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## \*CORRESPONDENCE

Yusi Xie  
✉ emily5225@126.com

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# Adapting to urban gardening in China: how will policymaking help migrant and native gardeners?

Yusi Xie\* and Zhong Xing

Key Laboratory of New Technology for Construction of Cities in Mountain Area of Education Ministry, School of Architecture and Urban Planning, Chongqing University, Chongqing, China

China's current urban gardening promotion policies mainly focus on community gardens and lack in-depth research on the differentiated needs of different urban gardeners. To meet the diverse needs of China's gardeners, this study proposes a typology that classifies gardeners into urban native and migrant ones based on their urban and rural living experiences in China. A questionnaire survey conducted in the core area of Chongqing city revealed significant differences and some similarities in gardening motivations and behaviors between urban native and migrant gardeners: (1) Although most of the gardeners approved of the value of food production and green scenery creation that Chinese urban gardening has, and disapproved of its value for family income generation, the urban native gardeners' disapproving attitude towards family income generation, and their approval of green scenery creation were more assertive, while on the contrary, the urban migrant gardeners had a more robust approval attitude towards food production. (2) The urban native gardeners preferred proximity and small private spaces for a combination of ornamental vegetation and edible vegetables. In contrast, the urban migrated gardeners preferred larger areas for gardening in non-community spaces and leaned towards edible vegetables. (3) Both have shared motivations related to the recreation and ecological conservation values of urban gardening. Given the above differences and similarities, this paper proposes an urban gardening development strategy that meets the needs of the two types of gardeners in China, including space planning and design, operation, and management of gardening spaces, and organization of activities.

## KEYWORDS

China, urban gardening policy, urban native gardeners, urban migrated gardeners, gardening motivation, gardening behavior

## 1 Introduction

The value of urban gardening is being recognized in urban socio-economic and natural ecosystems. From a socioeconomic perspective, it promotes the physical and mental health of gardeners (Van Den Berg and Custers, 2011; Castro et al., 2013; Booth et al., 2017; Suto et al., 2021), boosts family income (Lafontaine-Messier et al., 2016), and encourages social interaction (Armstrong, 2000; Bendt et al., 2013). From the perspective of natural eco-systems, it fosters urban biodiversity (Lin et al., 2015; Speak et al., 2015; Teuber et al., 2019), maintains

ecological functions, and strengthens the relationship between residents and the natural ecosystem (Askerlund and Almers, 2016; Hemmelgarn and Munsell, 2021). Although urban gardening has been widely acknowledged for its outstanding value, policy attitudes to it vary among governments due to differences in socio-economic contexts (Djokić et al., 2018; Górna and Górny, 2020; Schoen et al., 2021).

China's current urbanization process has garnered global attention. While its speed has slowed, the primary challenge remains ensuring that individuals who have migrated from rural areas genuinely become urban residents<sup>1</sup> (Xinhua News Agency, 2022). Between 2000 and 2020, the number of people living in Chinese cities permanently increased by 443 million. Of this total, 187 million individuals moved from rural to urban areas. However, according to the China Population Census, they continued to be registered in rural areas (China National Bureau of Statistics, 2020). Hence, we could infer that at least 187 million people from rural areas had migrated to Chinese cities from 2000 to 2020, while the actual figure is much more significant because the rural population that officially became urban residents after completing the registration transformation process is not included in this figure. At the same time, due to the dual-track household registration policy, migrants cannot access the equivalent public and social services as urban residents, especially in large cities where resources are limited (Chan and Buckingham, 2008). In addition, their urban lifestyles and recreational needs are highly influenced by their previous experiences in rural areas (Qiu, 2013; Macdonald and Winklerprins, 2019), distinguishing them from the native urban residents.

Against this backdrop, many urban migrated gardeners (UMGs) have emerged in cities across China. These individuals are typically characterized by (1) Having a certain amount of prior farming experience and having previously relied on agriculture for income; (2) either having been displaced from their rural arable land due to urbanization and relocating to cities or choosing to live in urban areas for the sake of their children's livelihood or to pursue employment opportunities [which has also contributed to the abandonment of rural lands in China to some extent (Chen et al., 2009, 2022)]; and (3) willing to continue their traditional way of life in cities by engaging in urban gardening practices. Research indicates that migrant gardeners significantly contribute to urban cultivation, particularly in certain regions (He and Zhu, 2018). Furthermore, some studies imply a possible correlation between migrant gardeners and elevated rates of informal gardening in Chinese urban areas (He and Zhu, 2018; Ding et al., 2022), which is also referred to as "guerrilla" gardening or gardening in "self-claimed gardens" (Zhu et al., 2020). Such gardening activities frequently encounter opposition from nearby residents (Adams et al., 2014; Zhu et al., 2020), which hinders the effective

management of public spaces within the community. Between 2018 and September 2022, Chongqing Municipal Urban Management Bureau and Shanghai Municipal Urban Management and Law Enforcement Bureau took 14 and 57 verifiable actions against urban informal gardening, respectively, concerning 41.15 hectares of informal fruit and vegetable gardens in Chongqing, mainly in city parks and green spaces, including parts of community parks, and 1,800 square meters in Shanghai, primarily small-scale informal gardens in public green spaces (Chongqing Urban Management Bureau, 2023; Shanghai Urban Management and Law Enforcement Bureau, 2023).

The expanding rural-migrated population is concurrent with increased community gardens in cities across China. During the urban renewal process in China, community gardens are highly applauded by managers for making efficient use of fragmented spaces (Li et al., 2023). Notably, community gardens did not emerge in official records until 2014 (Mai et al., 2023). Hence, urban gardening before that tended to be informal. Taking Shanghai as an example, over 200 new community gardens were constructed between 2014 and 2022 in Shanghai (Kou et al., 2019; Yuelai Liu et al., 2022). Additionally, more than 900 mini community gardens (Kou et al., 2021), which focus on small-scale gardening and home planting, have been created as self-initiated projects among residents. Businesses initially funded community gardens, while local government support at the grassroots level started in 2016 (Yuelai Liu et al., 2022; Mai et al., 2023). Shenzhen has constructed 360 community gardens as government initiatives between 2019 and 2023, with plans to add another 120 gardens by the end of 2023 (Zhang et al., 2022; Wen, 2023). The rapid expansion of government-led community garden construction in China is evident.

Against this backdrop, many city-dwelling urban native gardeners (UNGs) have emerged throughout Chinese cities. These individuals possess the following traits: (1) they were born in cities and benefit from urban-based public and social services; (2) they have no prior knowledge of agricultural production in rural areas; and (3) they are happy to engage in gardening ventures in the urban scenarios (typically in community gardens or their balconies). It is evident that both UNGs and UMGs participate in urban gardening in Chinese cities; however, they are differentiated urban gardeners due to their life experiences and current living conditions in cities.

Behavioral geography investigates how people interact with their environment to optimize space (Golledge and Timmermans, 1990; Golledge et al., 2007). Current research on urban gardening behavior investigates people's participation, selection of gardening spaces, and management of these spaces (Van den Berg et al., 2010; Hardman et al., 2018; He and Zhu, 2018; Ding et al., 2022; Wei and Jones, 2022). It has been discovered that the three behaviors above may affect the attainment of the value and benefits of urban gardening. Residents participating in urban gardening show greater willingness to pay for city horticulture and protect urban ecosystems (Lohr and Pearson-Mims, 2005; Ge et al., 2021). Additionally, space selection behaviors affect the well-being of gardening activities, with allotment gardens having significantly higher overall well-being than working farms. In contrast, working farms have substantially higher economic benefits than community farms and allotment gardens (Kirby et al., 2021). Finally, variances in the management of gardening spaces significantly affect the level of biodiversity and environmental landscape within the designated area. Animal-friendly gardening practices, including the installation of bird baths,

1 "Individuals moved to cities from rural area" refers to individuals who previously resided in rural areas but now dwell in urban areas. This encompasses individuals living in cities with rural household registration and those whose household registration and current residence are in cities but were formerly located in rural areas. When they not only live in a city but have integrated seamlessly into its social welfare, public services, attitudes, lifestyles, and more, following the practices and lives of typical city dwellers, they are considered entirely urban residents.

bird boxes, no-dig cultivation, and pest management, among others, have distinct impacts on urban biodiversity conservation, soil quality, and surrounding ecosystems (Gaston et al., 2005; Clarke et al., 2015; Liere et al., 2020). Adaptive management practices of gardening in arid environments enhance the ecological resilience of the area concerned (Egerer et al., 2020).

Motivations are at the core of their gardening behaviors (Lewis et al., 2018; Lee and Matarrita-Cascante, 2019; Philpott et al., 2020). Lewis et al. (2018) summarize urban gardening motives as social aspects, well-being, and tangible or intangible outputs. To add to this classification, nature and education are also mentioned (Menconi et al., 2020). Variations in those motivations impact the gardening behavior of individuals; for example, Wu et al. (2022) proposed that residents with positive opinions on the ecosystem advantages of urban gardening were more inclined towards taking part in gardening, as shown in a study of positive and negative perceptions of the ecological setting of gardening behavior. Meanwhile, Philpott et al. (2020) discovered that gardeners who agreed with the ecological benefits of urban planting preferred species diversification, which subsequently influenced the abundance of vegetation within the gardening space. Pearsall et al. (2019) discovered that gardeners' preference for specific plant species is influenced by their cultural identity, which is a major driving force behind their gardening activities.

The correlation among demands, behaviors, and value output in urban gardening provides a basis for policymakers to develop strategies that guide differentiated gardening behaviors, ensure better services for urban gardening spaces, and achieve the anticipated benefits of the activity (Eigenbrod and Gruda, 2014; Beavers et al., 2021; Jahrl et al., 2021; Kirby et al., 2021; Ryan, 2021). Instead of implementing a "one-size-fits-all" policy, whether it involves strict control of informal gardening or active promotion of community gardens, urban gardening authorities should allocate more resources to understanding urban gardeners' diverse needs and behaviors. This will enable them to "differentiate" and formulate urban gardening policies that cater to the diverse needs of gardeners and ensure that urban gardening can more effectively achieve its potential in promoting social well-being and ecological benefits. Lu's (2022) findings indicate that community garden projects pushed by management face maintenance problems, highlighting the need for the Chinese government to prioritize the requirements of urban gardeners.

The current policies for urban gardening heavily rely on typological classification criteria, such as age, ethnicity, and economic status, to fulfill gardener needs (Eigenbrod and Gruda, 2014; Kirby et al., 2021; Department of Agriculture and Markets, 2023; Pennsylvania Department of Agriculture, 2023). However, considering the larger context of urbanization in China, where people have migrated from rural areas to cities, they need to adapt to their new urban lives (Zhang and Song, 2003). This study aims to classify urban gardeners in Chinese cities into migrant gardeners (UMGs) and native gardeners (UNGs) based on their experiences of urban and rural life. These two groups are the central gardeners in urban China, and their previous living experiences, whether in urban or rural areas, are expected to influence their current gardening practices in cities. The contemporary urban gardening policy, which aims to promote community gardens and regulate informal gardening, may not adequately address the distinct needs of these two groups. Therefore, we utilize statistical surveys and quantitative analyses to identify

potential distinctions between the two groups. Based on this information, we develop a development strategy for urban gardening that adapts to their unique needs.

## 2 Materials and methodology

The research was conducted in two phases to explore the differences between migrant and native gardeners in urban China and to ensure reliable results. First, a questionnaire survey was conducted. The purpose was to obtain first-hand data on urban gardeners through field research. The main tasks included identifying the research area and the type of urban gardening space to be studied and selecting the sample area. The research questionnaire was also developed based on the research objectives and then distributed and collected. Finally, the data were archived, and quantitative analysis was performed. The primary purpose was to study the data collected in the first stage and determine whether there was a statistically significant difference between the two types of urban gardeners using the Chi-square test. More details are introduced in the following.

### 2.1 Survey sample area

#### 2.1.1 Study area

To capture the impact of urbanization and large-scale migration from rural areas to cities in China, we narrowed our focus to metropolises with distinct urbanization characteristics and cities with potential for urban gardening. Based on our criteria, we have selected Chongqing as our target city. For three reasons: (1) Chongqing is one of China's four metropolises directly governed by the central government. Supported by the State's Chengdu-Chongqing Twin-city Economic Strategy (China Daily, 2021), it went through rapid urbanization, increasing the urbanization rate by 34.7% between 2000 and 2021, reaching 70.3%. (2) In 2021, Chongqing had a built-up area of 1,834.20 square kilometers with a resident population of 32,124,300 (Chongqing Municipal Bureau of Statistics, 2022). Such rapid urbanization in a short period, which resulted in a rapid expansion of urban land and many people with previous rural experience moving into cities, meant that the city had a significant potential urban gardening population. (3) Chongqing is a big mountainous city in southwest China, where the Jialing River and the Yangtze River pass through its center. The city is developing in the group with clear separations of mountains and waterways between them, creating natural "ecological separation zones." The influence of the fragmented mountainous terrain and the outward expansion urbanization mode resulted in many small chunks of green space that are difficult to build between large and small constructed areas. They become abundant sources of urban gardening spaces. Due to the above three factors, Chongqing's high-density construction setting has long been characterized by many residents' spontaneous gardening behavior, with rooftops, gaps, lots, and unused land gardening common to see in the city (Yufeng Wang and Wang, 2023).

Our research scope was the built-up area of Chongqing city proper, which is surrounded by its inner-ring express road, excepting the

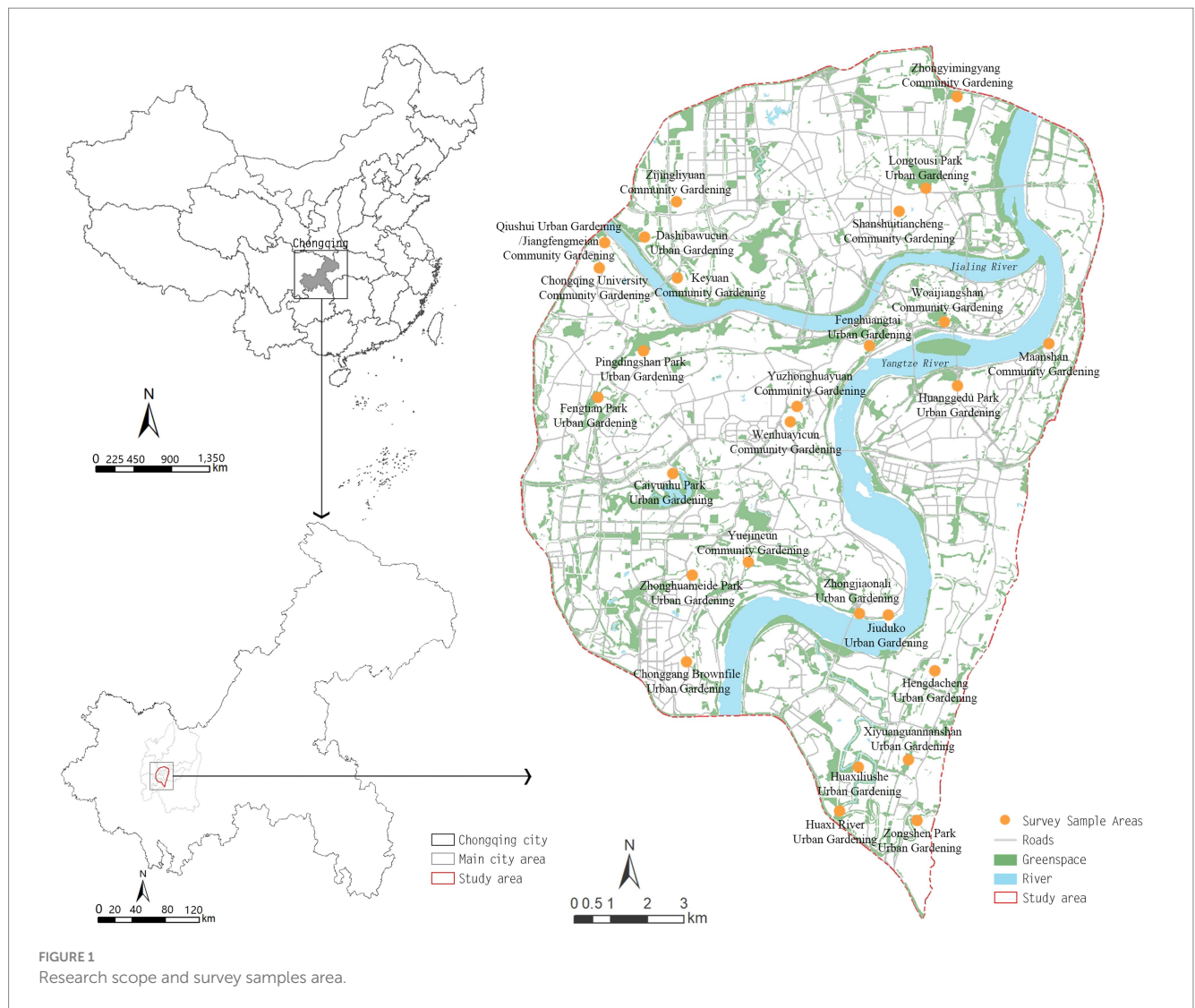


FIGURE 1  
Research scope and survey samples area.

reservation area of the “Four Mountains”<sup>2</sup> (as shown in Figure 1). This is the most critical area in urbanization, which the convergence of main city business districts and the natural topography of the intersection of the two rivers, further complicated by the Pingding Mountain, Eling, Pipa Mountain, Daliangzi Mountain, and other small mountain displacements, making the conflict between the urban development needs in the area and the gardening demands of the residents most prominent.

### 2.1.2 Urban gardening types in study area







One key issue in designing the survey was ensuring the comprehensive inclusion of all types of urban gardening spaces so that the questionnaire results could reflect the status quo of urban gardeners in Chinese cities. Although urban gardening forms vary around the world (Lin et al., 2015; Kirby et al., 2021; Mackiewicz et al., 2021), community gardens remain the principal practice of

urban gardening in China, which is also the focus in the literature on urban gardening in China (Ding et al., 2022; Lu, 2022). However, after conducting field visits and literature research, we observed various forms of urban cultivation beyond residential areas, including small patches of basic farmland.<sup>3</sup> The management of these areas resembles small-scale market gardens, a form of urban gardening run independently by the land users, and the produce is sold to the market. It also includes informal gardening spaces, like unused or abandoned land. At the same time, gardening in residential communities can be further subdivided into different forms, such as balcony gardening, roof gardening, and gardening in the spaces between residential buildings. Therefore, we compiled a list of representative types of urban gardening in China (Table 1), hoping that the survey will be more likely to cover various types of urban gardening spaces, making the research results more in line with the reality of urban gardeners in China.

2 The reservation area of the “Four Mountains” refer to the development, construction and its management activities control area, planning to protect the ecological and environmental resources of Jinyun Mountain, Zhongliang Mountain, Tongluo Mountain and Mingyue Mountain in main urban area.

3 In the Chinese context, the term “basic farmland” refers to those farms that are surrounded by cities because of rapid urbanization but must be protected under China’s farmland protection policy.

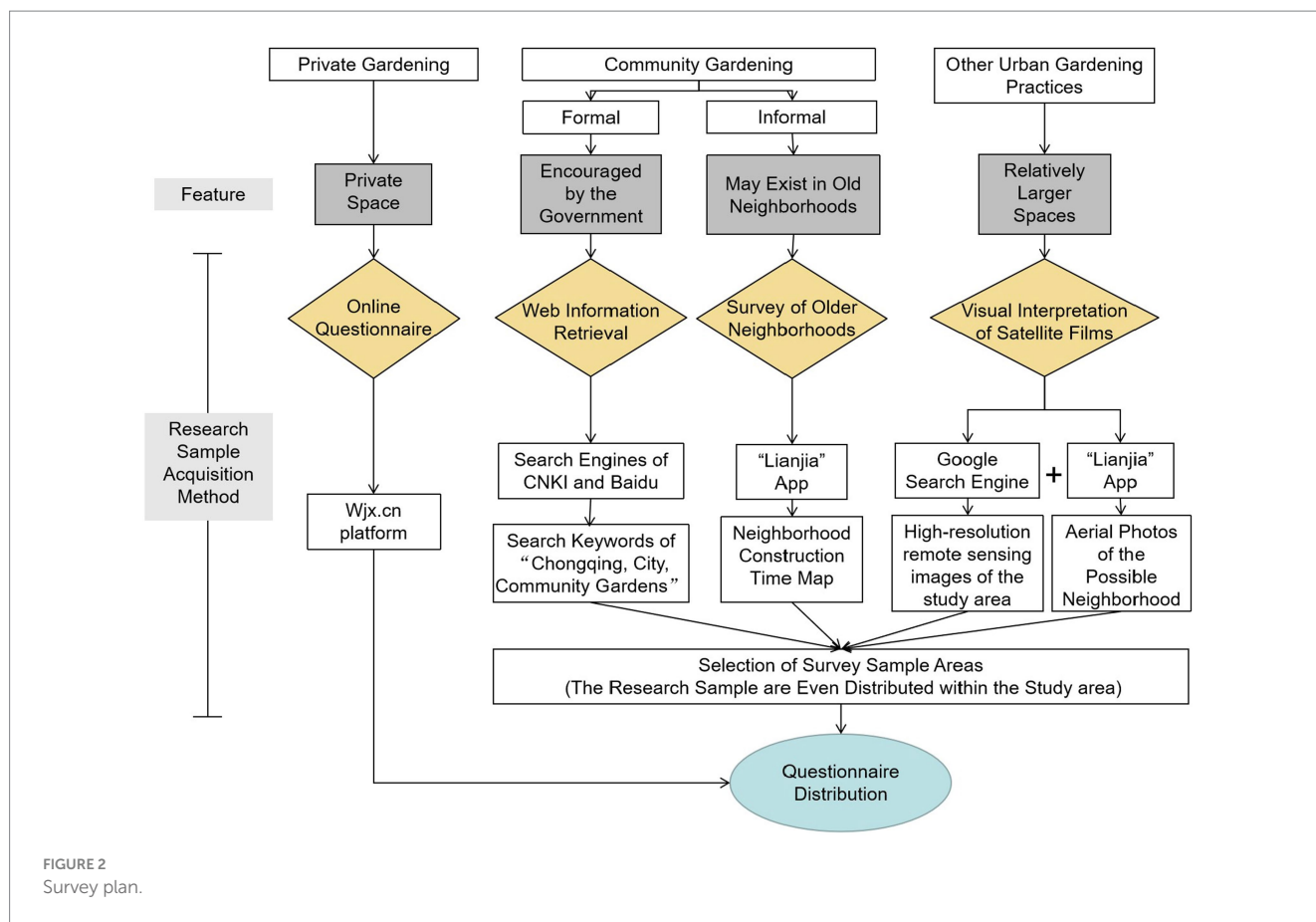
TABLE 1 Urban gardening types in research area.

Classification	Gardening type	Size	Ownership	Management	Pictures
Private gardening	Balcony gardening	About 1–10 m <sup>2</sup>	Householder	Householder	
	Backyard gardening	About 5–30 m <sup>2</sup>			
Community gardening	Rooftops gardening or gaps gardening between buildings	About 50–100 m <sup>2</sup>	Apartment residents	Normally, householders on the top floor	
	Community lots gardening	Area varies	Community residents	Normally ground-floor residents	
Other urban gardening practice	Unused urban land gardening	Area varies	Citizens	Normally nearby residents	
	Inefficient urban green space gardening	About 0.5–1 ha			
	Small scale market garden	About 0.5–5 ha	Land owner	Professional farmers	

### 2.1.3 Selection of survey sample areas

The survey was conducted from January to May 2022. To obtain comprehensive data on urban gardeners in the study area, we adopted different survey protocols for the three broad categories of urban gardening spaces described above (see Figure 2). (1) For gardening in balconies, backyards, and other private spaces, the main difficulty in obtaining research data stems from accessibility in the COVID context. We used wjx.cn, an online questionnaire survey platform, to distribute the questionnaire. The platform pushed questionnaires to accounts that meet the research requirements based on users' information (those who engage in private gardening in Chongqing City). (2) For community gardening, determining the location of community gardens is the first step. Based on the existing literature (Zhu et al., 2020; Ding et al., 2022) and field research experience, locations of

formal community gardens, as a form of urban gardening encouraged by the government, can usually be obtained through an online search of relevant location information. In contrast, informal community gardening is generally caused by poor property management in old neighborhoods. Therefore, we used web information for the formal ones and information on the housing sales and rental platforms to determine the location of the informal ones, respectively. Specifically, we searched CNKI and Baidu for formal community gardens with the keywords “Chongqing, urban, community gardens.” We screened the information we got to locate the neighborhoods where community gardens may exist. For informal community gardens, we used the neighborhood construction time map on the “Lianjia,” a property realtor platform, to screen for neighborhoods in the study area built before or near 2000. (3) For other urban gardening practices



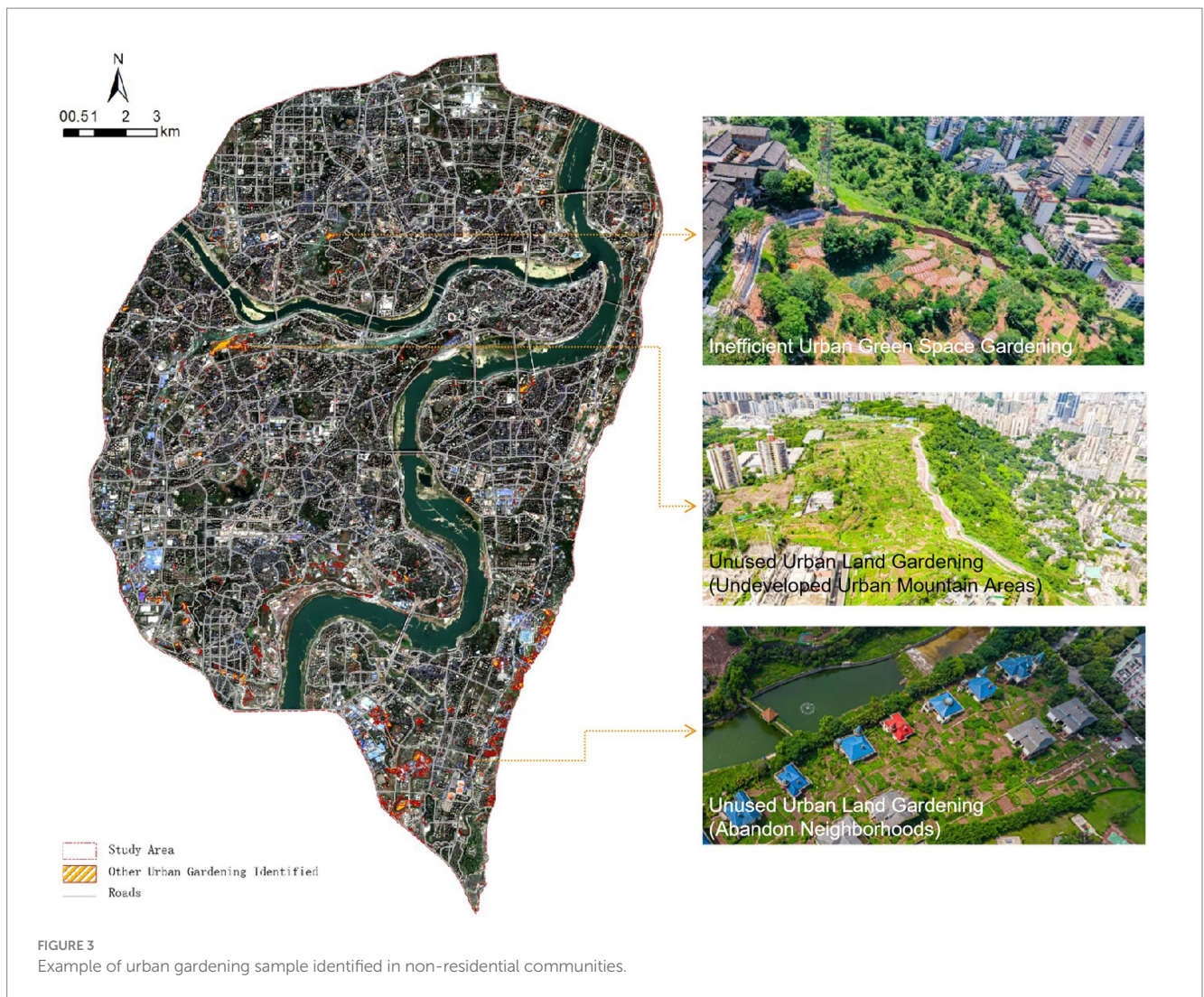
outside of the residential communities, it was also challenging to determine the locations of the survey sample area. Based on the research experience, we believe they usually occupy larger spaces, which can be identified from remote sensing imagery and aerial photographs. Therefore, we used Google satellite imagery and aerial photographs on realtor's websites to identify the more salient urban gardening areas in the study area. The Google satellite images used for identification were dated 27 March 2021. We looked for apparent urban gardening spaces, such as small-scale market gardens and unused or inefficiently used urban lands with gardening traits. We were reading the satellite images to obtain the names of the possible neighborhoods, which were rechecked by comparing them with the aerial photos of those places on [Lianjia.com](#). Further details and examples of such a process are shown in [Figure 3](#).

A list of field visit targets was determined based on the results of the information search for community gardens and old neighborhoods, together with that of analysis of images from satellite remote sensing and the aerial ones from the realtor website, taking into consideration the even distribution of such targets within the study area. The primary purposes of the visits were (1) to verify urban gardening activities (due to the gap between the timing of the research and the images, the actual use of the space may have been changed) and (2) to clarify the accessibility to the urban gardening spaces (some of the neighborhoods may have strict security systems, making it difficult to enter them. At the same time, some of the gardening spaces may be within the private premises of factories and institutions, which are also inaccessible) to

determine the feasibility of having field visits to these places. After all these procedures to screen the possible survey samples of field visits, 28 areas were finally selected for field questionnaire distribution, including 11 urban gardening spaces in residence communities and 17 other spaces, the locations of which are shown in [Figure 1](#).

## 2.2 Survey questionnaire

The value of urban gardening can be achieved by formulating policies to meet people's needs based on the motivation and behavior of different groups ([Eigenbrod and Gruda, 2014](#); [Beavers et al., 2021](#); [Jahrl et al., 2021](#); [Kirby et al., 2021](#)). To this end, we used two variables, i.e., gardening motivation and gardening behavior, to approach the differences between UMGs and UNGs and attempted to measure them using indicators. Referring to the analyses of urban gardening motivation and behavior in the literature ([Lindemann-Matthies and Marty, 2013](#); [Lindemann-Matthies and Brieger, 2016](#); [Menconi et al., 2020](#); [Sanyé-Mengual et al., 2020](#); [Song et al., 2022](#)), and taking into account the actual situation of urban gardening in China ([Ding et al., 2022](#); [Wei and Jones, 2022](#)), we summarize the measurement of motivation into three aspects: motivation closely related to food production, social and recreational well-being, and maintenance of urban ecology and landscape; and at the same time, the measurement of behavior is summarized into space choice and gardening management behavior. The specific indicators and data collection methods are shown in [Table 2](#).



## 2.3 Data analysis

We adopted a quantitative method to determine whether there is a difference between UNGs and UMGs. According to the answer to the question “Have you ever worked in agriculture and lived in rural China?” in the questionnaire, we divide the data into two categories: (1) UMGs who have experience in rural agriculture as well as rural life and are currently involved in gardening activities in the city; and (2) UNGs who have no experience in rural agriculture as well as rural life and are currently involved in gardening activities in the city. Chi-square tests are commonly used to analyze the degree of deviation between two data sets. They are used for statistical research data analysis on gardening motivations and behaviors among UMGs and UNGs. The analysis process was as follows: (1) The research data were entered into SPSS.24.0, and the validity test and confidence test were performed. To determine whether the measurement scale of gardening motivation can effectively describe this measurement variable, validity analysis was conducted to check the distribution of the data and the degree of correlation between the topics through KMO and Bartlett’s test. The KMO value is acceptable when it is more significant than 0.70, while the value of Bartlett’s test of sphericity must reach the significance level

( $p < 0.05$ ). Moreover, to ensure that the scale can reflect the data in question stably, reliability analysis was conducted by testing the Cronbach  $\alpha$  coefficient. The scale is acceptable if the Cronbach  $\alpha$  coefficient is more significant than 0.70. (2) To determine whether there is a difference between the two groups of survey data of UMGs and UNGs, we used the Chi-square test to discriminate the significance of the difference between the two data groups. During the Chi-square test, Fisher’s exact test was used when the expected number of answers from more than 20% of the individual question items was less than five to overcome the limitations of the Chi-square test on the distribution of the sample data (Fisher, 1922).

## 3 Research findings

### 3.1 Demographics

We collected 202 valid questionnaires, including 49 UNGs and 153 UMGs. The numbers of UMGs were significantly higher than the UNGs (see Figure 4). Considering the details, there were more female gardeners than male, and there were slightly more senior gardeners

TABLE 2 Measurement indicators of urban gardening motivation and behavior.

Variables	Aspects	Indicators	Sources	Data
Gardening motivation	Motivation closely related to food production	Food production	Menconi et al. (2020); Song et al. (2022)	A 5-point Likert scale ranging from 1–5, with 1 being strongly disagree and 5 being strongly agree.
		Family income generation		
	Social and recreational well-being	Physical and mental health	Newell et al. (2022); Petrovic et al. (2019)	
		Social interaction		
		Recreation		
	Maintenance of urban ecology and landscape	Ecological conservation	Lindemann-Matthies and Brieger (2016); Lindemann-Matthies and Marty (2013); Sanyé-Mengual et al. (2020)	
Green scenery creation				
Gardening behavior	Space choice	Type of gardening space	Ding et al. (2022); Wei and Jones (2022)	Multiple choices
		Traffic (min)		
		Size (m <sup>2</sup> )		
		Type of vegetation		
	Gardening management behavior	Pesticide application	Ainembabazi and Mugisha (2014); Newell et al. (2022); Zhu et al. (2020)	
		Chemical fertilizer use		
		Composting or ecological nutrient supplementation		
		Self-construction of Equipment		

than young gardeners, and this trend was relatively more pronounced among the UMGs. After examining the education, employment status, and monthly income, we found apparent differences between UMGs and UNGs: (1) UMGs tended to have lower educational levels. 56.86% of UMGs only had primary education, a much higher percentage than UNGs (18.37%). In contrast, UNGs are more evenly distributed across educational levels, with the highest result of vocational or college education (36.73%), significantly higher than UNGs (14.38%). (2) Most UMGs experienced higher unemployment rates (58.17%) compared to UNGs (12.24%), with a large proportion of UNGs being retirees (42.86%). (3) The income level of UMGs was significantly lower than that of UNGs, with 47.06% of them having a monthly income of fewer than 500 yuan (68.6 USD), which was far below the average monthly *per capita* disposable income of urban residents of 3,951 yuan (542.7 USD) in 2021 (Statistical Bureau of the People's Republic of China, 2021). In contrast, UNGs had a monthly income mainly concentrated between 2,000 and 10,000 yuan, which is relatively higher.

### 3.2 Differences in urban gardening motivations

The data on gardening motivations of UMGs and UNGs passed reliability and validity tests, with Cronbach's alpha of 0.734 and a KMO value of 0.787 ( $p < 0.001$ ). Differences in motivations between UMGs and UNGs were mainly in those closely related to food production, including food production, family income generation, and green scenery creation (see Table 3). To be more specific: (1) Food production. The study found that most gardeners (42.9% of urban non-gardeners and 50.3% of urban multi-gardeners) recognized the value of food production in urban areas. However, there were differences in their attitudes towards disagreement and complete

agreement. 6.1% and 16.3% of the UNGs had varying degrees of disagreement with the value of food production. In contrast, the percentages were 0% and 4.5% for the UMGs. There was also a significant difference among urban gardeners who ultimately agreed with the value of food production. Expressly, 37.9% of UMGs strongly agreed with the value of food production from urban gardening, whereas only 8.2% of the UNGs expressed complete agreement. (2) Family income generation. While most urban gardeners did not endorse the income-generating value of urban gardening, the percentage of gardeners in both categories who strongly disagreed and agreed with this motivation showed that UNGs had a significantly more negative attitude towards the income-generating value than UMGs. (3) Green scenery creation. While most urban gardeners recognized the importance of urban landscaping, UNGs had a much stronger positive attitude, with 67.3% agreeing with this value, significantly more than the 43.8% of UMGs.

UMGs and UNGs showed more consistent attitudes towards the recreation and ecological conservation values of urban gardening. The two groups generally recognized the physical and mental health and recreational values of urban gardening to a high degree while registering a low recognition of the social interaction value and holding a neutral attitude towards the ecological conservation value.

### 3.3 Differences in urban gardening behaviors

The results of the Chi-square and Fischer tests showed that the differences in gardening behavior between UNGs and UMGs were mainly in space selection. At the same time, there was some consistency in management. The behavior differences are shown in Table 4. (1) Types of spaces. Most of the UNGs preferred to use private space (38.8%), followed by community space (36.7%), whereas most



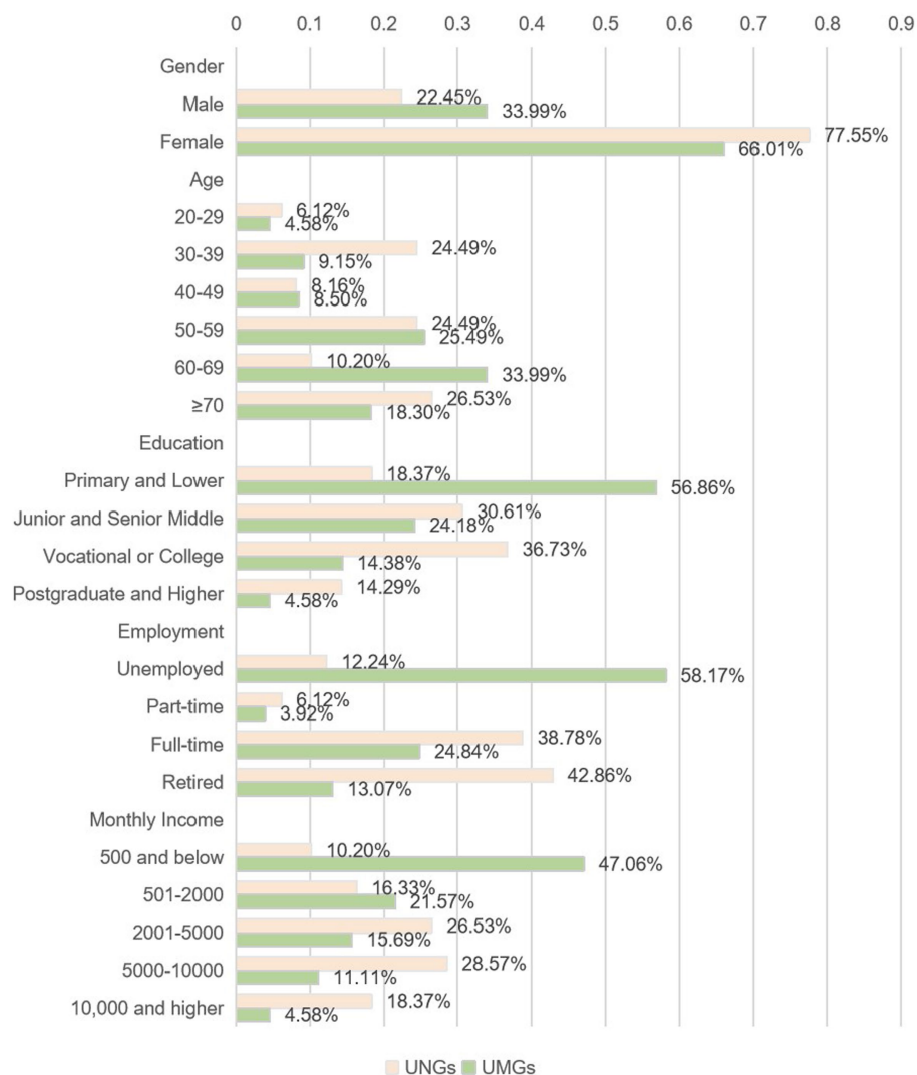


FIGURE 4  
Demographics of the two groups.

of the UMGs (58.2%) preferred utilizing urban gardening spaces outside of residential communities, such as abandoned or unused land. (2) Distance to gardening spaces. Although most of the spaces were within 30 min of walking distance, most of the UNGs gardened in more convenient places, while a significantly higher percentage of UMGs reported they needed more time to reach their gardening places (24.8%). (3) Space size. The UNGs' gardening spaces were smaller (49% of UNGs had less than 10 m<sup>2</sup>), while most UMGs (41.8%) had a relatively larger gardening space of 11–66 m<sup>2</sup>. (4) Types of plants. Most UMGs (57.5%) preferred to plant only vegetables, while UNGs liked to try a more diversified range of plants. Most UNGs (36.7%) chose to produce a mixture of vegetables and flowers, outnumbering UMGs (15.0%).

There were no significant differences between the two groups regarding management practices. Most gardeners did not favor the use of pesticides and did not build facilities on their land. They were neutral about using fertilizer and compost, with almost equal proportions of fertilizer users, non-users, and non-composters.

## 4 Discussions

### 4.1 Differences in the needs of UNGs and UMGs

Social and cultural contexts influence behavior (Triandis, 1989; Matsumoto, 2007). The differences in gardening motivations and behaviors between the UNGs and UMGs reflect, to some extent, the different needs for urban leisure of the native urban population and the rural migrated population in the context of China's urban–rural dual-track system (Chan and Buckingham, 2008). China's rural migrants are classified as urban residents but have limited access to public social services and welfare compared to native urban residents (Xinhua News Agency, 2022). Their rural backgrounds and differentiated access to the public service systems mean that they are more likely to face unstable employment, low-income levels, and marginalized social identities, which are reflected in the demographics of UMGs. They also have different needs for urban leisure: (1) they

TABLE 3 Gardening motivation scores and differences in UMGs and UNGs.

Gardening perception	NMGs and UNGs (N/%)					Aggregated mean	Statistical significance	Gardening perception
	1	2	3	4	5			
Food production								
UNGS	3 <sub>a</sub> (6.1)	8 <sub>a</sub> (16.3)	13 <sub>a</sub> (26.5)	21 <sub>a</sub> (42.9)	4 <sub>a</sub> (8.2)	49(100.0)	3.31	$p < 0.001$
UMGs	0 <sub>b</sub> (0.0)	7 <sub>b</sub> (4.6)	11 <sub>b</sub> (7.2)	77 <sub>a</sub> (50.3)	58 <sub>b</sub> (37.9)	153(100.0)	4.22	
Family income generation								
UNGS	32 <sub>a</sub> (65.3)	13 <sub>a</sub> (26.5)	1 <sub>a</sub> (2.0)	3 <sub>a</sub> (6.1)	0 <sub>a</sub> (0.0)	49(100.0)	1.49	$\chi^2(4, n = 202) = 16.373$ ; $p = 0.003$
UMGs	55 <sub>b</sub> (35.9)	50 <sub>a</sub> (32.7)	14 <sub>a</sub> (9.2)	21 <sub>a</sub> (13.7)	13 <sub>b</sub> (8.5)	153(100.0)	2.26	
Physical and mental health								
UNGS	0 <sub>a</sub> (0.0)	2 <sub>a</sub> (4.1)	1 <sub>a</sub> (2.0)	34 <sub>a</sub> (69.4)	12 <sub>a</sub> (24.5)	49(100.0)	4.14	$p = 0.062$
UMGs	5 <sub>a</sub> (3.3)	10 <sub>a</sub> (6.5)	22 <sub>b</sub> (14.4)	85 <sub>a</sub> (55.6)	31 <sub>a</sub> (20.3)	153(100.0)	3.83	
Social interaction								
UNGS	9 <sub>a</sub> (18.4)	23 <sub>a</sub> (46.9)	9 <sub>a</sub> (18.4)	8 <sub>a</sub> (16.3)	0 <sub>a</sub> (0.0)	49(100.0)	2.33	$\chi^2(3, n = 202) = 1.258$ ; $p = 0.739$
UMGs	29 <sub>a</sub> (19.0)	76 <sub>a</sub> (49.7)	32 <sub>a</sub> (20.9)	16 <sub>a</sub> (10.5)	0 <sub>a</sub> (0.0)	153(100.0)	2.23	
Recreation								
UNGS	2 <sub>a</sub> (4.1)	1 <sub>a</sub> (2.0)	3 <sub>a</sub> (6.1)	19 <sub>a</sub> (38.8)	24 <sub>a</sub> (49.0)	49(100.0)	4.27	$p = 0.202$
UMGs	8 <sub>a</sub> (5.2)	15 <sub>a</sub> (9.8)	10 <sub>a</sub> (6.5)	70 <sub>a</sub> (45.8)	50 <sub>b</sub> (32.7)	153(100.0)	3.91	
Ecological conservation								
UNGS	0 <sub>a</sub> (0.0)	1 <sub>a</sub> (2.0)	34 <sub>a</sub> (69.4)	14 <sub>a</sub> (28.6)	0 <sub>a</sub> (0.0)	49(100.0)	3.27	$\chi^2(2, n = 202) = 4.190$ ; $p = 0.123$
UMGs	0 <sub>a</sub> (0.0)	13 <sub>a</sub> (8.5)	112 <sub>a</sub> (73.2)	28 <sub>a</sub> (18.3)	0 <sub>a</sub> (0.0)	153(100.0)	3.1	
Green scenery creation								
UNGS	0 <sub>a</sub> (0.0)	3 <sub>a</sub> (6.1)	8 <sub>a</sub> (16.3)	33 <sub>a</sub> (67.3)	5 <sub>a</sub> (10.2)	49(100.0)	3.82	$p = 0.006$
UMGs	0 <sub>a</sub> (0.0)	14 <sub>a</sub> (9.2)	62 <sub>b</sub> (40.5)	67 <sub>a</sub> (43.8)	10 <sub>a</sub> (6.5)	153(100.0)	3.48	

1: totally disagree; 2: disagree; 3: neutral; 4: agree; 5: totally agree. Each identical letter indicates no significant difference between column proportions at the 0.05 significance level.

demand a more excellent value from urban leisure spaces, which constitutes part of their motivations for urban gardening. Specifically, due to low education levels, job instability, and low income levels, UMGs want to meet their needs for food production and increase family income while getting leisure and recreation through urban gardening. (2) They have a demand for larger spaces in urban gardening. As they demand food production and family income generation through urban gardening, UMGs are willing to spend more time commuting from where they live to their gardening spaces to pursue a larger size and plant vegetables to produce food and bring more income to the household.

## 4.2 Shared needs of UNGs and UMGs

Urban gardening is often seen as an essential means of promoting community interaction and improving social cohesion while protecting the urban ecosystem (Clark and Nicholas, 2013; Speak et al., 2015; Falkowski et al., 2022), but common attitudes towards urban gardening among both UNGs and UMGs suggest that the social interaction value of urban gardening is not currently recognized in China, while gardeners have reservations about the ecological protection function. The possible reasons may be: (1) In informal urban gardening, third-party management is usually absent. Gardeners often face a game of demarcation, using fences and barriers to determine the border of their space, resulting in fragmented use of growing areas. As an old Chinese

saying goes, “Everyone sweeps the snow in front of their door and does not care about the frost on other people’s roofs,” which may indicate the relationship between most gardeners in informal urban gardening spaces. On the other hand, in formal community gardens, community managers and informal organizations are the dominant forces in the gardening process (Lu, 2022; Mai et al., 2023) compared to the lack of autonomous participation of the residents. Therefore, the role of urban gardening as a hub of neighborhood interactions is not fully recognized, and there is a lack of related activities in some circumstances. (2) Most gardeners lack knowledge about organic gardening and eco-protection (Bon et al., 2010). We found in the survey that for most gardeners, eco-protection was a synonym for “no pesticides” or “green is eco.” A vacuum of guidance and training existed on eco-friendly practices and input in environmentally friendly facilities. Moreover, gardeners had no systematic understanding of the ecological value of urban gardening.

## 4.3 Urban gardening strategy recommendations targeting differentiated gardeners in China

Given the differences and similarities between UNGs and UMGs in Chinese cities, we propose targeted strategies in three areas: planning and design of urban gardening spaces, operation and management, and organization of activities (see Figure 5). (1) Space

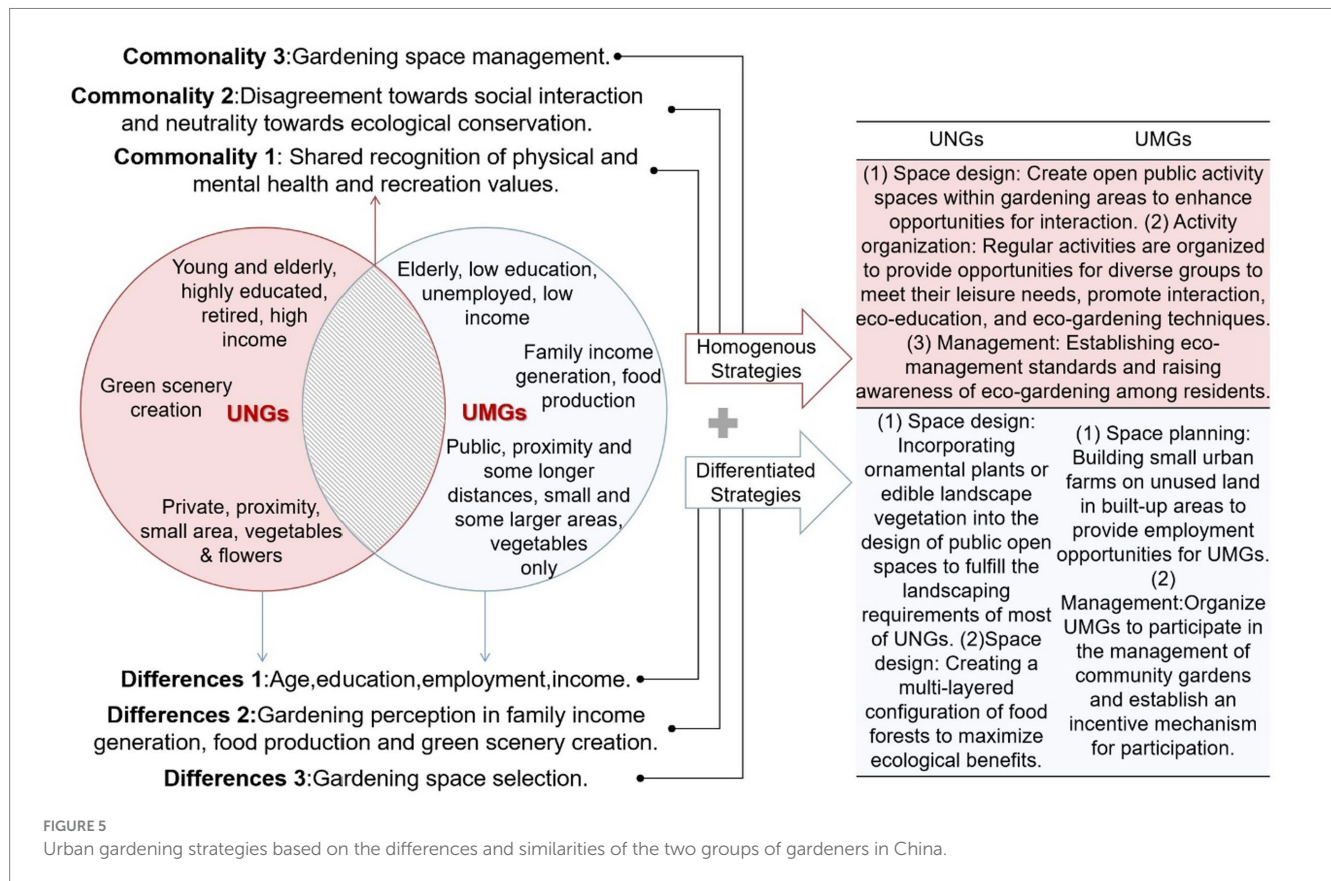
TABLE 4 Gardening behavior and differences in UMGs and UNGs.

Indicators	UNGS(N/%)	UMGs(N/%)	Statistical significance
Type of gardening space			
Private gardening	19 <sub>a</sub> (38.8)	27 <sub>b</sub> (17.6)	$\chi^2(2, n = 202) = 17.843; p < 0.001$
Community gardening	18 <sub>a</sub> (36.7)	37 <sub>a</sub> (24.2)	
Other urban gardening	12 <sub>a</sub> (24.5)	89 <sub>b</sub> (58.2)	
Traffic (min)			
Walk < 10	43 <sub>a</sub> (87.8)	103 <sub>b</sub> (67.3)	$p = 0.011$
Walk 10–30	4 <sub>a</sub> (8.2)	38 <sub>b</sub> (24.8)	
Walk > 30	0 <sub>a</sub> (0.0)	8 <sub>a</sub> (5.2)	
Vehicle < 30	2 <sub>a</sub> (4.1)	4 <sub>a</sub> (2.6)	
Vehicle > 30	0 <sub>a</sub> (0.0)	0 <sub>a</sub> (0.0)	
Size (m <sup>2</sup> )			
≤ 10	24 <sub>a</sub> (49.0)	47 <sub>b</sub> (30.7)	$\chi^2(4, n = 202) = 9.857; p = 0.043$
11–66	18 <sub>a</sub> (36.7)	64 <sub>a</sub> (41.8)	
67–333	7 <sub>a</sub> (14.3)	23 <sub>a</sub> (15.0)	
334–666	0 <sub>a</sub> (0.0)	11 <sub>a</sub> (7.2)	
≥ 667	0 <sub>a</sub> (0.0)	8 <sub>a</sub> (5.2)	
Type of vegetation			
Only vegetables	14 <sub>a</sub> (28.6)	88 <sub>b</sub> (57.5)	$\chi^2(4, n = 202) = 17.410; p = 0.002$
Veg. and grains	8 <sub>a</sub> (16.3)	25 <sub>a</sub> (16.3)	
Veg. and fruit or herb medicine	3 <sub>a</sub> (6.1)	9 <sub>a</sub> (5.9)	
Veg. and flower	18 <sub>a</sub> (36.7)	23 <sub>b</sub> (15.0)	
Veg. and two more other types	6 <sub>a</sub> (12.2)	8 <sub>a</sub> (5.2)	
Pesticide application			
No	35 <sub>a</sub> (71.4)	109 <sub>a</sub> (71.2)	$\chi^2(1, n = 202) = 0.001; p = 0.98$
Yes	14 <sub>a</sub> (28.6)	44 <sub>a</sub> (28.8)	
Chemical fertilizer use			
No	26 <sub>a</sub> (53.1)	68 <sub>a</sub> (44.4)	$\chi^2(1, n = 202) = 1.108; p = 0.293$
Yes	23 <sub>a</sub> (46.9)	85 <sub>a</sub> (55.6)	
Composting or ecological nutrient supplementation			
No	25 <sub>a</sub> (51.0)	78 <sub>a</sub> (51.0)	$\chi^2(1, n = 202) = 0.000; p = 0.996$
Yes	24 <sub>a</sub> (49.0)	75 <sub>a</sub> (49.0)	
Self-construction of equipment			
No	45 <sub>a</sub> (91.8)	126 <sub>a</sub> (82.4)	$\chi^2(1, n = 202) = 2.569; p = 0.109$
Yes	4 <sub>a</sub> (8.2)	27 <sub>a</sub> (17.6)	

Each identical letter indicates no significant difference between column proportions at the 0.05 significance level. Sixty-six square meters ≈ 1 Fen (分) of land; 666 square meters ≈ 1 Mu (亩) of land.

planning and design: in response to the demand of some of UMGs for growing vegetables and income-generation, small-scale urban farms should be planned and built using unused or abandoned land within the built-up area. These farms differ from community gardens, China's mainstream urban gardening spaces. The purpose of these small-scale urban farms is to provide some UMGs with nearby gardening spaces and, at the same time, meet their needs for employment and livelihood subsidies. Moreover, in response to the fact that most gardeners still need to recognize the function of urban gardening in social interaction sufficiently, open public spaces for public activities should be added in

conjunction with the gardening spaces to make public interactions possible in terms of space. Given the shared interest of UMGs and UNGs in creating green scenery, as well as the integration of traditional garden aesthetics in urban gardening in other Asian countries (Amani-Beni et al., 2021; Khalilnezhad et al., 2022), we suggest the utilization of ornamental plants in public open areas. This approach is also advantageous for improving the attractiveness of urban gardening areas (Amani-Beni et al., 2021). In addition, incorporating edible flowering plants is also a great way to balance aesthetics and practicality (Lu et al., 2021). To maximize the ecological



benefits of urban gardening, vegetation selection can be based on the multi-layered configuration of food forests (Clark and Nicholas, 2013). The case of agroforestry in South Asia illustrates the advantages of using a multilayered vegetation configuration strategy with woody crops to enhance food production and preserve biodiversity (Kumar et al., 2012).

(2) Organization of activities: First, organizing regular gardening-related activities that cater to the diverse needs of gardeners across different age groups and, at the same time, provide opportunities for residents to interact with each other to realize the social interaction benefits of urban gardening. Such activities include nature education activities for children, sports and leisure activities for young gardeners, interactive planting activities for core family gardeners, and leisure and sports activities for older people. Secondly, in response to the lack of recognition of the ecological function of urban gardening, eco-gardening activities can also be planned to improve their ecological gardening skills through eco-education.

(3) Operation and management: In response to the more substantial food needs of UMGs, it is possible to organize migrant gardeners' management groups and increase the possibility of obtaining material products for UMGs through the establishment of participation incentive mechanisms such as the "management time for vegetables: time-food exchange system." In addition, as gardeners generally lack an understanding of the eco-values of urban gardening, it is possible to raise awareness of the eco-value through setting ecological management standards for the facilities and eco-friendly gardening practices.

## 5 Conclusion

This paper proposes a typology for classifying Chinese urban gardeners based on their urban-rural life experiences to develop a corresponding urban farming strategy amid China's urbanization. Research reveals distinctions between Chinese UNGs and UMGs in motivations and behaviors. Recognizing shared needs for physical and mental health, leisure, and recreation, some UMGs also maintain a strong need for urban gardening to produce food and generate family income. Therefore, the study recommends a shift from the "one-size-fits-all" policy strategy of promoting community gardens and banning informal gardening to a more adaptable framework to address the needs of both types of gardeners, from space planning and design to the operation and management of the spaces and the organization of activities. Such a revised framework should also include the planning of small-scale urban farms, the creation of small public open spaces with ornamental plants to enhance the aesthetic appeal of urban gardening, and the establishment of an incentive mechanism to meet the diverse needs of urban gardeners and fully realize the value and benefits of urban gardening in promoting social cohesion and protecting the urban ecosystem.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Author contributions

YX: Data curation, Writing – original draft. ZX: Funding acquisition, Supervision, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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