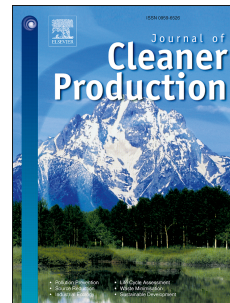# Journal Pre-proof

Method for the evaluation of residents' perceptions of their community based on landsenses ecology

Han Linwei, Shi Longyu, Yang Fengmei, Gao Lijie

Please cite this article as: Linwei H, Longyu S, Fengmei Y, Lijie G, Method for the evaluation of residents' perceptions of their community based on landsenses ecology, *Journal of Cleaner Production*, https://doi.org/10.1016/j.jclepro.2020.124048.

This is a PDF file of an article that has undergone enhancements after acceptance, such as the addition of a cover page and metadata, and formatting for readability, but it is not yet the definitive version of record. This version will undergo additional copyediting, typesetting and review before it is published in its final form, but we are providing this version to give early visibility of the article. Please note that, during the production process, errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

**Han linwei:** Conceptualization, Writing-Original draft preparation, Data Curation, Methodology, Software. **Shi Longyu:** Conceptualization, Writing- Reviewing and Editing, Funding acquisition. **Yang Fengmei:** Visualization. *Gao Lijie:* Investigation, Supervision.

**Word count: 8203**

**Title:** Method for the evaluation of residents' perceptions of their community based on landsenses ecology

**Authors:** Han Linwei [a,b], Shi Longyu [a], Yang Fengmei [a,b], Gao Lijie [a]

**Affiliations:**

[a] Key Lab of Urban Environment and Health, Institute of Urban Environment, Chinese Academy of Sciences, Xiamen 361021, China.

[b] University of Chinese Academy of Sciences, 19 A Yuquan Road, Beijing 100049, China.

**Corresponding author:** Lijie Gao, 1799 Jimei Road, Xiamen 361021, China

Tel: +86 592 6190676, Email: ljgao@iue.ac.cn

**Abstract:**

A comprehensive evaluation including residents' physical, psychological and cultural perceptions of their community can better guiding initiatives to improve community construction. Landsenses ecology is an emerging discipline which emphasizes the combination of the environment and human's subjective perceptions and provides a theoretical basis for the comprehensive assessment of the perceptions of community residents. In this study, a three-level evaluation system of residents' perceptions was constructed based on landsenses ecology and Maslow's hierarchy of needs theory, including physical perceptions (1st level), psychological perceptions (2nd level), and cultural perceptions (3rd level). Additionally, a comprehensive perception index was established based on a fuzzy comprehensive evaluation method. By evaluating the

residents' perceptions of five typical communities in the city of Xiamen, China, it was found that the cultural perceptions of residents had significantly lower index scores than their physical and psychological perceptions, that is, the higher the perception level is, the more difficult it is to realize the residents' demands. The results conform to Maslow's hierarchy of needs and the proposed perception levels based on landsenses ecology and verify the rationality of the present method for evaluating the residents' perceptions of their community. These findings could provide a scientific basis for community planning and management.

**Keywords:** landsenses ecology; community; Maslow's hierarchy of needs; resident perceptions; human settlement; fuzzy comprehensive evaluation.

## 1. Introduction

Human settlements are composed of facilities and services for residents and residents' perceptions of them (Doxiadis, 1970). Studies have shown that subjective perceptions are more representative of residents' quality of life than objective characteristics (Beveridge et al., 1976; Marans and Rodgers, 1975; Hamersma et al., 2014) and more important for the assessment of residents' health and wellbeing (Aragonés et al., 2017; Yu et al., 2019). Recent studies of residents' perceptions of their community have mainly focused on one of either the perception of physical health, mental health, or safety needs (Arthur et al., 2018; Yu et al., 2019; Jones et al., 2019). It is of significant practical and scientific value to carry out comprehensive evaluation of residents' multi-level perceptions of their community, including physiological and psychological perceptions.

Landsenses ecology is an emerging discipline based on ecological research, which emphasizes the integration of human sensory, psychological, and cultural perceptions, etc., into ecological environmental research (Zhao et al., 2016) and comprehensively summarizes the different dimensions of residents' perceptions of their living environment. Maslow's hierarchy of needs divides human needs into five categories, from basic physiological needs to higher "spiritual" needs (Hale et al., 2019). Some studies linked ecosystem services to Maslow's hierarchy and the results show that people's demand or recognition degree of different ecosystem services is in a pattern likes Maslow's hierarchy (Haida et al.,2016; Wang et al.,2017; Kang et al.,2019), which proved the rationality of Maslow's hierarchical framework. Based on the theory of landsenses ecology and Maslow's hierarchy of needs, this study established a comprehensive system for the evaluation of residents' perceptions of their community which can evaluate such perceptions more scientifically and comprehensively.

The remainder of this article consists of three parts: in part 1 (Section 2), the theories of Maslow's hierarchy of needs and landsenses ecology were expounded; part 2 (Section 3) describes the new index system for the comprehensive evaluation of residents' perceptions, including physical, psychological, and cultural perceptions; and part 3 (Sections 4 and 5) presents (1) an analysis of residents' perceptions of their community, taking five typical communities in Xiamen, China, as examples, and (2) a verification of the evaluation method established in part 2. The results show that physical, psychological, and cultural perceptions, and the comprehensive perception

indicators established in this paper, can accurately reflect the perceptions of community residents. The methods and findings of this study could be applied to community planning and management to help urban communities more efficiently manage human settlements and increase the level of human care.

## 2. Literature review

2.1. Evaluation of residents' perceptions of their community

Residents' perceptions of their community are the result of their understanding and evaluation of the objective conditions of the community's infrastructure, interpersonal relationships, culture, etc. (Burnett et al., 2014). These perceptions are influenced by many factors, which can be divided into physical and psychological–cultural aspects. The physical aspects include perceptions that are directly influenced by the community form and natural space, etc. (Lovejoy et al., 2010; Mohit and Azim, 2012), while the psychological–cultural aspects include perceptions that are further influenced by social harmony, a sense of belonging, cultural education, etc. (Carneiro et al., 2018; Hwang et al., 2019).

Previous studies mainly focus on residents' physical perceptions of their community including environmental and public facilities (Yang et al., 2018; Chen and Zhang, 2018), geographical location and convenience of transportation (Elldér, 2014; Poku-Boansi and Adarkwa, 2016), community services and security (Seekins et al., 2012; Pagliara and Wilson, 2010), housing quality (Phillips et al., 2004; Zhan et al., 2014), the social and economic environment (Lovejoy et al., 2010; Mohit and Azim, 2012), etc. Studies of residents' perceptions of psychological–cultural aspects are

relatively scarce. Hur and Nasar (2014) and Leverentz et al. (2018) analyzed the impact of residents' sense of security as well as sense of place on their overall satisfaction with community. While most studies only involved one factor and few performed simultaneous comprehensive evaluations of physical, psychological, and cultural perceptions.

## 2.2. Maslow's hierarchical framework

Maslow's hierarchy of needs theory divides people's needs into five levels: The 1st set of hierarchical needs identified by Maslow is physiological needs, including air, water, food, shelter and rest. They are the basic need of human beings and are mostly easily met; The 2nd set is safety needs. For residents, it mainly refers to original basic human need of safety from physical threats; The 3rd group is love and belonging, or social need, for humans desire to communicate with others and belongs to groups; The 4th group is esteem needs, including respect, fairness, and so on; the last level of need is self-actualization, namely, to be actualized in what a person is born to be; once these 4 levels of needs are met, he can become self-actualization (Clarke et al., 2006; Hale et al., 2018; Maslow, 1943). These five levels can be envisioned as a ladder, moving from low to high—that is, from material demands to higher "spiritual" demands (Hale et al., 2019).

Clarke et al. (2006) and Lazim and Qsman (2009) used Maslow's hierarchy to measure the welfare of Australian residents and the quality of life of Malaysian residents, respectively. Therefore, it is feasible to evaluate residents' perceptions of their community with reference to Maslow's hierarchy of needs.

2.3. Concept and connotations of landsenses ecology

Zhao et al. (2016) proposed the concept of landsenses ecology, and defined it as a scientific discipline that studies land-use planning, construction, and management to achieve sustainable development based on ecological principles and the analysis of natural elements, physical senses, psychological perceptions, socioeconomic perspectives, process risk, and associated aspects. Landsenses ecology integrates ecology, landscape ecology, environmental psychology, landscape aesthetics, and other disciplines, integrates humans into ecological processes to study the relationship between the two (Shi et al., 2017), and emphasizes human multi-sensory, psychological, and cultural perceptions.

Landsenses ecology extends the traditional definition of environment, based on urban ecology, environmental aesthetics, etc. In urban ecology, the environment includes human habitats, working environments, the regional ecological environment, and the cultural environment, which, together with human beings, constitute a complex "social–economic–natural" ecosystem (Ma and Wang, 1984; Wang, 1998). Environmental aesthetics holds that, in urban areas, the environment is closely related to daily human activities (Wohlwill, 1976). Landsenses ecology extends the scope of environment to all activities and things that human beings can perceive and experience.

Based on the above review, this paper argues that the term "landsenses" emphasizes the combination of environmental elements and the subjective perceptions of human beings and involves two main aspects: "land", referring to various material

factors that can be perceived objectively, including natural factors, the social economy, and social and natural processes and risks; and "senses", referring to human subjective perceptions of these material factors. Of these, "senses" can be divided into three levels: (1) physical perceptions, including vision, hearing, smell, taste, touch, and their combination, which are the most direct and first perceptions of the environment. Effective physical perceptions determine the other two levels of perceptions; (2) psychological perceptions—that is, the law of human psychological activity in different environments—which are subjective judgments formed in the process of human cognition, including higher-level feelings such as comfort and security; and (3) cultural perceptions, which are further impacted by factors such as ideology, lifestyle, customs, religious beliefs, aesthetics, morality, political factors, and production relations (Zhao, 2016), and are the highest level of perception.

Several studies based on landsenses ecology have been conducted, mainly focusing on ecological planning (Shi et al., 2017), ecological restoration (Wu et al., 2016; Tian et al., 2016), and landscape pattern planning and optimization (Dong et al., 2016; Tang et al., 2016). However, the scale of this research is mainly macroscopic or mesoscopic, with few studies focusing on the community scale.

## 3. Methods

The theoretical framework of the method used in this study for the comprehensive evaluation of residents' perceptions of their community is shown in Figure 1. Landsenses ecology emphasizes the inclusion of human subjective perception into the study of the eco-environment. Therefore, this study used people as

the main focus and established an indicator system for the evaluation of residents'
perceptions of the objective physical factors based on the theory of the science of
human settlements (Doxiadi, 1970; Wu, 2001) and Maslow's hierarchy of needs.
Additionally, a method for the comprehensive evaluation of residents' perceptions of
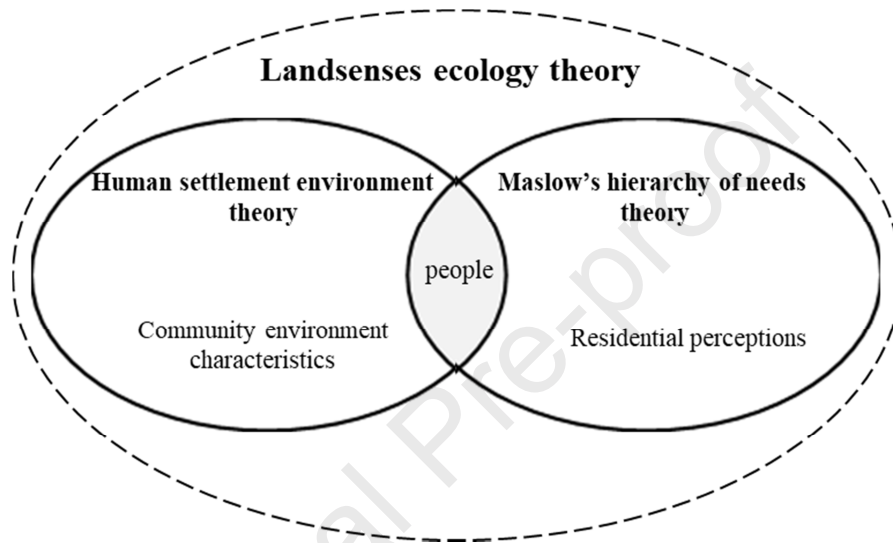their community was established.



Figure 1. Theoretical framework of the method used in this study to evaluate residents'
comprehensive perceptions of their community.

3.1. Study area

Xiamen (24°23' ∼ 24°54' N, 117°53' ∼ 118°26' E) is a typical coastal tourist city
with a total area of about 1699 $km^2$ and a water area of about 390 $km^2$. Therefore,
taking communities in Xiamen as case studies could be useful for evaluating the
effectiveness of community governance from multiple perspectives, and could be
used to inform the guidance of community construction and government. This study
used five typical communities in different districts of Xiamen (Figure 2) as case
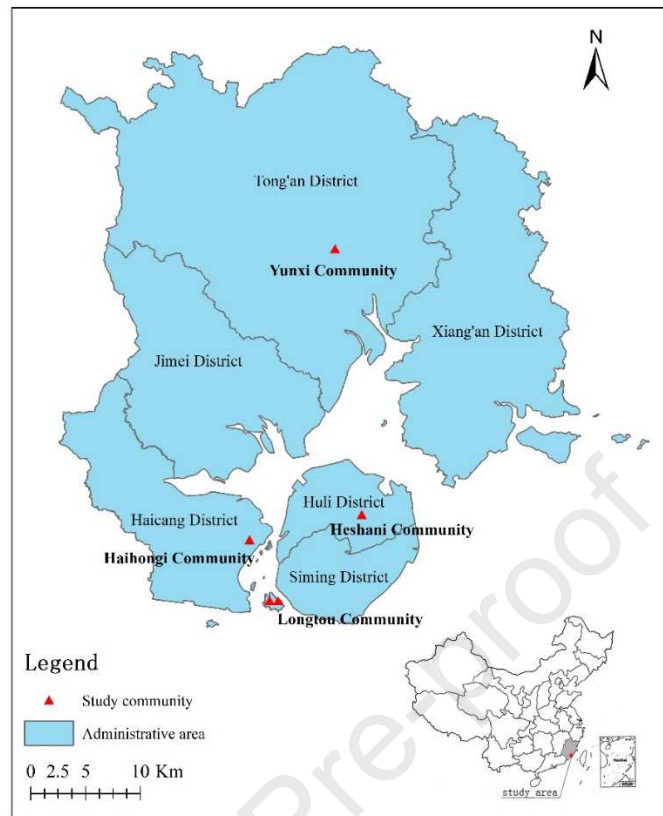studies. Specific information about these communities is shown in Table 1.

Figure 2. Locations of the communities investigated in this study.

3.2. Data

A questionnaire method was adopted to determine the perceptions of the residents regarding their communities. The questions were designed based on the indicator system for the evaluation of residents' perceptions of their community in section 3.3. To prevent leading answers, all survey questions were neutrally worded. With the help of the community residents' committee, residents of the five communities were asked to evaluate their perceptions of 13 selected indicators using a ten-step scale from 1 to 10 (1 being lowest and 10 being highest). In order to ensure the residents' comprehensive understanding of their community, only respondents who had lived in their community for at least one year were selected. The population composition, economic structure and cultural characteristics of each community were

carefully investigated through field research and unstructured interviews with community managers and neighborhood committees. The questionnaire survey was conducted in July 2017. A total of 155 questionnaires were sent out across all five communities, and the response rate was 100%. A total of eight questionnaires were discarded due to being incomplete. Therefore, a total of 147 valid questionnaires were obtained, representing a validity rate of 95%. The questionnaire data were analyzed using the IBM SPSS Statistics 19 (IBM Corporation, Armonk, NY, USA) and Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) software via descriptive statistical analysis, non-parametric analysis of variance, and multiple comparisons. Questionnaire data passed a reliability test (Cronbach's alpha = 0.874) and a validity test (Kaiser–Meyer–Olkin (KMO) = 0.838; Bartlett sphericity test $P<0.001$).

**Table 1. Details of the five communities used as case studies.**

| Name | Basic information | | | | Characteristics | Community type |
|---|---|---|---|---|---|---|
| | Construction date of buildings | Date of establishment of community administration | Area $(km^2)$ | Permanent population density (per $km^2$) | | |
| Haihong community, Haicang District (Community 1) | 2000s | 2008 | 2.00 | 2286.00 | The largest community in Haicang District, with mainly middle- to high-level housing estates. The community has a complete administration and rich community activities related to environmental protection. | Middle- to high-level community |
| Heshan community, Huli District (Community 2) | 2010s | 2013 | 1.40 | 10,714.29 | Established relatively late. Has rich community activities related to environmental protection. | New community |
| Longtou community, Siming District | 1980s–1990s | 2003 | 0.90 | 6681.11 | Located in the busy area of Kulangsu Island, a tourist area and UNESCO Intangible Cultural Heritage site. Has | Tourism community |

| | | | | | | |
|---|---|---|---|---|---|---|
| (Community 3) | | | | | a relatively complete administration and infrastructure but no property management companies. Belongs to the "Xiamen Community Construction Demonstration Community" and the "Xiamen Civilized Safe Community". | |
| Neicuo community, Siming District (Community 4) | 1980–1990s | 2003 | 1.01 | 5000.00 | Located in the quiet section of Kulangsu Island. Has relatively incomplete infrastructure and no property management companies. One of China's "National Top 100 Learning Communities". | Tourism community |
| Yunxi community, Tong'an District (Community 5) | 2000s | 2008 | 0.35 | 15,714.29 | Typical mixed urban and rural community with complete educational and entertainment facilities. Belongs to "Provincial Civilized Community" and "Green Community". | Green community |

Sources: Xiamen City Chronicle Volume 1, Volume 9 (2004): http://www.fzb.xm.gov.cn/dqsjk/xmsz/xmsz/ (last accessed 20 August 2019); internal documentation from the Environmental Protection Bureau of Tong'an District (2008).

3.3. Indicator system for the evaluation of residents' perceptions of their community

This paper believes that the perception levels in landsenses ecology are in line with Maslow's levels of need (Figure 3). The first level of the landsenses ecology hierarchy of perceptions, namely physical perceptions, consists of perceptions of the various objective material factors that exist in the community based on the five senses; these perceptions correspond to physiological needs in Maslow's hierarchy. The second level, namely psychological perceptions, refers to residents' feelings, corresponding to psychological needs in Maslow's hierarchy including safety, social and esteem. The third level, namely cultural perceptions, refers to residents' perceptions of humanistic value, the significance of education, their sense of identity, etc., in the community. These correspond to self-actualization needs in Maslow's

hierarchy, for if we wish most people could realize self-fulfillment, the community culture should be diverse and inclusive (Huang et al., 2018).

Based on the above two theories, this study established an indicator system for the evaluation of residents' perceptions based on three dimensions—namely physical perceptions, psychological perceptions, and cultural perceptions (Table 2)—and selected indicators for each dimension based on existing research.
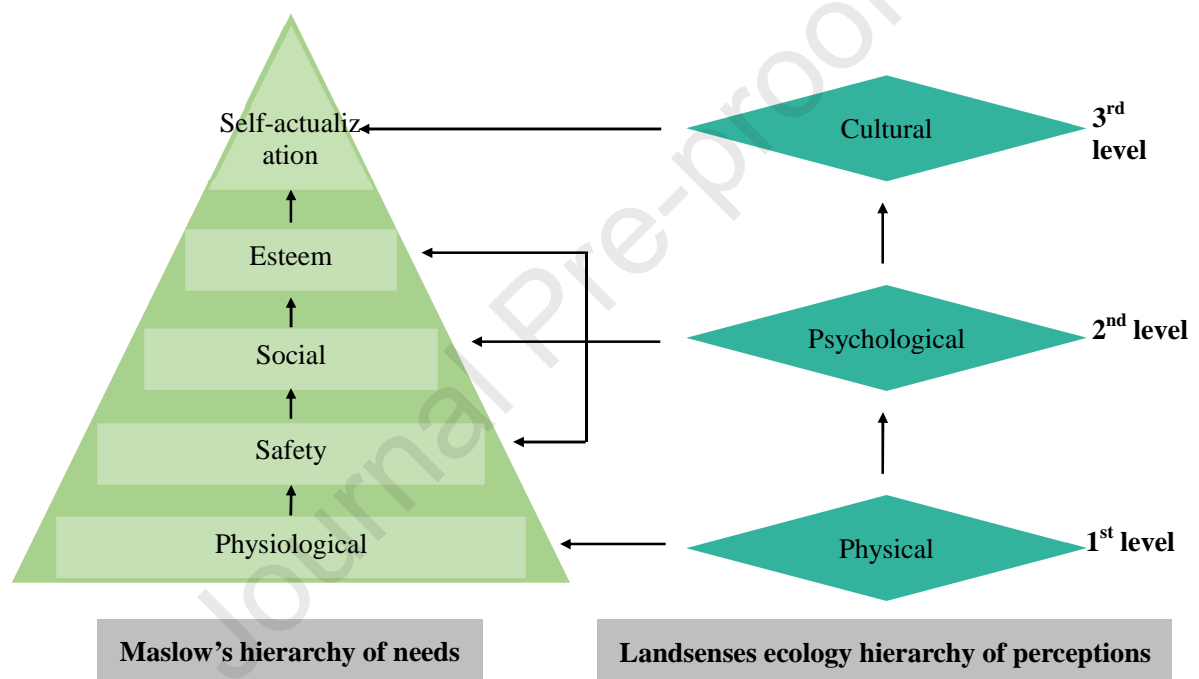


Figure 3. Perception levels of landsenses ecology and Maslow's hierarchy of needs

**Table 2. Details of the developed indicator system for the evaluation of the perceptions of community members based on landsenses ecology.**

| Target level | Perception level | Indicators |
|---|---|---|
| Community Perception Assessment | Physical (Level 1) | Green Space (Indicator 1) |
| | | Air freshness (Indicator 2) |
| | | Public facilities (Indicator 3) |
| | | Community Service (Indicator 4) |
| | | Convenient traffic (Indicator 5) |
| | | Housing quality (Indicator 6) |
| | Psychological (Level 2) | Sense of comfort (Indicator 7) |

|  | Sense of security (Indicator 8) |
|  | Sense of belonging (Indicator 9) |
|  | Social harmony (Indicator 10) |
|  | Esteem (Indicator 11) |
| Cultural (Level 3) | Educational Function (Indicator 12) |
|  | Identity (Indicator 13) |

For physical perceptions, six indicators were selected from three aspects of community—namely natural environment, service facilities, and housing—referring to previous research on human communities (Table 2, Indicators 1–6). The natural environment includes green space (Indicator 1) and air freshness (Indicator 2). Green space includes the vegetation, grassland, gardens, and water in a community, and is mainly perceived via the senses of vision, hearing, and smell. Green space has a significant impact on residents' physiological, aesthetic, and psychological health, and is an important indicator of the livability of a community and the satisfaction of its residents (Chen et al., 2017; Gascon et al., 2018; Madzia et al., 2019). Air freshness, which refers to the cleanliness of the air in a community, is closely related to health problems such as respiratory diseases (Chen et al., 2019) and is primarily perceived via the sense of smell. Public facilities (Indicator 3) refers to public infrastructure in the community, including roads, streetlights, parking lots, and facilities for fitness and recreation (Panter and Ogilvie, 2015). Community service (Indicator 4) includes social welfare activities for the material and "spiritual" needs of residents, which have a significant impact on their quality of life (Christenson, 1979). Convenient traffic (Indicator 5) indicates the severity of road traffic in and around the community. Housing quality (Indicator 6) expresses the quality of the residential buildings in the community. These indicators are closely related to the residents' quality of life, and

their perception involves combinations of different types of perceptions, including visual, tactile, and olfactory.

For psychological perceptions, five representative indicators were selected based on previous research (Table 2, Indicators 7–11). Sense of comfort (Indicator 7) refers to the feelings of relaxation, pleasure, and ease felt in the community (Watanabe et al., 2006). Sense of security (Indicator 8) refers to personal safety; sense of a stable life; freedom from threats, pain, and disease; and the need for institutions, order, and physical and interpersonal boundaries (Chong et al., 2017). Sense of belonging (Indicator 9) refers to the feeling of love and attachment to the community (Gehl, 1989). Social harmony (Indicator 10) refers to the willingness to build interpersonal relationships with others in the community (Zheng et al., 2012). Esteem (Indicator 11) refers to the mutual respect among residents, which reflects the social equality of the community (Huang et al., 2018).

For cultural perceptions, two representative indicators were selected (Table 2, Indicators 12 and 13). Educational function (Indicator 12) refers to the function of community culture in improving the residents' culture quality, other than that related to their psychological and spiritual needs (Liu and Feng, 2002). Identity (Indicator 13) mainly refers to culture identity, including values, thinking mode, behaviors, etc., which embodies culture diversity and inclusion. It is formed in the interaction of community members and organizations and mainly is reflected in the care and participation in community public affairs (Wu, 2011).

3.4. Comprehensive fuzzy evaluation method for residents' perceptions

3.4.1. Analysis steps for comprehensive fuzzy evaluation

(1)  Establish the factor set and the evaluation set

The factor set is defined as $U = \{u_1, u_2, \cdots, u_m\}$, where m represents the number of indicators. U can be divided into several categories according to the attributes of the evaluation indicators, namely $U = U_1 \cup U_2 \cup \cdots \cup U_s$. The evaluation set is defined as $V = \{v_1, v_2, \cdots, v_n\}$, where n is the number of different evaluations and is generally 3–5. In this study, the evaluation set was established as V={Very Good, Relatively Good, Moderate, Relatively Bad, Bad}, and the corresponding relationships between these five grades and the scores of the questionnaire were set as Very Good = (9, 10), Relatively Good = (7, 8), Moderate = (5, 6), Relatively Bad = (3, 4), and Bad = (1, 2). These five grades (Very Good, Relatively Good, Moderate, Relatively Bad, and Bad) were assigned values of 1, 2, 3, 4, and 5, respectively.

（2）Establish the fuzzy evaluation matrix

The relationship between the evaluation indicators and the evaluation set can be demonstrated using a membership function. Let $r_{ij}$ be the degree of membership of an evaluated object to the graded fuzzy subset $v_j$ in terms of factor $u_i$. The fuzzy evaluation matrix (R) can be expressed as $R = (r_{ij})_{n \times m}$, and is generally normalized so that $\sum r_{ij} = 1$.

(3) Establish the fuzzy comprehensive evaluation model

A method was adopted to determine the weight of each evaluation factor $Z = \{z_1, z_2, \cdots, z_m\}$, where $z_i$ represents the weight of the ith factor. The fuzzy

comprehensive evaluation vector (B) can be expressed as $B = Z°R = (b_1, b_2 \cdots, b_m)$, where "°" is the operator of the fuzzy operation. In this paper, "°" refers to the weighted average model.

### 3.4.2. Indicator weights

The determination of weight is critical to the results of the comprehensive evaluation. The hierarchical structure of the three levels of perceptions proposed in this paper is consistent with the five human demands in Maslow's hierarchy of needs, that is, only after physiological needs are met will people pursue psychological enjoyment and finally "spiritual" needs. Therefore, as the level of demand increases, the weights of the perception indicators should also increase. Lazim (2009) give higher weights to indicators in higher levels of Maslow's hierarchy of needs, with physiological, security, social, and self-actualization requirements being given weights of 1, 2, 3, and 4, respectively. Compared with other weighting methods, this method can better reflect hierarchical and linear progressions, which is more in line with the indicator system used in this study. Therefore, according to the method of Lazim (2009), in this study, third-level weight ($\times$1) was given to the indicators of physical perceptions, second-level weight ($\times$2) was given to the indicators of psychological perceptions, and first-level weight ($\times$3) was given to the indicators of cultural perceptions. After normalization, the weights of the indicators of physical, psychological, and cultural perceptions were 0.05, 0.09, and 0.14, respectively.

## 4. Results and discussions

4.1. Fuzzy comprehensive evaluation

A fuzzy comprehensive evaluation method was used to calculate the comprehensive perceptions of the residents of the five communities. The evaluation set was established as V= {Very Good, Relatively Good, Moderate, Relatively Bad, Bad}, and the corresponding relationships between these five grades and the scores of the questionnaire were set as Very Good = (9, 10), Relatively Good = (7, 8), Moderate = (5, 6), Relatively Bad = (3, 4), and Bad = (1, 2). These five grades (Very Good, Relatively Good, Moderate, Relatively Bad, and Bad) were assigned values of 1, 2, 3, 4, and 5, respectively. The results of the questionnaires show that the comprehensive perception indexes of the residents of all five communities were high and all above 8.5 (Fig. 4). The comprehensive perception indexes of the residents of the five communities had the following order: Yunxi community (Tong'an District) > Heshan community (Huli District) > Haihong community (Haicang District) > Longtou community (Siming District) > Neicuo community (Siming District). The highest score was obtained for the physical perception level; however, since this level had the lowest weight, its comprehensive index is low. Despite having the highest weight, the cultural perception level had the lowest score, and its comprehensive index was therefore the lowest of all levels.
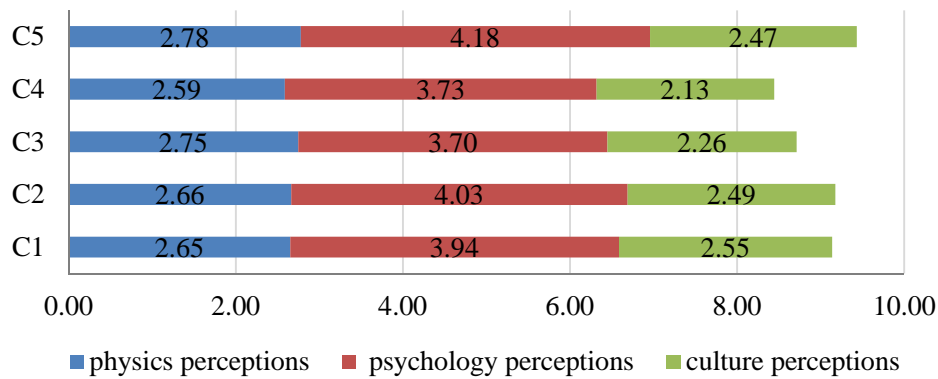
Figure 4. Comprehensive perception indexes of residents of the five studied communities in Xiamen, China, as determined by questionnaire survey. C1: Haihong community (Haicang District); C2: Heshan community (Huli District); C3: Longtou community (Siming District); C4: Neicuo community (Siming District); C5: Yunxi community (Tong'an District).

4.2. Comparison of different perceptions

For all five communities, the perception indicator scores for all three perception levels were higher than 6.5 (Figure 5). Furthermore, the comprehensive perception index scores for the three perception levels had the following order: physical perceptions > psychological perceptions > cultural perceptions; moreover, for all of the communities, the scores for physical and psychological perceptions were significantly higher than those for cultural perceptions (P<0.01) (Figure 6). These results are in good agreement with Maslow's hierarchical demand theory and the perception levels based on landsenses ecology established in this paper—that is, the higher the perception level is, the more difficult it is to realize the residents' demands. The result of multi-collinearity test show that Pearson correlation coefficients between indicators are all less than 0.71, and the VIF of within-group indicators are less than 2.70 (Table 3), so there is no high multi-collinearity between within-group indicators. The results of this study also verify the rationality of the proposed evaluation system.

**Table 3. Result of multi-collinearity test.**

| Perception level | Indicators | $R^2$ | VIF |
|---|---|---|---|
| Physical (Level 1) | Green Space (Indicator 1) | 0.43 | 1.75 |
| | Air freshness (Indicator 2) | 0.23 | 1.29 |
| | Public facilities (Indicator 3) | 0.62 | 2.63 |
| | Community Service (Indicator 4) | 0.50 | 2.01 |
| | Convenient traffic (Indicator 5) | 0.20 | 1.25 |
| | Housing quality (Indicator 6) | 0.32 | 1.48 |
| Psychological (Level 2) | Sense of comfort (Indicator 7) | 0.30 | 1.43 |
| | Sense of security (Indicator 8) | 0.16 | 1.19 |
| | Sense of belonging (Indicator 9) | 0.22 | 1.27 |
| | Social harmony (Indicator 10) | 0.32 | 1.48 |
| | Esteem (Indicator 11) | 0.30 | 1.43 |
| Cultural (Level 3) | Educational Function (Indicator 12) | 0.26 | 1.36 |
| | Identity (Indicator 13) | 0.26 | 1.36 |
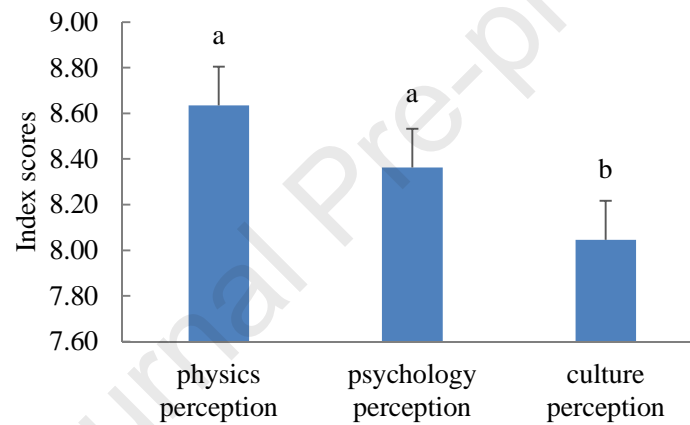


Figure 5. Residents' perceptions for different levels of the landsenses ecology hierarchy of perceptions.
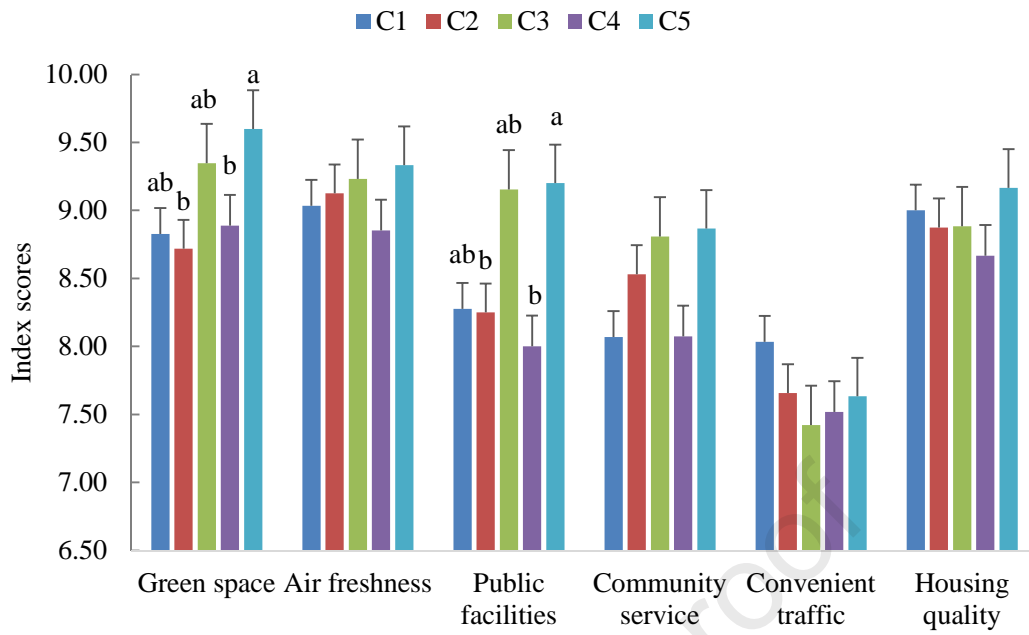
(a)
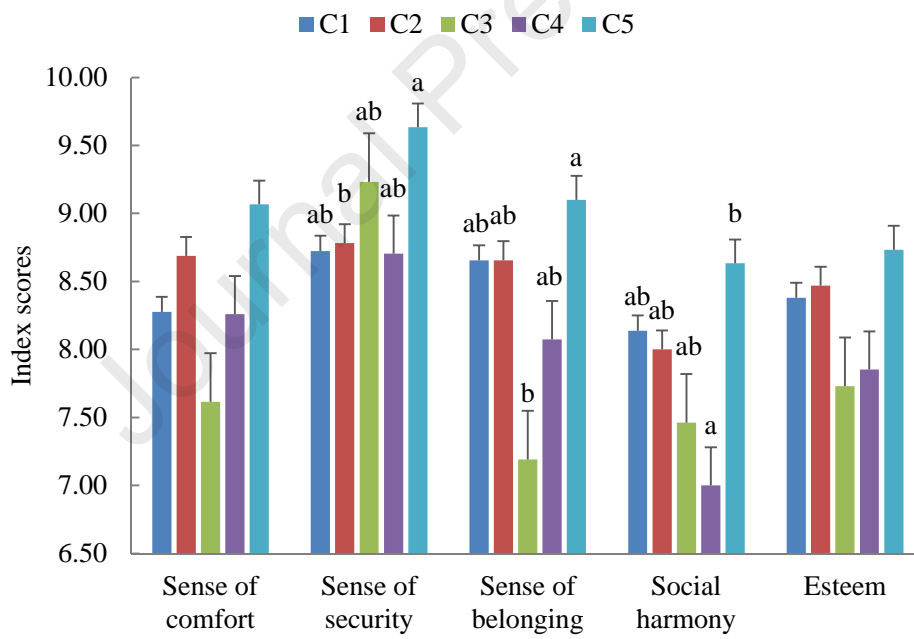


(b)
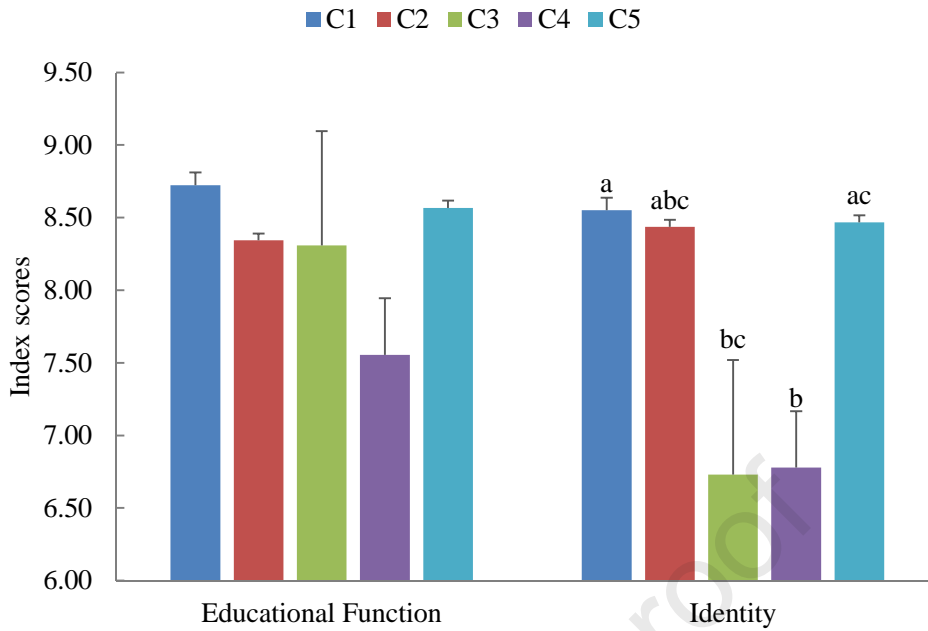
(c)

Figure 6. Evaluation of the perceptions of residents of the five studied communities. (a) physical perceptions. (b) psychological perceptions. (c) cultural perceptions. Note: letters above the perceptions indicate a significant difference.

### 4.2.1. Physical perceptions

Among physical perceptions, the residents' perceptions of green space and air freshness had the highest index scores. This can be attributed to the good environmental conditions in Xiamen. The perceptions of green space and public facilities of Yunxi community had significantly higher index scores than those of Heshan community ($P<0.01$) and Neicuo community ($P<0.05$). Through the field research and interviewing of community managers (Section 4.2), it was found that the main reason for these differences may be that Yunxi community has been actively establishing a "green community" since 2006; the green coverage rate of the community is close to 70%. Additionally, Yunxi community has paid significant

attention to the construction of fitness facilities for its residents, especially for the elderly, who account for nearly 1/3 of the population. The green space perception of Heshan community had the lowest index score of the five communities. This can be attributed to the fact that Heshan community is the newest of the five communities and is located in the most urbanized area; this could lead the residents to have higher requirements and expectations, which could in turn lead to a negative perception of public services. This observation supports the findings of Coldwell and Evans (2018). Moreover, in Neicuo community, residents' physical perceptions were relatively poor, which can be attributed to this community's lack of property management and the fact that it is located in an underdeveloped section of the city.

4.2.2. Psychological perceptions

Psychological perceptions are generally based on physical perceptions (Hale et al., 2019). However, in the present study, the physical perceptions of residents of Longtou community had high index scores but their psychological perceptions had low scores (Figure 6a, b). Longtou community and Neicuo community are both located in the tourist area of Kulangsu Island, which is an old residential area that lacks property management. However, the physical perceptions of the residents of Longtou community had higher index scores than those of the residents of Neicuo community, and the perceptions of community services and public facilities of the residents of Longtou community had relatively high index scores. This can be explained by the fact that Longtou community is located in a busier and more commercial area than Neicuo community and its community management and support

facilities are more complete. This conclusion is supported by the results of most studies on the relationship between residents' physical perceptions of their community and the distance from their place of residence to core scenic spots—that is, the closer someone's residence is to the core scenic spots, the more employment opportunities they have, the better the infrastructure, and the higher their perceptions of their community (Vargas-Sanchez et al., 2011). Additionally, the closer someone's residence is to the core scenic spots, the more negative impacts of tourism development they will tolerate (Bestard and Nadal, 2007). Although the physical perceptions of the residents of Longtou community had high index scores, the psychological perceptions of the residents of Longtou community and Neicuo community both had low index scores (Figure 6b), and the perceptions of esteem and sense of comfort and belonging of the residents of Longtou community had lower index scores than those of the residents of Neicuo community. In the field research and interviews with community residents and managers, we found that the demographics of Longtou community and Neicuo community mainly consisted of elderly people and people from other cities, and that the economic structures of these two communities were dominated by businesses. From the interviews conducted in this study, it was found that the interpersonal relationships of residents in these two communities were relatively poor, and it is therefore difficult to carry out community work. Additionally, Kulangsu Island attracts a large number of tourists (both domestic and foreign), which, although improving the local economy, brings problems, such as the occupation of streets for stalls, the presence of many unlicensed guides, and the

expansion of family hotels. These problems have led to a high demand for resources on the island, including electricity, water, and sanitation, which in turn has reduced residents' psychological perceptions of their community (Ji et al, 2014). From the above analysis, it can be seen that physical perceptions will affect psychological perceptions to a certain extent. Usually, the lower the index scores of the physical perceptions are, the lower the index scores of the psychological perceptions will be. However, higher physical perceptions will not necessarily lead to higher psychological perceptions, since psychological perceptions are also directly affected by other factors, such as interpersonal relationships.

### 4.2.3. Cultural perceptions

Based on Maslow's theory, perceptions of identify should represent the highest level of residents' perceptions of their community (Gong, 2012), and high perceptions of identity should generally correspond to high psychological perceptions of community. However, although the psychological perceptions of the residents of Yunxi community had the highest index scores among the five communities and were significantly higher than those of the residents of Heshan community ($P<0.05$), Longtou community ($P<0.01$), and Neicuo community ($P<0.05$) (Figure 6b), the cultural perceptions of the residents of Haihong community had the highest index scores , while the identity perceptions of the residents of this community had significantly higher comprehensive scores than those of the residents of Neicuo community ($P<0.05$) and Longtou community ($P<0.05$) (Figure 6c). According to the field research, Yunxi community has a community academy, chess and card rooms,

and regularly organizes public welfare education activities, and its residents had a high sense of respect and belonging. However, community activities in Yunxi community are mainly service-oriented, and residents had a low sense of self-service. Haihong community is part of a pilot project of community network management in Fujian Province which divides communities into 12 responsibility grids, with one unit containing 400 families. Furthermore, basic information platforms and interactive platforms had been established in this community. Unlike Yunxi community, the activities of Neicuo community are mainly participation-oriented. Residents' autonomy is high, which can effectively improve their sense of community identity (Stürmer and Kampmeier, 2003; Cicognani et al., 2008). Nevertheless, although Haihong and Heshan community both focus on resident participation, residents' perception of identity is lower in Heshan community than in Haihong community. Heshan community was established later than Haihong community, which could explain why the relationship between residents and their community is not close enough in the former community. Frequent high-quality interactions between residents and their community can improve residents' sense of identity (Fei, 2002; Lin and Luyt, 2014). From the above analysis, it can be concluded that increasing residents' participation in community affairs can effectively improve their sense of identity. However, it also suggests that it takes time for residents to develop a sense of identity, requiring long-term interaction between them and their community.

4.3. Research limitations

This paper is a preliminary exploration of landsenses ecology, and the index

system established herein is not sufficiently comprehensive and detailed. For example, some elements of the index system belong to multiple attributes, such as physical and psychological perceptions (Zhao et al., 2016). Other researchers suggest that residents' demographic characteristics or socioeconomic background have a considerable influence on residents' demand and subjective perceptions (Hegetschweiler et al., 2017; Wang et al., 2019; Suppakittpaisarn et al., 2019). However, as this research mainly divided the respondents by community, no further analysis of the respondents' individual characteristics was conducted. Related research considering these factors is recommended in the future.

Due to the complexity and Spatiotemporal variability of urban system, residents' demands may vary in different developing periods and not change linearly (Pan et al., 2019, 2020). Quintas-Soriano et al. (2018) found that cultural ecosystem services were the most highly mentioned among those surveyed four sites in southern Spain and USA. According to the experts' interviews, culture ecosystem services including aesthetic and recreation correspond to psychological or spiritual needs in the Maslow's hierarchy (Haida et al.; 2016). While Wang et al. (2017) found that basic material for a good life was most valued in the Huailai mountain-basin system, China, while mental health was disregarded. Therefore, the assessment approached integrating spatiotemporal process are recommended in future studies.

Planning and construction based on landsenses ecology emphasizes the integration of data on stakeholders' perceptions into the process of city planning. During this process, it is necessary to explore the rules and characteristics of the

interaction between humans and the environment. As well as the residents who live in them, communities include physical elements, such as green space, buildings, and infrastructure, and is an important action unit and a key interface between residents and landscape elements. Compared with research on perceptions at an urban scale, it is easier to ensure the integrity of such research at a community scale due to the relative simplicity of the community system. In the future, the results of the present study can be extended to related research at other scales.

## 5. Conclusions and suggestions

In order to achieve a comprehensive and accurate assessment of residents' perceptions of their community, this study established an index system for the evaluation of residents' perceptions of their community based on three levels of perception—namely physical, psychological, and cultural—based on landsenses ecology and Maslow's hierarchy of needs theory, and established a comprehensive perception index based on fuzzy theory. By evaluating the perceptions of residents of five typical communities in the city of Xiamen, China, it was found that the higher the comprehensive index score of the residents' perception level is, the more difficult it is to realize the residents' demands. Physical needs are the basic needs of human beings. This study found that, if the comprehensive index score of residents' physical perceptions is low, the comprehensive index score of their psychological and cultural perceptions will also generally be low. However, it was also found that physical perceptions with high index scores do not necessarily correspond to high index scores for psychological and cultural perceptions. These findings are in line with Maslow's

hierarchy of needs and with the perception levels based on landsenses ecology that are proposed in this paper. Additionally, it was found that residents' physical perceptions generally had a higher comprehensive index score than their psychological and cultural perceptions. This can be attributed to the fact that construction and reconstruction can be performed more quickly for the physical environment than the psychological and cultural environment, and the results are easier to see. The construction and improvement of the psychological and cultural environment is a long-term process which requires long-term interaction between residents and their community. The results of the present study verify the rationality of the fuzzy comprehensive perception index established therein.

Based on the results and analysis presented above, the following suggestions for the planning and management of human communities are put forward:

(1) The construction and management of human settlements should not only lay stress on residents' physical perception, but also psychological and culture perceptions. Based on the results of this study, people's physical perception level of living environment is improved, but their psychological perception and cultural perception are still low. Therefore, it is necessary to further strengthen the research of residents' comprehensive perceptions of physical, psychological and cultural aspects of community living environment, and make comprehensive and accurate assessments of community residents' perception, so as to improve residents' life quality.

(2) At the community level, community developers and managers should establish long-term relationships and interactions between residents and improve the

degree of residents' active participation in community projects. By comparing C1 and C5, it could be indicated that through participation in community projects, residents can be educated and guided to coordinate their relationships in the community by themselves and thereby improve their sense of ownership and sense of serving both themselves and the community, which . This process can develop emotional connections between residents and the community, as well as community identity.

(3) Historic and cultural tourist communities usually have old buildings and infrastructure. Therefore, the construction and development of tourist areas should focus on not only the construction of core scenic spots and their surroundings, but also the renovation and property management of non-core scenic spots in order to improve the physical perceptions of residents. Through the survey of C3 and C4, it could be indicated that resource competition caused by tourism development can easily lead to the degradation of residents' psychological perceptions of their community. However, if residents are fully involved in the decision-making and benefit allocation of tourism planning, and their perceptions of the impact of tourism can thereby be improved.

**Acknowledgement**

## References

Aragonés, J.I., Amérigo, M., Pérezlópez, R., 2017. Residential satisfaction and quality of life, handbook of environmental psychology and quality of life research. international handbooks of quality-of-life. Springer, Cham.

Arthur, K.N., Spencer-Hwang, R., Knutsen, S.F., Shavlik, D., Soret, S., Montgomery, S., 2018. Are perceptions of community safety associated with respiratory illness among a low-income, minority adult population? BMC Public Health 18, 1089. https://doi.org/https://doi.org/10.1186/s12889-018-5933-4

Berleant, A., 1984. Aesthetic participation and the urban environment. Urban Resour. 1, 37–42.

Bestard, A.B., Nadal, J.R., 2007. Modelling environmental attitudes toward tourism. Tour. Manag. 28, 688–695.

Beveridge, A.A., Campbell, A., Converse, P.E., Rodgers, W.L., 1976. The quality of American life: Perceptions, evaluations, and satisfactions. Polit. Sci. Q. 529–531. https://doi.org/10.2307%2F2148954

Bourassa, S.C., 1988. Toward a theory of landscape aesthetics. Landsc. Urban Plan. 15, 241–252.

Burnett, A.J., Hershey, J.H., Pennington, H.T., 2014. Mapping residents' perceptions of health-related quality of life and community needs in southwest virginia: an exploratory study. J. Rural Community Dev. 9, 258–279.

Carneiro, M.J., Eusebio, C., Caldeira, A., 2018. The influence of social contact in residents' perceptions of the tourism impact on their quality of life: a structural equation model. J. Qual. Assur. Hosp. Tour. 19, 1–30. https://doi.org/10.1080/1528008x.2017.1314798

Chen, C., Zhang, H., 2018. Using emotion to evaluate our community: exploring the relationship between the affective appraisal of community residents and the community environment. Archit. Eng. Des. Manag. 14, 256–271.

Chen, E., Miller, G.E., Shalowitz, M.U., Story, R.E., Levine, C.S., Hayen, R., Sbihi, H., Brauer, M., 2017. Difficult family relationships, residential greenspace, and childhood asthma. Pediatrics 139. https://doi.org/10.1542/peds.2016-3056

Chen, M., Dai, F., Yang, B., Zhu, S., 2019. Effects of neighborhood green space on PM2. 5 mitigation: Evidence from five megacities in China. Build. Environ. 156, 33–45.

Chong, S.T., Koh, D., Fauziah, I., Samsudin, A.R., 2017. Neighbourhood social capital and neighbourhood safety in predicting the subjective well-being of young malaysians. Pertanika J. Soc. Sci. Humanit. 25.

Christenson, J.A., 1979. Urbanism and community sentiment: extending Wirth's model. Soc. Sci. Q. 60, 387–400.

Cicognani, E., Pirini, C., Keyes, C., Joshanloo, M., Rostami, R., Nosratabadi, M., 2008. Social participation, sense of community and social well being: A study on American, Italian and Iranian university students. Soc. Indic. Res. 89, 97–112.

Clarke, M., Islam, S.M.N., Paech, S., 2006. Measuring Australia's well-being using hierarchical needs. J. Socio. Econ. 35, 933–945.

Coldwell, D.F., Evans, K.L., 2018. Visits to urban green-space and the countryside associate with different components of mental well-being and are better predictors than perceived or actual local urbanisation intensity. Landsc. Urban Plan. 175, 114–122.

Dong, R., Liu, X., Liu, M., Feng, Q., Su, X., Wu, G., 2016. Landsenses ecological planning for the Xianghe Segment of China's Grand Canal. Int. J. Sustain. Dev. World Ecol. 23, 298–304.

Doxiadis, C.A., 1970. Ekistics, the science of human settlements. Science (80-. ). 170, 393–404. https://doi.org/10.1126/science.170.3956.393

Elldér, E., 2014. Residential location and daily travel distances: the influence of trip purpose. J. Transp. Geogr. 34, 121–130.

Fei, X., 2002. Autonomy of resident: New target of community construction in urban China. Jianghai Acad. J. 15–18.

Fried, M., 1982. Residential attachment: Sources of residential and community satisfaction. J. Soc. Issues 38, 107–119. https://doi.org/10.4324/9781912282661

Gao, F., Zhu, Y., 2005. Towards safety and welfare: A study on community security of Shanghai citizens. China Soc. Welf. 32–34.

Gascon, M., Sanchez-Benavides, G., Dadvand, P., Martinez, D., Gramunt, N., Gotsens, X., Cirach, M., Vert, C., Luis Molinuevo, J., Crous-Bou, M., Nieuwenhuijsen, M., 2018. Long-term exposure to residential green and blue spaces and anxiety and depression in adults: A cross-sectional study. Environ. Res. 162, 231–239. https://doi.org/10.1016/j.envres.2018.01.012

Gehl, J., 1989. Life between buildings: using public space. Landsc. J. 8, 54–55. https://doi.org/10.3368/lj.8.1.54

Gong, W., 2012. Maslow's hierarchy of needs theory and the construction of current landscape environment. Art Educ. 158–159.

Haber, W., 2004. Landscape ecology as a bridge from ecosystems to human ecology. Ecol. Res. 19, 99–106. https://doi.org/10.1111/j.1440-1703.2003.00615.x

Haida C, Rüdisser J, Tappeiner U. Ecosystem services in mountain regions: experts' perceptions and research intensity. Reg Environ Change, 2015, 16(7): 1989-2004.

Hale, A.J., Ricotta, D.N., Freed, J., Smith, C.C., Huang, G.C., 2019. Adapting Maslow's hierarchy of needs as a framework for resident wellness. Teach. Learn. Med. 31, 109–118.

Hamersma, M., Tillema, T., Sussman, J., Arts, J., 2014. Residential satisfaction close to highways: The impact of accessibility, nuisances and highway adjustment projects. Transp. Res. Part A Policy Pract. 59, 106–121.

Hegetschweilera K.T., Vriesb S., Arnbergerc A., Belld S., Brennane M., Siter N., Olafsson A.S., Voigth A., Hunzikera M., 2017. Linking demand and supply factors in identifying cultural ecosystem services of urban green infrastructures: A review of European studies. Urban For. Urban Green. 21, 48-59. https://doi.org/10.1016/j.ufug.2016.11.002

https://doi.org/10.1007/978-3-319-31416-7_17

Hur, M., Nasar, J.L., 2014. Physical upkeep, perceived upkeep, fear of crime and neighborhood satisfaction. J. Environ. Psychol. 38, 186–194.

Hwang, J., Wang, L., Siever, J., Medico, T. Del, Jones, C.A., 2019. Loneliness and social isolation among older adults in a community exercise program: a qualitative study. Aging Ment. Health 23, 736–742. https://doi.org/10.1080/13607863.2018.1450835

Ji, Z., Jiang, Y., Xie, T., 2017. The perceptions and attitudes of residents towards the impacts of tourism. Resour. Sci. 39, 396–407. https://doi.org/10.18402/resci.2017.03.02

Jones, N., Malesios, C., Aloupi, M., Proikaki, M., Tsalis, T., Hatziantoniou, M.,
Dimitrakopoulos, P.G., Skouloudis, A., Holtvoeth, J., Nikolaou, I., 2019.
Exploring the role of local community perceptions in sustainability
measurements. Int. J. Sustain. Dev. World Ecol. 1–13.
https://doi.org/10.1080/13504509.2019.1638330

Lazim, M.A., Osman, M.T.A., 2009. A new Malaysian quality of life index based on
fuzzy sets and hierarchical needs. Soc. Indic. Res. 94, 499.

Lin, H., Luyt, B., 2014. The National Library of Singapore: creating a sense of
community. J. Doc. 70, 658–675.

Liu, Q., Feng, J., 2002. Review on community culture and it's influence in the
building of community. J. Tsinghua Univ. Soc. Sci. 19–24.
https://doi.org/10.13613/j.cnki.qhdz.000661

Lovejoy, K., Handy, S., Mokhtarian, P., 2010. Neighborhood satisfaction in suburban
versus traditional environments: An evaluation of contributing characteristics in
eight California neighborhoods. Landsc. Urban Plan. 97, 37–48.

Ma, S., Wang, R., 1984. The social-economic-nature complex ecosystem. Acta Ecol.
Sin. 4, 4–9.

Madzia, J., Ryan, P., Yolton, K., Percy, Z., Newman, N., LeMasters, G., Brokamp, C.,
2019. Residential Greenspace Association with Childhood Behavioral Outcomes.
J. Pediatr, 207, 233–240. https://doi.org/10.1016/j.jpeds.2018.10.061

Marans, R.W., Rodgers, W., 1975. Toward an understanding of community
satisfaction. Metrop. Am. Contemp. Perspect. 299–352.

Mohit, M.A., Azim, M., 2012. Assessment of residential satisfaction with public
housing in Hulhumale', Maldives. Procedia-Social Behav. Sci. 50, 756–770.

Pagliara, F., Wilson, A., 2010. The state-of-the-art in building residential location models. https://doi.org/10.1007/978-3-642-12788-5_1

Pan H Z, Page J, Zhang L, Cong C, Ferreira C, Jonsson E, Nässtrom H, Destouni G, Deal B, Kalantari Z. Understanding interactions between urban development policies and GHG emissions: A case study in Stockholm Region. Ambio, 2020, 49(7): 1313-1327.

Pan H Z, Zhang L, Cong C, Deal B, Wang Y T. A dynamic and spatially explicit modeling approach to identify the ecosystem service implications of complex urban systems interactions[J]. Ecol Indic, 2019, 102(JUL.):426-436.

Panter, J., Ogilvie, D., 2015. Theorising and testing environmental pathways to behaviour change: natural experimental study of the perception and use of new infrastructure to promote walking and cycling in local communities. BMJ Open 5, e007593.

Phillips, D.R., Siu, O.-L., Yeh, A.G.O., Cheng, K.H.C., 2004. Factors influencing older persons' residential satisfaction in big and densely populated cities in Asia: A case study in Hong Kong. Ageing Int. 29, 46–70.

Pillay, S., Pahlad, R., 2014. A gendered analysis of community perceptions and attitudes towards green spaces in a Durban Metropolitan residential area: implications for climate change mitigation. Agenda 28, 168–178.

Poku-Boansi, M., Adarkwa, K.K., 2016. Determinants of residential location in the Adenta Municipality, Ghana. GeoJournal 81, 779–791.

Quintas-Soriano C, Brandt J S, Running K, Baxter C V, Gibson D M, Narducci J, Castro A J. Social-ecological systems influence ecosystem service perception: a Programme on Ecosystem Change and Society (PECS) analysis. Ecol Soc, 2018, 23(3): 3.

Reid, D.G., Mair, H., George, W., 2004. Community tourism planning: A self-assessment instrument. Ann. Tour. Res. 31, 623–639.

Rüdisser J, Schirpke U, Tappeiner U. Symbolic entities in the European Alps: Perception and use of a cultural ecosystem service. Ecosyst Serv, 2019, 39:100980.

Rudlin, D., 2010. Sustainable Urban Neighbourhood. https://doi.org/10.4324/9780080939544

Seekins, T., Arnold, N., Ipsen, C., 2012. Developing methods for grading the accessibility of a communality's infrastructure. J. Urban Plan. Dev. 138, 270–276.

Shan, Q., 2006. The community attachment and China urban community's construction. J. Grad. Sch. Chinese Acad. Soc. Sci. 125–131.

Shi, L., Zhao, H., Zheng, S., Yu, T., Dong, R., 2017. "Landsenses"ecological planning for urban-rural ecotones. Acta Ecol. Sin. 37. https://doi.org/10.5846/stxb201605251009

Stürmer, S., Kampmeier, C., 2003. Active citizenship: The role of community identification in community volunteerism and local participation. Psychol. Belg. 43, 103–122.

Suppakittpaisarn, P., Jiang, B., Slavenas, M., Sullivan, W.C., 2019. Does density of green infrastructure predict preference? Urban For. Urban Green. 40, 236-244. https://doi.org/ 10.1016/j.ufug.2018.02.007

Tang, L., Wang, H., Wang, L., Qiu, Q., 2016. Landscape pattern optimization for Xianghe segment of china's grand canal. Int. J. Sustain. Dev. World Ecol. 23, 305–311.

Tian, Y., Guo, Z., Zhong, W., Qiao, Y., Qin, J., 2016. A design of ecological restoration and eco-revetment construction for the riparian zone of Xianghe Segment of China's Grand Canal. Int. J. Sustain. Dev. World Ecol. 23, 333–342.

Vargas-Sanchez, A., Porras-Bueno, N., de los Ángeles Plaza-Mejía, M., 2011. Explaining residents' attitudes to tourism: Is a universal model possible? Ann. Tour. Res. 38, 460–480.

Wang B J, Tang H P, Xu Y. Perceptions of human well-being across diverse respondents and landscapes in a mountain-basin system, China. Appl Geogr, 2017, 85:176-183.

Wang, R., 1998. From materialized civilization to ecological civilization—ecology for sustainable development. World Sci-Tech R D 87–98. https://doi.org/I:10.16507/j.issn.1006-6055.1998

Wang, R.H., Zhao, J.W., Meitner, M.J., Hu, Y., Xu, X.L., 2019. Characteristics of urban green spaces in relation to aesthetic preference and stress recovery. Urban For. Urban Green. 41, 6-13. https://doi.org/10.1016/j.ufug.2019.03.005

Watanabe, E., Fukuda, S., Hara, H., Maeda, Y., 2006. Differences in relaxation by means of guided imagery in a healthy community sample. Altern. Ther. Health Med. 12, 60.

Wohlwill, J.F., 1976. Environmental aesthetics: The environment as a source of affect, in: Human Behavior and Environment. Springer, pp. 37–86.

World urbanization prospects: Statistical Papers - United Nations (Ser. A), Population and vital statistics report, 2014. https://doi.org/10.18356/527e5125-en

Wu, G., Tan, L., Yan, Y., Tian, Y., Shen, Y., Cao, H., Dong, M., 2016. Measures and planning for wetland restoration of Xianghe Segment of China's Grand Canal. Int. J. Sustain. Dev. World Ecol. 23, 326–332.

Wu, L., 2001. Search for the theory of science of human settlement. Planners 17, 5–8.

Yang, J., Li, X., Li, Y., Sun, C., Wang, F., 2012. Assessment on spatial of human settlement environment in communities based on DPSIRM model: The case study of Dalian. Geogr. Res. 31, 135–143.

Yao, J., 2015. The thinking of modern community planning and design based on Maslow's needs theory. Planners 31, 140–144.

Yu, R., Wong, M., Woo, J., 2019. Perceptions of neighborhood environment, sense of community, and self-rated health: an age-friendly city project in Hong Kong. J. urban Heal. 96, 276–288.

Zhan, D., Meng, B., Zhang, W., 2014. A study on residential satisfaction and its behavioral intention in Beijing. Geogr. Res. 33, 336–348. https://doi.org/10.11821/dlyj201402012

Zhao, J., Liu, X., Dong, R., Shao, G., 2016. Landsenses ecology and ecological planning toward sustainable development. Int. J. Sustain. Dev. World Ecol. 23, 293–297. https://doi.org/10.1080/13504509.2015.1119215

Zheng, W., Fan, L., Zheng, L., 2012. Socio-ecological system and neighborhood planning. Planners 28, 20–23.

**Declaration of interests**

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

☐The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

<br>
<br>
<br>
<br>