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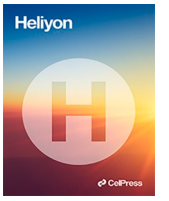

Research article

Explaining demographic-destination preferences for cultural ecosystem services: A set-theoretic configurational analysis

Yiyao Wang [a,*], Kiichiro Hayashi [b]

[a] Department of Civil and Environmental Engineering, Nagoya University, Furo-cho, Chikusa-ku, Nagoya, Aichi, 464-8601, Japan
[b] Institute of Materials and Systems for Sustainability, Nagoya University, Furo-cho, Chikusa-ku, Nagoya, Aichi, 464-8601, Japan

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ABSTRACT

Many fundamental studies on cultural ecosystem services (CES) and CES destination preferences still tend to focus on detecting the respective importance of destination attributes. However, this perspective needs more efforts on the fact that visitors always select a CES destination through a configurational consideration of its ecological and environmental attributes. Based on this consideration, 22 urban green spaces in Nagoya, Japan were studied, and a configurational model was developed by applying complexity theory and qualitative comparative analysis (QCA), to explain and better understand the causal patterns of CES quality and availability influencing demographic-CES destination preferences. The results showed that similar preference modes occurred between young adults and males who were very concerned about the time spent on transportation, and between older people and females who had multiple considerations regarding both CES quality and availability. Such findings on the demographic-destination preferences for CES could not only provide configurational insight into the relationships between destination attributes and travel preferences, but also help CES organizations develop multi-factor cooperative management for better CES provision.

1. Introduction

At the faster-than-ever pace of modern life, cultural ecosystem services (CES), the non-material benefits provided by ecosystems [1], play an increasingly significant role by helping release stress and improving fitness [2]. Such important services have been further emphasized [3] under the persistence of Coronavirus Disease 2019 (COVID-19), which has taken a heavy toll on people's mental and physical health [4,5]. However, the situation of CES in decision-making is slow [6] because of its intangible, subjective, and difficult-to-quantify characteristics [1], which compounds the difficulty in meeting the increasing CES needs. Therefore, governments are compelled to urgently consider how to plan and manage CES destinations effectively; that is, to determine what kind of CES destinations can attract dwellers and whether different demographic groups have different preferences.

To answer these factor analysis questions, numerous efforts have been put in, and finally two solutions have been proposed. One is to employ opinion-report methods such as interviews [7] or questionnaires [8] to directly obtain opinions about which factors are important to CES beneficiaries for CES perception. The other relies on variance-based methods, including structural equation modelling [9] and generalized linear mixed models [10], to ascertain how each variable contributes to explaining the visitors' preferences by separating out the variance change of the outcome. Sometimes both the methods are applied simultaneously. However,

* Corresponding author.
E-mail address: yiyao_WANG@outlook.com (Y. Wang).

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regardless of the case, the results derived from these two solutions mainly focus on the respective impacts of variables on people's decisions regarding CES destinations.

However, tourists' consideration of CES destinations is regarded as complex, dynamic, and nonlinear [11]. This implies that no single factor can determine visitors' destination choices. Instead, as the compensatory strategy stated in the choice literature suggests [11], tourists often make trade-offs among the factors; for example, they may choose a distant CES destination because of its beautiful views. This highlights the fact that traveling decisions can also be made by the combined effect of destination attributes; however, such a phenomenon has rarely been explored in CES research. Hence, the current research was conducted to enhance insight into how destination attributes interact to explain visitors' travel decisions rather than focusing only on each attribute's average or net effect.

This study builds on complexity theory and qualitative comparative analysis (QCA), a method for revealing complex causal mechanisms, to explore the influencing patterns of destination attributes that explain visitors' destination preferences. In this study, the destination attributes were considered as CES quality and availability, representing the attractiveness of CES sites to visitors and the opportunity to gain CES, respectively. This study developed four dimensions of CES quality: basic infrastructure, diversity, rarity, and CES; the scope of consideration for availability was also extended to include accessibility, excludability, and overcrowding. Additionally, the age and gender of CES visitors are key to managing CES sites [12]. By identifying the preference modes of different groups of visitors, managers can better understand their visitors' needs and interests, make decisions to enhance the CES experience, and provide higher-quality CES. In summary, the research question of this study is as follows:

For CES destinations, what configurations of CES quality and availability can win the favor of different segments based on age and gender?

The remainder of this paper is organized as follows. Rooted in the existing CES literature, the selected conceptual framework for the causal analysis and the employed data are explained in Section 2. Section 3 introduces the research method, and Section 4 presents the empirical results. In Section 5, the findings are discussed, along with the theoretical and practical implications. Finally, a brief conclusion is presented in Section 6.

2. Conceptual framework and data collection

2.1. Antecedent conditions

To date, a plethora of factors affecting visitors' CES perceptions have been explored, including, but not limited to, ecological quality (e.g., Refs.[13,14]), landscape features (e.g., Refs. [14,15]), biodiversity (e.g., Refs. [16,17]), infrastructure (e.g., Refs. [18,19]), and accessibility (e.g., Refs. [20,21]).

In line with these notions, those that have already been proven to be significant were selected for this study and summarized as two aspects: CES quality and availability.

2.1.1. CES quality of CES sites

The CES quality of a CES site is described from four dimensions: *basic infrastructure, diversity*, *rarity,* and *CES condition*.

Sufficient *basic infrastructure* is the basis for worry-free CES enjoyment and helps CES sites support a wide range of visitors [22]. The common method to evaluate the influence of amenities on CES perception is to check "are there toilets" [23] or to obtain visitors' attitudes toward amenities [24]. However, when considering individual differences in subjective experiences and the effect on opinions of when studies are conducted (e.g., peak tourist seasons or peak hours), a more objective way was sought to evaluate whether amenities (toilets, lights, and disability-friendly facilities) can meet visitors' demands.

For toilets, the advice that the distance to the nearest toilet should not exceed 500 m [25] was applied. By checking whether the buffers with a 500 m distance around the toilets could cover the entire CES site, it was determined if the toilets were sufficient. Because relevant standards and references are lacking for lights and disability-friendly facilities, this study was limited to checking whether there were lights and facilities for disabled visitors (special toilets and parking areas). If a type of amenity was sufficient, it was assigned a value of 0; otherwise, it was assigned as −1. Finally, CES sites were scored by the integrated results from these three amenities, which ranged from 0 to −3, with 0 and -3 representing that all three amenities were sufficient or insufficient, respectively.

Diversity reflects the degree of CES experience's diversity provided by CES sites. To evaluate this dimension, this study argues that the diversity of CES providers better captures this dimension than the diversity of CES classes, as the latter may mask the effects of the former on attracting visitors. CES providers[1] are landscape features such as lawns, lakes, or forests, but may also be detailed spots such as entertainment facilities [26], whereas CES classes are known for cultural diversity, spiritual and religious value, aesthetic value, etc. [1]. For example, consider a park that has two CES providers–a garden and a beautiful lake–both of which provide aesthetic CES experiences. If the diversity of CES classes was used as an indicator of diversity, these two CES providers would be considered to offer the same type of CES experience. However, they would actually attract different visitors, as visitors can enjoy the different beauty provided by the lake and the garden. Moreover, it is also doubtful whether general visitors have such knowledge about CES classes and

[1] "CES providers" are the carriers of CES, and various CES are generated at or provided by CES providers. However, it is a relative concept, depending on the spatial scale of the study objects. If a study is about the CES of a city, then the parks, museums, and tourist attractions are the CES providers; if the study is about the level of urban green spaces, like this study, the CES providers are more detailed spots in the spaces. However, the focus should not be put on the minutia. The authors advise a "functional area" perspective when identifying the CES providers at a level like parks; for example, the functional area of sports facilities can be regarded as a CES provider, not a specific sports facility.

base their travel decisions on this.

Rarity refers to the representatives of a CES experience occurring in a region [27]. As the definition clarifies, this concept is relative and not absolute, and depends on the scale and context of the study. For instance, if, hypothetically, there is only one place in a city that allows fishing, the fishing experience would be rare in this city context; however, it may not be rare from a state or country's perspective. Additionally, the rarity of a CES experience would also be determined by the uniqueness of its CES provider. If there is a special and famous CES provider, such as Mount Tai in Taian city, Shandong province, China, then the CES experience provided by this special CES provider would be considered rare. For example, climbing a mountain may not be rare, but climbing Mount Tai would be regarded as a rare CES experience. Therefore, the rarity of a CES site depends on both the rarity of the CES experience itself and the uniqueness of the CES experience provided by special CES providers.

CES condition indicates the quality of the CES experience at a CES site. Based on the aforementioned introduction, diversity measures the "quantity" of a CES site, and rarity adds a "weight" of uniqueness to it. However, these factors do not capture the "caliber" of a CES site, such as the quality of the natural environment, facilities, and services, which also influence the CES perceptions of visitors. For instance, a site with diverse but poorly managed landscapes may have high diversity but low CES experience. To address this gap, CES condition is included in this antecedent framework.

2.1.2. Availability of CES sites

In addition to CES quality, the availability of a CES site is another key consideration in visitors' decision-making processes, and is always described as accessibility. However, the scope of this study was extended to a more comprehensive consideration of the external impacts on visitors' decisions by using availability to draw conclusions.

Accessibility here is an inherent characteristic of a location and defined as the ease with which a place or location can be reached [28]. The three most common ways of accessing CES sites were considered: walking, public transportation (bus and subway), and driving by car. To evaluate the walking proximity to CES sites, the surrounding resident population in different buffer sizes was employed for different ages (500 m for older persons and 1000 m for other ages) [29]. In terms of public transportation, the number of bus and metro lines within a 500 m radius around the CES sites [30] was checked. Finally, the parking capacities of CES sites were used to evaluate the convenience of traveling by car.

Excludability means that someone can prevent others from consuming goods or service [31]. In the CES context, this applies to some areas such as nature reserves that have a daily visitor capacity cap for sustainable tourism and conservation. Thus, even if other conditions for traveling are ripe, CES sites may still be unavailable to visitors because of excludability.

Overcrowding. Visitors sometimes avoid overcrowded places because of the degraded CES experience [32,33]. Therefore, overcrowding should be considered in terms of the availability of CES sites. Tourism density is a recommended metric to determine whether overcrowding occurs in an area, and the corresponding benchmark proposed by McKinsey and Company [33] can be used to determine the degree of overcrowding.

2.2. Outcome: visitors' destination preferences

As the outcome of this causal analysis, visitors' destination preferences are recommended to be represented by visitor arrivals at CES sites. This is more objective than preference scores or visit frequency obtained from questionnaires or interviews and more comprehensive than the amount of social media content or the number of participants used in some studies that generalize them to all visitors.

2.3. Study area

Nagoya City is located in Aichi, central Japan, covering an area of 326.50 km^2. As the third largest metropolitan area in Japan, it has a population of over 2.3 million. The heavy concentration of commercial and service industries indicates that Nagoya is typical of large cities [34].

Nagoya also holds multiple natural CES resources. According to the latest municipal survey in 2020, natural land areas accounted for 21.5 % of the entire city, including 10.7 % forest, 5.3 % lawns and meadows, 2.6 % farmland, and 3 % water bodies [35]. In summary, Nagoya's stable social development increases its residents' potential CES demand, while its natural landscape provides various opportunities to counter this.

As one of the most common and available CES sites in daily life, urban green spaces play an irreplaceable role in providing CES benefits [36]. Furthermore, because urban green spaces are fungible to each other, people seldom visit them for a specific purpose or event. In this context, the combined effect of attributes always gains the upper hand in visitors' decisions. Taking all of the aforementioned information together, this research finally focused on 22 urban green spaces in Nagoya, including parks and forests (Fig. S1).

2.4. Data collection

Outcome: visitor arrivals of four segments based on age and gender. Young adults and older people were defined as those in their 20s and 30s and those over 60 years of age, respectively. Because the study areas are open public green spaces, the visit arrivals of these four groups at the CES sites were difficult to obtain from existing statistical materials. Therefore, KDDI Location data, provided by "*au* by KDDI" brand under KDDI Corporation (a Japanese telecommunications operator), was employed to obtain relevant information

including the aggregated monthly visitor arrivals, visit time, visitor age (with a minimum age of 20 years old), and visitor gender, which were collected from *au* smartphone users [37]. An imitation of this data is presented in Fig. 1. In this example, Grid 110 has a total of 48 moves (if a visitor spends less than 15 min in a grid, this will be counted as a move; otherwise, it will be counted as a stay) of men in their 60s from 12:00 to 12:59 a.m. on weekdays (as shown in the holiday column coded as 0) in September 2019. As the example shows, KDDI only provided completely anonymized data in order to maintain confidentiality. Permission was not granted to identify the individuals to whom the data belonged. To avoid the impact of COVID-19 on regular outdoor recreational behavior, the data used were for September 2019 in Nagoya, with a grid size of 125 m × 125 m. More detailed information on the use of KDDI Location data to assess visitor arrivals in an area can be found in Ref. [38].

Data for the antecedents. The data were mainly obtained from two sources. The first was a direct check by the authors, which included information on *Basic Infrastructure* (based on official maps of the CES sites and *Google Maps*), *Public Transport* (from Ref. [39]), and *Diversity* and *Rarity* (based on the authors' field surveys which were conducted in October 2021; details of the field surveys can be found in Ref. [38]). Within this urban context, CES experience was deemed rare if fewer than three sites were offering it. The second source was official information, such as using the Population Census data from Ref. [40] to obtain the surrounding resident population for evaluating *Walking Proximity*,[2] checking official websites for CES sites to obtain *Parking Capacity*, and referring to the review scores on *Google Maps*, which were assigned by previous visitors based on their CES experiences, to define *CES Condition*.

For *Overcrowding,* in our study areas, the highest density of tourism did not exceed the fourth quintile defined by McKinsey and Company [33], where the top quintile represents the highest overcrowding risk, and the fifth quintile represents the lowest risk; and no CES sites involved *Excludability*. Thus, it is argued that these two phenomena did not occur in this study and were not included in further analyses.

3. Complexity theory and qualitative comparative analysis

3.1. Complexity theory

Complexity theory means "relationships between variables can be non-linear, with abrupt switches occurring, so the same 'cause' can, in specific circumstances, produce different effects" [41]. Insight into this theory can be gained from three principles: conjunction, equifinality, and causal asymmetry [42,43].

Conjunction implies that the antecedent conditions within a configuration are cooperative (operating interdependently) rather than competing (separating the variance change of an outcome and obtaining each condition's unique effect) to explain the outcome of interest. *Equifinality* is defined as "a system can reach the same final state from different initial conditions and by a variety of different paths" [44]. *Causal asymmetry* is reflected as follows: 1) the conditions leading to the presence of an outcome may also cause the absence of the outcome, and 2) the inverse of the conditions achieving the presence of an outcome may not lead to the absence of the outcome. This concept can be understood through the following example: while a beautiful view can lead to high attractiveness to visitors, a CES site with a beautiful view (the condition leading to the presence of the outcome) may also have limited visitors (the absence of the outcome), whereas a CES site with a bad view (the inverse of the condition) may still attract many visitors (the presence of the outcome). This shows that the relationship between conditions and the outcome is not fixed [45,46].

As a CES site is a combination of various attributes [47], it can be argued that the process through which people make travel decisions is based on a comprehensive consideration of the attributes of available destination options [11]. In this context, QCA is well-suited for this causal mechanism analysis owing to its features of accommodating conjunction, equifinality, and causal asymmetry.

3.2. Contrarian case analysis

Before commencing the detailed QCA analyses, it was essential to establish the presence of complex causality within the context of this study. This examination is therefore critical for demonstrating the necessity of considering the complexity theory and the suitability of applying QCA method in the following analysis. Consequently, a contrarian case analysis was conducted to identify contrarian cases that could not be explained by main effects. By following the steps described in Ref. [48]: by splitting samples into quintiles and conducting cross-tabulation using SPSS software (v. 26) (IBM Corporation, Armonk, NY, USA), 5 × 5 tables were created to show all possible combinations of the antecedents and the outcome.

The contrarian cases (shown in Table S1) were found in each demographic group, and some of them even constituted a considerable percentage of the whole sample. By taking the relationship between public transport and young adults as an example (see the boxes in bold shown in Table S1a), there were three sites with a high convenience level for public transport but only attracted a few young adults, and five sites had less convenient public transport but gained frequent visits by young adults, where all these contrarian cases accounted for 36.4 % of the 22 study areas. In conjunction with these findings, the presence of causal asymmetry in this study underscores the suitability of applying both complexity theory and the QCA method to analyze the intricate causal relationships explored.

[2] The population data in 2020 is provided at a chome level, considering the intersections of the chomes with the setting buffers, the chomes whose centers of gravity are in the buffers were considered.

grid_code	holiday	period		gender	age_group	stay	move
110	0	12:00:00	12:59:59	1	20	0	0
110	0	12:00:00	12:59:59	1	30	0	0
110	0	12:00:00	12:59:59	1	40	0	0
110	0	12:00:00	12:59:59	1	50	0	0
110	0	12:00:00	12:59:59	1	60	0	48
110	0	12:00:00	12:59:59	2	20	0	0
110	0	12:00:00	12:59:59	2	30	0	0
110	0	12:00:00	12:59:59	2	40	0	0
110	0	12:00:00	12:59:59	2	50	0	0
110	0	12:00:00	12:59:59	2	60	0	0

Fig. 1. An imitation of KDDI location data.

3.3. Qualitative comparative analysis

Qualitative comparative analysis (QCA) is a research method that integrates qualitative and quantitative methods rooted in Boolean algebra and set theory [49], which can identify the necessary and sufficient configurations associated with an outcome of interest. Antecedents in different states (presence, absence, or "do not care") act as core or peripheral elements in each configuration, where the core elements are the ones with a strong causal association with the outcome, while peripheral elements are those with weaker associations [45].

Calibration. First, it is necessary to set suitable calibration thresholds to convert quantitative data into qualitative data ranging from 0 (full non-membership or fully out) to 1 (full set membership or fully in) to indicate the degree to which they are more in or out of the object set [46]. In other words, the calibrated qualitative data are the degrees that reflect how each sample's characteristic belongs to the object set. For example, suppose the monthly visitor arrivals of CES sites would be converted into qualitative data, and 1000 visits monthly is set as the threshold of high visit; if an area has 1800 visits a month, then this visit number (quantitative data) will be calibrated as the degree (qualitative data) to which it belongs to the "high visit" set, in this case, the 1800-visit will be calibrated as 1.

By following the advice from Ref. [50], the calibration thresholds were set based on substantive knowledge and percentiles. Using the direct calibration method, the variables were transformed into set memberships [45,46]. The detailed calibration thresholds used in this study are listed in Table 1.

By performing the aforementioned calibration process, a CES site was described as a fuzzy set, namely a combination of degrees to which each attribute belongs to its "high level" set (set membership scores). The calibrated fuzzy set scores were then coded (if a set membership score was greater than or equal to 0.5, it was coded as 1 to represent the presence of the condition or outcome; otherwise, it was coded as 0 to represent the absence). This resulted in a tabulation of all possible combinations of causal conditions and their corresponding outcomes, known as a *Truth table* [46]. Based on the identification the presence and absence of conditions in the *Truth table*, Boolean algebra would give a further analysis about the (combinations of) conditions that are subsets or supersets of the outcome to arrive at the sufficient and necessary conditions, respectively.

3.3.1. Sufficient condition analysis

To find the sufficient conditions for the outcome of interest, the minimum thresholds of *frequency* and *consistency* need to be confirmed to select the samples that can be considered in sufficient condition analysis [46].

Frequency refers to the number of observations for each possible combination of attributes, and its cut-off point is set to specify the minimum number of cases to be considered in the analysis. For this small-sized samples (22 CES sites), a cut-off point of one for frequency was applied.

Consistency indicates the proportion of cases that share a given configuration of attributes consistent with the outcome [45]. To find a fitting criterion for consistency, the following procedure was performed: 1) all configurations were first identified by a minimum raw consistency of 0.80; 2) then, the eligible configurations were filtered further by using a *Proportional Reduction in Inconsistency* (PRI) consistency of 0.75, which is a standard for confirming that a given configuration is specifically a subset of the target outcome and not a subset of the negation of the target outcome [51]; 3) finally, by checking the natural break in raw consistency scores, 0.85 was regarded as the threshold of raw consistency [52].

Based on the above procedures, the core and peripheral sufficient conditions will be directly generated using the fsQCA software (v. 4.1) [53] as parsimonious and intermediate solutions, respectively.

3.3.2. Necessary condition analysis

To identify which individual factors are necessary for the outcome, a necessity analysis was conducted using the fsQCA software directly. The calibrated data were input into the software, and the consistency of each antecedent was calculated. According to Ref. [46], the antecedents with a consistency of greater than 0.9 would be considered to be potential necessary conditions.

Table 1
Descriptions of the antecedents and outcomes, and their set memberships.

Antecedent	Definition	Variable	Calibration threshold		
			Fully in (≧)	Crossover (=)	Fully Out (≦)
CES quality					
Basic Infrastructure	A site can serve enough amenities	Assigned as 0, -1, -2, -3 based on how many kinds of amenities are enough	0	−1	−2
Diversity	A site can provide a diverse CES experience	Number of CES providers' types	75%iles	50%iles	25%iles
Rarity	A CES provider itself or a CES is rare in a region	Number of rare CES experiences	2	1	0
CES Condition	A site can give visitors a good CES experience	Review scores on Google Maps	4.5	4.0	3.5
Availability					
Walking Proximity	A site is easy to access by walking	Surrounding resident population	75%iles	50%iles	25%iles
Public Transport	A site is easy to access by public transport	Number of bus and metro lines around	75%iles	50%iles	25%iles
Parking Capacity	A site is easy to access by driving	Parking capacity of CES sites	75%iles	50%iles	25%iles
Outcome					
	Visitor arrivals of young adults, older adults, males, females		75%iles	50%iles	25%iles

4. Results

4.1. High-performance configurations from the QCA

The results of the necessity analysis (Table S2) showed that none of the individual attributes were necessary for a high visit in this research. Therefore, the CES preference modes of each demographic group were directly based on the derived sufficient conditions (Table S3) and were presented in a more readable format (Tables 2 and 3).

Table 2
Configurations for achieving high attraction to young and older adults
Notes: a. Black circles (" ● ") indicate the presence of a condition, circles with a cross-out (" × ") indicate its absence, and blank spaces are an indication of a "do not care" situation in which the causal condition may be either present or absent. Large circles indicate core conditions and small circles indicate peripheral conditions.
b. Combinations marked by the same numeral with different letters are neutral permutations, such as 1a, 1b, 1c, and 1d in High attraction to young adults, and 1A and 1B in High attraction to older adults. However, the configurations with the same number with different capitalization does not mean anything special. For example, 1a and 1A are just labels for different combinations, and they have no connection or similarity to each other. The same is true for Table 3.
c. Coverage and consistency are indicators that reflect the quality of the derived sufficient conditions. Coverage assesses the degree to which a cause or causal combination "accounts for" instances of an outcome. There are two types of coverage: raw coverage, which indicates the extent to which the outcome is covered by each generated path, and unique coverage, which reflects the extent to which the outcome is covered only by a specific path. Consistency means the same thing in Section 3.3.1 but is used differently compared with the consistency in data processing for sample selection. Here, consistency is to reflect the quality of the derived sufficient conditions, namely the degree to which the derived configurations sharing a given condition or combination of conditions agree in displaying the outcome in question [54]. The recommended level for coverage is 0.2, whereas the recommended level for consistency is 0.8 [55]. The derived results were all consistent with the standards (see Tables 2 and 3). The same is true for Table 3.
d. In the standard analysis of high attraction to older adults, there were several prime implicants need to be chosen. Older people generally attach importance to walking proximity; therefore, by comparing the corresponding results of the prime implicants, finally the prime implicants *Diversity *Rarity * Walking Proximity* and *CES condition * Diversity * Public Transport* were chosen for further research.
e. The original QCA results please refer to Tables S3a and S3b.

	High attraction to young adults				High attraction to older adults			
	1a	1b	1c	1d	1A	1B	2	3
CES quality								
CES condition	•	•	•	⊗		⊗	●	●
Diversity	•	•	•	•	●	●	●	●
Rarity	•	•	⊗	•	●	●	●	⊗
Basic Infrastructure	•	⊗	•	•	•	•	⊗	•
Availability								
Walking Proximity	●	●	●	●	●	●	●	•
Public Transport	⊗	•	•	•	•	•	●	●
Parking Capacity	●	●	●	●	⊗		•	•
Consistency	0.935	0.893	0.971	0.935	0.967	0.910	0.965	0.855
Raw coverage	0.180	0.112	0.158	0.180	0.157	0.238	0.124	0.134
Unique coverage	0.087	0.047	0.069	0.056	0.004	0.059	0.046	0.055
Overall solution consistency	0.966				0.928			
Overall solution coverage	0.383				0.352			

Table 3
Configurations for achieving high attraction to males and females
Notes: black circles (“ ● ”) indicate the presence of a condition, circles with a cross-out (“ × ”) indicate its absence, and blank spaces are an indication of “a do not care” situation in which the causal condition may be either present or absent. Large circles indicate core conditions and small circles indicate peripheral conditions. The original QCA results please refer to Tables S3c and S3d.

	High attraction to males					High attraction to females			
	1	2a	2b	2c	2d	1A	1B	2	3
CES quality									
CES condition	⊗	•	•	•	⊗		⊗	●	●
Diversity	●	•	•	•	•	•	•	•	•
Rarity	•	•	•	⊗	•	●	●	●	⊗
Basic Infrastructure	•	•	⊗	•	•	●	●	●	●
Availability									
Walking Proximity	⊗	●	●	●	●	●	●	●	●
Public Transport	⊗	⊗	•	•	•	•	•	⊗	•
Parking Capacity	•	●	●	●	●	⊗		●	●
Consistency	0.977	0.978	0.977	0.982	0.985	0.894	0.916	0.901	0.963
Raw coverage	0.209	0.173	0.125	0.155	0.189	0.164	0.215	0.153	0.146
Unique coverage	0.100	0.040	0.049	0.069	0.056	0.004	0.026	0.074	0.056
Overall solution consistency	0.984					0.948			
Overall solution coverage	0.481					0.358			

4.1.1. CES destination preferences: young adults vs. older adults

As shown in Table 2, convenience of availability obviously oriented the travel of young adults, as evidenced by the walking proximity and parking capacity of CES sites as the core conditions in each solution. All configurations in the high attraction to young adults were neutral permutations, which are the configurations that share the same core conditions but have different peripheral conditions [45]. Neutral permutations are always marked by the same numeral with different letters such as 1a, 1b, 1c and 1d in High attraction to young adults. Their common core conditions are walking proximity and parking capacity, and a relatively low level of public transport, basic infrastructure, rarity, and CES condition are the differentiating peripheral conditions.

In contrast, the travel of older people was characterized by CES quality (especially diversity)-availability-combined driving mode. Solutions 1A and 1B suggested that high diversity, rarity, and walking proximity as core conditions combining basic infrastructure and public transport as peripheral conditions was sufficient for achieving a high outcome, and this pair of neutral permutations also indicated that the absence of a high CES condition and high parking capacity can be treated as substitutes. Solution 2 advised, with the precondition of the presence of parking capacity and the absence of basic infrastructure, that other attributes should be maintained at high levels to attract older visitors. Solution 3 also showed similar conditions to Solution 2, with a substitution between rarity and basic infrastructure.

4.1.2. CES destination preference: male vs. female

For the gender group in Table 3, the QCA offered five causal configurations for males and four for females, reflecting their destination attribute preferences. For males, Solution 1 suggested that under the absences of high CES condition, public transport, and walking proximity, the diversity of CES sites should be important. The other neutral permutations (Solutions 2a, 2b, 2c, and 2d) showed that when walking proximity and parking capacity were present as core conditions, one absence among public transport, basic infrastructure, rarity, and CES condition was allowed, provided that the other conditions were present.

With respect to high attractiveness for females, the first pair of neutral permutations (Solutions 1A and 1B) showed a combination of high rarity, basic infrastructure, and walking proximity as core conditions working with diversity and public transport were a sufficient recipe for that goal. Solution 2 indicated that, in the context of the presence of diversity and the absence of public transport, high levels of the other conditions could lead to frequent female visits. Solution 3 suggested when rarity was in short supply, more attention should be focused on improving the CES condition, infrastructure, walking proximity, and parking capacity. Viewed holistically, basic infrastructure and walking proximity play irreplaceable roles in females' CES decisions.

4.2. Robustness checks

Because the QCA analysis inevitably involves the authors' decisions (e.g., the choice of calibration thresholds), to test the sensitivity of the findings, a robustness analysis was conducted by varying the calibration criteria for causal variables. The calibration standards based on substantive meanings were maintained, and the remaining thresholds for full membership and full non-membership were changed from the 75th to the 80th and the 25th to the 20th percentiles, respectively. As Ref. [51] stated, "QCA solutions can be deemed robust if they involve similar necessary and sufficient conditions and if consistency and coverage are roughly the same across different model specifications." As shown in Table S3, the similar solutions indicate that the derived results are robust and not overly sensitive to the discriminatory choices made by the authors.

5. Discussion

5.1. The similarity in the preference modes

Interestingly, the results showed similar preference modes cross age-gender, especially for the pair of young adults and males: they were more concerned about the availability of CES sites than CES quality, and both focused on walking proximity and parking capacity. By contrast, CES quality and availability were both important to older people and females, although their specific concerns differed.

Such observed similarities might be attributed to a large demographic overlap between the similar groups. For example, the dominance of young males in both the young adult and male groups likely contributed to their similar preferences. However, further data checking (detailed processes and results are shown in Appendix B) indicated that the similarities did not stem from data issues.

An alternative explanation can be obtained from the field of leisure psychology. Some evidence can be found in relevant studies such as Ref. [56]. Young adults and males both have strong curiosity, so they prefer adventurous and stimulating travel; moreover, they are more likely to generate travel intentions and implement that quickly [56]. Against this Japanese background, young adults and males are always limited by work [57], so they mostly travel on weekends and public holidays; thus, as shown by the results, they were very concerned about the walking proximity and convenience of driving to CES sites, spending as little time as possible traveling to CES sites rather than choosing public transport, which always takes longer.

By contrast, the travel of older people and women is often subject to a number of factors that make it harder for them to implement their travel, such as physical constraints and family responsibilities [56]. This is evidenced by the multiple core conditions in their configurations, which suggests that they are less likely to generate travel intentions and act on them easily. They favor low-intensity, slow-paced, and safe leisure activities, and have a high demand for CES quality [56]. Moreover, considering physical strength and greater flexibility around travel and leisure time, older people preferred to use public transportation, whereas females preferred driving because of the inclusion of young, middle-aged, and working females.

5.2. Theoretical and managerial implications

Theoretical implications. This research has explored the causal relationships between CES destination attributes and visitors' decisions for CES enjoyment. The common methods used to address this research question typically focus on the individual importance of factors on the outcome, as in Refs. [7–10], and finally obtain the result like "beautiful scenery is important to CES destinations for attracting visitors, so if the scenery of a CES site is improved, more visitors would come for CES enjoyment [58]."

However, as mentioned in Ref. [10], there remains a lack of knowledge on how the combined impact of destination attributes affects visitors' CES decisions. In line with this view, this research has tackled to emphasized the importance of considering the causal relationships between destination attributes and visitors' CES preferences from a conjunctive, asymmetric, and equifinal perspective. The importance of such consideration can also be found in other studies, as illustrated below, although some of them are not CES-related.

1) *Conjunctive.* As mentioned in complexity theory, the factors work together to explain the outcome rather than independently. This thinking is consistent with the compensatory strategy in the choice literature [11] and the utility function in economics [59]. The compensatory strategy suggests that people may be willing to trade off one attribute with another to obtain the desired overall outcome. For example, Ref. [60] found that visitors have a "portfolio of favorite natural places" for CES demand, which includes both places that are nearby and easily accessible and places that are located farther away but highly attractive. Similarly, the utility function in economics also considers the joint effects of different factors, which is a method aiming to measure the satisfaction or pleasure that consumers receive from consuming a set of goods or services [61].
2) *Asymmetric.* As the contrarian cases shown in Table S1, the causal asymmetry relationships between destination attributes and visitors' preferences have been examined, which means: 1) there is an asymmetry between the presence of factors and the presence of the outcome. For example, a highly accessible CES site may not necessarily attract many visitors, whereas areas with low accessibility may attract frequent visits. This is because there are other factors that also influence visitors' travel decisions, such as the diversity and rarity of the CES experience; and 2) as described in the law of diminishing marginal utility, marginal utility falls as the quantity of goods consumed by an individual concerning the income spent rises [62]. In our case, if we want to enhance CES provision to attract visitors by improving destination attributes, the enjoyment a visitor can obtain from each additional unit of improvement in destination attributes may also eventually decline. This is another reflection of causal asymmetry that differs from the proportionality assumption in a linear programming model [63].

3) *Equifinal.* Finally, to reach the outcome of interest, multiple paths are available [44], as evidenced by the several causal configurations obtained for explaining the CES preference pattern of each demographic group. This finding has important implications for managing CES destinations. It suggests that there is no single "right" way to manage CES destinations as has already been found in forest management where multiple objectives, values and preferences are involved [64]. Instead, destination managers require more flexible and adaptable management plans tailored to the specific CES needs and preferences of their target audience [65].

Another advantage of employing QCA methodology in this research is that the method can be used to study complex causal relationships in the context of a small sample size (22 study areas) but a large number of parameters (7 antecedents in this research) [66]. This is difficult to be achieved by the commonly used variance-based method, which requires large samples to identify significant relationships between variables.

Managerial implications. By such configurational consideration, the effect of environmental management would be maximized, because the results of this research provide a potential for different CES destinations to find a tailored plan for improving the provided CES by combining their inherent attributes and adjusting the structure of the provided CES based on their regular visitors [67]. Additionally, the results of this study also have implications for personal sustainability. Achieving the above improvements in CES destinations could lead to a more balanced lifestyle for dwellers with dual benefits of mental and physical health because well-managed CES destinations would provide more and better opportunities for citizens' CES needs [68].

5.3. Limitations

One of the limitations of this study is that the derived CES preference patterns may not be generalizable to other cities or regions, as the results were based on the specific context of the CES perception of urban green spaces in Nagoya, Japan. Different cultures and social contexts may influence people to assign different importance to the same antecedent conditions [69]. Therefore, future research should be conducted in other regions to obtain more generalizable results or to compare the results with this case in Nagoya to examine the similarities and differences.

Owing to the availability of the KDDI location data, this research only studied CES preference patterns for a limited period (September 2019). However, visitor preferences may change over time, especially across seasons [70]. Therefore, further research is required to examine whether there is a temporal dynamic change in visitor preferences. Additionally, researchers who wish to replicate this study should be aware that the values of the destination attributes of a CES site may change over time, particularly in terms of diversity and rarity. For example, in Japan, April is typically cherry blossom season. If a study focused on this period, the diversity value may change from the normal value depending on whether the study area provides a more diverse CES experience.

6. Conclusion

This study constructed a configurational theory to determine the configurations of CES destination attributes that can drive the CES decisions of different demographic. The results show that both differences (between groups of different ages or genders) and similarities (cross age-gender) exist in the CES destination preferences. The study has challenged the common understanding that, to meet people's CES demand and provide CES effectively, a single improvement of the "regarded" important factor is sufficient or there is a single "right" way to improve the attractiveness of a CES destination. Instead, it emphasized the importance of thinking from a conjunctive, equifinal, and asymmetric perspective when considering the relationships between factors and people's travel preference; in such a process, the connection with other disciplines, including leisure psychology and behavioral economics, will help enrich the study and provide more inspiration.

Ethics statement

Review and/or approval by an ethics committee was not needed for this study because all data was aggregated and anonymized before being provided to the authors.

Data availability statement

The authors do not have permission to share the KDDI location data, but it could be obtained by contacting the KDDI corporation, and other data will be made available on request.

CRediT authorship contribution statement

Yiyao Wang: Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization. **Kiichiro Hayashi:** Writing – review & editing, Supervision, Methodology, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:Yiyao WANG reports financial support was provided by China Scholarship Council of the Ministry of Education.

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Appendix A. Supplementary data

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