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Integrating perceptions of ecosystem services in adaptive management of country parks: A case study in peri-urban Shanghai, China

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ABSTRACT

As a type of peri-urban green space with natural environments and countryside features, country parks provide numerous ecosystem services (ES) for human beings. In China, the multifunctional characteristics and diverse social groups related to the country park construction in the context of urbanization indicate that these ES need to be managed in the social dimension through adaptive decision-making. However, little work has focused on the perceptions of ES for country park management. In this study, we developed a three-step research framework aiming to integrate ES perceptions in adaptive country park management. We carried out face-to-face photo-elicitation questionnaire surveys (n = 229) in a country park pilot in Shanghai to analyze the perceptions of ES by park users. Multiple analytical methods, including statistical analyses, importance-performance analysis, and ES indexes, were applied to reveal the linkages among perceived ES, users' characteristics, and specific landscape features. Our results showed that water and air quality maintenance, aesthetic, habitat, and physical and mental health, were perceived as the most important, highest performance, and highest priority ES. Users' education level and their self-reported knowledge about the country park were the two most important variables that explained perceived ES. Perceptions of user groups differed along the distance of the place of residence from the study area, with locals assigning high priorities to provisioning ES and cognitive cultural ES and more distant visitors assigning high priority to education. Semi-natural landscape features, such as lakes and rivers, marsh, swamp forest, and lotus ponds, were perceived as providing the most ES. We further communicated and discussed the results with managers and experts, and provided insights for the next stage of management. We argue that adaptive management should be woven toward environmental justice by understanding the diverse perspectives and views of users on ES.

1. Introduction

Country parks are green spaces located in peri-urban areas with natural environments and countryside features (Gu et al., 2017). Originating in the United Kingdom (UK) in the 1960s (Lambert, 2006), such country parks are now protected areas (Jim, 1986; Ma et al., 2021) and crucial components of green infrastructure (Qi et al., 2017). They could be regarded as nature-based solutions to address the societal challenges related to environmental change in urban and peri-urban areas (Gai et al., 2022; Lafortezza and Sanesi, 2019). Typically, they play a role in safeguarding high-quality land and conserving wildlife habitats (Lambert, 2006), whereas their good accessibility satisfies the needs of people to be close to nature and offers outdoor recreation, aesthetic experiences, and educational opportunities (Gong et al., 2015; Gu et al., 2020). Therefore, they provide numerous direct and indirect benefits to human well-being, which are known as ecosystem services (ES) (Braat and de Groot, 2012; Costanza et al., 2017; Millennium Ecosystem Assessment, 2005).

In mainland China, country park construction was proposed in the 2000s (Gu, 2019). However, the construction of country parks in mainland China is slightly different from those in the UK or Hong Kong, as it is closely related to rapid urbanization (Gong et al., 2015). These

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country parks in China correspond to Categories V "Protected landscape" of the IUCN protected area management categories along with forest and wetland parks, as they emphasize recreation and outdoor activities based on landscape conservation and could also be compatible with agriculture (Zhang et al., 2017). These parks have multiple characteristics: (1) They are relatively large in size and together form a network to curb urban sprawl (Gong et al., 2015). (2) They often contain agricultural lands with a history of farming over thousands of years (SMAPLR and SUPDRI, 2015). (3) They play a role in the transformation of the countryside in peri-urban areas, as their constructions in recent years have tried to avoid land expropriation and instead retained the collective land property rights of local village committees (Gu, 2019) to allow locals to benefit from multifunctional country parks similar to those of distant visitors. Given these, country parks in China are, on the one hand, related to a broader range of ES and, on the other hand, oriented toward more diverse social groups that use and benefit from ES. It is critical to assess the perceived ES to determine who values what and to what extent they value them.

ES valuation does not only rely on scientific expert judgment, but users' perspectives and bottom-up participatory processes are highly relevant (McHale et al., 2018; Tadaki et al., 2015). By capturing the voices of those who are affected by their uses or demands of ES, it could avoid potential power asymmetries in ES assessments (McHale et al., 2018), promote equity and transparency of ES management (Jax et al., 2013; Kenter et al., 2015), and is consistent with the Sustainable Development Goals principle of leaving no one behind (Zhang et al., 2020). Hence, the perceptions of ES could be used as an approach to promote environmental justice, which could be understood as enabling equitable benefit and use of ES for diverse social groups (Brück et al., 2022; Langemeyer and Connolly, 2020; Loos et al., 2023).

ES management is a vital way to satisfy social demands and to promote sustainable development (Gunderson et al., 2016). Social–ecological systems are characterized by uncertainties, which have become more prominent under rapid urbanization and global environmental change, and have numerous impacts on the provision of ES (Hou et al., 2013; Millennium Ecosystem Assessment, 2005). Some of these uncertainties stem from the fact that users have diverse perceptions, which leads to different judgments of the management (Pahl-Wostl et al., 2007). Top-down management might neglect the plurality of ES perceptions, which may result in injustice for certain user groups, particularly in the recognition dimensions (Brück et al., 2022; Langemeyer and Connolly, 2020), and thus raises additional societal challenges. Adaptive management, which is an integrated and learning-based approach for social–ecological systems, could be used to address such issues (Folke et al., 2005; Gunderson et al., 2016). It is a process that promotes decision-making by learning and managing the environment simultaneously (Williams, 2011). Adaptive management can be applied to country parks in China as they are multifunctional green spaces that involve different groups of people, from locals to more distant visitors, and decision-making needs to be flexible to balance multiple uses, coordinate possible trade-offs, and set priorities in irreconcilable circumstances (Gu et al., 2020). Understanding social perceptions of ES is key to this management process (Jacob et al., 2021; Uehara et al., 2021).

Although social perceptions are often overlooked in ES studies compared with ecological or economic valuation (Ciftcioglu, 2021; Malinauskaite et al., 2021), the growing body of literature demonstrates that it has gained increasing attention (Scholte et al., 2015). Currently, studies of ES perceptions mainly focus on the importance of ES (Liu et al., 2022), and some scholars have argued for considering both the perceived importance and performance of ES (Das and Basu, 2020; Gai et al., 2022; Hua and Chen, 2019; Wang et al., 2022). In this context, performance refers to "the assessed state or trend of (an) ES", and importance refers to "what extent and how this service or its associated benefits matter for someone or for a group of persons" (Breyne et al., 2021). Both of them would jointly create mental maps of social satisfaction and prioritization with ES and provide insights into management (Wang et al., 2022; Zhang et al., 2020). Regarding the assessment methods, social perception studies have developed a range of participatory methods, with questionnaire surveys as the most commonly used (Scholte et al., 2015). Most of these studies assessed study areas as a whole; several scholars have noted the linkages between perceived ES and specific landscape features (Dou et al., 2021; Zoderer et al., 2016). Visual techniques, including photo-elicitation, are applied to reveal these linkages (Plieninger et al., 2022; Zoderer et al., 2019). While scholars have explored this social approach and made continuous progress in urban and peri-urban ES studies (Casado-Arzuaga et al., 2013; Das and Basu, 2020; Swapan et al., 2017), few studies have been reported on the perceptions of ES of country parks in peri-urban areas and take them into account in the management.

In the present study, we developed a framework to integrate the perceptions of ES in the adaptive management of Qingxi Country Park (QCP), a pilot in peri-urban Shanghai, China. According to the "Shanghai Ecological Space Plan (2021–2035)" (SLCAAB and SMBPNR, 2021), there will be more than 30 country parks in Shanghai by 2035. As of 2021, there are eight country park pilots open to the public. Due to the construction complexity and high capital investment, all these country parks, including QCP, have divided a single plan into several stages and implemented sequentially to examine how well it is working. All these pilots have completed first-stage construction, while several of these will soon start their second-stage construction. Users' perceptions of the parks, however, are still less understood. Against this background, ES perception approach could be applied in this transition gap between the construction of first and second stage, through learning from users' perspectives of ES for the current status to inform adjustments for the sustainable management of the next stage construction, and to provide lessons for the adaptive management of similar peri-urban green spaces that involve different user groups in diverse geographic contexts. Specifically, our study involved the following objectives:

(1) To assess the characteristics of the perceived importance and performance of ES.
(2) To identify the differences among users' prioritizations of ES.
(3) To uncover the linkages between perceived ES and landscape features.
(4) To discuss the insights for the adaptive management of country parks.

2. Methods

2.1. Study area

QCP is located in the west of Qingpu District, Shanghai (Fig. 1). It is one of the country park pilots in Shanghai, with a total planning area of 22.35 km^2, and contains ten administrative villages and two communities (Gu, 2019). The park is currently managed by the government of Qingpu District and a state-owned enterprise, but the land within the planning area is collectively owned by local village committees (Wu et al., 2018). It is situated on the Yangtze River Delta Plain, with a dense network of rivers and waterways. The area has a subtropical maritime monsoon climate, with an annual precipitation of 1056 mm and an annual average temperature of 15.5 ℃. Before the QCP was built, abundant precipitation and rich freshwater resources had nurtured natural wetland landscapes in this area. Along the lakes and rivers, agriculture and aquaculture gradually developed and once became the main livelihood for local people. In the last two decades, rapid urbanization has influenced the development of this area (Liu and Liu, 2016; Sun et al., 2018). In 2012, the government of Qingpu District announced the construction of the QCP, which protects the peri-urban green spaces to promote multifunctional development of ecological conservation, agricultural production and leisure experience in the context of urbanization (Gu, 2019). It is part of the Qingsong Ecological Corridor in

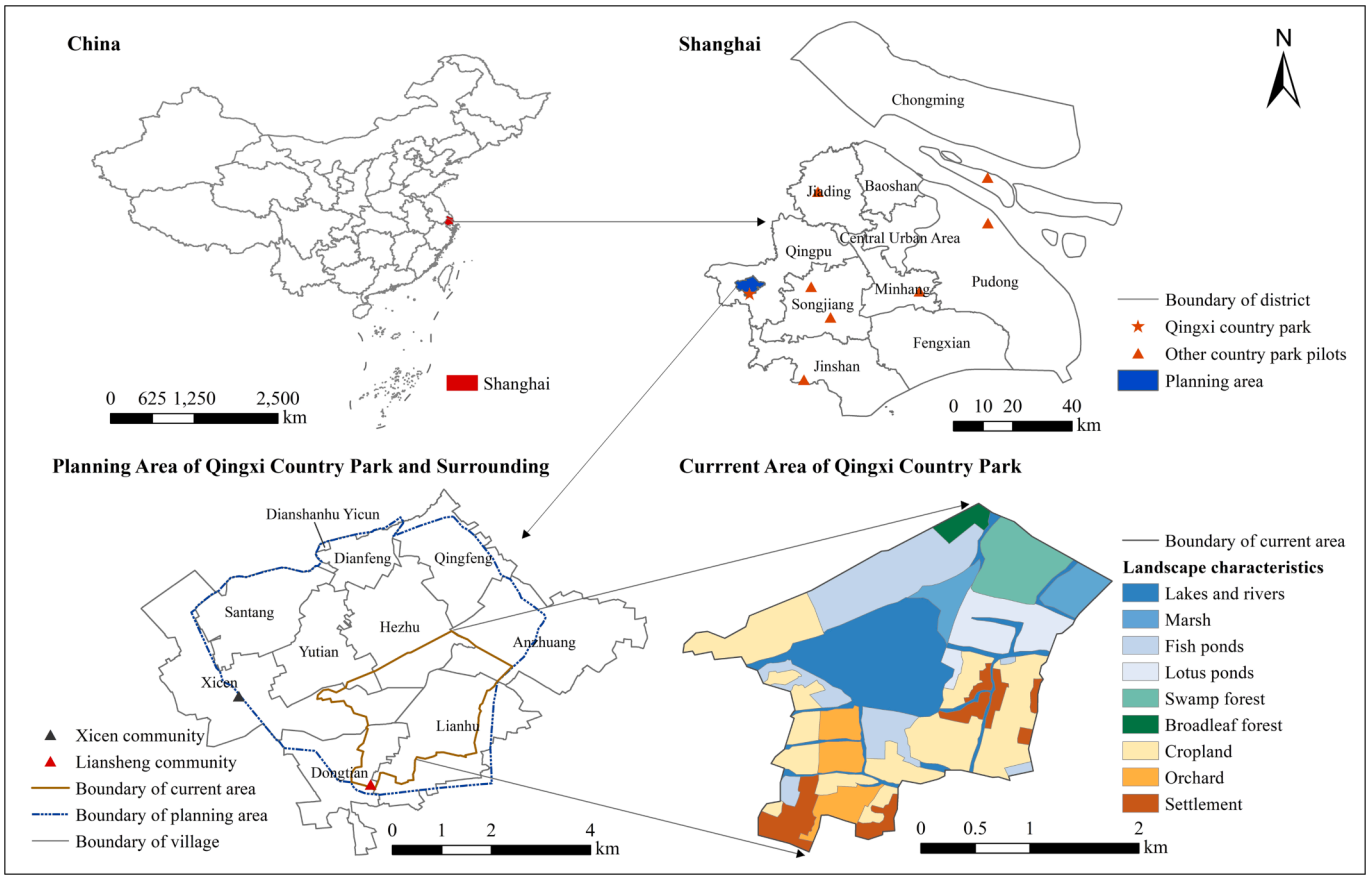

Fig. 1. Location of the QCP in Shanghai, planning area with its surroundings, and current area with its landscape characteristics.

Shanghai, as well as the water source protection area (SLCAAB and SMBPNR, 2021; SMAPLR and SUPDRI, 2015).

The current area of QCP's first-stage construction is 4.65 km^2, and it has been open to the public since 2016. Although the current area covers the land of six villages, Lianhu Village is the only village officially declared to be inside the country park, mainly because all its settlements are included. The land within the QCP is collectively owned by local village committees, and the locals still retain the contract rights to the land and have transferred the operation rights (Wang and Zhang, 2017). Nonetheless, paddy rice cultivation, orchard planting, and pond-based fish farming still exist in the current area, which provide numerous agriculture-related ES. A swamp forest was planted during wetland afforestation in the 1980s, which has now become one of the main scenic spots. Rural settlements have been preserved and restored to maintain the traditional architectural form. Bed-and-breakfast inns and agritainment are also run by some locals in the QCP. In 2021, the second-stage construction of the QCP was launched by the government. Yet, as far as we know, users' perceptions of the environment are largely unknown. In this study, we assessed the perceptions of ES provided by the current area of QCP to take them into account in the adaptive management.

2.2. Research design

Fig. 2 shows the research framework that we used to carry out the integration of the perceptions of ES in adaptive management. We adopted the adaptive management framework by learning from the implemented management, followed by assessment and decision-making for improving management (Pahl-Wostl et al., 2007; Williams, 2011). In Step 1, we selected ES based on the categories in the Millennium Ecosystem Assessment (2005), and identified diverse perspectives by involving key users related to the country parks. We randomly selected different users and conducted face-to-face questionnaire surveys on-site. In Step 2, we assessed users' perceptions of ES for the current country park management using multiple analytical methods, including statistical analyses, importance-performance analysis (IPA), and ES indexes. For the ES indexes, we refer to different indexes designed to capture the characteristics of perceived ES provided by different landscape features, such as abundance, diversity, and consistency (Dou et al., 2021; Loc et al., 2018; Plieninger et al., 2013). In Step 3, we further discussed our results with local managers and experts by organizing meetings, and through learning from perceptions of ES in the current status of management, we provided implications for the next stage of management. This process needs to be cycled and iterated in the subsequent construction. The iterative process in Fig. 2 is shown as a dashed line as management practices often take time (in years) to adjust and the time available for research projects is limited, so this framework is used only to demonstrate the methodological flow inside a single loop similar to Uehara et al. (2021).

2.3. Step 1: Define indicators and elicit pluralistic perspectives

2.3.1. Classification of ES

Step 1 focuses on the process of data collection and sample classification to elicit diverse perceptions. We first selected ES in cooperation with the management of the QCP and the local village committees based on the categories established in the Millennium Ecosystem Assessment (2005). After pre-testing with residents and visitors, we finally chose 12 ES (Table 1). Following the precedents of Plieninger et al. (2013) and Rodríguez-Morales et al. (2020), we divided cultural ES into two subcategories: recreational ES and cognitive ES. While recreational ES contained experience of the environment, cognitive ES were related to the characteristics of the environment such as a sense of place or

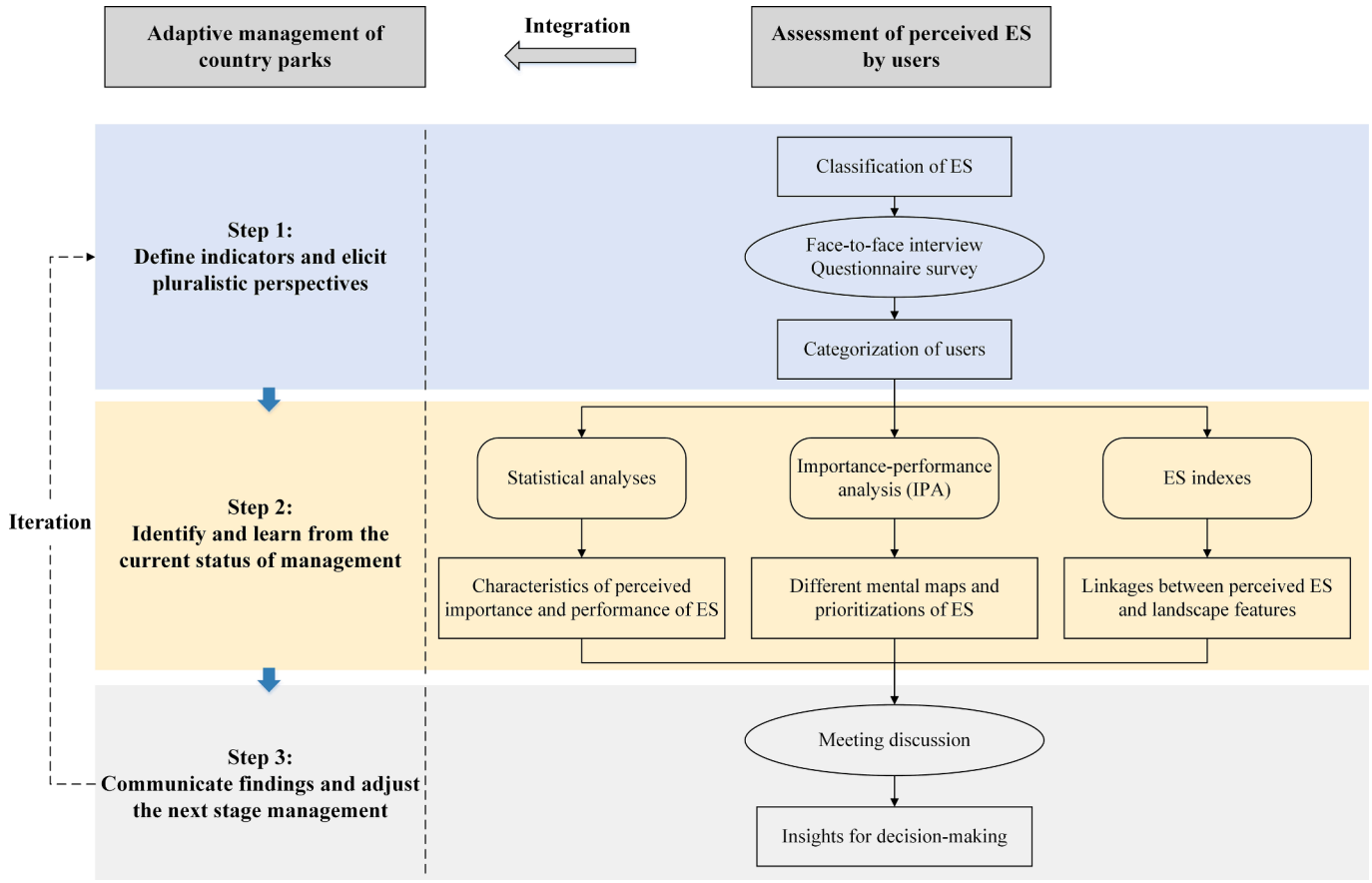

Fig. 2. Research framework for integrating the perceptions of ES in the adaptive management of country parks.

Table 1
Classification and descriptions of ES.

ES	Descriptions
Supporting	
Habitat	It provides habitats for a variety of plants and animals.
Regulating	
Water and air quality maintenance	It preserves and cleans water and air.
Microclimate regulation	It lowers air temperature.
Cultural – Cognitive	
Education	It enables to learn about the environment through observation or study.
Cultural heritage	It embodies the long-standing local history, traditions, wisdom, and way of life.
Sense of place	It promotes environmental connection and creates a sense of belonging.
Spiritual	It has special personal meanings, such as reverence and respect for nature.
Cultural – Recreational	
Recreation	It provides outdoor recreational activities for leisure time.
Aesthetic	It has attractive scenery.
Physical and mental health	It allows for relaxation and therapy, both physically and mentally.
Provisioning	
Food products	It provides local food products.
Fresh water	It provides fresh water for multiple uses.

spiritual values which are difficult to quantify without socio-cultural perception approaches (Cheng et al., 2019). This distinction could clearly reflect the differences within cultural ES. We developed ES descriptions in the local context based on empirical studies (e.g., Dou et al., 2020; Plieninger et al., 2013; Schmidt et al., 2017; Swapan et al., 2017).

2.3.2. *Survey implementation and questionnaire*

We used a questionnaire survey to collect quantitative data on the perceptions of ES. We conducted a pre-test in July 2021 and then the final survey in August 2021, both through face-to-face interviews. We surveyed respondents aged 16 years and older as they are generally defined by scholars in China and abroad as adults (Ament et al., 2017; Zhang et al., 2020). Meanwhile, respondents older than 80 years old were excluded from the survey as they may have difficulties with speaking or reading (Hua and Chen, 2019). Apart from that, respondents were randomly selected and approached at different public spaces of the QCP. The survey was conducted during the COVID-19 pandemic, with traffic control measures implemented in some cities and counties near Shanghai for entering and leaving the city, while the activities of residents within Shanghai were not affected. This had little impact on our survey, since the QCP was recently established and mainly provides a place for leisure and recreational activities for residents in Shanghai, rather than being a well-known tourist attraction in other areas. Therefore, park users are mainly from Shanghai and fewer from other areas. A total of 229 valid questionnaires from the final survey were collected on-site.

The questionnaire in the final survey was structured into three sections. In the first section, we explored the perceived importance and performance of 12 ES by different users. We invited respondents to separately rate the importance and performance of each ES by using a five-point Likert scale ranging from 1 (not important at all/strongly disagree) to 5 (very important/strongly agree). "Agree/disagree" was used to describe the actual performance level of ES in the questionnaire items (Das and Basu, 2020; Hua and Chen, 2019).

The second section of the questionnaire was based on photo-elicitation to explore the relationships between ES and specific landscape features. With the help of QCP management and local village

committees, we identified seven landscape features, which reflected the distinctive characteristics of the current area of QCP (Fig. 3). The photos were taken by two of the co-authors under similar weather and light conditions shortly before the surveys (Zoderer et al., 2016). We used this approach to demonstrate the current state of the landscapes and reduce the influence of changing appearances of the landscapes (Loc et al., 2018). All the photos were shown on an A3 paper sheet. We asked respondents to select whether the landscape features shown in the photos provided a certain ES or not. As locals were relatively familiar with these landscape features and were able to distinguish them without misinterpretation, we made sure that more distant groups of visitors had visited the whole park before answering the questionnaire. Interviewers also helped respondents recognize photos if necessary and ensured they could relate these landscape features to ES. For each ES, respondents were required to indicate no more than five landscape features.

In the third section of the questionnaire, we collected respondents' sociodemographic characteristics (e.g., gender, age, education, and place of residence) and their self-reported knowledge of the QCP. The complete questionnaire can be found in Appendix A in the Supplementary Material.

2.3.3. Categorization of users

We identified four user groups involved in the questionnaire surveys based on the distance of their place of residence from the current area of the QCP, following the studies of Das and Basu (2020) and He et al. (2018). These groups were as follows: (1) those who live inside the QCP, (2) those who live less than or equal to 3 km to the QCP, (3) those who live more than 3 km to the QCP but less than or equal to 30 km, and (4) those who live more than 30 km to the QCP. Users living inside the QCP are considered locals who are residents of Lianhu Village, and they have the contract rights to collective lands in the QCP and develop long-term relationships with landscapes. Meanwhile, other categories of respondents can also influence landscape change indirectly.

2.4. Step 2: Identify and learn from the current status of management

2.4.1. Perceived importance and performance of ES: Statistical analyses

Step 2 involves quantitative analysis of the questionnaire data collected in the previous step to analyse the current management. First, Cronbach's α was used to test the internal consistency reliability of the survey dataset. The values of Cronbach's α for importance and performance were 0.883 and 0.908, respectively, which indicated good internal consistency (Taber, 2018). Then, a Chi-square test was performed to identify significant differences in characteristics among the four user groups. The descriptive statistics were used to assess the importance and performance ratings of ES provided by the QCP. A paired samples *t*-test was performed for the ratings of importance and performance of each ES to measure the gaps between these two dimensions. Two separate one-way ANOVAs were also conducted, with one on the importance ratings and one on the performance ratings, to identify differences in the perceptions across the four groups. The least significant difference (LSD) method was performed for post hoc multiple comparisons in ANOVAs (using the R package "agricolae", de Mendiburu, 2021). In addition, the multiple linear regression was conducted using ordinary least squares (OLS) to analyze the relationships between the perceived ES and the characteristics of users (i.e., dummy variables including sociodemographic characteristics and knowledge about QCP, see Table B1 in Appendix B). Standardized Beta coefficients were extracted from the regression model (using the R package "QuantPsyc", Fletcher, 2022) to reveal the influence of different variables. All statistical analyses were performed using R software version 4.1.0 (R Core Team, 2021).

2.4.2. Mental maps of ES: IPA

While the ANOVAs in the statistical analyses tested the differences across user groups, they did not illustrate the perceived performance of ES concerning their importance and might not reveal the prioritization of ES (Keith and Boley, 2019). Hence, IPA was applied to create mental maps of different users (Zhang et al., 2020). Originally designed for marketing research (Martilla and James, 1977), IPA combines respondents' average importance and performance ratings of different products or services into a two-dimensional grid, with importance and performance as the horizontal and vertical axes, respectively (Azzopardi and Nash, 2013). This graphical approach allows managers to prioritize different products or services. In this study, IPA was carried out to explore the perceived importance and performance of ES and derive mental maps of users.

For IPA mapping, we applied the basic structure of the "data-centered diagonal line model" introduced by Lai and Hitchcock (2015). In this model, a cross-hair was set at the mean of the overall importance and performance ratings (i.e., data-centered approach). Then, a 45° diagonal line was drawn to meet this cross-hair, and the grid was divided into four quadrants (Fig. 4). These were Quadrant I "Keep up the good work" (high importance and high performance), Quadrant II "Possible overkill" (low importance and high performance), Quadrant III "Low priority" (low importance and low performance), and Quadrant IV "Concentrate here" (high importance and low performance). As its name showed, ES that fall into Quadrant IV are unsatisfied social demands, which should be paid special attention as high priorities. By using the "data-centered diagonal line model", the proportion of Quadrant IV "Concentrate here" was enlarged, and more points could be placed in

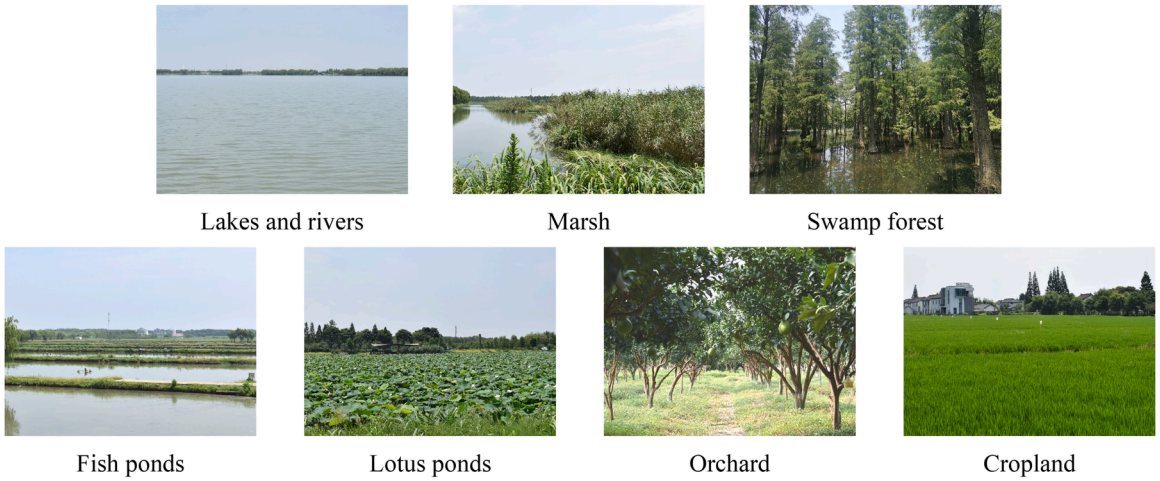

Fig. 3. Photos of landscape features in the QCP. All photos were taken by the authors.

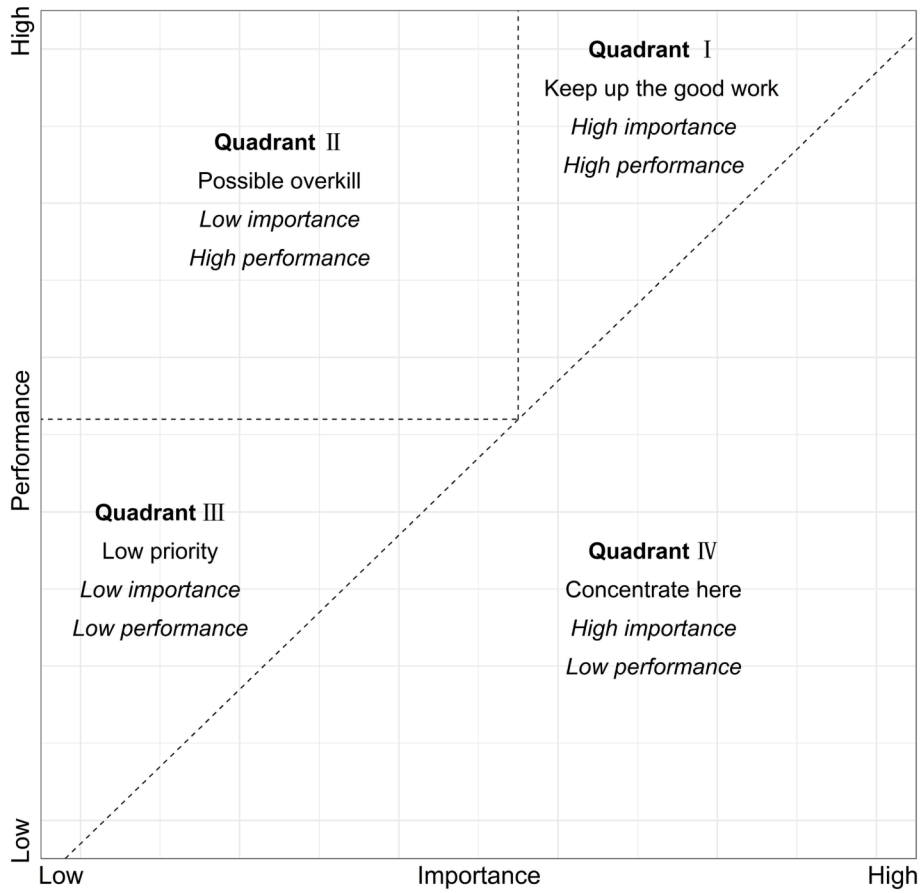

Fig. 4. Basic structure of the data-centered diagonal line model in the IPA. .
Source: Lai and Hitchcock (2015)

this quadrant (Lai and Hitchcock, 2015). Thus, the managers could improve the level of ES management. In this study, we provided IPA mapping for the overall sample and different user groups.

As a complement to the IPA mapping approach, we calculated an improvement index following previous studies of Hua and Chen (2019) and Das and Basu (2020) to prioritize the perceptions of ES. The improvement index (I_i) for ES i was calculated as follows:

$$I_i = \frac{IS_i - PS_i}{RI_i} \tag{1}$$

$$RI_i = \frac{IS_i - IS_{min}}{IS_{max} - IS_{min}} \tag{2}$$

where IS_i and PS_i are the importance and performance score of ES i, respectively; RI_i represents the relative importance of ES i; and IS_{max} and IS_{min} are the highest and lowest importance ratings for ES i, respectively. The improvement index was used in combination with the IPA mental maps to derive detailed information.

2.4.3. ES and landscape features: ES indexes

Different ES indexes were applied to identify the relationship between different perceived ES and pre-identified landscape features (Fig. 3). Originally used in participatory mapping approach (Brown et al., 2014), these indexes have been applied for pre-identified landscape features in recent years (Dou et al., 2021; Loc et al., 2018).The indexes were developed on two levels, one on the overall landscape feature level and one decomposition to categories of respondents.

Following previous studies of García-Llorente et al. (2020) and Loc et al. (2018), two indexes on the overall landscape feature level were applied, including an abundance index, defined as the total number of ES mentioned with a given landscape feature, and a diversity index, calculated using the Shannon diversity index:

$$AI = \sum_{i=1}^{N} P_i \tag{3}$$

$$DI = -\sum_{i=1}^{N}\left(P_i / \sum_{i=1}^{N} P_i\right) \times \ln\left(P_i / \sum_{i=1}^{N} P_i\right) \tag{4}$$

where AI and DI represent the abundance index and diversity index of a given landscape feature, respectively; N is the total number of ES; and P_i is the number of people who mentioned ES i from a certain landscape feature.

Two other indexes were devised on the user level. A relative abundance index was defined as the proportion of the total ES number mentioned with a given landscape feature from a given user group. Following Huang et al. (2016), a consistency index was defined as the pairwise comparison of the relative abundance of a given landscape feature across the user groups, which were calculated as follows:

$$RAI = \frac{\sum_{i=1}^{N} P_{ij}}{\sum_{j=1}^{M}\left(\sum_{i=1}^{N} P_{ij}\right)} \tag{5}$$

$$CI = 1 - \frac{\sqrt{(RAI_n - RAI_m)^2}}{\overline{RAI}} \tag{6}$$

where RAI and CI represent the relative abundance index and consistency index of a given landscape feature, respectively; P_{ij} denotes the number of people who mentioned ES i from a given landscape feature j; M is the total number of the landscape features; RAI_n and RAI_m are the

relative abundance indexes of the landscape features within user group n and m, respectively; and $\overline{RAI}$ is the arithmetic mean of the relative abundance index across the four user groups.

Finally, to link the preceding rating approach with the landscape perceptions, a hierarchical cluster analysis (HCA) was conducted on respondents' perceived ES from landscape features, which was weighted by their importance ratings (Xu et al., 2020). The Euclidean distance and Ward's method were applied in HCA to show the similarities among landscape features according to users' perceptions (Affek and Kowalska, 2017). The number of clusters was determined by the majority "votes" in the R package "NbClust" (Charrad et al., 2014). HCA was also performed in R.

2.5. Step 3: Communicate findings and adjust the next stage management

After obtaining results from users' perceptions of the ES provided by current QCP through the first two steps, Step 3 is the process of further communicating our findings with managers and experts to provide implications for the next stage of management (Camps-Calvet et al., 2016; Sy et al., 2018). We held a meeting in November 2022 and invited three managers associated with the QCP project and three experts in the field of ecology, land use management, and landscape planning who were familiar with country park projects for discussion. In the meeting, we first asked for their views on the 12 ES provided by the QCP listed in this study, including the ES that need to be concentrated on and its linkage with landscape features. Then, we presented and compared the results of user perceptions in our study. Finally, we discussed how these results might guide decision-making and policy implications in subsequent management. The meeting was recorded with the consent of the interviewees, and the contents were later transcribed and coded (Newing et al., 2010).

3. Results

3.1. Characteristics of respondents

From the 229 respondents surveyed, women and men were fairly balanced (47.6% VS 52.4%, respectively). Respondents aged 26–35 years old accounted for the largest proportion (30.7%), followed by those aged 36–45 years old (20.2%) and 46–55 years old (17.1%). In terms of education, 33.5% of the respondents achieved an undergraduate degree, 20.7% reached junior college, while 5.3% had primary school education or no access to any formal education. The largest proportion (44.7%) of the respondents self-reported a moderate level of knowledge about the QCP.

Regarding different user categories, 41 (17.9%) were locals living inside the QCP (Group 1), 73 (31.9%) were from the vicinity i.e., living less than or equal to 3 km to the QCP (Group 2), 52 (22.7%) were living more than 3 km to the QCP but less than or equal to 30 km (Group 3), and 63 (27.5%) were living more than 30 km to the QCP (Group 4, Table 2). Chi-square tests indicate that there were significant differences ($p < 0.001$) in age, education, and knowledge about the QCP across these four groups. Locals were older and more knowledgeable about the QCP, while their education levels were lower. No significant difference was found for gender in the four groups.

3.2. Perceived importance and performance of ES

Fig. 5 presents the mean and standard deviations of ES ratings of the total sample. For the importance ratings of individual ES, water and air quality maintenance was the highest (4.387) among all ES, followed closely by aesthetic (4.344) and habitat (4.336). The performance ratings of individual ES show similar characteristics to their importance, with the three highest ratings in descending order as follows: water and air quality maintenance (4.129), habitat (4.071), and physical and mental health (4.040). The lowest importance and performance ratings were both assigned to food products (3.552 and 3.413 in importance and performance, respectively, the same below). For the ES categories, respondents highly considered the supporting ES (4.336 and 4.071), regulating ES (4.286 and 4.049), and recreational ES (4.233 and 3.894), whereas cognitive ES (3.832 and 3.677) and provisioning ES (3.720 and 3.527) were considered lower. The results of the importance and performance ratings of the four user groups are shown in Table B2 in Appendix B.

Table 2
Characteristics of the sample (N = 229). Results shown in percentages (%). *** indicates significant differences at $p < 0.001$.

	Group 1: Inside QCP (N = 41)	Group 2: ≤ 3 km (N = 73)	Group 3: >3 km but ≤ 30 km (N = 52)	Group 4: >30 km (N = 63)	Chi-square tests
Gender					3.802
Female	53.7	38.4	50.0	52.4	
Male	46.3	61.6	50.0	47.6	
Age					93.571***
16–25	4.9	8.3	13.5	36.5	
26–35	17.1	23.6	50.0	31.7	
36–45	9.8	20.8	23.1	23.8	
46–55	19.5	33.3	9.6	3.2	
>55	48.8	13.9	3.8	4.8	
Education level					114.428***
Primary school or below	24.4	1.4	1.9	0.0	
Junior high school	34.1	13.9	5.8	4.8	
Senior high/ technical school	12.2	20.8	13.5	4.8	
Junior college	14.6	37.5	17.3	8.1	
Undergraduate	12.2	23.6	36.5	56.5	
Postgraduate or above	2.4	2.8	25.0	25.8	
Knowledge about QCP					49.501***
Little	4.9	9.7	17.3	28.6	
Moderate	26.8	33.3	57.7	58.7	
Good	68.3	56.9	25.0	12.7	

In terms of the relationships between the importance and performance ratings of each ES, the results of the paired samples t-test show that there were significant differences ($p < 0.05$) in all of the 12 ES and the ES categories (Fig. 5). The importance ratings for all ES were significantly greater than their performance ratings, which demonstrated that performance gaps existed. However, these performance gaps were not large, ranging between 0.134 (spiritual) and 0.392 (aesthetic). In this case, perceptions of performance could be high considering the fact that the QCP was recently constructed.

Education level was the most important individual characteristic that influence both the importance and performance of ES, except for food products which was not significant in both (Table 3). Respondents with higher education levels perceived higher importance and performance of ES. Knowledge about QCP also had the significant positive influence on most ES, but it was not significant with all the perceived regulating and supporting ES. Age influenced the perceived importance and performance of sense of place and the importance of fresh water, with older respondents having higher perceptions. Gender only influenced the perceived performance of recreation, with male respondents perceiving a higher performance of recreation than female respondents.

3.3. Mental maps and prioritizations of ES

Fig. 6a shows the different mental maps of overall perceived ES plotted by IPA. Crucially, six ES were placed in the "Concentrate here" quadrant (high importance and low performance), which were all three recreational ES (recreation, aesthetic, and physical and mental health),

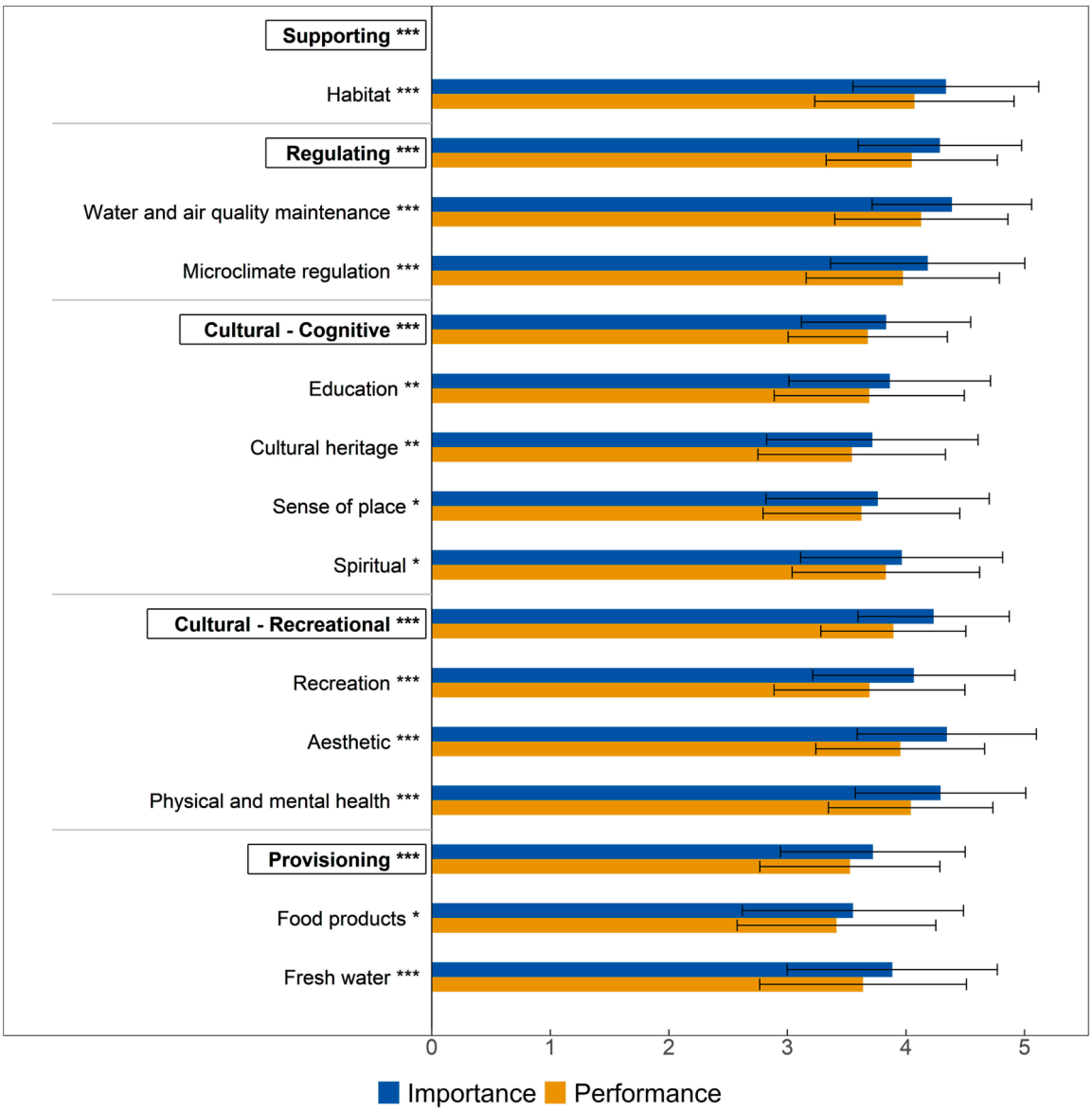

Fig. 5. Importance and performance ratings of the 12 ES and ES categories. Ratings of five-point Likert scale: 1 (not important at all/strongly disagree) to 5 (very important/strongly agree). *, **, and *** indicate significant differences at $p < 0.05$, $p < 0.01$, and $p < 0.001$, respectively.

one regulating ES (water and air quality maintenance), one supporting ES (habitat), and one provisioning ES (fresh water). These six ES were prioritized by the overall respondents. Education, cultural heritage, sense of place, and food products were in the "Low priority" quadrant (low importance and low performance). Microclimate regulation was the only ES that fell into the "Keep up the good work" quadrant (high importance and high performance), whereas spiritual fell into the "Possible overkill" quadrant (low importance and high performance).

Fig. 6b–e suggest that mental maps were divergent across the four groups. The greatest differences existed between Group 1 (locals inside QCP) versus Group 4 (more distance visitors who live more than 30 km to the QCP). Compared with the other three groups, Group 1 assigned high importance to several cognitive ES (cultural heritage, and sense of place) and provisioning ES (food products), both in the "Concentrate here" quadrant, which indicates high priorities. Interestingly, they were also the only group that were satisfied with the performance of habitat and aesthetic (in the "Keep up the good work" quadrant, Fig. 6b). On the other hand, Group 4 assigned high priority to education (in the "Concentrate here" quadrant) while satisfied with the performance of water and air quality maintenance compared with the rest of the groups (in the "Keep up the good work" quadrant, Fig. 6e).

Furthermore, some groups showed associations while distinguishing from other groups. For example, Group 1 and 2 highly considered the importance of fresh water (in the "Concentrate here" quadrant) compared with the other two groups (Fig. 6b and 6c). Group 2 and 3 were dissatisfied with the performance of microclimate regulation (in the "Concentrate here" quadrant) compared with the other groups (Fig. 6c and 6d).

As a complement to the mental maps, we considered the potential for improvements of ES on respondents' perceptions (Table 4). The ranking of improvement indexes shows the detailed priorities of different ES. Overall, recreational ES was highly prioritized by the total respondents as recreation ranked first among all ES in the overall sample, followed by aesthetic and fresh water. As a cognitive ES, sense of place was ranked low by the total respondents, which indicated its low priority. The ranking of improvement indexes of the four groups show priorities similar to Fig. 6.

Table 3
Multiple linear regression results of influences of individual characteristics on importance and performance ratings for ES, showing standardized Beta coefficients. Only the statistically significant variables are displayed. $^{+}$, *, **, and *** indicate significant differences at $p < 0.1$, $p < 0.05$, $p < 0.01$, and $p < 0.001$, respectively.

ES importance	Significant variables	Standardized coefficients	ES performance	Significant variables	Standardized coefficients
Mean ES	EduLevel**	0.220	Mean ES	EduLevel**	0.240
	Knowledge^{+}	0.134			
Supporting			**Supporting**		
Habitat	EduLevel***	0.277	Habitat	EduLevel***	0.308
Regulating			**Regulating**		
Water and air quality maintenance	EduLevel^{+}	0.128	Water and air quality maintenance	EduLevel*	0.172
Microclimate regulation	EduLevel*	0.173	Microclimate regulation	EduLevel*	0.176
Cultural – Cognitive			**Cultural – Cognitive**		
Education	EduLevel*	0.167	Education	EduLevel^{+}	0.125
	Knowledge*	0.148		Knowledge**	0.182
Cultural heritage	Knowledge*	0.140	Cultural heritage	EduLevel*	0.154
Sense of place	Age*	0.164	Sense of place	Age*	0.157
	Knowledge**	0.192		EduLevel^{+}	0.126
Spiritual	–		Spiritual	EduLevel*	0.166
Cultural – Recreational			**Cultural – Recreational**		
Recreation	EduLevel***	0.250	Recreation	Gender^{+}	0.126
	Knowledge*	0.141		EduLevel*	0.150
				Knowledge*	0.142
Aesthetic	EduLevel***	0.290	Aesthetic	EduLevel***	0.226
	Knowledge*	0.153			
Physical and mental health	EduLevel***	0.264	Physical and mental health	EduLevel**	0.231
Provisioning			**Provisioning**		
Food products	Knowledge^{+}	0.127	Food products	–	
Fresh water	Age**	0.212	Fresh water	EduLevel*	0.173
	EduLevel^{+}	0.147			

3.4. Relationships between ES and landscape features

Fig. 7a displays the abundance and diversity of ES provided by different landscape features. In the study area, the highest abundance values were assigned to swamp forest ($AI = 730$), lakes and rivers ($AI = 672$), and marsh ($AI = 634$), with the lowest for fish ponds ($AI = 269$). The landscape features obtained approximate diversity values, with lotus ponds perceived as the most important landscape feature for providing diverse ES ($DI = 2.408$), followed by lakes and rivers ($DI = 2.394$) and marsh ($DI = 2.388$), while orchard perceived as the least important ($DI = 2.324$).

ES indexes were further decomposed into user groups and calculated two other indexes. The relative abundance index in Fig. 7b shows that among the four groups, Group 1 (locals) had the highest perception of ES provided by swamp forest, lakes and rivers, and cropland. Group 2 from the vicinity had the highest perception of ES provided by orchard, whereas the other two groups perceived the highest on marsh and fish ponds. Moreover, Fig. 7c shows that Group 1 of locals had a weaker consistency with the other three groups, which means that their views differed more. The other three groups showed a relatively stronger level of consistency.

In addition, we linked the respondents' importance ratings with landscape feature selections by HCA. The dendrogram shows that the landscape features could be divided into two clusters (Fig. B1 in Appendix B). Cluster one contained several semi-natural landscape features of lotus ponds, marsh, lakes and rivers, and swamp forest. Cluster two was formed by all the rest of human-made landscape features.

3.5. Views of managers and experts

In the view of three local managers and three experts, four of them considered that aesthetic and physical and mental health should be improved and concentrated on in subsequent management. Three of them considered that recreation and spiritual should be improved. These are all cultural ES while other ES were mentioned less frequently, which is slightly different from the users. Nevertheless, lakes, rivers and swamp forest were considered by them to be the landscape features that could provide the most ES, similar to the users' perceptions.

Through learning from users' perceptions, managers and experts expressed the guiding role of the assessment of perceptions for the next stage of management. As one manager noted, users' perceptions of QCP could *"fill in our views and uncover the imperfections in the construction work carried out"*. Another pointed out that managers *"could carefully study the current state of the park and the needs of users, to know what to regulate"*. However, there were also views that these diverging perceptions of different users should be addressed with caution in management, as one expert argued that country parks *"need to have a unifying theme and positioning, and could not have the same priorities as some of those user groups."*

4. Discussion

4.1. Perceptions of ES provided by the country park

Our results show that among different ES provided by the QCP, regulating ES (e.g., water and air quality maintenance), supporting ES (habitat), and recreational ES (e.g., aesthetic and physical and mental health) were perceived as the most important, highest performance, and highest priorities, whereas provisioning ES (e.g., food products) were rated lower by the overall respondents. This is generally consistent with other studies related to urban and peri-urban ecosystems (Casado-Arzuaga et al., 2013; Das and Basu, 2020; Schmidt et al., 2017). QCP is located in an area where agriculture has been developed in the past centuries. With the rapid urbanization in the past two decades, aquaculture and agricultural landscapes in this area have been transformed into multifunctional landscapes of recreation, tourism, and education (Sun et al., 2018). Particularly after the construction of the QCP, social demands for these peri-urban landscapes have also evolved in the direction of satisfying the needs of being close to nature and improving the quality of life. Therefore, the provisioning ES was not as highly considered compared with regulating and recreational ES.

Diverging perceptions were found in our study. Large differences existed between locals and urban people. Locals were the only group that assigned high priorities to food products, cultural heritage, and sense of place (in the "Concentrate here" quadrant), whereas more distant visitors assigned high priority to education. Different socio-demographic characteristics and self-reported knowledge were associated with diverse perceptions and prioritizations (Affek and Kowalska,

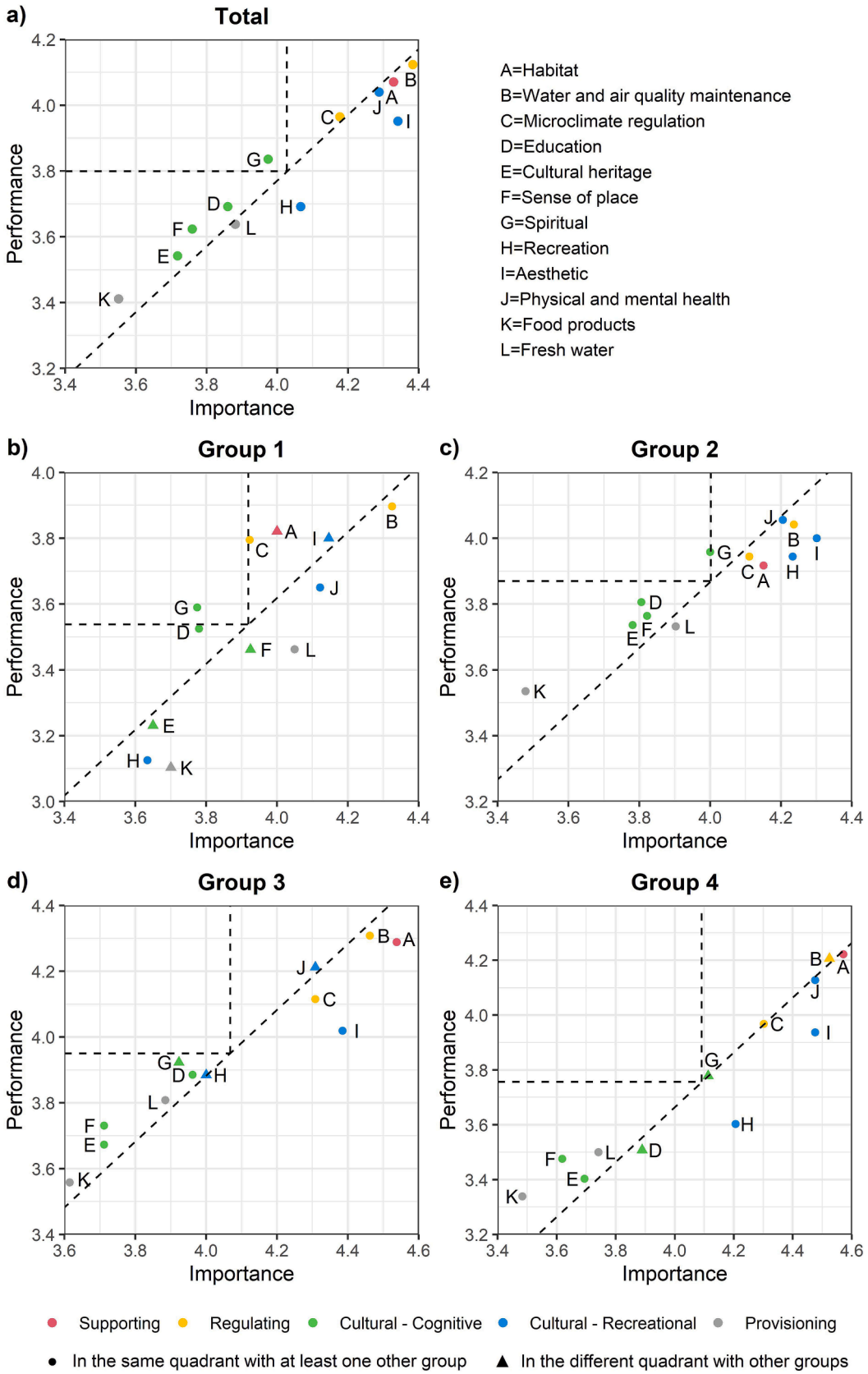

Fig. 6. IPA mental maps for 12 ES: a) Total; b) Group 1; c) Group 2; d) Group 3; and e) Group 4.

Table 4
Prioritizations of ES using the rankings of improvement index (I_i). Bold texts indicate that perceived ES fall into the "Concentrate here" quadrant in the mental maps, and italicized texts indicate that the perceived ES of certain user groups fall into a different quadrant in the mental maps from the other three groups.

Ranking	Total	User groups			
		Group 1: Inside QCP	Group 2: ≤ 3 km	Group 3: >3 km but ≤ 30 km	Group 4: >30 km
1	**Recreation**	**Fresh water**	**Aesthetic**	**Aesthetic**	**Recreation**
2	**Aesthetic**	***Food products***	**Recreation**	**Habitat**	**Aesthetic**
3	**Fresh water**	***Sense of place***	**Habitat**	**Microclimate regulation**	***Education***
4	**Water and air quality maintenance**	**Recreation**	**Fresh water**	**Water and air quality maintenance**	*Spiritual*
5	**Physical and mental health**	***Cultural heritage***	**Water and air quality maintenance**	*Recreation*	**Physical and mental health**
6	**Habitat**	**Physical and mental health**	**Microclimate regulation**	Education	**Habitat**
7	Microclimate regulation	**Water and air quality maintenance**	**Physical and mental health**	*Physical and mental health*	Cultural heritage
8	Cultural heritage	*Aesthetic*	Sense of place	Fresh water	*Water and air quality maintenance*
9	Education	Education	Cultural heritage	Food products	Microclimate regulation
10	Food products	Spiritual	Spiritual	Cultural heritage	Fresh water
11	Spiritual	*Habitat*	Education	*Spiritual*	Food products
12	Sense of place	Microclimate regulation	Food products	Sense of place	Sense of place

2017; Martín-López et al., 2012), which were also demonstrated in our study, particularly the influence of education level. Furthermore, the results of Step 3 show that the prioritizations of managers and experts also slightly differed from those of park users. Among the ESs that users perceived as requiring improved management, recreational cultural ES (i.e., recreation, aesthetic, and physical and mental health) were also considered by managers as requiring improvement, yet other ES such as fresh water, water and air quality maintenance, and habitat were considered by managers to be satisfied at present and do not require improvement. This is similar to the study of the protected landscape by Maestre-Andrés et al. (2016), which found that park managers tended to enhance touristic and cultural activities in the park, while some users, such as hiking groups, considered that priority should be given to nature conservation.

Our results reveal some possible trade-offs between perceived ES within different users. Perceived ES of user group falls into a different quadrant in the mental maps from the other three groups were identified, and the ES in the "Concentrate here" quadrant and the ES in the other quadrants (i.e., bold italic characters and non-bold italic characters in Table 4) were considered as possible trade-offs. The main trade-offs were found in Group 1 (locals), which shows the trade-off between food products/sense of place/cultural heritage as one set of ES and habitat/aesthetic as another; and Group 4 (visitors from more distant), which shows the trade-off between education and water and air quality maintenance. Among these, a typical example is the trade-off between habitat and food products in locals' perceptions, which can be commonly found in case studies (Flaherty et al., 2019; Jiren et al., 2020; Thiel et al., 2012). Locals were the only group that did not assign high priority to habitat ES and plotted it in the "Keep up the good work" quadrant of mental maps instead. During the interviews, locals were generally satisfied with the current state of habitat, and some also expressed their concern that excessive focus on habitat conservation might lead to birds eating the fruits or crops in the QCP which they highly consider. A possible explanation for this is that food products belong to private goods that locals once consumed and depended on, whereas habitat belongs to public goods that other user groups could simultaneously benefit (Costanza et al., 2017; Gómez-Baggethun and Muradian, 2015). This could similarly explain the trade-off between food products and aesthetic in locals' perceptions. Possible trade-offs have also been found in the perceptions of ES that are all public goods, for instance, between cognitive cultural ES perceptions and regulating/supporting ES perceptions. These findings reflect that users valued ES based on their experiences and activities in these places, as well as the needs or desires of their coming (Xu et al., 2020).

Our results also show that semi-natural landscape features, such as lakes and rivers, marsh, swamp forest, and lotus ponds, were perceived as providing more ES than other human-made landscape features. In the QCP, these semi-natural landscape features cover a large area and were selected as the theme for the country park. In this context, users could get more opportunities to interact with them, and "people may perceive the local dominant landscape type more important because of more interaction with it, more familiarity with it, or more (non) material benefits gained from it" (Dou et al., 2020). Meanwhile, interaction and familiarity can also be used to explain the differences found in the mention of landscape features by different groups. For instance, respondents from the vicinity highly considered orchards, which are commonly planted in the nearby villages; and visitors spent more time in their preferred natural landscape features such as marsh, as well as fish ponds that can provide them with recreational fishing. Notably, both locals and more distant visitors have a high perception of the ES provided by the swamp forest. It is a landscape type developed by wetland afforestation in the 1980s, which is the cultural identity for locals and is also the main visitor attraction of the QCP. Therefore, both locals and distant visitors could have interactions with this landscape, and perceive the ES it provides. Furthermore, locals differed from the other three groups in their views on the ES provided by the landscape, while the other three groups showed higher consistency. This suggests the need for a systematic analysis of diverse perceptions of different groups, not only regarding the overall ES perceptions but also regarding landscape features (Zoderer et al., 2019).

4.2. Management implications

In the following, we present implications for the next stage management based on users' perceptions of ES from current QCP management and dialogues with managers and experts. As a general guide, the IPA mental mapping approach in the adaptive management framework can be used to improve user satisfaction with ES. We suggested that for ES placed in Quadrant IV "Concentrate here" (high priorities) in the mental maps of the total sample, management improvements can be implemented according to the order of improvement index ranking. And for the mental maps derived from different user groups, if ES were perceived as high management priorities for certain user groups but were less prioritized in the total sample, these users can be encouraged to participate in the management to improve the related ES. Conversely, if ES were perceived as high management priorities in the total sample but were less prioritized by certain user groups, the awareness of the related ES by these groups should be raised. Moreover, for the

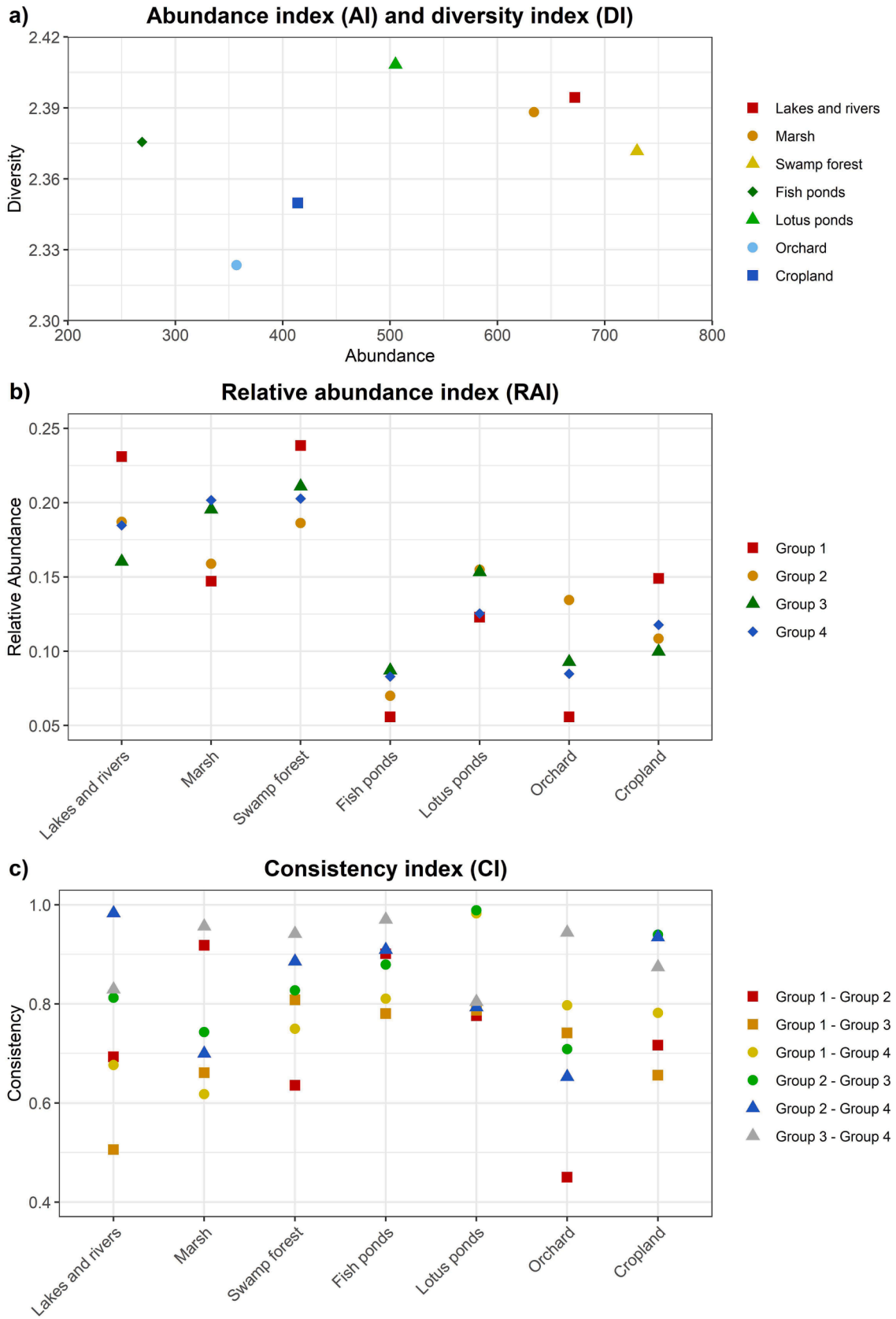

Fig. 7. ES indexes for seven landscape features: a) abundance index and diversity index; b) relative abundance index; c) consistency index.

perceptions of users of the corresponding landscape features, ES indexes in the adaptive management framework can be used to target landscape conservation in management accordingly. Based on these, the following specific approaches are recommended for the next stage of management:

1) Promote environmental experiences and environmental conservation through ecotourism

The management of country parks requires a certain goal, which can be adjusted according to the management priorities of the total sample. Based on our results, six ES were placed in Quadrant IV "Concentrate here" (high importance but low performance) of the mental maps for the total sample, ranked according to the improvement index as recreation, aesthetic, fresh water, water and air quality maintenance, physical and mental health, and habitat (Table 4). These ES are mainly related to environmental experiences and environmental capacities (Fagerholm et al., 2020; Schmidt et al., 2017), and ecotourism is a common adaptive solution to address these ES, which emphasizes tourism and recreation based on ecosystem conservation in protected landscapes (Zhang et al., 2017). Currently, QCP managers are aware of the term "ecotourism" and introduce it in management, but our meeting discussion showed that they are more concerned with improving tourism and cultural activities in management, while less about water and climate regulation or air quality maintenance. Focusing much on the recreational facet may lead to negative impacts such as wildlife disturbance and habitat fragmentation, which can be found in ecotourism activities (Ocelli Pinheiro et al., 2021). Based on this, it is necessary to adjust initiatives in the next stage of management, to keep the distance between people and wildlife and maintain the quality and normativity of recreational activities, thus allowing ecotourism to be a practical approach for promoting environmental experiences and environmental conservation in country parks.

2) Increase local participation in management

In addition to perceptions about the ES that need to be improved for general park management in the total sample, users' diverging perceptions should be taken into account to achieve the possible win–win solution. Our results show that some ES with high management priorities were found within certain user groups, such as locals perceived food products/sense of place/cultural heritage as high priorities for management, while visitors from more distant perceived education as a high priority (Table 4). Increasing the participation of users in management could give a voice to the improvement of these ES, which could also contribute to mitigating trade-offs (Meyfroidt et al., 2022; Ruiz-Frau et al., 2018). Moreover, improving local participation has also been regarded as an effective initiative to alleviate environmental injustice (Tozer et al., 2020). As a type of peri-urban green space, the construction of country parks could lead to the occurrence of environmental injustice such as green gentrification (Gould and Lewis, 2016), leaving locals and nearby people exposed to being excluded. For example, one local respondent claimed that the construction of the QCP *"benefits visitors who come from more distant places, but doesn't do much for us"*. Yet considering local participation, a survey by Gu (2019) found that only 43% of local villagers at country parks in Shanghai considered themselves involved in country park projects.

We recommend that one way to improve participation is to integrate local knowledge into daily management. Our results show that locals were less formally educated (24.4% had only primary school education or no access to any formal education, compared with 5.3% for the total sample), but were more knowledgeable about the QCP (68.3% self-reported a good level of knowledge, compared with 39.5% for the total sample) than other groups. This local knowledge stemmed from everyday practices by locals as natural-born stewards of the landscapes (Folke et al., 2005), rather than through formal education. While locals may have an incomplete understanding of ecosystems, they have actually been practicing adaptive management in their long-term relationships with the landscapes (Olsson et al., 2004) and have developed good knowledge about the provisioning ES and cognitive ES that they highly concentrated. Currently, the collective land in QCP is retained, yet the park is under planning and management control by the government and its commissioned state-owned enterprises, and this top-down management model may overlook local knowledge. While the transition of local livelihoods is encouraged, the QCP and many country parks contain agricultural systems with a history of thousands of years and are protected by China's land policy (SMAPLR and SUPDRI, 2015). Thus, work positions and practice opportunities should be created for locals. Practice opportunities can concern local knowledge of provisioning ES and cognitive ES that were highly prioritized by locals, such as which foods could be produced in the park and how cultural heritage could be restored. In addition, this knowledge can also be shared through meetings and discussions in the process of adaptive management.

3) Provide education initiatives

While country parks need to have a general solution to improve ES that received more concern in the total sample, users have their priorities as mentioned above and some valued less about those ES. Our results show that among ES of concern in the total sample, locals perceived habitat/aesthetic as low priorities for management, and visitors from more distant perceived water and air quality maintenance as a low priority (Table 4). This may prevent them from understanding the general development of the park and cause potential conflicts. Moreover, some scholars argued that establishing management decisions only on these perceptions could be detrimental, since users' information about the environment and understanding of the benefits that ecosystems provide to society may be inadequate and incomplete (Ruiz-Frau et al., 2018). As we have formulated ecotourism development goals for the park, there is a need to improve users' awareness and understanding of the related ES to ensure the general management and protection of the park. In this regard, educational initiatives are of great importance. Education projects could be developed for more distant visitors, which would correspond to the education ES they highly considered and also raise their awareness of environmental capacities. For locals, the role of habitat and aesthetic ES should be elaborated and made understood through education initiatives. Meanwhile, agricultural production is also one of the purposes of country park development, and locals have high priorities for the improvement of provisioning ES such as food products, but this could partly disturb ecosystem conservation in the park. In this case, educational programs can be applied for the introduction and training of alternative livelihoods and to gradually guide locals' adaptation to livelihoods supported by regulating and cultural ES (Dehghani Pour et al., 2023; Zhang et al., 2020). These educational initiatives can be provided mainly based on "scientific knowledge", that could complement the local knowledge discussed earlier (Raymond et al., 2010).

4) Foster multifunctional landscapes

Landscapes that provide diverse ES to a broad range of beneficiaries are multifunctional and critical to human well-being (Fagerholm et al., 2020; Fischer et al., 2017). Fostering multifunctional landscapes could be based on landscape features on the one hand, and our study found that semi-natural landscape features such as lakes and rivers, marsh, and swamp forest, were perceived as providing more ES than other human-made landscape features. Therefore, by relying on a more natural and less artificial approach, ecological restoration could be applied to conserve landscape features in the park to deliver diverse ES. On the other hand, the landscape as a composition of different features should be considered. Different users in our study varied in their perceptions of the ES provided by landscape features, and multifunctional landscapes were characterized by diversified landscape features that could mitigate trade-offs to some extent and provide more equity outcomes (Jiren et al., 2020), for example, by developing coexist landscapes for ecological conservation, agricultural production, and recreational activities in the QCP that meet its purposes. In this way, they provide bases for supporting ecotourism development, local sustainable livelihoods, and social–ecological resilience that we proposed above.

5. Conclusions

A three-step research process was developed in this study to integrate ES perceptions in adaptive country park management. As practical and convenient tools, the IPA mental maps and ES indexes provide managers with a guiding picture of prioritizing ES and protecting landscapes. The assessment of perceptions should be ongoing and the ES and landscape features selected can be revised in the subsequent iterative process. This adaptive management framework also supports disaggregation into different beneficiary groups, and incorporates pluralistic perspectives. In this regard, our study uncovered users' different perceptions and prioritizations of ES for the park and various landscape features. Thus, in management and decision-making, there is a need to increase users' participation or raise their awareness in cases where their perceptions differ from the general improvement target, thereby mitigating potential conflicts and promoting environmental justice.

Future research would need to address several limitations and challenges in this study. First, how to determine the categorization of users in different contexts? Our study derived user groups according to their proximity to the study area, and follow-up studies could further consider other individual characteristics to obtain potential user groups. Second, how to measure the perceived importance and performance of ES more accurately and validly? In this study, we used the Likert scale, which may lead to the "ceiling effect" of relatively high ratings of importance and performance, as well as the proximity of results between these two dimensions. Future research may require the ranking of perceptions of question items as a complement to the rating (Malinauskaite et al., 2021) and explore pathways to incorporate them into the IPA. Third, how to perform spatially explicit measures of perceived ES of different landscape features? Photo-elicitation applied in this study allows for the involvement of visitors who may not be familiar with the geography of the park (van Berkel and Verburg, 2014), but does not reveal the complex spatial heterogeneity of potential ES. In this regard, combining it with participatory mapping approaches has the potential for future research. Addressing these issues would enable better integration of ES perceptions in the adaptive management of country parks and other peri-urban green spaces.

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

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ecoser.2023.101522.

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