Exploring preferences for biodiversity and wild parks in Chinese cities

Citation for published version:
Hu, X, Lima, MF & McLean, R 2022, 'Exploring preferences for biodiversity and wild parks in Chinese cities: A conjoint analysis study in Hangzhou', *Urban Forestry and Urban Greening*, vol. 73, 127595. https://doi.org/10.1016/j.ufug.2022.127595

Digital Object Identifier (DOI):
10.1016/j.ufug.2022.127595

Published In:
Urban Forestry and Urban Greening

Exploring preferences for biodiversity and wild parks in Chinese cities: A conjoint analysis study in Hangzhou

Abstract

There has been a transformation of value orientation from an anthropocentric to eco-centric view in Chinese urban park design. Biodiversity enhancement has been increasingly seen as a prioritised park design aim by landscape designers. This promotes the rise of a novel park style with wild, less manicured appearance in cities, which shows strong contrasts to the traditional park style with ornamental, manicured characteristics. However, in this urban park transformation process, people's opinion has been almost ignored. This research investigated the importance of biodiversity compared with other relevant urban park attributes (i.e., Facilities, Woodlands, Maintenance, and Seasonal views) identified from preliminary focus groups. The research further predicted preferences between wild and traditional urban parks. Conjoint analysis was used to address these questions. Five urban park attributes (i.e., Biodiversity, Facilities, Woodlands, Maintenance, and Seasonal views) were included in the conjoint questionnaire survey. The survey (N=187) was conducted with the public and ecology/landscape professionals in Hangzhou, China. Results showed that for professionals, biodiversity was the most important attribute relative to others; for the public, both facilities and biodiversity were the most important attributes. Preferences for the two park styles varied between the two groups: professionals preferred wild parks, whereas the public preferred traditional parks. Yet, public preferences for wild parks were enhanced by improving maintenance levels and providing recreation facilities. The study concluded the appreciation of biodiversity among both the public and professionals. Differences in professional preferences for wild parks compared to the public should be considered when professionals design wild parks in the future.

Keywords: Conjoint analysis; Park style; Preferences; Professional versus the public comparison; Urban biodiversity

1. Introduction

1.1 From the traditional to wild style: biodiversity-led urban park transformation

Historically, traditional Western urban parks fulfil human needs such as aesthetic enjoyment, social mingling, and recreation/physical exercise (Ward Thompson, 1998; Cranz and Boland, 2004; Mclean, 2020). Apart from their anthropocentric functions, some historic traditional parks, e.g., English-style historic parks, can contribute to urban biodiversity conservation today (Cornelis and Hermy, 2004). Such traditional parks have ornamental, manicured characteristics with flowerbeds, lawns, and orderly planting layouts. Owing to the increasing urban biodiversity loss and multiple benefits of biodiversity such as providing ecosystem services, connecting people with nature, and enhancing human well-being (Dearborn and Kark, 2010; Keniger et al., 2013), conserving and promoting biodiversity have become a pressing issue in contemporary cities (Miller, 2005; Grimm et al., 2008). Creating and managing urban green spaces (UGSs), notably parks, have been recognised as a critical component for enhancing urban biodiversity in the past 20 years (Müller and Werner, 2010; Aronson et al., 2017). A variety of biodiversity-based design theories have emerged, including *co-habitat* (Orff, 2016), *animal-aided design* (Weisser and Hauck, 2017), *intended wildness* (Hwang and Yue, 2019), and *biodiversity-friendly design* (Palliwoda et al., 2017; Ignatieva, 2018; Fischer et al., 2020; Kowarik et al., 2020).

Prioritising biodiversity enhancement may potentially conflict with other attributes involved in park design such as maintenance/neatness, scenic aesthetic, and recreation. Though biodiversity can exist in highly managed UGSs, studies suggest that reduced maintenance intensity supports higher biodiversity levels (Rudolph et al., 2017; Müller et al., 2018). In this sense, biodiverse environments tend to be (albeit not always) linked with lower maintenance intensity, appearing wild, despite that they can also look ordered and can be maintained with higher degrees of care and ecological knowledge. Research has shown that biodiversity is preferred by residents (Fischer et al., 2018), but orderly frames are important (Nassauer, 1995; Fischer et al., 2020). Though a convergence can happen, biodiversity enhancement often conflicts with scenic aesthetic which is usually associated with a neat, ornamental character of landscape beauty (Nassauer, 1995; Gobster et al., 2007; Ignatieva, 2018). Potential conflicts between biodiversity improvement and recreation amenity provision can arise in urban park design (Kowarik and Langer, 2005; Qiu et al., 2013), and prioritising biodiversity may compromise the perceived appropriateness for recreation (Bjerke et al., 2006; Fischer et al., 2020).

Prioritising biodiversity enhancement in urban park design tends to create a novel park style with wilder, less manicured appearance compared to the traditional park style. In this paper, the term "wild parks" refers to this park style/type which is designed for enhancing urban biodiversity, and has wild, less manicured qualities, vegetation with complex structures and compositions (e.g., multi-layered dense vegetation), and few artificial recreation/play facilities or attractions. This concept of wild parks also includes the existence of maintenance interventions and recreational activities. "Traditional parks" are defined as parks designed for anthropocentric purposes, and marked by intensive maintenance, ample facilities or attractions, and vegetation with relatively simple structures and compositions (e.g., open lawns scattered with single-tiered trees). While the concept of "biodiversity" embraces the habitat, the species, and the gene levels, this study defines biodiversity as the diversity between species at the species level, i.e., species richness. Species richness has been frequently used by studies as a biodiversity indicator (Qiu et al., 2013; Fischer et al., 2018).

The design of wild parks involves several specific strategies, including conserving existing remnant pristine and/or novel ecosystems, restoring degraded ecosystems, and creating new ecosystems (Kowarik, 2011; Kowarik, 2018). There is an increasing focus on rewilding that advocates replacing human intervention with natural succession (Navarro and Pereira, 2012; Corlett, 2016). Though the research of rewilding is usually concentrated in the rural ecosystem, it has become an important measure for urban parks to improve biodiversity, especially through the use of natural vegetation (Kühn, 2006; Del Tredici, 2010; Hwang and Yue, 2019). Another approach is the combination of intervening in parts of the site and allowing natural processes to dominate in other parts, e.g., Natur Park Südgelände (Kowarik, 2018).

1.2 Wild parks in Chinese cities

Since the economic reforms of 1978, a large number of traditional parks have been built within Chinese cities, which feature manicured lawns, flower beds and artificial facilities/structures (Fig. 1). Meanwhile, massive natural habitats have been degraded due to rapid urbanisation, posing a serious threat to biodiversity (Wu et al., 2014; Yang et al., 2016). Urban greening policies have started to highlight biodiversity enhancement. For example, *Outline of Urban Green Space System Planning (Trial)* incorporates biodiversity enhancement and endangered species protection as a core part of UGS planning and design (Ministry of Housing and Urban-Rural Development of the People's Republic of China, 2002). The attention to urban biodiversity also involves the consideration of the importance of biodiversity on human wellbeing (Yang et al., 2016; Yang, 2020). As Chinese cities become more and more artificial and denser, residents risk being increasingly disconnected from biodiverse nature in daily lives, threatening people's physical and mental health (Yuan, 2021).

In China, though urban remnant novel ecosystems tend to be eradicated and redeveloped for utilitarian uses (Hu and Lima, 2019), some wild park projects have made efforts to conserve such ecosystems, for example, Jiangyangfan Eco-Park in Hangzhou (Fig. 2a) and Qunli Wetland Park in

Harbin (Fig. 2b). Strong attention has been paid to restoring and/or creating ecosystems to form different wild park types such as wetland park and forest park. By early 2018, 58 national urban wetland parks have been designated (Feng et al., 2019). Rewilding has been introduced in recent wild park projects, with a distinct emphasis on the use of native species (Yuan et al., 2021).

Fig. 1. Traditional parks in Chinese cities (photos were taken by the authors).

Fig. 2. Wild parks in Chinese cities. (a) Jiangyangfan Eco-Park; (b) Qunli Wetland Park (photos were taken by the authors).

1.3 Preferences for biodiversity and the wild style of designed urban green spaces

Within the urban park transformation from the traditional to wild style/type in China, a few scholars investigated how Chinese people prefer biodiversity and the wild park style (e.g., Li et al., 2019), but this question has not been sufficiently clarified in China (Zhong et al., 2021). A better understanding of people's attitudes towards biodiversity and wild parks is essential for designing policies and strategies supporting biodiversity.

While a few Western studies have shown the public appreciates urban biodiversity (Fischer et al., 2018; Fischer et al., 2020), the question of how people prefer and value the importance of biodiversity compared with other park attributes (e.g., facilities, maintenance/neatness, scenic value, etc) remains open. Research has shown facilities, beauty, and accessibility are more important than biodiversity (Voigt et al., 2014; Bertram and Rehdanz, 2015). Madureira et al., (2018) found maintenance is more important than biodiversity, whereas van Vliet et al., (2021) found the diversity of flowers in flowerbeds (which they termed as "biodiversity") and the number of trees are the most important park attributes. The relative importance of biodiversity compared to other park attributes is still an open question, and that this relationship has not yet been sufficiently clarified in Chinese cities. Studies have shown that ecology/landscape professionals are more likely to prefer biodiversity (Lindemann-Matthies et al., 2014) or certain aspects of biodiversity, e.g., woodland edges, deadwoods (Qiu et al., 2013), spontaneous plant biodiversity (Muratet et al., 2015), or wilder UGSs (Hwang et al., 2019), compared to the public. This might because professionals possess more ecological knowledge than the public, and this knowledge may play a significant role in shaping preferences for biodiversity.

A number of Western studies have examined preferences between wild and traditional styles of designed UGSs (e.g., Özgüner and Kendle, 2006, Qiu et al., 2013 for parks; Lindemann-Matthies and Marty, 2013 for gardens; Zheng et al., 2011 for residential landscapes; Kaplan, 2007 for business landscapes). Taken as a whole the research shows inconsistent results with a mixed picture. However, the majority supports a general conclusion that the traditional style is preferred over the wild. Research also suggests the importance of care and accessibility (Nassauer, 1995; Jorgensen et al., 2007; Hofmann et al., 2012; Ward Thompson et al., 2013; Hwang et al., 2019) in enhancing preferences for the wild style.

There might be conflicts between the public and professionals regarding preferences between wild and traditional styles of UGSs. There is evidence that professionals prefer the wild (Zheng et al., 2011;

Hofmann et al., 2012; Hwang et al., 2019), probably because they concern more about ecological aspects of UGSs. The public, however, tends to prefer the traditional due to its neatness and the higher degree of space usability for everyday activities (Zheng et al., 2011; Hofmann et al., 2012). In wild UGSs, elements such as traces of neglect and litter might mask biodiversity impacts (Nassauer, 1995; Fischer et al., 2018). By excluding such elements, Fischer et al., (2018) have clearly identified biodiversity was indeed preferred. Studies have reported that the public can correctly recognise biodiversity (Fuller et al., 2007; Qiu et al., 2013), but the ecological knowledge can be a significant factor influencing perceptions of and preferences for biodiversity (Qiu et al., 2013).

Some Chinese studies have reported the lower importance attached to biodiversity in UGSs by the public (Jim and Chen, 2006a; Jim and Chen, 2006b; Zhang et al., 2020), whereas others have found the appreciation of biodiversity (Gao et al., 2019), and biodiversity is even more important than recreation facilities (Chen et al., 2018) and cultural services (Yang, 2021). A few studies have shown that while lawns and flowerbeds are preferred over spontaneous vegetation by the public, professionals hold more positive attitudes towards spontaneous vegetation (Jiang and Yuan, 2017; Li et al., 2019). Jim and Chen (2006b) have reported a preference for the naturalistic–ecological over traditional park style in Guangzhou. People's preference for biodiversity and wild parks is still unclear in China, since previous studies are not sufficient and have reported ambiguous results (e.g., Jim and Chen, 2006b; Zhang et al., 2020 vs. Chen et al., 2018; Yang, 2021) which requires further research.

Based on the previous studies, we concluded that (1) a nuanced understanding of the importance of biodiversity relative to other park attributes and preferences between wild and traditional park styles in the Chinese context is needed; (2) there is a lack of research on the comparison between public and professional preferences for biodiversity and wild parks in China. The comparison helps to understand if the two groups have conflicting preferences, which is important for providing implications for future park design that addresses public needs.

1.4 Research questions

This research aims to investigate the importance of biodiversity in urban parks, compared to other park attributes. In detail, we asked:

(1) What is the importance of biodiversity in urban parks compared to other park attributes from the perspectives of the public versus professionals?

(2) What are the preferences between wild parks and traditional parks from the perspectives of the public versus professionals?

(3) What environmental interventions or changes would make wild parks more attractive?

2. Methods

2.1 Study area

The study was conducted in Hangzhou, an eastern Chinese city. By the end of 2020, the population of permanent residents was 12.0 million (Hangzhou Municipal Statistical Bureau, 2021). Rapid urbanisation in Hangzhou has destroyed or damaged many urban natural ecosystems. As a consequence, Hangzhou natural grassland change rate was as high as 70% from 2000 to 2010 (Zhang et al., 2020). In response to the deterioration of urban ecosystems, Hangzhou has made an effort towards incorporating ecological and biodiversity concepts in UGS planning and design. Policies such as *Key Points of Natural Ecological Protection in Hangzhou (2020)* (Hangzhou Municipal Ecology and Environment Bureau, 2020) and *Action Plan for High-level Promotion of Land Greening and Beautification in Hangzhou (2019-2022)* (Hangzhou Municipal Government, 2019) indicate biodiversity enhancement is the focus in UGS planning and design. Different wild park types such as forest park, wetland park, and heritage tree park are high on Hangzhou's urban agenda. These active efforts have earned Hangzhou a national reputation as a leader in ecological UGS planning and design compared to other Chinese cities (Wolch et al., 2014; Byrne et al., 2015).

The study focused on Hangzhou's urban region. According to Master Plan of Hangzhou (2001-2020) (Hangzhou Municipal Government, 2001), Hangzhou's urban region has 8 administrative districts, including Shang Cheng, Xia Cheng, Jiang Gan, Gong Shu, Xi Hu, Bin Jiang, Xiao Shan, and Yu Hang (Fig. 3). The study was conducted in these districts.

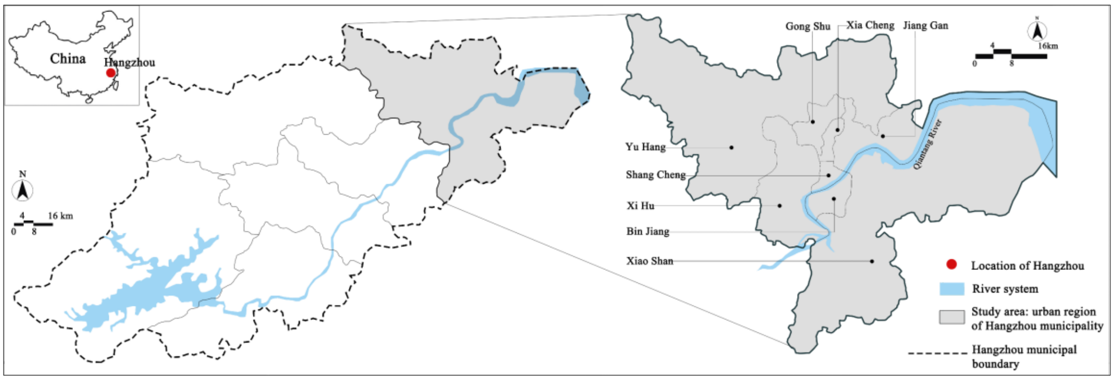


Fig. 3. Study area in Hangzhou (source: the authors).

2.2 Conjoint analysis

Conjoint analysis, a quantitative method for studying how people trade off importances of multiple attributes of an object and how people respond to different object scenarios composed of varying levels of several attributes, was used (Aspinall et al., 2010; Orme, 2010; Lima, 2016; Ward Thompson, 2016; Lima et al., 2020). Conjoint analysis is conducted through the conjoint questionnaire, which involves a number of choice tasks by presenting participants with various object scenarios and asking participants to choose their preferred one. Each scenario consists of attributes of interest at some level. The levels are descriptions of the varying possibilities in the attribute.

Compared with conventional questionnaires/interviews that ask each attribute in a separate and direct way, conjoint analysis works in a de-compositional way by examining joint effects of attributes (Aspinall et al., 2010; Lima, 2016; Ward Thompson, 2016; Lima et al., 2020). This de-compositional approach reflects the way people make trade-offs in real life, which is more reliable in judging comparative importances than conventional questionnaires/interviews.

Attributes used should cover all the important aspects of the object under study, including aspects involved in research questions, and/or the aspects that participants consider important. In this study, urban park was the "object." Biodiversity was first set as one park attribute, since it is involved in research questions. Consistent with previous conjoint analysis research (Aspinall et al., 2010; Lima et al., 2020), this study used preliminary focus groups to identify other relevant park attributes. Focus groups were carried out in Hangzhou in April and June 2020 to explore park aspects that group members considered important and influenced their park preferences. We included top five frequently mentioned aspects as attributes in this study: Biodiversity (this was first set as the attribute used), Facilities, Woodlands, Maintenance, and Seasonal views. Other aspects were excluded, since they were not that frequently mentioned, and the inclusion of all aspects would generate cognitive burden for respondents in responding to conjoint questionnaires. Different levels of all the attributes except for Seasonal views included the main characteristics of wild parks and traditional parks, and these attributes and levels can be practically used for designing wild and traditional parks. The description of attributes and levels is in table 1. Levels of the attribute Seasonal views were inspired by quotes from group members.

Table 1. Attributes and levels in this study.

Attributes	Levels
Biodiversity	1. Species rich flora and fauna 2. Species moderate flora and fauna 3. Species poor flora and fauna
Facilities	1. Supporting facilities (e.g., resting facilities) & recreation/play facilities 2. Supporting facilities (e.g., resting facilities), no recreation/play facilities 3. Few facilities
Woodlands	1. Wooded areas with dense trees 2. Open areas with some trees 3. Sparse trees
Maintenance	1. Well-maintained, neat-looking 2. Moderate-maintained, less neat-looking 3. Low maintenance, wild-looking
Seasonal views	1. Spring flowers 2. Summer green canopy trees 3. Autumn colourful (such as golden or red) foliage 4. Winter branch-trunk viewing plants/conifer trees

2.3 Conjoint questionnaire design and pilot study

The research used Adaptive Choice-Based Conjoint (ACBC), the latest conjoint analysis version (Orme, 2010; Lima, 2016; Lima et al., 2020). ACBC permits the use of five or more attributes. The software for designing web-based ACBC questionnaires was provided by Sawtooth Software on an academic grant. Words rather than images were used in ACBC questionnaires to describe attributes because of the following reasons. First, using texts enables respondents to focus on all park attributes equally and not be distracted by other elements featured in images that are more prone to be visually seductive (e.g., lighting, composition, colour, etc.) (Aspinall, 2010; Lima, 2016; Ward Thompson, 2016). Using texts enables respondents to envisage attributes and levels cognitively based on real-life park experiences. Second, within conjoint analysis, the use of images is more suitable when attributes are related to aspects which are sensitive to the image processing brain system, e.g., size of objects (Paivio, 1991; Lima, 2016; Lima et al., 2020). Attributes in our study are not related to size, and can be described in texts. The text approach has been used by conjoint analysis studies in fields of landscape planning and design (Aspinall et al., 2010; Lima, 2016; Veitch et al., 2017; Lima et al., 2020; Veitch et al., 2022). However, we understand the text approach relies on the respondent's ability to imagine parks, which might not be straightforward. This is one of the limitations of this study. On how consistently people imagine different levels, especially for different levels of the attribute biodiversity, our preliminary focus groups revealed people were able to distinguish different levels of biodiversity at a coarse scale, and their distinction for each level involved a few consistent words (e.g., higher levels of biodiversity: "rich in plant and animal species" vs. lower levels of biodiversity: "lack of diverse plants and animals").

The initial ACBC questionnaire was piloted twice in October, 2020 with conjoint analysis experts, landscape professionals, and the public. The pilot aimed at verifying whether the questionnaire was unambiguously worded, whether the use of words to represent attributes was feasible, whether the questionnaire was too long, and whether respondents could correctly understand the questionnaire. After the pilot, several refinements were added to make the questionnaire user-friendlier. Pilot results were not used in data analysis.

The final ACBC questionnaire included six parts. The first part was *Introduction*. It contained a brief introduction of the research, information about the anonymity, and a description of attributes and levels. The second part was *Build-Your-Own (BYO)* where respondents were asked to select their preferred level for each attribute and to "build" their idealised park scenarios. The third part was *Screening*. The Sawtooth software program behind the questionnaire selected an array of text-based park scenarios for respondents' evaluation from a pre-developed matrix of scenarios. This matrix was developed when we designed the ACBC questionnaire, and it equalled the number of all possible combinations between different levels of the five attributes. Determined by the algorithm within the software, the scenario selection was based on the answers to the *BYO* section and also covered the full range of levels. Since the *BYO*-specified ideal scenario differed across respondents, the questionnaire was customised and it was generated on-the-fly for each respondent. During *Screening*, the software scanned respondents' answers to see levels that were constantly avoided (*Unacceptables*) or were absolute requirements (*Must-Haves*) for parks. This process ensured remaining scenarios tailored to each individual's needs. The fourth part was *Choice Task*. A series of 13 choice tasks were presented. Each task included two park scenarios and respondents were asked to choose the preferred one. The final part asked respondents' socio-demographic information, including gender, age, residential district in Hangzhou, education, marital status, and professional background.

2.4 Main survey process

The main survey was conducted in November 2020, and in January and April 2021. ACBC questionnaires, in Chinese, were distributed among dwellers living within the eight survey districts. The survey covered all districts to avoid over-sampling within one district. Due to the impact of Covid-19, field surveys were combined with online surveys. For field surveys, participants above 18 years old were randomly recruited in various public spaces in each survey district. Since the ACBC questionnaire is web-based, all field survey questionnaires were undertaken on researchers' computer. Online surveys were carried out with neighbourhood residents and ecology/landscape professionals. ACBC questionnaires were uploaded to Sawtooth Software Hosting Server and a questionnaire link was generated. With the assistance of several community committees, more residents entered the web survey with the questionnaire link. To recruit professionals, staff from Zhejiang University, Zhejiang Wilderness Nature Education, Zhejiang Museum of Natural History, Hangzhou Municipal Bureau of Garden and

Cultural Relics were contacted through emails and Wechat. As the response rate was relatively low, other professionals were recruited through personal contacts.

A total of 245 respondents entered the survey. The total number of valid questionnaires for the final analysis was 187 (112 face-to-face and 75 online): public participants (N=147) and professional participants (N=40). The sample size of professional participants met the rule of thumb that sample size should be larger than 30 for statistical analysis (Roscoe, 1975; Sekaran, 1992). Moreover, ACBC study can achieve reliable results with a smaller sample size (Orme, 2010; Lima, 2016; Lima et al., 2020; Veitch et al., 2022), about one-third of the sample size needed for a Choice-Based Conjoint (CBC) study (with the same questionnaire settings as ACBC study), another conjoint analysis version (Jervis et al., 2012). The one-third threshold by referring to CBC sample sizes has been used for estimating appropriate sample sizes for ACBC study (Lima, 2016; Lima et al., 2020). The sample size required for a CBC study is usually estimated using the formula: $nta/c>500$, where n=number of respondents, t=number of choice tasks (t=13 in this study), a=scenarios per choice task (a=2 in this study), c=largest number of levels of an attribute (c=4 in this study). It was deduced that n should be larger than 77 and the threshold of one-third of n was 26. Both public and professional group sample size surpassed the threshold of 26 participants.

2.5 Data analysis

Descriptive analysis for the sample was conducted using SPSS Statistics version 25. ACBC data was analysed with Hierarchical Bayes (HB) model and choice simulation within Sawtooth Software Lighthouse Studio version 9.8.1. HB model generated two sets of data: utility value and average attribute importance. Based on the two sets of data, choice simulation was used to predict preferences between wild and traditional parks. Using different attribute levels that characterise the two park styles, various wild and traditional park scenarios were created. Then these scenarios were grouped into a wild park group and a traditional park group. By using choice simulation, preferences between the two park groups were compared and which park group respondents would choose/prefer was predicted. The result "share of preference" (%) for a group indicates how many respondents (%) "vote" (i.e., prefer) for that group. The sum of shares of preferences for the two groups equals 100 percent.

The main characteristics for describing wild and traditional park scenarios were summarised from previous research (Zhang & Zhang, 2002; Özgüner et al., 2007; Ignatieva, 2018) and interviews with experts. The main characteristics of wild parks include species diversity, fewer recreation and artificial amenities, vegetation with complex structures and compositions (e.g., multi-layered dense vegetation), a lower maintenance intensity, whilst the main characteristics of traditional parks include limited species diversity, more artificial amenities, vegetation with simple structures and compositions (e.g., open areas with single-tiered trees scattered), and a high maintenance intensity. Correspondingly, for data analysis, wild park scenarios were created using levels "species rich flora and fauna," "supporting facilities, no recreation/play facilities" and "few facilities," "wooded areas with dense trees" and "open areas with some trees," "moderate-maintained, less neat-looking" and "low-maintenance, wild-looking" and the four levels of the attribute Seasonal views. This specification generated 32 wild park scenarios and all of them were grouped into a wild park group. Traditional park scenarios were created using "species moderate flora and fauna" and "species poor flora and fauna," "supporting facilities & recreation/play facilities" and "supporting facilities, no recreation/play facilities," "open areas with some trees" and "sparse trees," "well-maintained, neat-looking" and the four levels of the attribute Seasonal views. This generated 32 traditional park scenarios and all of them were grouped into a traditional park group.

Levels of each attribute (except for Seasonal views) that describe wild parks (baseline levels) were then changed (while holding other attributes' levels specified in wild park scenarios constant) to levels of the respective attribute of traditional parks to observe changes in share of preference from wild park scenarios to the changed wild park scenarios. For example, "moderate-maintained, neat-looking" and "low-maintenance, wild-looking" were changed as "well-maintained, neat-looking" (holding other attributes' levels specified in wild park scenarios constant). When changing "facilities" levels in wild parks, "supporting facilities, no recreation/play facilities" and "few facilities" were changed as "supporting facilities & recreation/play facilities" (holding other attributes' levels specified in wild park scenarios constant). This analysis explores effective changes of attribute levels in wild parks (i.e., environmental interventions for wild parks) that would increase wild park preferences, offering practical solutions to park designers and managers about how to intervene to maximise wild park appreciation.

In order to check whether there were statistically significant differences between public and professional groups, parametric Independent Samples T test was used when both variables showed a normal distribution, and non-parametric Mann Whitney U test was used when one or two of the variables did not show normal distributions. To test if there were statistically significant differences between variables within each group, parametric Paired Samples T test was carried out if the difference between the variables to be tested was normal, and non-parametric Wilcoxon test was used when the difference between the variables to be tested was non-normal. Statistical significance was set at 0.05.

3. Results

3.1 Descriptive analysis of participant characteristics

In the public group, participants were almost equally distributed by gender (Table 2). 36.1%, 40.8% and 23.1% of public participants respectively fall within younger adult (aged 18-34), middle-aged adult (aged 35-59), and older (aged 60+) groups. Undergraduate degree was the most represented education group (43.5%) in the public sample. 68.0% of public participants were married. In the professional group, male participants (55.0%) slightly outnumbered females (45.0%). The younger adult group was the largest (60.0%). Postgraduate degree or higher was the most represented education group (65.0%). 45.0% were married.

Table 2. Hangzhou participant characteristics.

	General public (N=147)		Ecology/landscape professional (N=40)	
	N	%	N	%
Gender				
Male	70	47.6	22	55.0
Female	77	52.4	18	45.0
Age				
Younger adults (Aged 18-34)	53	36.1	24	60.0
Middle-aged adults (Aged 35-59)	60	40.8	11	27.5
Older (Aged 60+)	34	23.1	5	12.5
Education				
High school or below	31	21.1	2	5.0
Junior college	32	21.8	3	7.5
Undergraduate degree	64	43.5	9	22.5
Postgraduate degree or higher	20	13.6	26	65.0
Marital status				
Married	100	68.0	18	45.0
Single/other (including cohabitated and divorced)	47	32.0	22	55.0

3.2 Average importances of park attributes

For the public group, “facilities” (24.2; 95% CI=22.7, 25.6) and “biodiversity” (23.8; 95% CI=21.9, 25.8) were the most important attributes (Fig. 4). These two attributes were followed, by “maintenance” (20.0; 95% CI=18.4, 21.6) and “woodlands” (19.2; 95% CI=17.9, 20.5), which did not differ significantly in importance from each other ($p>0.05$; for details, see Table S1). “Seasonal views” was the least important attribute relative to other attributes (12.8; 95% CI=11.8, 13.8). For professionals, “biodiversity” (27.9; 95% CI=24.3, 31.5) was the most important attribute (Fig. 4). This was followed, by “facilities”

(22.2, 95% CI=19.1, 25.3), "maintenance" (19.2, 95% CI=16.7, 21.7), and "woodlands" (19.2, 95% CI=16.6, 21.8), which did not differ significantly from each other in importance (p>0.05; for details, see Table S1). "Seasonal views" was the least important attribute compared to others (11.5, 95% CI=9.6, 13.3). There were no significant differences in the importance of any attribute between public and professional groups (all ps>0.05. Fig. 4; for details, see Table S2).

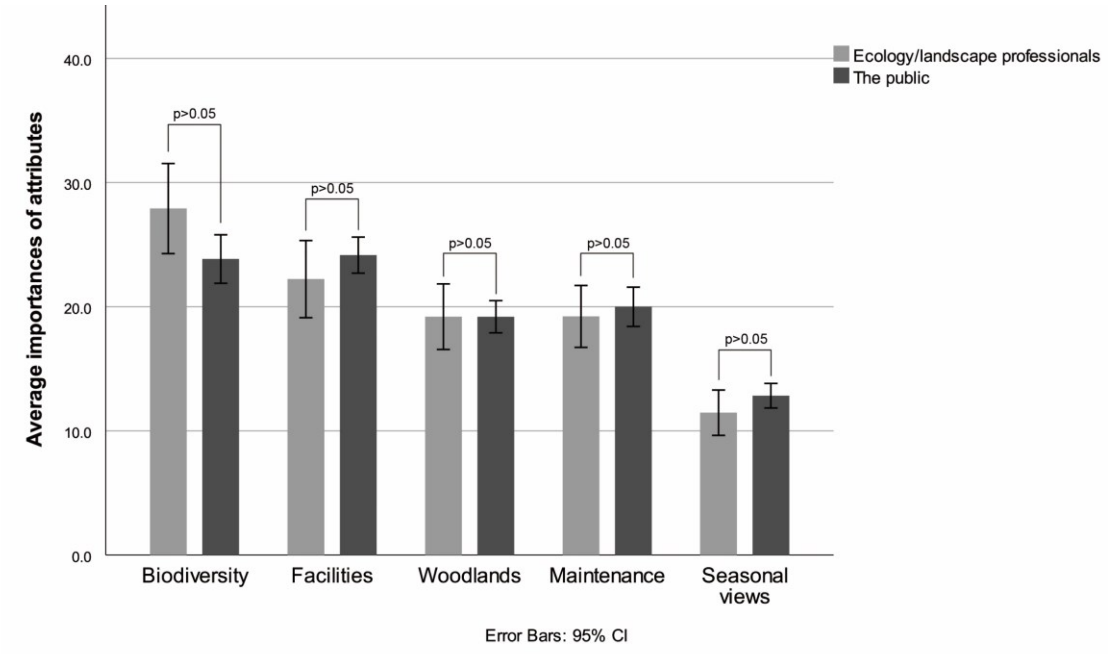
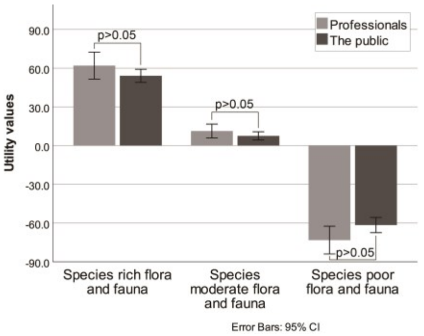


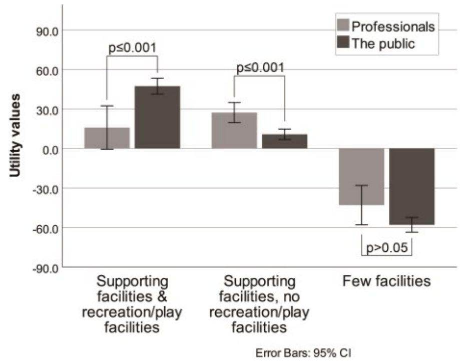
Fig. 4. Average importances of park attributes. The p values refer to the differences between the public versus professionals regarding each attribute importance. For details of p values, see Table S1 and S2.

3.3 Preferences between wild and traditional parks

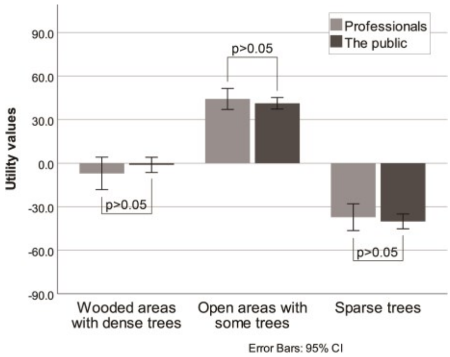
Utility value for each level of five attributes (Fig. 5) and tests of significant differences between utility values show that "species rich flora and fauna," "supporting facilities & recreation/play facilities," "open areas with some trees," "well-maintained, neat-looking," "autumn colourful foliage" and "spring flowers" were the most preferred level(s) for their respective attributes in the public group (for details see Table S3). For professionals, "species rich flora and fauna," "supporting facilities, no recreation/play facilities" and "supporting facilities & recreation/play facilities," "open areas with some trees" "moderate-maintained, less neat-looking," and "autumn colourful foliage" were the most preferred level(s) for their respective attributes (for details see Table S3). The public highly significantly preferred "supporting facilities & recreation/play facilities" than professionals (p≤0.001), and "supporting facilities, no recreation/play facilities" was highly significantly favoured by professionals (p≤0.001, Fig. 5b). "Moderate-maintained, less neat-looking" was significantly preferred by professionals (p≤0.05), and "low maintenance, wild-looking" was highly significantly preferred by this group (p≤0.001), whereas "well-maintained, neat-looking" was highly significantly preferred by the public (p≤0.001, Fig. 5d). The public also significantly preferred "spring flowers" than professionals (p≤0.05, Fig. 5e; for details see Table S4).



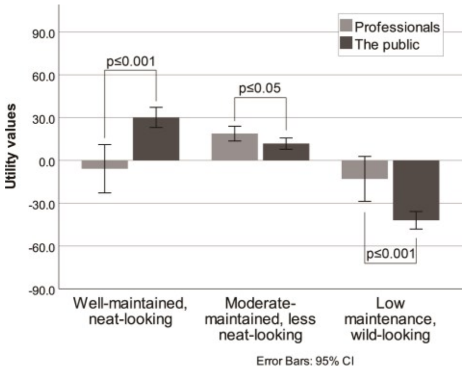
(a) Biodiversity



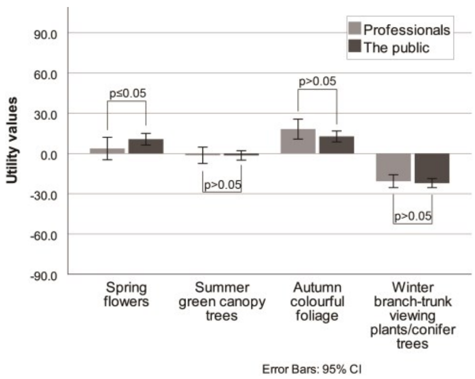
(b) Facilities



(c) Woodlands



(d) Maintenance



(e) Seasonal views

Fig. 5. Utility value for each level of (a) biodiversity, (b) facilities, (c) woodlands, (d) maintenance, (e) seasonal views. The p values indicate the differences between public and professionals regarding each attribute level. For details of p values, see Table S3 and S4.

In the public group, traditional parks captured a share of preference at 56.9% (95% CI=50.4%, 63.3%), and wild parks received a preference share at 43.1% (95% CI=36.7%, 49.6%) (Fig. 6). Traditional parks were significantly preferred than wild parks among the public (Wilcoxon test: $p \leq 0.05$). For professionals, wild parks received 68.5% of preference (95% CI=56.0%, 81.1%), which was about twice higher than the preference share at 31.5% of traditional parks (95% CI=19.0%, 44.0%). Wild parks were significantly preferred over traditional parks among professionals (Wilcoxon test: $p \leq 0.01$). Moreover, professionals highly significantly preferred wild parks more than the public (Mann Whitney U test: $p \leq 0.001$), and the public highly significantly preferred traditional parks in comparison to professionals (Mann Whitney U test: $p \leq 0.001$).

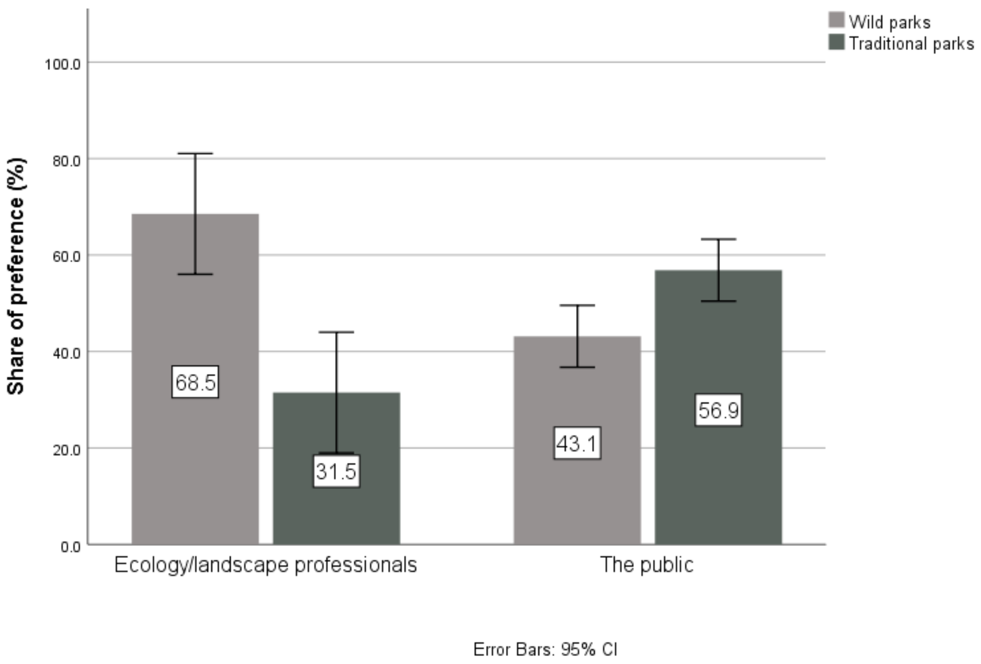


Fig. 6. Shares of preferences: comparing wild and traditional parks

3.4 Environmental interventions that would increase preferences for wild parks

Changing "biodiversity" levels in wild parks (baseline: "species rich flora and fauna," see section 2.5) to "species moderate flora and fauna" and "species poor flora and fauna" would highly significantly decrease preferences from 43.1% to 27.6% (Fig. 7) among the public (Wilcoxon test: $p \leq 0.001$). Traditional parks were still preferred over changed wild parks by the public (share of preference for traditional parks: 72.4%. Fig. 8a). Professional preferences for wild parks decreased highly significantly from 68.5% to 54.3% (Fig. 7) (Wilcoxon test: $p \leq 0.001$). Traditional parks received a preference share at 45.7% (Fig. 8a).

Changing "facilities" levels in wild parks (baseline: "supporting facilities, no recreation/play facilities" and "few facilities") to "supporting facilities & recreation/play facilities" highly significantly increased public wild park preferences from 43.1% to 59.5% (Fig. 7) (Wilcoxon test: $p \leq 0.001$), and changed wild parks were preferred over traditional parks (share of preference for traditional parks: 40.5%. Fig. 8b). No significant preference increase was found within professionals (Wilcoxon test: $p > 0.05$).

Preferences for changed wild parks were about 3 times high than traditional parks (share of preference for traditional parks: 25.0%, for changed wild parks: 75.0%. Fig. 8b).

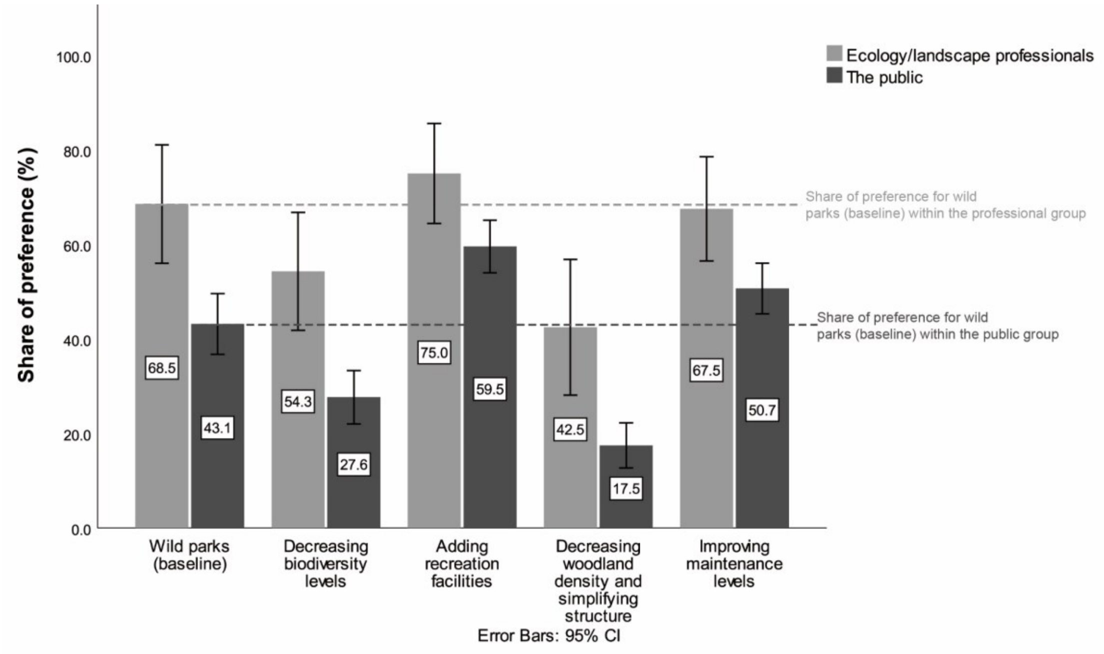


Fig. 7. Shares of preferences of wild parks (baseline), and shares of preferences of changed wild parks

The change from "wooded areas with dense trees" and "open areas with some trees" (baseline) to "sparse trees" highly significantly decreased public wild park preferences from 43.1% to 17.5% (Fig. 7) (Wilcoxon test: $p \leq 0.001$), and preferences for traditional parks were about 5 times that of altered wild parks (share of preference for traditional parks: 82.5%. Fig. 8c). For professionals, this change also highly significantly decreased wild park preferences from 68.5% to 42.5% (Fig. 7) (Wilcoxon test: $p \leq 0.001$), and traditional parks obtained a preference share at 57.5% (Fig. 8c).

Changing from "moderate-maintained, less neat-looking" and "low-maintenance, wild-looking" (baseline) in wild parks to "well-maintained, neat-looking" highly significantly increased public preferences from 43.1% to 50.7% (Fig. 7) (Wilcoxon test: $p \leq 0.001$), and traditional parks received a preference share at 49.3% (Fig. 8d). For professionals, this change would not significantly improve preferences for wild parks (Wilcoxon test: $p > 0.05$), and traditional parks were less preferred than altered wild parks (share of preference for traditional parks: 32.5%, for altered wild parks: 67.5%, Fig. 8d).

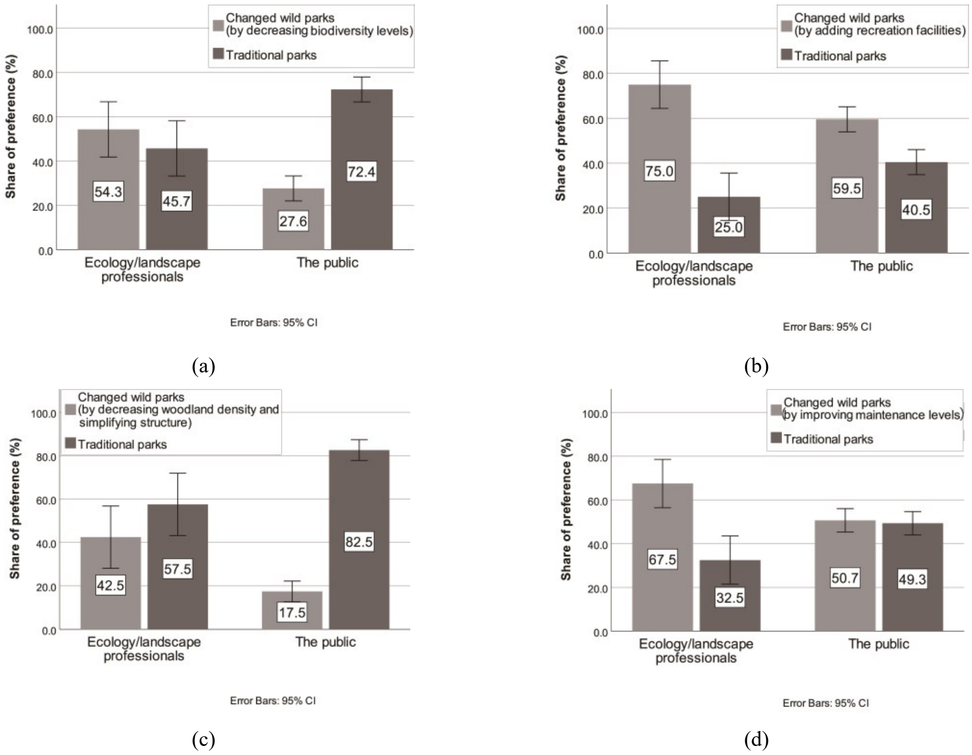


Fig. 8. Shares of preferences: comparing changed wild parks and traditional parks

4. Discussion

4.1 Importance of biodiversity compared to other park attributes

For the public in Hangzhou, both "facilities" and "biodiversity" were the most important park attributes compared to other attributes. Public respondents highly valued good facilities, aligning with the research from Jim and Chen (2006a) showing the importance of amenities in Chinese UGSs. Meanwhile, public strong appreciation of biodiversity in parks revealed by our study echoes other Chinese research (Gao et al., 2019; Yang, 2021). Gao et al., (2019) and Yang (2021) explored public preferences for biodiversity in People's Park in Baoji and Xi'xi Wetland Park in Hangzhou, respectively. Their studies focused on a particular park and their findings of public appreciation of biodiversity are site-based which limits general statements. Our study provides more general evidence of public preferences for biodiversity in the urban park context in Hangzhou. Moreover, to our knowledge, this is the first study to use the ACBC research method to investigate preferences for biodiversity in urban parks in China. The public's preference for biodiversity in Hangzhou may be attributed to environmental education directed towards the public. There are many popular environmental education institutions in Hangzhou such as "Zhejiang Wilderness" and "Wild Earth." At the same time, preferences for biodiversity might be associated with urban residents' desires for biodiverse natural environments. Rapid urbanisation in Hangzhou has damaged many local ecosystems, leading to a separation between human and biodiverse natural environments. For professionals, biodiversity was the most important attribute. This is unsurprising, since professionals who possess ecology/landscape knowledge tend to care about ecological aspects of parks. Ecology/landscape knowledge is known to have a positive influence on preferences for biodiversity (Qiu et al., 2013; Hwang et al., 2019).

From the practical perspective, public high preferences for facilities and biodiversity call attention to prioritising the two aspects in park design. Public high preferences for biodiversity partially support the emphasis on biodiversity in current park transformation in China. However, at the same time, park design should also aim to provide good facilities. Landscape designers should explore ways to promote the coexistence of biodiversity and facilities in spite of the possible conflicting relationship between the two. The design strategy of "cues to care," including adding placed fences, walking tracks, ecological-based recreation facilities (e.g., nature education signage, wildlife feeders and houses), etc., is a good choice (Nassauer, 1995; Kowarik and Langer, 2005; Hwang et al., 2019). Additionally, dividing parks into several zones with corresponding objectives and functions can enhance biodiversity and amenity in both.

4.2 Preferences between wild and traditional parks

Our study reveals a preference for traditional over wild parks in Hangzhou public participants. This echoes studies from Zheng et al., (2011), Hofmann et al., (2012), and Qiu et al., (2013), yet seems to show a difference with studies that have identified residents appreciate wilder UGSs (Jim and Chen, 2006b; Hwang et al., 2019). The difference might be attributed to different methods used and different socio-economic and cultural contexts of study areas. Moreover, though biodiversity, as described as species richness in the questionnaire, was highly preferred by the public, wild parks were less attractive compared with traditional parks. This might indicate preferences for biodiversity at the species level do not means preferences for wild parks at a larger spatial level, i.e., the ecosystem level. In our study, other features in wild parks such as low maintenance and few recreation amenities were not that attractive and counteracted the positive evaluation of biodiversity. For wild UGSs, traces of neglect and litter may mask positive biodiversity impacts (Nassauer, 1995; Fischer et al., 2018).

Among professionals, wild parks were more attractive than traditional parks, showing a difference with the public. This difference is also revealed by other studies (Zheng et al., 2011; Hofmann et al., 2012; Hwang et al., 2019). Related ecology/landscape knowledge might play a positive role as a mediating variable in shaping this difference, and professionals were probably better-informed about biodiversity benefits associated with some characteristics of wild parks, for example, the less manicured manner. This points to the importance of informative interpretive signs in wild parks to provide knowledge of biodiversity benefits associated with characteristics of wild parks. Communicating knowledge is a significant way to increase public acceptance of biodiversity and wild UGSs (Fischer et al., 2020). It is also crucial to continue environmental education, in particular, education about biodiversity benefits of wild parks, via different forms (e.g., social media, pamphlets, environmental centres, etc.) to achieve general public ecological literacy.

4.3 Environmental interventions that would increase preferences for wild parks

Our study shows public preferences for wild parks were enhanced by adding recreation facilities and improving maintenance levels, aligning with previous research about the importance of care in wild UGSs (Nassauer, 1995; Jorgensen et al., 2007; Hofmann et al., 2012; Ward Thompson et al., 2013). Future wild park designs should incorporate higher maintenance and recreation facilities based on ecological principles. This is not a means of changing wild parks into traditional parks, but rather a means of responding to human expectations in a way that benefits biodiversity. Following examples of "cues to care" for promoting the coexistence of biodiversity and facilities (see section 4.1), other examples of "cues to care" to indicate maintenance include mowing a strip along pathways, clear visible edgings, etc. (Nassauer, 1995). Natur Park Südgelände in Berlin is a good example in combining biodiversity and maintenance by defining three types of spaces: two types "clearings" and "groves" are to be maintained, and the "wild woods" type ensures unfettered natural succession (Kowarik and Langer, 2005).

4.4 Limitations and future recommendations

The conjoint questionnaire was text-based and it relied on participants' capability to imagine park scenarios, which might not be straightforward. Texts only may not be able to convert people's perception of wild and traditional parks into perceptions of attributes and levels. Future work could consider adding images when introducing some attributes and levels. Participants might have had different interpretations of attributes and levels if images were used, and that different findings could have resulted. The limited and unbalanced sample size is acknowledged. Future research should incorporate more participants and achieve relatively more balanced samples.

5. Conclusion

The findings of this study report public and ecology/landscape professional appreciation of biodiversity in parks in China, providing supportive evidence for promoting biodiversity in urban parks.

Meanwhile, the study reveals the less attractiveness of wild parks compared to traditional parks in the public, although improving maintenance levels and adding recreation facilities in wild parks help to enhance their attractiveness. In contrast, professionals preferred the wild style more. Hence, professionals should consider this difference in their preferences compared to the public when designing wild parks in the future. To enhance public appreciation of wild parks, this study suggests public environmental education should be continued. From the practical perspective, incorporating "cues to care" (e.g., ecological-based recreation facilities, mowing a strip along pathways to indicate maintenance, etc.) (Nassauer, 1995) in wild parks might be effective in enhancing Chinese public appreciation. This study could benefit future Chinese urban park design in searching for win-wins of biodiversity improvement and social expectations.

References

Aronson, M.F.J., Lepczyk, C.A., Evans, K.L., Goddard, M.A., Lerman, S.B., MacIvor, J.S., Nilon, C.H., Vargo, T., 2017. Biodiversity in the city: key challenges for urban green space management. Front. Ecol. Environ. 15, 189–196. https://doi.org/10.1002/fee.1480

Aspinall, P., 2010. On environmental preference: applying conjoint analysis to visiting parks and buying houses, in: Ward Thompson, C., Aspinall, P., Bell, S. (Eds.), Innovative Approaches to Researching Landscape and Health. Open Space: People Space 2. Routledge, pp. 179–208.

Aspinall, P.A., Ward Thompson, C., Alves, S., Sugiyama, T., Brice, R., Vickers, A., 2010. Preference and relative importance for environmental attributes of neighbourhood open space in older people. Environ. Plan. B Plan. Des. 37, 1022–1039. https://doi.org/10.1068/b36024

Bertram, C., Rehdanz, K., 2015. Preferences for cultural urban ecosystem services: Comparing attitudes, perception, and use. Ecosyst. Serv. 12, 187–199. https://doi.org/10.1016/j.ecoser.2014.12.011

Bjerke, T., Østdahl, T., Thrane, C., Strumse, E., 2006. Vegetation density of urban parks and perceived appropriateness for recreation. Urban For. Urban Green. 5, 35–44. https://doi.org/10.1016/j.ufug.2006.01.006

Byrne, J.A., Lo, A.Y., Yang, J., 2015. Residents' understanding of the role of green infrastructure for climate change adaptation in Hangzhou, China. Landsc. Urban Plan. 138, 132–143. https://doi.org/10.1016/j.landurbplan.2015.02.013

Chen, W.Y., Hua, J., Liekens, I., Broekx, S., 2018. Preference heterogeneity and scale heterogeneity in urban river restoration: A comparative study between Brussels and Guangzhou using discrete choice experiments. Landsc. Urban Plan. 173, 9–22. https://doi.org/10.1016/j.landurbplan.2018.01.010

Corlett, R.T., 2016. Restoration, Reintroduction, and Rewilding in a Changing World. Trends Ecol. Evol. 31, 453–462. https://doi.org/10.1016/j.tree.2016.02.017

Cornelis, J., Hermy, M., 2004. Biodiversity relationships in urban and suburban parks in Flanders. Landsc. Urban Plan. 69, 385–401. https://doi.org/10.1016/j.landurbplan.2003.10.038

Cranz, G., Boland, M., 2004. Defining the Sustainable Park: A Fifth Model for Urban Parks. Landsc. J. 23, 102–120. https://doi.org/10.3368/lj.23.2.102

Dearborn, D.C., Kark, S., 2010. Motivations for Conserving Urban Biodiversity. Conserv. Biol. 24, 432–440. https://doi.org/10.1111/j.1523-1739.2009.01328.x

Del Tredici, P., 2010. Spontaneous Urban Vegetation: Reflections of Change in a Globalized World. Nat. Cult. 5, 299–315. https://doi.org/10.3167/nc.2010.050305

Feng, Q., Hao, P., Dong, L., Li, X., 2019. Study on Biodiversity Characteristics and Indicators of Urban Wetland Park Based on Habitat. Landsc. Archit. 26, 37–41. https://doi.org/10.14085/j.fjyl.2019.01.0037.05

Fischer, L.K., Honold, J., Cvejić, R., Delshammar, T., Hilbert, S., Lafortezza, R., Nastran, M., Nielsen, A.B., Pintar, M., van der Jagt, A.P.N., Kowarik, I., 2018. Beyond green: Broad support for biodiversity in multicultural European cities. Glob. Environ. Chang. 49, 35–45. https://doi.org/10.1016/j.gloenvcha.2018.02.001

Fischer, L.K., Neuenkamp, L., Lampinen, J., Tuomi, M., Alday, J.G., Bucharova, A., Cancellieri, L., Casado-Arzuaga, I., Čeplová, N., Cerveró, L., Deák, B., Eriksson, O., Fellowes, M.D.E., Fernández de Manuel, B., Filibeck, G., González-Guzmán, A., Hinojosa, M.B., Kowarik, I., Lumbierres, B., Miguel, A., Pardo, R., Pons, X., Rodríguez-García, E., Schröder, R., Gaia Sperandii, M., Unterweger, P., Valkó, O., Vázquez, V., Klaus, V.H., 2020. Public attitudes toward biodiversity-friendly greenspace management in Europe. Conserv. Lett. 13, 1–12. https://doi.org/10.1111/conl.12718

Fuller, R.A., Irvine, K.N., Devine-Wright, P., Warren, P.H., Gaston, K.J., 2007. Psychological benefits of greenspace increase with biodiversity. Biol. Lett. 3, 390–394. https://doi.org/10.1098/rsbl.2007.0149

Gao, T., Zhu, L., Zhang, T., Song, R., Zhang, Y., Qiu, L., 2019. Is an Environment with High Biodiversity the Most Attractive for Human Recreation? A Case Study in Baoji, China. Sustainability 11, 4086. https://doi.org/10.3390/su11154086

Gobster, P.H., Nassauer, J.I., Daniel, T.C., Fry, G., 2007. The shared landscape: What does aesthetics have to do with ecology? Landsc. Ecol. 22, 959–972. https://doi.org/10.1007/s10980-007-9110-x

Grimm, N.B., Faeth, S.H., Golubiewski, N.E., Redman, C.L., Wu, J., Bai, X., Briggs, J.M., 2008. Global change and the ecology of cities. Science (80-.). 319, 756–760. https://doi.org/10.1126/science.1150195

Hangzhou Municipal Ecology and Environment Bureau, 2020. Key points of natural ecological protection in Hangzhou (2020).

Hangzhou Municipal Government, 2019. Action Plan for High-level Promotion of Land Greening and Beautification in Hangzhou (2019-2022).

Hangzhou Municipal Government, 2001. Master Plan of Hangzhou (2001-2020).

Hangzhou Municipal Statistical Bureau, 2021. Hangzhou Statistical Yearbook 2021: Population and Employment, in: Hangzhou Statistical Yearbook 2021. Hangzhou, pp. 62–84.

Hofmann, M., Westermann, J.R., Kowarik, I., van der Meer, E., 2012. Perceptions of parks and urban derelict land by landscape planners and residents. Urban For. Urban Green. 11, 303–312. https://doi.org/10.1016/j.ufug.2012.04.001

Hu, X., Lima, M.F., 2019. Ecological value of abandoned wild landscapes in Chinese cities, in: Mambretti, S., Miralles i Garcia, J.L. (Eds.), WIT Transactions on Ecology and the Environment. WIT Press, pp. 331–342. https://doi.org/10.2495/SC190301

Hwang, Y.H., Yue, Z.E.J., 2019. Intended wildness: Utilizing spontaneous growth for biodiverse green spaces in a tropical city. J. Landsc. Archit. 14, 54–63. https://doi.org/10.1080/18626033.2019.1623548

Hwang, Y.H., Yue, Z.E.J., Ling, S.K., Tan, H.H.V., 2019. It's ok to be wilder: Preference for natural growth in urban green spaces in a tropical city. Urban For. Urban Green. 38, 165–176. https://doi.org/10.1016/j.ufug.2018.12.005

Ignatieva, M., 2018. Biodiversity-friendly designs in cities and towns: towards a global biodiversinesque style, in: Ossola, A., Niemelä, J. (Eds.), Urban Biodiversity: From Research to Practice. Milton Park, Abingdon, Oxon; New York, NY: Routledge, pp. 216–235.

Jervis, S.M., Ennis, J.M., Drake, M.A., 2012. A Comparison of Adaptive Choice-Based Conjoint and Choice-Based Conjoint to Determine Key Choice Attributes of Sour Cream with Limited Sample Size. J. Sens. Stud. 27, 451–462. https://doi.org/10.1111/joss.12009

Jiang, Y., Yuan, T., 2017. Public perceptions and preferences for wildflower meadows in Beijing, China. Urban For. Urban Green. 27, 324–331. https://doi.org/10.1016/j.ufug.2017.07.004

Jim, C.Y., Chen, W.Y., 2006a. Recreation-amenity use and contingent valuation of urban greenspaces in Guangzhou, China. Landsc. Urban Plan. 75, 81–96. https://doi.org/10.1016/j.landurbplan.2004.08.008

Jim, C.Y., Chen, W.Y., 2006b. Perception and Attitude of Residents Toward Urban Green Spaces in Guangzhou (China). Environ. Manage. 38, 338–349. https://doi.org/10.1007/s00267-005-0166-6

Jorgensen, A., Hitchmough, J., Dunnett, N., 2007. Woodland as a setting for housing-appreciation and fear and the contribution to residential satisfaction and place identity in Warrington New Town, UK. Landsc. Urban Plan. 79, 273–287.

https://doi.org/10.1016/j.landurbplan.2006.02.015

Kaplan, R., 2007. Employees' reactions to nearby nature at their workplace: The wild and the tame. Landsc. Urban Plan. 82, 17–24. https://doi.org/10.1016/j.landurbplan.2007.01.012

Keniger, L.E., Gaston, K.J., Irvine, K.N., Fuller, R.A., 2013. What are the benefits of interacting with nature? Int. J. Environ. Res. Public Health 10, 913–935. https://doi.org/10.3390/ijerph10030913

Kowarik, I., 2018. Urban wilderness: Supply, demand, and access. Urban For. Urban Green. 29, 336–347. https://doi.org/10.1016/j.ufug.2017.05.017

Kowarik, I., 2011. Novel urban ecosystems, biodiversity, and conservation. Environ. Pollut. 159, 1974–1983. https://doi.org/10.1016/j.envpol.2011.02.022

Kowarik, I., Fischer, L.K., Kendal, D., 2020. Biodiversity conservation and sustainable urban development. Sustainability 12, 1–8. https://doi.org/10.3390/su12124964

Kowarik, I., Langer, A., 2005. Natur-Park Südgelände: Linking Conservation and Recreation in an Abandoned Rail Yard in Berlin, in: Kowarik, I., Korner, S. (Eds.), Wild Urban Woodlands New Perspectives for Urban Forestry. Berlin; New York: Springer, pp. 287–299.

Kühn, N., 2006. Intentions for the Unintentional: Spontaneous Vegetation as the Basis for Innovative Planting Design in Urban Areas. J. Landsc. Archit. 1, 58–65. https://doi.org/10.1080/18626033.2006.9723372

Li, X., Fan, S., Kühn, N., Dong, L., Hao, P., 2019. Residents'ecological and aesthetical perceptions toward spontaneous vegetation in urban parks in China. Urban For. Urban Green. 44, 126397. https://doi.org/10.1016/j.ufug.2019.126397

Lima, M.F., 2016. The Role of Open Spaces in the Future of Depopulated Urban Environments. The University of Edinburgh.

Lima, M.F., Ward Thompson, C., Aspinall, P., Bell, S., 2020. Communities facing urban depopulation: exploring people' s environmental preferences. A case study of Lisbon, Portugal. Cities Heal. 1–21. https://doi.org/10.1080/23748834.2020.1727820

Lindemann-Matthies, P., Keller, D., Li, X., Schmid, B., 2014. Attitudes toward forest diversity and forest ecosystem services-a cross-cultural comparison between China and switzerland. J. Plant Ecol. 7, 1–9. https://doi.org/10.1093/jpe/rtt015

Lindemann-Matthies, P., Marty, T., 2013. Does ecological gardening increase species richness and aesthetic quality of a garden? Biol. Conserv. 159, 37–44. https://doi.org/10.1016/j.biocon.2012.12.011

Madureira, H., Nunes, F., Oliveira, J.V., Madureira, T., 2018. Preferences for urban green space characteristics: A comparative study in three Portuguese cities. Environments 5, 1–13. https://doi.org/10.3390/environments5020023

Mclean, R., 2020. Transformative ground: a field guide to the post-industrial landscape. London; New York: Routledge, Taylor & Francis Group.

Miller, J.R., 2005. Biodiversity conservation and the extinction of experience. Trends Ecol. Evol. 20, 430–434. https://doi.org/10.1016/j.tree.2005.05.013

Ministry of Housing and Urban-Rural Development of the People’s Republic of China, 2002. Outline of Urban Green Space System Planning (Pilot version).

Müller, A., Bøcher, P.K., Fischer, C., Svenning, J.-C., 2018. ‘Wild’ in the city context: Do relative wild areas offer opportunities for urban biodiversity? Landsc. Urban Plan. 170, 256–265. https://doi.org/10.1016/j.landurbplan.2017.09.027

Müller, N., Werner, P., 2010. Urban Biodiversity and the Case for Implementing the Convention on Biological Diversity in Towns and Cities, in: Müller, N., Werner, P., Kelcey, J.G. (Eds.), Urban Biodiversity and Design. pp. 3–33. https://doi.org/10.1002/9781444318654.ch1

Muratet, A., Pellegrini, P., Dufour, A.B., Arrif, T., Chiron, F., 2015. Perception and knowledge of plant diversity among urban park users. Landsc. Urban Plan. 137, 95–106. https://doi.org/10.1016/j.landurbplan.2015.01.003

Nassauer, J.I., 1995. Messy Ecosystems, Orderly Frames. Landsc. J. 14, 161–170. https://doi.org/10.3368/lj.14.2.161

Navarro, L.M., Pereira, H.M., 2012. Rewilding Abandoned Landscapes in Europe. Ecosystems 15, 900–912. https://doi.org/10.1007/s10021-012-9558-7

Orff, K., 2016. Toward an urban ecology. New York: The Monacelli Press.

Orme, B.K., 2010. Getting started with conjoint analysis : strategies for product design and pricing research. Madison, WI : Research Publishers.

Özgüner, H., Kendle, A.D., 2006. Public attitudes towards naturalistic versus designed landscapes in the city of Sheffield (UK). Landsc. Urban Plan. 74, 139–157. https://doi.org/10.1016/j.landurbplan.2004.10.003

Özgüner, H., Kendle, A.D., Bisgrove, R.J., 2007. Attitudes of landscape professionals towards naturalistic versus formal urban landscapes in the UK. Landsc. Urban Plan. 81, 34–45. https://doi.org/10.1016/j.landurbplan.2006.10.002

Paivio, A., 1991. Imagery and language, in: Paivio, A. (Ed.), Images in Mind: The Evolution of a Theory. New York: Harvester Wheatsheaf, pp. 107–133.

Palliwoda, J., Kowarik, I., von der Lippe, M., 2017. Human-biodiversity interactions in urban parks: The species level matters. Landsc. Urban Plan. 157, 394–406. https://doi.org/10.1016/j.landurbplan.2016.09.003

Qiu, L., Lindberg, S., Nielsen, A.B., 2013. Is biodiversity attractive?-On-site perception of recreational and biodiversity values in urban green space. Landsc. Urban Plan. 119, 136–146. https://doi.org/10.1016/j.landurbplan.2013.07.007

Roscoe, J.T., 1975. Fundamental Research Statistics for the Behavioral Sciences. Holt, Rinehart and Winston.

Rudolph, M., Velbert, F., Schwenzfeier, S., Kleinebecker, T., Klaus, V.H., 2017. Patterns and potentials of plant species richness in high- and low-maintenance urban grasslands. Appl. Veg. Sci. 20, 18–27. https://doi.org/10.1111/avsc.12267

Sekaran, U., 1992. Research methods for business: A skill building approach. Wiley.

van Vliet, E., Dane, G., Weijs-Perrée, M., van Leeuwen, E., van Dinter, M., van den Berg, P., Borgers, A., Chamilothori, K., 2021. The influence of urban park attributes on user preferences: Evaluation of virtual parks in an online stated-choice experiment. Int. J. Environ. Res. Public Health 18, 1–20. https://doi.org/10.3390/ijerph18010212

Veitch, J., Ball, K., Rivera, E., Loh, V., Deforche, B., Best, K., Timperio, A., 2022. What entices older adults to parks? Identification of park features that encourage park visitation, physical activity, and social interaction. Landsc. Urban Plan. 217. https://doi.org/10.1016/j.landurbplan.2021.104254

Veitch, J., Salmon, J., Deforche, B., Ghekiere, A., Van Cauwenberg, J., Bangay, S., Timperio, A., 2017. Park attributes that encourage park visitation among adolescents: A conjoint analysis. Landsc. Urban Plan. 161, 52–58. https://doi.org/10.1016/j.landurbplan.2016.12.004

Voigt, A., Kabisch, N., Wurster, D., Haase, D., Breuste, J., 2014. Structural diversity: A multi-Dimensional approach to assess recreational services in urban parks. Ambio 43, 480–491. https://doi.org/10.1007/s13280-014-0508-9

Ward Thompson, C., 2016. Landscape and health, in: van den Brink, A., Bruns, D., Tobi, H., Bell, S. (Eds.), Research in Landscape Architecture: Methods and Methodology. London; New York, NY: Routledge/Taylor & Francis Group, pp. 235–262. https://doi.org/10.4324/9781315396903

Ward Thompson, C., 1998. Historic American Parks and Contemporary Needs. Landsc. J. 17, 1–25. https://doi.org/10.3368/lj.17.1.1

Ward Thompson, C., Roe, J., Aspinall, P., 2013. Woodland improvements in deprived urban communities: What impact do they have on people’s activities and quality of life? Landsc. Urban Plan. 118, 79–89. https://doi.org/10.1016/j.landurbplan.2013.02.001

Weisser, W.W., Hauck, T.E., 2017. Animal-Aided Design: using a species’ life-cycle to improve open space planning and conservation in cities and elsewhere. bioRxiv.

Wolch, J.R., Byrne, J., Newell, J.P., 2014. Urban green space, public health, and environmental justice: The challenge of making cities‘just green enough.’ Landsc. Urban Plan. 125, 234–244. https://doi.org/10.1016/j.landurbplan.2014.01.017

Wu, J., Xiang, W., Zhao, J., 2014. Urban ecology in China: Historical developments and future directions. Landsc. Urban Plan. 125, 222–233. https://doi.org/10.1016/j.landurbplan.2014.02.010

Yang, J., 2021. The heterogeneous preferences for conservation and management in urban wetland parks: A case study from China. Urban For. Urban Green. 60, 127064. https://doi.org/10.1016/j.ufug.2021.127064

Yang, J., 2020. Big data and the future of urban ecology: From the concept to results. Sci. China Earth Sci. 63, 1443–1456. https://doi.org/10.1007/s11430-020-9666-3

Yang, J., Yan, P., Li, X., 2016. Urban biodiversity in China: Who are winners? Who are losers? Sci. Bull. 61, 1631–1633. https://doi.org/10.1007/s11434-016-1187-7

Yuan, J., 2021. Urban Wilderness: Nature and the Potential in the Urban Cracks. Landsc. Archit. Front. 9, 10–13. https://doi.org/10.15302/J-LAF-1-010013

Yuan, J., You, F., Hou, C., Ou, H., Yin, Y., 2021. Reconstruction of Urban Wilderness Habitats Based on Vegetation Rewilding: Taking Wildflower Meadows as an Example. Landsc. Archit. Front. 9, 26–39. https://doi.org/10.15302/J-LAF-1-020041

Zhang, M., Song, K., Da, L., 2020. The diversity distribution pattern of ruderal community under the rapid urbanization in Hangzhou, east China. Diversity 12, 116. https://doi.org/10.3390/d12030116

Zhang, Q., Zhang, J., 2002. Discussion on Urban Ecological Park. Chinese J. Ecol. 21, 61–64.

Zhang, X., Ni, Z., Wang, Y., Chen, S., Xia, B., 2020. Public perception and preferences of small urban green infrastructures: A case study in Guangzhou, China. Urban For. Urban Green. 53, 126700. https://doi.org/10.1016/j.ufug.2020.126700

Zheng, B., Zhang, Y., Chen, J., 2011. Preference to home landscape: Wildness or neatness? Landsc. Urban Plan. 99, 1–8. https://doi.org/10.1016/j.landurbplan.2010.08.006

Zhong, L., Yang, R., Xue, F., 2021. State of Art on Urban Biodiversity Conservation Research. Chinese Landsc. Archit. 37, 25–30. https://doi.org/10.19775/j.cla.2021.05.0025