distinct and shared influences of these factors on tourist preferences. Following this, using the choice experiment results, we calculated the WTP and compared the difference in WTP between aesthetic and natural attributes.

2. Literature review

2.1. Environmental knowledge and attitudes

Environmental knowledge and attitudes are two key factors that influence pro-environmental behaviour (Golob & Kronegger, 2019). Environmental knowledge refers to an individual's understanding of environmental facts, concepts and relationships, while environmental attitudes encompass feelings, cognitive assessment of environmental issues, affective responses to the environmental issues (Liebe et al., 2011; Otto & Pensini, 2017). Both factors have a crucial influence on shaping an individual's likelihood of engaging in pro-environmental behaviour, as greater environmental knowledge and positive attitudes towards the environment can lead to a stronger sense of responsibility and motivation to act in an environmentally responsible manner (Agag & Colmekcioglu, 2020; Chen et al., 2017; Hansmann et al., 2020).

In summary, the theoretical basis for pro-environmental behaviour emphasises the importance of understanding the motivations and factors that drive individuals to engage in environmentally responsible actions (Lades et al., 2021; Liu, Zhang, et al., 2020). Environmental knowledge and attitudes are essential components of this understanding, as they significantly influence an individual's likelihood of adopting pro-environmental behaviours (Liu et al., 2019; He & Filimonau, 2020). By examining these factors, researchers and policymakers can develop effective strategies to promote sustainable practices and environmental stewardship among individuals and communities (Parizeau et al., 2015; Pothitou et al., 2016).

In this context, the influence of environmental attitude and knowledge should be considered to understand tourists' preferences and WTP more comprehensively (Rajapaksa et al., 2019). Environmental attitudes encompass an individual's feelings, beliefs and behavioural intentions towards environmental issues (Chen et al., 2017). Environmental knowledge refers to an understanding of environmental facts, concepts and relationships (Otto & Pensini, 2017). Both environmental attitude and knowledge can significantly influence tourists' preferences, pro-environmental behaviours and WTP (He & Filimonau, 2020). By investigating the relationship between environmental attitudes and knowledge, preferences and WTP, researchers and policymakers can obtain a more comprehensive understanding of tourists'

decision-making processes and more accurately assess evaluations of the RES in nature-based tourism (Bachi et al., 2020; Truelove & Gillis, 2018).

2.2. RES evaluation

The notion of assessing the RES value of ecological scenic spots was first proposed by Bultena and Taves (1961), and empirically studied by Driver and Tocher (1970). Since the United Nations Millennium Ecosystem Assessment (MA, 2000) included RES as a crucial category of RES value in the total value of ecosystem services, the assessment of RES value has become a hot topic in natural resource economics (Pröbstl-Haider et al., 2020; Zhong et al., 2020).

Previous scholars carried out quantitative evaluations of the recreational value of ecological scenic spots (Huang et al., 2020), including forests (Bartczak et al., 2008; Barua et al., 2020), grasslands (Ning et al., 2019), wetlands (Zhou et al., 2020), and cultural-ecological scenic spots (Bachi et al., 2020). These assessments not only enrich and improve the existing theoretical system of ecological civilization value (Vandeveer & Pierce., 1998), but also provide a certain reference basis for the ticket pricing of ecological scenic spots (Pearce et al., 2006). The academic consensus regarding the recreational value of ecological scenic areas is that assessing these areas from the perspective of tourists can provide a more comprehensive reflection of the RES they offer (Liu, Zhang, et al., 2020; Liu & Ma, 2019; Zeng et al., 2023). This approach is widely recognized as the appropriate method for assessing the value of RES.

As research deepens, the current assessment of the recreational value of ecological scenic spots mainly involves three aspects: Firstly, exploring the impact of tourists' individual characteristics or environmental responsibility on the recreational value of ecological scenic spots (Ghazvini et al., 2020; Wu & Geng, 2020), generally measured through mediation effect models such as structural equation models and treatment effect models (Kiattipoom & Heesup, 2017); Secondly, characterizing tourists' specific willingness to pay through micro econometric models, such as the Contingent Valuation Method (CVM) or Travel Cost Method (TCM) (Abri et al., 2023; Huang & Lin, 2023; Torres-Ortega et al., 2018); Thirdly, using welfare economics theory to explore the mechanisms of tourists' willingness to pay for RES value, such as evolutionary game models (Platania & Rizzo, 2018; Tutic & Liebe, 2009).

The existing literature highlights the significance of environmental knowledge and attitudes in influencing pro-environmental behaviour and the assessment of RES value in ecological economics. However, there is a gap in understanding the interplay between environmental knowledge and attitudes and their combined impact on tourist preferences and willingness to pay (WTP). Additionally, while previous research has explored various aspects of RES evaluation, there is a need for a more comprehensive analysis that considers both individual characteristics and environmental responsibility. Therefore, our research aims to address these gaps by examining the relationship between environmental knowledge and attitudes, tourist preferences, and WTP, providing a more holistic understanding of decision-making processes in nature-based tourism.

3. Materials and methods

3.1. Survey area and sampling

The experiment took place in east China, covering Anhui, Jiangsu and Zhejiang provinces within the Yangtze River Delta region. This area is primarily comprised of plains and has a humid monsoon climate and diverse natural ecosystems. It is the most developed region for the cultural and tourism industry in the country, with many ancient towns, villages and distinctive garden architecture.

In 2019, the region's GDP reached 23.37 trillion yuan ($3.38 billion), with a domestic tourism revenue of 3.77 trillion yuan (China National Bureau of Statistics). The area is host to numerous nature reserves and scenic spots, including 55 5 A-level and 644 4 A-level scenic spots (from the Ministry of culture and tourism of the people's republic of China). In China, tourist attractions, including nature reserves and scenic spots, are graded according to a classification system ranging from A to 5 A. This system, which was established by the Ministry of Culture and Tourism, aims to regulate and standardise the quality of tourism services and facilities, as well as providing a reference for tourists when selecting destinations.

In this study, we utilized a stratified random selection method to choose 11 parks from three provinces: Anhui, Jiangsu, and Zhejiang (Fig. 1). Initially, these provinces were selected as our primary sampling regions. We then conducted a second level of sampling within each province, based on the number of 4 A and 5 A scenic spots within each area. This resulted in the selection of five parks in Anhui, two in Jiangsu, and four in Zhejiang. To ensure the validity and reliability of our findings, we undertook a meticulous measurement and control of the parks' physical attributes. This process involved comprehensive evaluations of various aspects, including the parks' landscapes (Ly & Xiao, 2016; Othman & Jafari, 2019; Tyrväinen et al., 2021), ecosystems (Huang et al., 2020; Ning et al., 2019; Schägner et al., 2018), and infrastructure (Baumeister et al., 2020). We also assessed factors such as accessibility, safety, and cleanliness (Hu et al., 2018). By controlling for these physical attributes, our study more effectively isolates the impact of tourists' preferences on the evaluation of RES in nature-based tourism.

The study's sample size was determined using Equation (1) (Scheaffer et al., 2006) as follows:

$$n = \frac{N}{(N-1)\sigma^2 + 1} \tag{1}$$

Here, n is the number of tourist samples; N is the annual number of the tourists in the nature-based tourism; and σ is the sampling error, which is generally less than 5% and set at 3% in this case. In 2016, the survey areas received 1.547 million tourists, leading to a sample size of 1105 according to Equation (1). Assuming a validity rate of 80% after

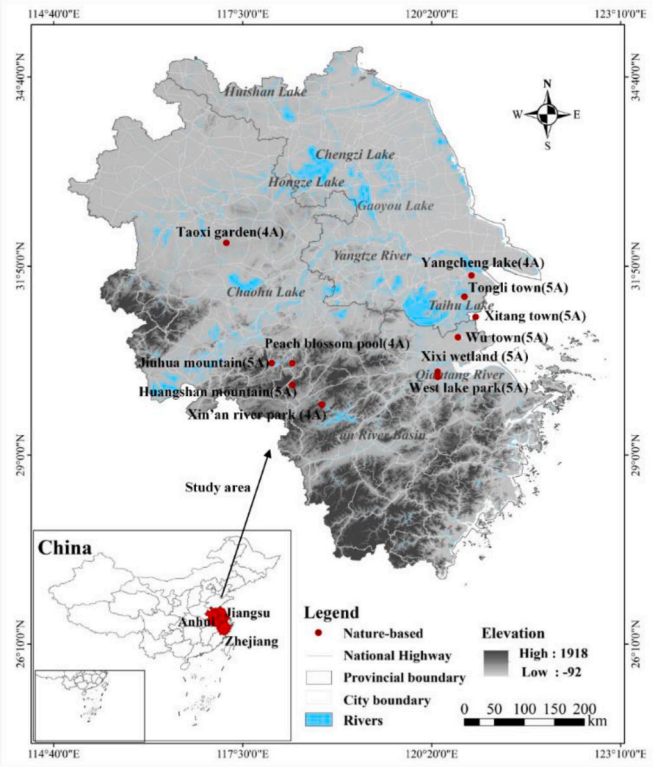

Fig. 1. Location and distribution of survey areas.

excluding missing data and non-responses, about 884 questionnaires are expected in this survey.

The surveys took place from July to October 2019, and were conducted by three trained interviewers. After excluding incomplete and invalid responses, 896 responses were included in the final sample size, with a response rate of 81.09%. We first explained the purpose of the research and the environmental attributes in nature-based tourism, then described the choice experiment method in detail. Each respondent then completed a simulation question followed by those of the choice experiment. Finally, respondents completed sociodemographic information at the end of the questionnaire.

3.2. Choice experiment

We obtained information from tourists and other stakeholders at the experimental site to distil the RES enhancements. A focus group (Owuor et al., 2019) of 12 participants was organised in 2018 to determine the attributes of the study. The invited participants represented different genders, income levels and age groups. The group included residents who lived near the survey area and travellers interested in nature-based tourism (Torres-Ortega et al., 2018). We also invited university professors and government officials to participate in this group. All participants completed the questionnaires (including Likert-scale questions), took part in discussions and provided suggestions. To reduce potentially biased estimates, we use 50 yuan to distinguish the WTP difference and 200 yuan as the upper limit of tourists' WTP.

The choice experiment method is primarily adopted to evaluate respondents' marginal WTP for common products and ecosystem services (Owuor et al., 2019; Shan et al., 2019; Tavárez & Elbakidze, 2019). This stated preference-based method (Mark & Swait, 2004) generally requires interviewees to select among three (or more) options varying in two (or more) features (i.e. the natural and aesthetic attributes of nature-based tourism in this research). When choice sets are presented to respondents, there are generally differences in alternatives. Based on the literature (Aguilar et al., 2018; Manomaivibool, 2015; Tan et al., 2018) and the pre-investigation results, this research determined five features that tourists pay the most attention to, including natural attributes (forest coverage, water quality), aesthetic attributes (visual effects of tourist flows, amount of waste) and the level of tourists' WTP (Table 1). The detailed information regarding these attributes is described below.

Table 1
Description of environmental attributes in the choice experiment.

Environmental attributes	Attribute levels
Forest coverage	$Forest_0$: Current status (forest coverage as the status quo) $Forest_1$: 5% improvement $Forest_2$: 10% improvement
Water visibility	$Water_0$: Current status (water visibility is 0.5 m) $Water_1$: Water visibility is 1 m $Water_2$: Water visibility is 2 m
Tourist flow rate	$Tourist_0$: Current status (the number of tourists is about 30/200 m^2) $Tourist_1$: The number of tourists is about 25/200 m^2 $Tourist_2$: The number of tourists is about 10/200 m^2
Amount of waste	$Waste_0$: Current status (the amount of waste is about seven pieces/20 m^2) $Waste_1$: The amount of waste is about five pieces/20 m $Waste_2$: The amount of waste is about two pieces/20 m
Willingness to Pay	WTP: Current status (0); 50; 100; 150; 200 (unit: yuan)

Note: The average closing price of 1 USD is 6.91 Chinese yuan; thus, the alternatives of the payment levels are 0, 7.24, 14.47, 21.71 and 28.94 measured in USD, corresponding to the options presented.

1. Forest coverage. As an important indicator of the abundance of natural resources and ecological balance in nature-based tourism, forest coverage refers to the proportion of total forest area to the total area of the ecological scenic spot (Ke et al., 2021). A higher level of forest coverage can improve the air quality in the small-scale environment of urban ecological scenic locations and attract more tourists for outdoor activities (Liu, Hanley, & Campbell, 2020). Considering the planning requirements for forest coverage in urban ecological scenic locations, this study divides potential conditions into three levels according to the actual circumstances of the study area, including 1) maintaining the status quo, 2) improving by 5% and 3) improving by 10%.
2. Water quality. Water is an indispensable scenic resource of ecological scenic tourist attractions (Lin & Liu, 2021), and water quality is a crucial aspect, as it directly influences the overall health and ecosystem sustainability (Chaikaew et al., 2017). High water quality is essential for maintaining the natural beauty and appeal of an area, supporting diverse flora and fauna and ensuring a safe and enjoyable experience for visitors. In this study, we choose water visibility as the standard of water quality because the visibility of water is the most intuitive sensory quality for tourists (Wang et al., 2020). According to the requirements of urban ecological scenic spots for waterscapes and water quality in China, the study defines water visibility as 0.5 m (the current status), 1 m and 2 m.
3. Tourist flow. Tourist flow refers to the degree of crowdedness of nature-based tourism (Prakash et al., 2019). For instance, during the golden week of the National Day holiday in 2018, the single-day tourist flow in West Lake (Zhejiang Province) reached as high as 833,700, which exceeded the carrying capacity of the destinations, undermining the tourist experience. To account for reasonable variation, this study divides the tourist flow of ecological scenic attractions into 30 people/200 m^2, 25 people/200 m^2 and 10 people/200 m^2.
4. Waste amount. The cleanliness of nature-based tourist attractions will directly affect the natural image of the destination (Rangel-Buitrago et al., 2018). According to the pre-investigation, the average amount of refuse in tourist attractions was about five pieces for every 20 m walk. Therefore, levels of trash are set to seven pieces, five pieces and two pieces within a 20 m walk, representing deteriorated, unchanged and improved circumstances compared with the current situation, respectively.
5. Degree of WTP. According to the data collected and synthesised from focus group discussions, this study sets five levels of respondents' WTP to improve the various recreational attributes of nature-based tourism. Specifically, the levels of 0 (the current status), 50, 100, 150 and 200 yuan are used to measure the WTP for preferred attributes by altering the levels of environmental attributes. The level of 150 yuan was reported as the maximum marginal WTP for environmental attributes in focus group participants' perspective. An additional level of 200 yuan was added as an underlying higher price level that may have been omitted from the focus group.

3.3. Experimental design

A complete randomised experiment should include hundreds of choice sets. For instance, the full factorial design contains 405 possible options ($3 \times 3 \times 3 \times 3 \times 5 = 405$) for attribute levels. It is exceedingly unrealistic to expect respondents to consider all the selection sets, which would be difficult, if not impossible, to achieve in reality (Tavárez & Elbakidze, 2019). Therefore, an orthogonal experimental design was developed using JMP software to filter a choice subset and preserve sufficient information. We develop a preliminary experimental design based on previous information or assumptions regarding the parameters of interest and conduct a pilot study, implementing the initial design with a small sample of respondents to assess the instrument and gather data on their preferences.

Pilot studies help determine how people respond to the different choice tasks and alternatives. We then estimate the parameters of the choice model using the data collected from the pilot study. This is accomplished using statistical software and applying methods such as maximum likelihood estimation, Bayesian estimation or other appropriate estimation techniques to provide us with the initial estimates of the parameters and distributions. We then update the previous distributions based on the estimated parameters from the pilot study to create a set of updated priors. This is conducted by combining the initial prior distributions (based on previous information) with the likelihood function (based on the pilot study data) applying Bayes' theorem.

The result of this process is a set of posterior distributions that more accurately reflect the target population's preferences. Finally, we generate a new experimental design that is optimised for D-efficiency using the updated prior distributions. This is accomplished using JMP experimental design software which allows for Bayesian optimisation. The design efficiency (D-efficiency) is 94.79%, indicating that the degree of orthogonality is high. We limit the number of sets per interviewee to six to reduce the cost, which may affect the respondents' efforts and data quality, with each set containing a status quo option (current status) and two alternatives. We use five attributes in the choice experiment, including four with three levels and one with five levels. The payment level indicates the cost for each environmental attribute. Different levels of environmental attributes are estimated based on the information obtained from focus group participants. We use realistic and relatable scenarios, designing choice tasks that closely resemble real-life scenarios, which can help participants engage more authentically with the experiment, reducing hypothetical bias. Table 2 provides a schematic example of a set of respondent choices.

3.4. Choice experiment method and econometric models

Based on new consumer theory (Lancaster & Tsushima, 1966) and random utility theory (McFadden, 1973), the indirect utility of tourists in this study consists of two parts. The first part is the determinant of attribute factors that can be observed, and the other part is the random error term that is unobservable and has an impact on consumers. The model with only attributes is specified as follows:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \tag{2}$$

Table 2
Schematic example of a choice set showing combinations of attribute levels in the questionnaire.

Attribute	Option 1	option 2	option 3
Forest coverage		Current status	5% improvement
Water visibility		Water visibility is 1 m	Water visibility is 1 m
1 m 1.5 m 2 m		1 m	1m
Tourist flow		The number of tourists is about 30/200 m^2	The number of tourists is about 10/200 m^2
Waste amount	I would not choose either of these options	The amount of garbage is about five pieces/20 m	The amount of garbage is about five pieces/20 m
Willing to pay		50 yuan	150 yuan

$$V_{ij} = ASC + \sum_{k=1}^{K} x_{ijk}\beta_{ijk} \tag{3}$$

According to the above model, when tourist i choose option j, the total utility is U_{ij}. V_{ij} is the observable part of the utility function, which is composed of a vector of various (the size is k) environmental attributes (X_{ij}). β is the estimated parameter and ε_{ij} is the unobservable utility of other related factors, also known as the random disturbance terms. *ASC* is the alternative specific constant.

Utility maximisation refers to the principle that consumers follow when making a decision. When tourist i selects option j, the probability is as follows:

$$P_{ij} = P\left(U_{ij} > U_{ik}\right) = P\left(V_{ij} + \varepsilon_{ij} > V_{ik} + \varepsilon_{ij}\right), \forall k \neq j \tag{4}$$

In reality, tourists' WTP for environmental conservation of nature-based tourism will also be affected by individual characteristics and other factors, which are introduced into Equation (3) to examine the influences of tourists' characteristics as follows:

$$V_{ij} = X_{ij}^{'}\beta + ASC\left(C_i^{'}\delta_i + Z_i^{'}\gamma_i\right). \tag{5}$$

Here, C'_i and Z'_i respectively represent tourists' individual characteristics and environmental attitude and knowledge. These explanatory variables only change with individual respondents. In addition, δ_i and γ_i represent the coefficient regarding tourists' individual characteristics, environmental attitude and knowledge, respectively.

This study uses a multinominal logit model to estimate the parameters. Different assumptions regarding the random error terms yield different models. If the random error term ε_{ij} obeys the assumption of the independent irrelevant alternative (IIA) assumption, the possibility of choosing alternative i over alternative j is not affected by the present probability of alternative k. By obtaining a conditional logit model (CLM), the probability of tourist i choosing option j can be expressed as follows:

$$P_{ij} = \frac{\exp\left(V_{ij}\right)}{\sum_{k=1}^{K}\exp\left(V_{ik}\right)} \tag{6}$$

Here, V_{ij} includes the attributes of selecting a specific constant and selecting option i, as well as tourists' characteristics. However, the CLM not only obeys strict IIA but also assumes that different decision-makers' preferences for the experimental attributes are homogeneous. The mixed logit model (MLM) relaxes the above restrictions (Wang et al., 2007) by allowing model parameters to vary randomly between individuals, which can more effectively reflect the problem of heterogeneity. With the development of the random parameter (β_{im}), the model is specified as follows:

$$\beta_{im} = \beta_m + \sigma_m \upsilon_{im} \tag{7}$$

Here, β_m represents the preference parameter's mean value of individuals, ν_{im} denotes heterogeneity that is specific to individuals with a mean of zero and a standard deviation of one and σ_m denotes the standard deviation of the random parameter distributed around the population mean. Thus, the specified model forms the distribution of the random parameter, noted as $f\left(\beta|\theta\right)$. As the parameter varies across tourists with a distribution $f\left(\beta|\theta\right)$, the mixed logit choice probability can be written as follows:

$$P_{ij} = \int \frac{\exp\left(V_{ij}\right)}{\sum_{k=1}^{K}\exp\left(V_{ik}\right)} f(\beta|\theta)d\beta \tag{8}$$

The marginal willingness of tourists to pay for the environmental attributes of natural scenic spots can be obtained as follows:

$$MWTP = -\frac{\beta_j}{\beta_p} \tag{9}$$

Here, β_i represents the coefficient of environmental attribute j and β_p denotes the estimated parameters of an individual's WTP.

We use the maximum simulated likelihood method in this study to obtain consistent estimates of parameters for the models. We first compare the CLM and MLMs by including only the environmental attributes designed within the choice experiment. In the MLMs, we specify the random parameters for each set of alternative levels of forest coverage, which is the major component in nature-based tourism. Following the comparison, we then test the role of tourists' environmental attitude and knowledge while controlling for personal characteristics of gender, age, monthly income and education, focussing on the MLMs. We choose four questions to representative environmental attitude (A–whether participate in public welfare activities, B–whether dissuade others' destruction, C–have ever donated to environmental protection and D–have ever paid for the environmental activities) and four to representative environmental knowledge (A–using public transportation, B–using recyclable packages, C–no littering and D–garbage classification). Finally, based on the modelling estimates using Nlogit software, welfare analysis was estimated to further understand tourists' WTP for each of the environmental attributes presented.

4. Results

4.1. Description of respondents' socioeconomic characteristics

The composition of tourists is presented in Fig. A1 in the Appendix. The average age of the respondents is about 27 years (SD = 0.98) and the median age is 42 years, 68.5% of the respondents had participated in environmental protection public welfare activities and 20% have a bachelor's degree. The average personal income is 3100 yuan per month (approximately 449.50 US dollars). The male ratio is 48.66% (SD = 0.50), which is slightly lower than the male-to-female ratio in China. Respondents have participated in environmental protection activities about twice per year (Mean = 2.34, SD = 0.97). The mean number of trips taken per year is 1.2 (SD = 0.58). The composition of responding tourists' characteristics is generally representative of the country's population.

4.2. Statistical summary of (un)selected attributes

Respondents reveal both similar and different preferences on the alternatives compared with the current circumstances among the environmental attributes of nature-based tourism (Fig. 2). Regarding the first attribute of forest cover, tourists appear to be prominently inclined to increasing the area of forest as part of the natural landscape, as more respondents selected the alternatives with 5% ($p = 0.024$) and 10% ($p = 0.000$) improvement in forest coverage (Fig. 2a). Similarly, respondents also prefer improved water visibility to the current circumstances (Fig. 2b), although the difference in the percentage of only selecting the level-1 alternative (visibility is 1 m) is statistically significant ($p = 0.000$ for levels 2 and 3), suggesting that a sufficiently moderate improvement in water would suffice for tourists. Regarding tourist flow and waste amount, the patterns are generally similar to that of forest coverage, wherein tourists lean towards less tourist flow and reduced trash among the improvement alternatives, and all pairs of (un)selecting percentages significantly differ (Fig. 2c and d). In combination with the setting choices, respondents' choices reveal the extent of WTP for the alternative attributes, manifested in the two main aspects (Fig. 2e). First, tourists are willing to make payments for improved environmental attributes of the RES provided by parks as opposed to making no contribution, as reflected by the significantly lower ($p = 0.000$) percentage of the selection of the no payment base level. Second, among the four alternative payment levels (excluding the base level), for the comparison of (un)selection, tourists tend to select the medium level of 100 yuan (~US$14.47) rather than not selecting this level, while no significant difference is observed for levels 2 and 4. The size of Level-5 is less than

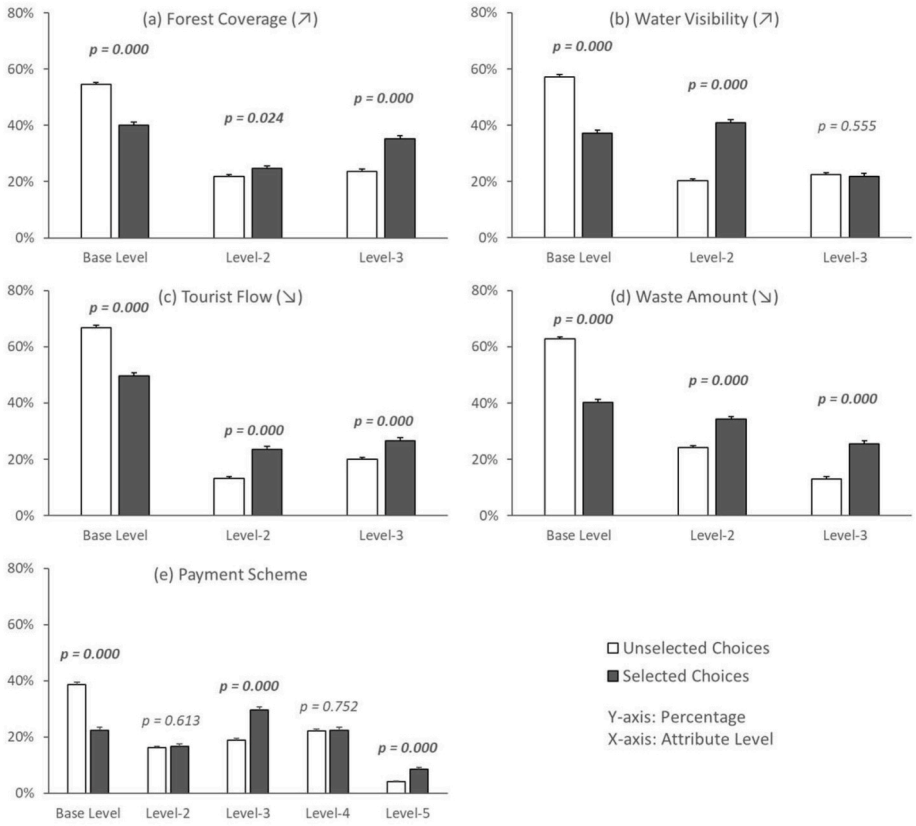

Fig. 2. Proportion of (un)selected choices by attribute level. Note: Likelihood-ratio tests are performed for comparing the differences in the proportion of selected and unselected environmental attributes and payment options.

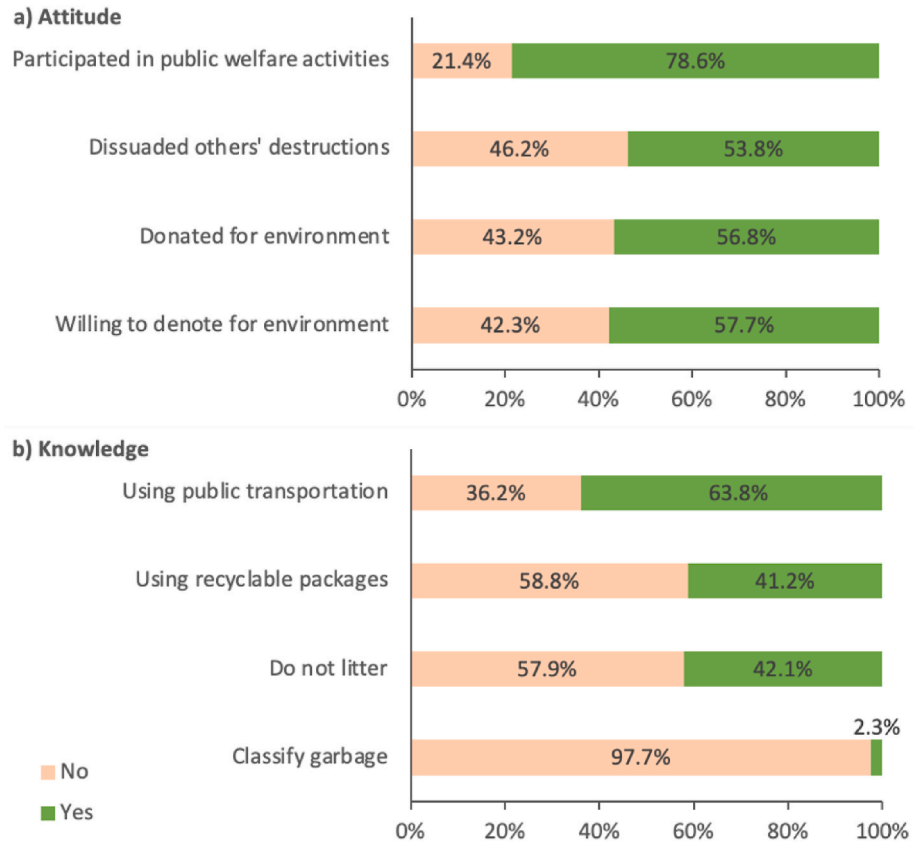

Fig. 3. Tourists' attitudes and knowledge.

15% of total sample, and while p = 0.000, it lacks representativeness.

Both attitude and knowledge responses have similar and different compositions (Fig. 3). For the four attitude questions, more than half of the respondent's express willingness (57.7%) and actual acceptance (56.8%) of protecting the recreational tourist environment by making payments or donations. Comparably, about 53.8% note that they had dissuaded other people from destroying public items. Over three-quarters of the respondents participated at least once in public welfare activities. Regarding knowledge, less than half indicated that they follow the rule of no littering (42.1%) and use recyclable packages (41.2%), while nearly two-thirds express the inclination to use public transportation. In contrast, an extremely small proportion of the respondents follow garbage classification in their daily lives.

4.3. Composition of selected attributes by environmental attitude and knowledge

To compare tourists' attitudes and knowledge, we provide graphs on the compositions of respondents' attribute selection by different types of environmental attitude and knowledge, i.e., attitude (Fig. 4) and knowledge (Fig. 5), focussing on those with substantial differences.

Regarding attitude (Fig. 4), tourists who participated in public welfare activities have a stronger preference for improved forest coverage, particularly at higher levels (10%), and they are slightly more inclined to choose higher payment levels, such as 150 yuan (~US$21.71). Noting that being willing to and having already accepted making payments for environmental protection is not equal, and respondents' corresponding attribute selections reveal different compositions. Specifically, tourists who are willing to donate to environmental protection care more about decreasing waste (28.9% vs. 25.6%) and tend to pay at the level of 50 yuan (~US$7.24). Among those who have already donated, a prominently higher number of tourists prefer a cleaner environment with less refuse, in addition to improved forest coverage, with a WTP relatively more for these attributes than the previous type (willing to donate), at the level of 100 yuan (~US$14.47).

Across the four types of knowledge (Fig. 5), the preferences for choosing enhanced environmental conditions with reduced waste are consistent, as more participants select the alternative featuring the level-2 scenario (i.e., 5 pieces/20 m). Comparing those using public transportation with those who do not, respondents tend to select improved forest coverage (increased by 5%), while respondents using recyclable packages prefer better water visibility (2 m) in addition to less waste amount, with the former selecting a payment level higher than the latter (100 vs. 50 yuan or ~ US$14.47 vs. US$7.24). For the last two types, the composition regarding garbage classification is more similar than that regarding using public transportation with preference for forest coverage, but no obvious difference is found regarding 'no littering.'

4.4. Examination of the role of environmental attitude and knowledge

The CLM and MLMs with only environmental attributes are presented in Table 3. According to the CLM, for the baseline model or Model

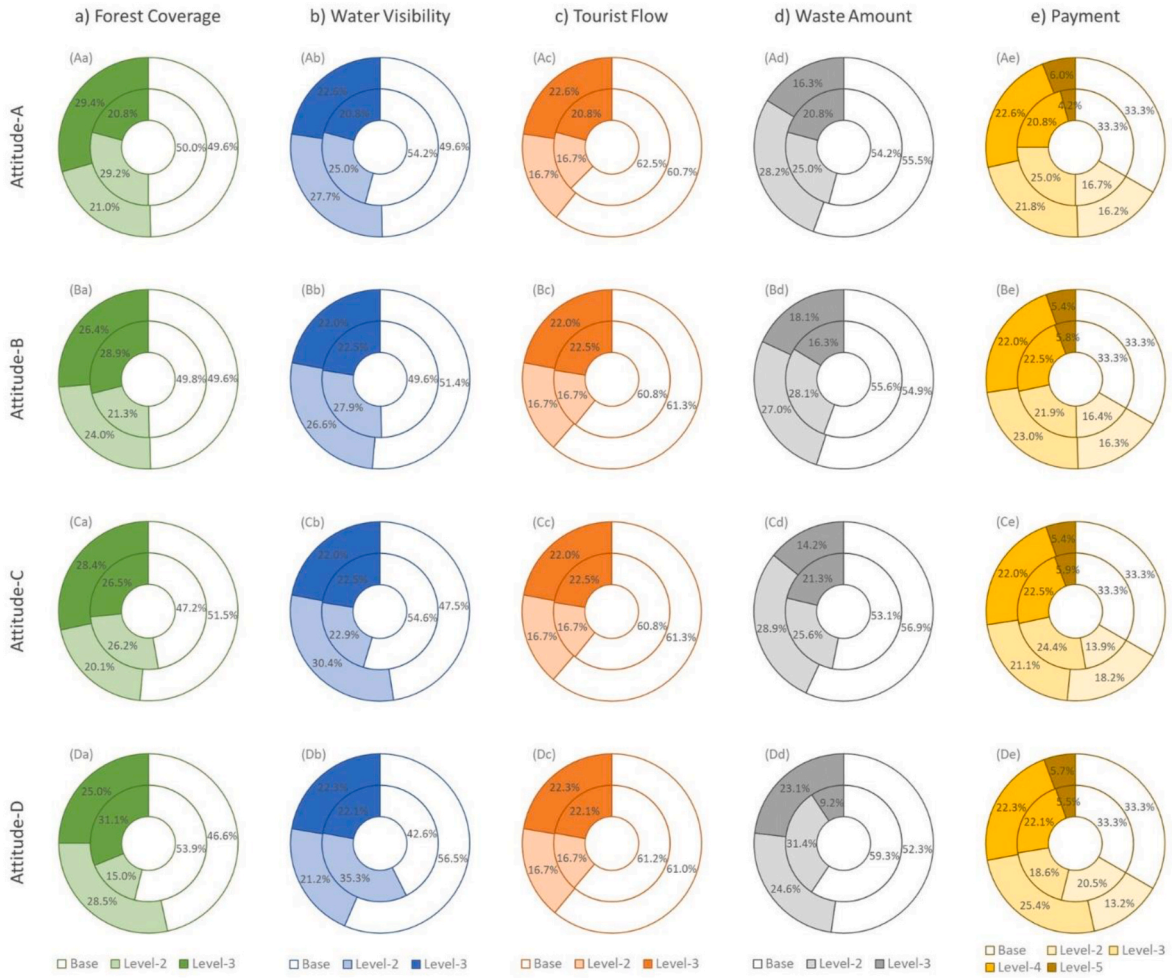

Fig. 4. Comparison of selected recreational attributes by attitude. Note: For a given type of attitude, the outer ring denotes that the response is positive (1 = yes), while the inner ring is negative (0 = no). Types of attitudes: A) participate in public welfare activities, B) dissuade others' destruction, C) donate to environmental protection and D) WTP for the environmental activities.

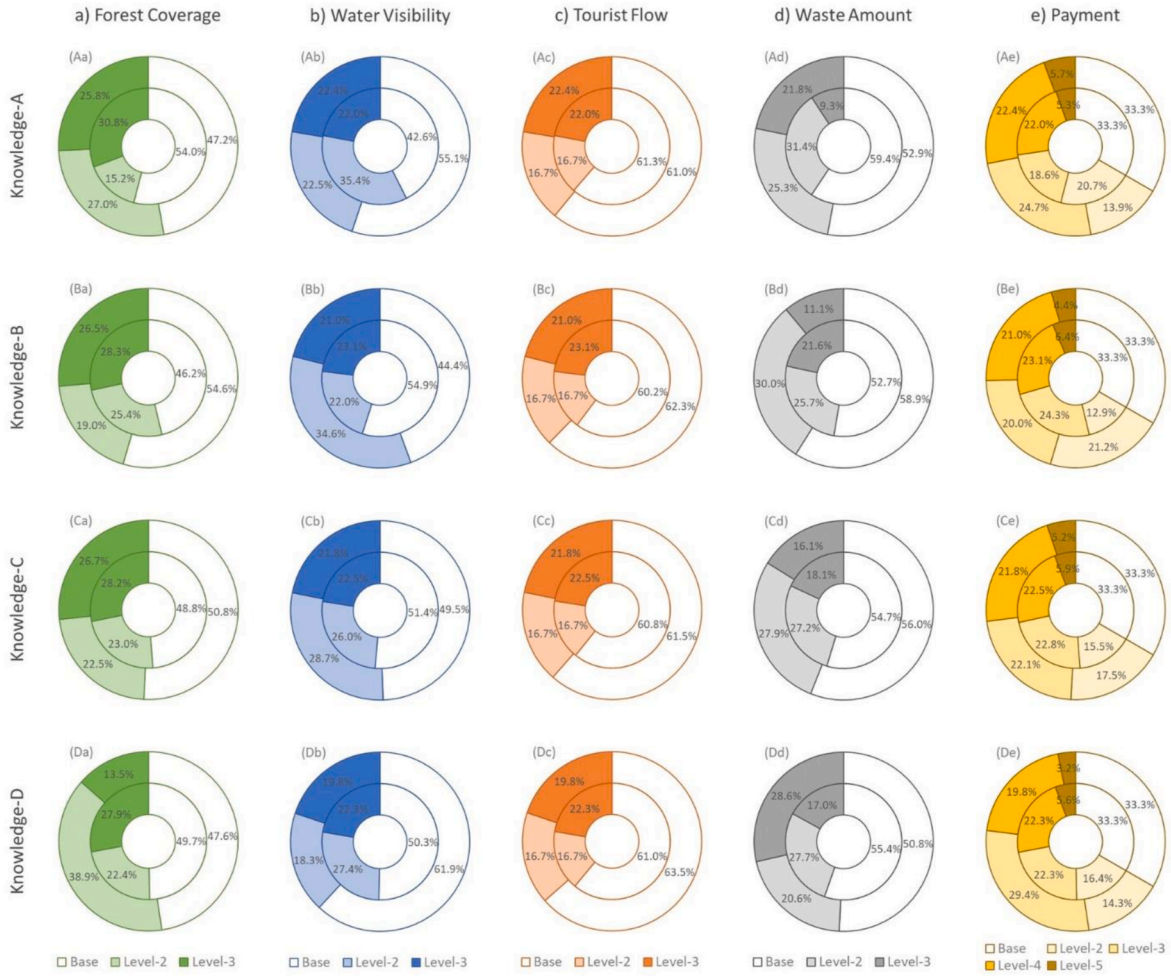

Fig. 5. Comparison of selected recreational attributes regarding knowledge. Note: For a given type of knowledge, the outer ring denotes that the response is positive (1 = yes), while the inner ring is negative (0 = no). Types of knowledge: A) using public transportation, B) using recyclable packages, C) no littering and D) garbage classification.

(0), nearly all the attributes' coefficients, except that of $Water_1$ (water visibility of 1 m), are statistically significant. A Hausman test indicates that there was a breach of the IIA assumption in the CLM (Table A2 in Appendix A2), which requires an alternative specification such as the MLMs to relax this assumption. The fixed WTP attribute is a restrictive assumption as it implies that the marginal disutility of income is the same for all tourists. However, similar to many previous studies, we use this assumption to facilitate the calculation of welfare effects.

We use the forest coverage attribute as a random parameter because this attribute exhibits more heterogeneity in descriptive statistics. The results for Models (1)–(3) indicate that almost all attributes' coefficients in Models (1) and (2) are statistically significant, except that of $Water_1$. The positive coefficients suggest that enhancements in recreation increase the probability of selecting an alternative. The WTP coefficient is significantly negative, indicating that the higher the price is, the lower the demand will be. The alternative specific constant (ASC) corresponding to the status quo is negative in Model (3); on average, tourists place a negative value on maintaining the status quo. In Models (1) and (2), the respondents are indifferent between staying or leaving the status quo.

In the extended models, as shown in Table 4, we test the effect of environmental attitude and knowledge of interest on the coefficients associated with each attribute and ASC, controlling for socioeconomic variables. Examining these interactions can facilitate a more comprehensive understanding of tourists' preferences regarding each attribute. We assume that the effects of the environmental variables are homogeneous over the sample, with constant coefficients. This assumption is made for several reasons. Firstly, assuming homogeneity and constant coefficients simplifies the model and the analysis. It allows for a more straightforward interpretation of the results. Secondly, Ordinary Least Squares (OLS) can be used for estimation.

The results in MLM (1)–MLM (5) reveal that the environmental attribute coefficients are statistically significant while considering tourists' environmental attitude and knowledge. This finding is consistent with the MLMs without interactions, indicating that the estimations are robust. Regarding the influences of attitude [MLM (1)] and knowledge (MLM (2)] of environmental attitude and knowledge interacting with ASC separately, several factors appear to have significant influence on tourists' WTP for environmental attributes. Specifically, the effects of whether tourists have ever dissuaded others' destruction of public goods (Attitude-B) and whether tourists have ever donated for environmental protection (Attitude-C) are significantly positive, with coefficients of 0.299 ($p < 0.05$) and 0.426 ($p < 0.05$), respectively. Similarly, Knowledge-C (no littering) and Knowledge-D (garbage classification) also have significant positive coefficients with respective values of 0.308 ($p < 0.05$) and 2.048 ($p < 0.05$). When combining these two categories of environmental attitude and knowledge [MLM (3)], the estimated results remain stable, along with the emerging positive role of tourists' participating in public welfare activities, which is marginally significant (coefficient = 0.132, $p < 0.10$). Furthermore, the significance level corresponding to Knowledge-C changes slightly to the 10% level. Regarding the models with only one alternative forest attribute set to be

Table 3
Estimation results of the conditional logit model and mixed logit models with random parameters for the Environmental attributes of forest cover.

Variable	Model (0) CLM	Model (1) Forest coverage	Model (2) $Forest_1$ only	Model (3) $Forest_2$ only
Random parameter				
$Forest_1$		4.423***	4.356***	
		(1.278)	(1.260)	
$Forest_2$		6.843***		9.757***
		(2.128)		(2.186)
Fixed parameter				
$Forest_1$	2.002***			3.747***
	(0.666)			(0.998)
$Forest_2$	4.085***		6.342***	
	(1.152)		(1.904)	
$Water_1$	0.294	−0.871	−0.678	−2.192**
	(0.543)	(0.923)	(0.812)	(0.932)
$Water_2$	4.229***	6.166**	5.563***	10.166***
	(1.350)	(2.538)	(2.152)	(2.469)
$Tourist_1$	4.577***	6.091**	5.348**	11.662***
	(1.625)	(3.008)	(2.317)	(3.185)
$Tourist_2$	5.020***	6.901**	6.139**	12.388***
	(1.741)	(3.164)	(2.548)	(3.269)
$Waste_1$	6.341***	7.644**	6.733**	14.555***
	(1.926)	(3.692)	(2.818)	(3.638)
$Waste_2$	4.741***	6.385***	5.799***	10.468***
	(1.312)	(2.419)	(1.979)	(2.436)
WTP	−0.091***	−0.137**	−0.125**	−0.217***
	(0.032)	(0.056)	(0.049)	0.058
ASC	−1.537*	−0.681	−0.216	4.336**
	(0.789)	(1.849)	(1.027)	(1.746)
Standard deviations				
$Forest_1$		3.481***	3.678***	
		(1.175)	(0.709)	
$Forest_2$		0.876		3.749***
		(1.591)		(0.830)
Log likelihood	−1723.8	−1709.3	−1712.093	−1707.631
Prob > chi2	0.000	0.000	0.000	0.000
R2-Adj	0.082	0.128	0.127	0.129
AIC	3469.6	3441.3	3448.2	3439.3

Note: *ASC* denotes an alternative specific constant. Values in parentheses are standard deviations corresponding to the coefficient above them. For significance, *** denotes a 1% significance level, ** indicates a 5% significance level and × denotes a 10% significance level.

with the random parameter [MLM (4) and MLM (5)], the results are similar to those of MLM (3), except that the effect of Knowledge-C is eroded and becomes statistically insignificant. Finally, the ASC coefficient is significant except in MLM (4). In summary, the willingness to improve the status quo identified in the model without interactions can be well explained by the environmental attitude and knowledge variables, including tourists' attitude and knowledge, when viewing the preference for forest coverage in a heterogeneous way.

4.5. Welfare analysis

Welfare measures can be determined in the form of marginal WTP by estimating the marginal rate of substitution between the considered attributes. The marginal utility of income is represented by the cost attribute's coefficient. The WTP estimates presented in Table 5 are calculated using the MLMs presented in Tables 3 and 4 In the comparison between the baseline model [Model (1)] and the experimental models [MLMs (1)–(3)], the level of marginal WTP for each environmental attribute changes when introducing environmental attitude and knowledge and the interactions of individual characteristics with the ASCs. Furthermore, the levels of marginal WTP among the three experimental models do not substantially differ from one another, indicating a stable estimation when controlling for environmental attitude and knowledge. Specifically, after considering environmental attitude and knowledge, tourists' marginal WTP for the attributes of tourist flow and waste increased to the largest extent. For instance, for the level-2 alternative of tourist flow, the marginal WTP rose from 44.5 yuan (~6.4 USD) in Model (1) to 53.1 yuan (~7.7 USD) in MLM (3) (both attitude and knowledge included) with an increasing to 8.7 yuan (~1.3 USD) or 19.5%. The positive change in water visibility is relatively trivial, whereas the marginal WTP for the attribute of forest coverage reduced considerably.

5. Discussion

5.1. Impacts of environmental attitude and knowledge on WTP

The choice experiments provide strong evidence that individuals' environmental attitudes and knowledge, exerts a critical influence on choices regarding various environmental attributes pertaining to recreational ecosystem services in nature-based tourism. Based on MLM estimations, nearly all attribute coefficients are statistically significant with positive values, suggesting that enhancements in recreational opportunities increase the probability of choosing an alternative. The cost coefficient is negative, indicating that the higher the cost is, the lower the support will be for the attributes. The coefficients of the ASC [MLM (3) and (5)] are positive and significant, indicating a preference for improvement. The negative sign of the ASC is often used as a status quo bias or endowment effect in choice experiments (Hoyos, 2010). The standard deviation of $Forest_2$ is significant in the models, indicating preference heterogeneity across tourists for this attribute.

Tourists with positive environmental attitudes (participating in public welfare activities, dissuading others' destruction and donating to environmental protection) and positive environmental knowledge (no littering and garbage classification) are more likely to support environmental attribute improvements (Fig. 5 and Table 4). This indicates that tourists with positive environmental attitudes and abundant environmental knowledge will pay more for RES.

The estimation results demonstrate that among the four environmental attributes, tourists value tourist flow (fewer) and waste amount (less) the most. Improvements to forest coverage and the water visibility include lack of flexibility, indicating that aesthetic attributes are more valued in nature-based tourism RES, even when considering the effects of environmental attitude and knowledge. One likely rationale is that the tourists may prefer a more relaxed and cleaner environment over crowds in nature-based tourism (Prakash et al., 2019; Rangel-Buitrago et al., 2018). Many nature-based tourism destinations include multiple forests and clean water so that tourists will not have a strong demand. Furthermore, tourists with positive environmental attitude and knowledge are more sensitive to aesthetic services than natural services; therefore, their WTP will be greater.

Consistent with previous choice experiment studies, the findings reveal that WTP values are similarly equal except for forest coverage. Comparing the estimates for nature-based tourism to past studies, a previous study (Aguilar et al., 2018) estimated tourists' WTP for water quality, a similar type of water, at 27.6–47.6 yuan (~4–6.8 USD) per year. The similarity of the results demonstrates some stability in the preferences for tourist flow (Saveriades, 2000). However, another study estimated a level of WTP of 5.7–18.2 yuan (~0.8–2.6 USD) per year for forest coverage in Xian-Ren-Tai National Forest Park (Kang et al., 2018), the results of which differed from our findings. Previous research has shown that pro-environmental behaviour could be a primary driver of WTP to protect the environment (Ku & Zaroff, 2014), which supports the significance of the effect of environment attitude and knowledge on WTP (Kil et al., 2014; Liu, Teng, & Han, 2020). Regarding the influence of environmental knowledge, most studies have determined that abundant environmental knowledge could lead to the adoption of more pro-environmental behaviours (Casaló et al., 2019; Glick et al., 2019). The study did not assess the respondents' knowledge in this aspect; thus, the results elicit the same outcomes except for the garbage classification. The potential rationale that may explain this effect is that nearly all the

Table 4
Estimation results of mixed logit models with tourists' environmental attitude and knowledge.

Variable	MLM (1)	MLM (2)	MLM (3)	MLM (4)	MLM (5)
Random parameter					
$Forest_1$	4.323***	4.986***	4.997***	4.505***	
	(1.240)	(1.297)	(1.329)	(1.380)	
$Forest_2$	11.170***	12.607***	12.295***		12.022***
	(2.585)	(2.721)	(2.703)		(2.683)
Fixed parameter					
$Forest_1$					4.841***
					(1.326)
$Forest_2$				6.511***	
				(2.063)	
$Water_1$	−2.629**	−3.195***	−3.152***	−0.78	−3.029**
	(1.137)	(1.191)	(1.191)	(0.899)	(1.188)
$Water_2$	11.238***	12.823***	12.591***	5.715**	12.282***
	(2.907)	(3.050)	(3.031)	(2.336)	(3.015)
$Tourist_1$	12.963***	14.751***	14.459***	5.535**	14.058***
	(3.779)	(3.973)	(3.897)	(2.526)	(3.879)
$Tourist_2$	13.848***	15.778***	15.512***	6.388**	15.096***
	(3.887)	(4.083)	(4.033)	(2.789)	(4.014)
$Waste_1$	16.116***	18.298***	17.954***	7.005**	17.497***
	(4.312)	(4.530)	(4.467)	(3.084)	(4.445)
$Waste_2$	11.643***	13.145***	12.947***	6.006***	12.641***
	(2.877)	(3.022)	(2.999)	(2.162)	(2.983)
WTP	−0.241***	−0.277***	−0.272***	−0.129**	−0.265***
	(0.069)	(0.073)	(0.072)	(0.053)	(0.072)
ASC	3.992*	5.833**	4.598**	−0.404	4.393*
	(2.235)	(2.318)	(2.313)	(1.634)	(2.307)
Personal Characteristics					
ASC × Gender	0.280*	0.272*	0.254*	0.326**	0.254*
	(0.153)	(0.153)	(0.154)	(0.142)	(0.154)
ASC × Education	0.428**	0.440**	0.414**	0.157	0.406**
	(0.168)	(0.172)	(0.170)	(0.136)	(0.171)
ASC × Age	−0.392***	−0.377***	−0.382***	−0.183**	−0.379***
	(0.091)	(0.091)	(0.091)	(0.074)	(0.091)
ASC × Income	−0.086	−0.094	−0.072	0.043	−0.074
	(0.094)	(0.094)	(0.095)	(0.088)	(0.095)
Attitude and knowledge					
ASC × Attitude-A	0.121		0.132*	0.140*	0.133*
	(0.079)		(0.080)	(0.073)	(0.080)
ASC × Attitude-B	0.299**		0.325**	0.355**	0.325**
	(0.151)		(0.152)	(0.139)	(0.152)
ASC × Attitude-C	0.426**		0.397**	0.350**	0.393**
	(0.167)		(0.169)	(0.158)	(0.169)
ASC × Attitude-D	0.103		0.091	0.123	0.093
	(0.201)		(0.205)	(0.176)	(0.205)
ASC × Knowledge-A		−0.035	−0.048	0.099	−0.048
		(0.189)	(0.192)	(0.158)	(0.192)
ASC × Knowledge-B		0.200	0.172	0.102	0.158
		(0.175)	(0.178)	(0.154)	(0.178)
ASC × Knowledge-C		0.308**	0.269*	0.142	0.273*
		(0.156)	(0.158)	(0.142)	(0.158)
ASC × Knowledge-D		2.048**	2.191**	2.172**	2.136**
		(1.000)	(0.996)	(0.997)	(0.980)
Standard deviations					
$Forest_1$	0.174	0.037	0.039	3.541***	
	(0.863)	(0.534)	(0.834)	(0.781)	
$Forest_2$	4.900***	5.242***	4.906***		4.844***
	(0.973)	(1.057)	(0.981)		(1.016)
Log Likelihood	−1677.272	−1676.921	−1664.988	−1680.000	−1663.396
Prob > chi2	0.000	0.000	0.000	0.000	0.000
R2-Adj	0.141	0.141	0.145	0.138	0.146
AIC	3412.5	3411.8	3404	3432	3398.8

Note: ASC denotes an alternative specific constant. Values in parentheses are standard deviations corresponding to the coefficient above them. For significance, *** denotes a 1% significance level, ** indicates a 5% significance level and × denotes a10% significance level. Types of attitudes: A) participate in public welfare activities, B) dissuade others' destruction, C) donate to environmental protection and D) WTP to for the environmental activities. Types of knowledge: A) using public transportation, B) using recyclable packages, C) no littering and D) garbage classification.

respondents (98%) choose not to support the garbage classification (Fig. 4), which leads to analysing possible heterogeneity.

5.2. Theoretical and policy implications

Our findings align with and contribute to existing theories regarding consumers and public goods from three aspects. First, the effects of environmental attitudes and knowledge on WTP have been consistently tested in developing countries such as China, one of the countries with the world's largest population (Yin, 2016; Gong et al., 2020). The differences in the estimations from other countries may be attributed to consumer's random utility and China's special economic background. The estimated coefficient for the influence of environmental attitude and knowledge is consistent with the hypothesis and previous literature

Table 5
Welfare analysis based on models and comparison between WTP with and without including environmental attitude and knowledge.

Attribute	Model (1) Baseline	MLM (1)-Attitude		MLM (2)-Knowledge		MLM (3)-Attitude&Knowledge	
	Mean [95% CI]	Mean [95% CI]	Difference (change %)	Mean [95% CI]	Difference (change %)	Mean [95% CI]	Difference (change %)
$Forest_1$	32.28 [14.00; 50.57]	17.91 [7.84; 27.97]	−14.37 (−44.5%)	18.00 [8.83; 27.18]	−14.28 (−44.2%)	18.29 [8.72; 27.86]	−13.99 (−43.3%)
$Forest_2$	49.95 [19.51; 80.39]	46.27 [25.28; 67.26]	−3.68 (−7.4%)	45.52 [26.26; 64.79]	−4.43 (−8.9%)	45.18 [25.71; 64.45]	−4.77 (−9.5%)
$Water_1$	/	−10.89 [-20.12; 1.66]	/	−11.54 [-19.96; −3.11]	/	−11.58 [-20.16; −3.00]	/
$Water_2$	45.00 [8.7; 81.31]	46.55 [22.95; 70.16]	1.55 (3.4%)	46.31 [24.72; 67.89]	1.31 (2.9%)	46.26 [24.44; 68.09]	1.26 (2.8%)
$Tourist_1$	44.46 [1.44; 87.49]	53.70 [23.01; 84.38]	9.24 (20.8%)	53.27 [25.15; 81.39]	8.81 (19.8%)	53.13 [25.07; 81.19]	8.67 (19.5%)
$Tourist_2$	50.37 [5.11; 95.63]	57.37 [25.81; 88.93]	7 (13.9%)	56.98 [28.08; 85.87]	6.61 (13.1%)	57.00 [27.95; 86.04]	6.63 (13.2%)
$Waste_1$	55.79 [2.97; 108.61]	66.76 [31.75; 101.77]	10.97 (19.7%)	66.08 [34.02; 98.14]	10.29 (18.4%)	65.97 [33.80; 98.14]	10.18 (18.2%)
$Waste_2$	46.61 [12.00; 81.21]	48.23 [24.88; 71.59]	1.62 (3.5%)	47.47 [26.08; 68.86]	0.86 (1.8%)	47.57 [25.97; 69.17]	0.96 (2.1%)

Note: Change percentage is based on the MLM (1)–(3) (Table 4) and the baseline model (Model (1) in Table 3), respectively, with the environmental attributes of forest cover having random parameters. 1 yuan = 0.145 USD (2019).

(Huang et al., 2014) when considering individuals' WTP to improve the environmental attributes in nature-based tourism. These studies support the consideration of the WTP for the non-market value of nature-based tourism (Fig. 1). Moreover, the results enrich the empirical research on public goods theory. A new ecological paradigm should be strengthened which fully leverages tourists' autonomous power and fundamental role in the field of public affairs. This could potentially decrease the direct expenses associated with government management and alleviate various challenges, thereby enhancing the vitality of the tourism sector. The basic goal of this new governance paradigm is to internalise and socialise natural resource management issues.

Our results offer practical insights for improved natural resource management and planning for nature-based tourism with nature-based tourism. We determined that tourists' environmental knowledge is significantly lower than actual inclinations towards environmental responsibility, particularly in waste classification, which significantly influences their environmental valuation and willingness to conserve nature. Encouraging garbage classification awareness in daily life can promote the sustainable consumption of public goods. Furthermore, payment is strongly related to aesthetic attributes, with tourists demonstrating positive WTP for improved features. Planners can better regulate nature-based tourism by understanding which attributes tourists are willing to spend extra for, such as creating themed mini-zones with specific recreational attributes and controlling tourist flow. Administrators could also offer off-season volunteering opportunities for garbage collection, offering rewards such as discounted tickets. Finally, the lack of environmental knowledge among tourists highlights ecotourism's potential for driving change in the industry and daily life, emphasizing the need for a pro-environmental approach. Ecotourism managers can also leverage differences in tourist preference elasticity to reduce the total visitor numbers.

5.3. Limitations and future work

This research provides insights into the relationships between environmental attitude and knowledge and natural and aesthetic attributes in recreation evaluation, but it has limitations. First, although our large sample of Chinese tourists is representative, caution should be exercised when generalising these findings in a wider context. Future research should explore whether these results can be applied to other regions, considering potential confounders such as cultural values. Second, our cross-sectional survey data lack time-varying tastes, and panel data in future studies could address this issue. Third, our focus on attitude and knowledge when examining environmental attitude and knowledge may overlook other immeasurable factors. Expanding the scope to better represent tourists' environmental attitude and knowledge, while controlling for constraints such as age, education and income, would be worthwhile. Future research should include more detailed classifications of environmental attitude and knowledge and consider psychological influences, such as examining respondents' biosphere conception or attitudes towards nature-based tourism. Finally, since our data were collected in 2019, this study does not analyse the impact of the COVID-19 pandemic on recreation attribute preferences.

6. Conclusions

This study employs social surveys, choice experiments and statistical models to investigate tourists' environmental attitude and knowledge and preferences for natural and aesthetic attributes for the case of the RES of nature-based tourism activities in the Yangtze delta region, China. The results reveal a stronger preference for aesthetic attributes over natural ones, with differing impacts of environmental attitude and knowledge on tourists' WTP, revealing the highest WTP for reduced waste generation and decreased tourist congestion. These findings can inform cost–benefit analyses for tourism management to compare the economic benefits of environmental improvements in nature-based tourism. Future ecotourism management in developing countries should consider tourists' preferences to make nature-based tourism planning and management more cost-effective by accounting for environmental attitude and knowledge.

CRediT authorship contribution statement

Ying Ge: Data curation, Writing – original draft. **Guoxing Xu:** Visualization, revision. **Qi Zhang:** Supervision, Writing – review & editing. **Xin Wang:** Software, Validation. **Tan Li:** Conceptualization, Methodology.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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Appendix A1

Descriptive statistics of personal characteristics for tourists.

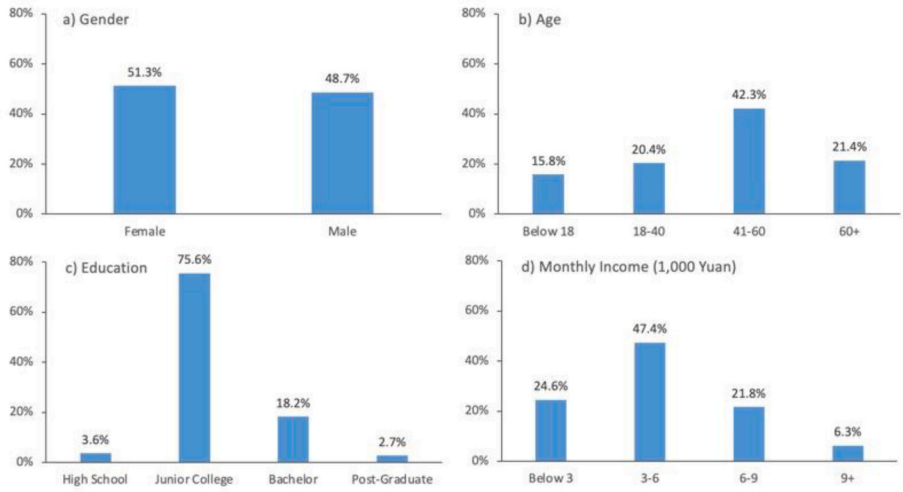

Fig. A1. Composition of tourists by different personal characteristics.

Appendix A2

Test of Independence of irrelevant Alternatives.

Alternative dropped	CLM without interactions				CLM with interactions			
	Chi2	Df	*P*-value	Evidence	Chi2	Df	*P*-value	Evidence
Option 1 (status quo)	−0.000	1	1.000	Accept H_0	−2.200	13	1.000	Accept H_0
Option 2	297.126	1	**0.000**	**Reject H_0**	92.476	13	**0.000**	**Reject H_0**
Option 3	−0.000	1	1.000	Accept H_0	0.501	13	1.000	Accept H_0

Note: Df denotes degrees of freedom of the Hausman and McFadden (1984) test for the IIA property. CLM denote conditional logit model. This statistic of the test obeys a Chi^2 distribution, where Chi^2 corresponds to the Chi-squared value of the test.

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