

Study on the Differences of Urban Forestry Demands of Citizens in Beijing, Shanghai and Guangzhou, China

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Abstract. From a global perspective, urban forestry plays an important role in improving the living environment of urban citizens, expanding the space for urban development, improving human health and well-being, and promoting sustainable economic and social development. In China, Beijing, Shanghai, Guangzhou and other cities have made remarkable achievements in urban forestry development in recent years, which changes people's demands for urban forestry accordingly, especially for citizens living in the large cities. The degree and dimension of the demands for cities are constantly increasing. In order to study the public demands for urban forestry in the large cities of China, this paper selects Beijing, Shanghai and Guangzhou as the research area, using the method of single factor analysis of variance from gender, age, education, marital status, health status to discuss the three urban citizens in urban forestry total demand, education demand, health demand and recreation demand. The results show that: (1) There is no gender difference in the demand for urban forestry between Shanghai and Guangzhou. Only there is a difference in the educational and cultural demand for urban forestry between males and females in Beijing. And the educational and cultural demand of females is slightly higher than that of males. (2) Unmarried people in the three cities generally have higher educational and cultural demand for urban forestry than married people. (3) In different cities, people of different age groups have different demands for urban forestry. Beijing citizens lay more stress on the educational and cultural demand of urban forestry, Shanghai citizens lay more stress on the recreational demand of urban forestry and Guangzhou citizens lay more stress on the health demand of urban forestry.

1. Introduction

Urbanization is a historical task of modernization, and provides the greatest potential for expanding domestic demands. However, with the continuous improvement of China's urbanization rate, a series of social problems, such as resource depletion and environmental degradation, have become increasingly prominent, gradually diluting the dividends brought by economic development to the people. Therefore, urban ecological construction has become one of the urban infrastructure projects. As an important part of ecological environment, urban forestry is not only an important subject of urban ecological construction, but also a key link to realize harmonious coexistence among city, man and nature. For the citizens living in the city, the development of urban forestry should not only meet their material needs, but also provide them with ecological products and a good living environment. It should also be able to meet the spiritual needs of citizens and provide places for recreation, education and culture. Therefore, the development of urban forestry should not only pay attention to the role of improving the environment and beautifying the city, but also pay attention to the role of urban forestry construction.
that can meet the various needs of citizens\(^5\). At present, countries in the world are exploring urban forestry which can meet the needs of citizen model in accordance with the principle of people-oriented, from the perspective of people to build forest cities. The first International Conference on Forest Cities in 2016, themed "Forest Cities and Human Settlements", aims to promote the development of urban forest construction in various countries. At the symposium on Forest Cities in China in 2019, it is also pointed out that we should continue to promote the construction of forest cities and strive to create a better and happier life for the people.

After the industrial revolution, countries began to pay more attention to environmental problems due to the increasingly damaged environment, and the concept of urban forestry was first proposed. In view of this, more and more scholars began to conduct in-depth research on the theme of urban forestry. At present, studies on urban forestry can be mainly divided into two aspects: broad sense and narrow sense. In the broad sense, the object of urban forestry is to support the sustainable development of cities. It manages all the vegetation in the administrative division and studies the relationship between urban forestry and urban environment\(^5\)–\(^8\). In the narrow sense, the studies of urban forestry mainly focus on the plants and vegetation with economic benefits. With the improvement of living standards, people's demands will change from the most basic material needs of food, clothing, housing and transportation to the higher requirements of living environment. Hence, the public attach great importance to the construction of urban forestry and prefer to live in places with forest green space\(^9\). The importance of urban green space is positively correlated with the demands of citizens\(^10\). Citizens’ demands of urban forestry have similarities and differences. The similarities are the requirements of settlements and approaching parks and green lands. The differences are that people of different ages, genders and incomes have different demands for urban forestry, such as morning exercise, relax body and mind and health care\(^7\).

Nowadays, studies on urban forestry are mostly based on their understanding of the concept, and few studies have payed attention to citizens' demands for urban forestry and their influencing factors. The selected study areas are also relatively single, lacking comparative analysis of different cities. Based on the above status quo, this paper selects Beijing, Shanghai and Guangzhou as sample collection points to analyse the difference of citizens' demands for urban forestry.

2. Materials and methods

2.1. Study area

In recent years, the mutual integration of urban forest and urban planning layout, urban cultural landscape and natural landscape, urban forest network, road network and water network makes urban forestry and urban development complement each other. As China's first-tier cities, Beijing, Shanghai and Guangzhou are in the forefront of China's economic development. Correspondingly, their forest construction quality and urban forestry development speed are also ahead of most Chinese cities. As the three most important central cities in China, we should not only make them economic cities, but more importantly, make them livable cities and create an environment suitable for the long-term survival of citizens\(^11\). Based on the above factors, this paper selected Beijing, Shanghai and Guangzhou as sample collection points to analyse the difference of citizens' demands for urban forestry.

2.2. Comparison of urban forestry construction in Beijing, Shanghai and Guangzhou

As shown in figure 1, urban green space area is the visual embodiment of urban forestry construction. Looking at the green space area of the three cities, Beijing has the largest urban forest area, followed by Guangzhou and finally Shanghai. The forest coverage rate of the three cities is 43.5%, 42.31% and 16.9% respectively. The total forest volume and forest coverage rate of Beijing and Guangzhou are much larger than that of Shanghai, which is mainly due to the large areas under their jurisdiction. And the land area suitable for vegetation growth in their jurisdiction areas is larger than that of Shanghai. However, due to the geographical restrictions and the needs of its own economic construction and development,
Shanghai does not have too much land to build urban forestry. Nevertheless, as shown in figure 2, in the past five years, the per capita green space area of the three cities showed an increasing trend, indicating that the three cities have achieved remarkable results in the construction of urban garden green space.

As shown in figure 3, the level of investment reflects the development of urban forestry to a certain extent. Among the three, the forestry investment in Beijing is about 10 times that in Shanghai and Guangzhou, which are gradually approaching. On the whole, the investment of urban forestry in Beijing and Guangzhou is increasing year by year, while that in Shanghai tends to be stable, which directly reflects the current construction status of urban forestry. Beijing is the only country with the most policy support. The other two places still need more government support.
As shown in figure 4, urban parks are the direct embodiment of urban citizens' demands and willingness to pay. The number and area of parks in a city can reflect the basic status quo of urban forestry construction. Among the parks in Beijing, Shanghai and Guangzhou, the number of urban parks in Beijing takes up the largest proportion, while the number of urban parks in Shanghai grows the fastest. The number of urban parks in Guangzhou is basically unchanged. As shown in figure 5, the green area of urban parks in Beijing and Guangzhou is higher than that of Shanghai and steadily growing. The growth of green space area in Beijing park benefits from the non-capital function, while the growth of green space area in Guangzhou park benefits from the proposal of the construction scheme of "two districts, three axes, four sections, eighteen corridors, multi-core and multi-network". In view of intensive urban building planning, the main land in Shanghai is land for production and construction, and less land can be used for urban forestry construction. Moreover, the urban area is small, so the green space area and growth rate of urban parks are both smaller than that of Beijing and Guangzhou.

![Figure 4](image1.png)

Source: National Bureau of Statistics of China

Figure 4. The number of City Park of Beijing, Shanghai and Guangzhou during 2014-2018

![Figure 5](image2.png)

Source: National Bureau of Statistics of China

Figure 5. Green Space Area of Parks in Beijing, Shanghai and Guangzhou during 2014-2018

2.3. The index system of citizens' demands for urban forestry

At present, few studies constructed the index system of citizens' demands for urban forestry from the perspective of citizens, and only a few scholars evaluate the index system of urban forestry function based on the perspective of citizens. The concept of urban forest function has a strong subjectivity. citizens' awareness, behaviour and preference of demand and so on all belong to categories of the study of the function of urban forest[12, 13]. In consequence, this study combined with the actual situation of Beijing, Shanghai and Guangzhou, selecting health demand, education and culture demand[14] and
recreation demand\cite{15} to measure differences of demands among the three cities.

2.4. The research methods

The research group randomly selected 5 districts and counties in Shanghai, 6 districts and counties in Beijing and 7 districts and counties in Guangzhou from October to November in 2019. In each district and county, 3-4 representative urban green parks were selected according to green space distribution, local population flow and population structure and other factors. In each urban green park, the quota sampling method was adopted, and a total of about 50-100 citizens were selected to conduct a questionnaire survey according to the ratio of five to one.

Prior to the investigation, the research team recruited researchers from undergraduate and graduate students of Beijing Forestry University. During the interview, students with research experience were selected in preference. After the selection, the research group focused on professional training for the examiners. In the research process, 4-5 people were in a group, and the proportion of graduate students in each group was not less than 40%. Special supervisors were assigned to supervise the research process of researchers to ensure that questionnaires were filled in face to face and collected on the spot, and supervisors did not participate in the research work of questionnaires.

As shown in Table 1, a total of 2,482 questionnaire results were collected during the whole survey process, including 1,378 from Beijing, 603 from Shanghai and 501 from Guangzhou. After the examination and rating of the questionnaire results, some invalid questionnaires were removed, and the number of remaining valid questionnaires were 1,722, including 850 from Beijing, 422 from Shanghai and 450 from Guangzhou. In order to maintain the consistency of the analysis samples during data analysis, valid questionnaires were randomly selected from each district and county of each city in proportion. Finally, 400 valuable questionnaire results were selected in each city for data analysis with the help of STATA.

| city       | district | Number of questionnaires |
|-----------|----------|--------------------------|
| Beijing   | Haidian  | 130                      |
|           | Chaoyang | 164                      |
|           | Dongcheng| 157                      |
|           | Xicheng  | 152                      |
|           | Fengtai  | 134                      |
|           | Shijingshan | 113                  |
|           | Huangpu  | 278                      |
|           | Putuo    | 83                       |
| Shanghai  | Jing'an  | 21                       |
|           | Xuhui    | 20                       |
|           | Minhang  | 20                       |
|           | Tianhe   | 102                      |
|           | Baiyun   | 54                       |
|           | Yuexiu   | 43                       |
| Guangzhou | Liwan    | 57                       |
|           | Fanyu    | 81                       |
|           | Huangpu  | 58                       |
|           | Zuhai    | 55                       |
| total     |          | 1722                     |

In terms of data processing, one-way analysis of variance is adopted in this study to analyse the differences between the demands of citizens in Beijing, Shanghai and Guangzhou for urban forestry.
Under different individual characteristics, this paper analyses whether there are significant differences between citizens' total demands for urban forestry, health demand, education and culture demand, recreation demand, and presents the results in the form of contingency table. One-way analysis of variance is a non-parametric test method used to test whether there are significant differences among multiple independent samples. Its null hypothesis is "the distribution of multiple independent samples shows no significant differences", and its purpose is to test whether the mean number of the populations belonging to multiple samples is equal. According to the existing research and the actual situation of Beijing, Shanghai, and Guangzhou, this study selects gender, age, educational background, marital status, and health status for the difference analysis of the three cities. Based on other univariate variance research ideas, F test dependent variables selected in this study are citizens' total demands for urban forestry, health demand, education and culture demand, recreation demand, and other variables selected are gender, age, educational background, marital status, and health status\[^{16,17}\].

3. Results

3.1. Difference analysis of Beijing's urban forestry demand

As shown in table 2, the analysis of the questionnaire data in Beijing indicated that: (1) There were significant differences between male and female in education and culture demands, but there were no significant differences between male and female in health demand and recreation demand. (2) People of different ages had significant differences in education demand, but not significant differences in health demand and recreation demand. People aged 18-39 had higher education and culture demand. (3) People with different educational backgrounds had different demands for recreation, while there were no significant differences in health demand and education and culture demand. Generally speaking, people with high school education or above had higher demands for rest and entertainment. (4) The person of different marital status had differences in education and culture demand, and unmarried people demanded higher than married people, while there were no significant differences in other demands. (5) People with different health conditions had different health demands, and people with normal health conditions had higher demand, while there was no significant differences in other demands.

| variable       | property level | total demand | health demand | education and culture demand | recreation demand |
|----------------|----------------|--------------|---------------|-----------------------------|------------------|
|                |                | mean         | mean          | mean                        | mean             |
|                |                | F            | F             | F                           | F                |
| gender         | male           | 1.696        | 0.425         | 0.310                       | 2.927*           |
|                | female         | 1.819        | 0.409         | 0.315                       | 1.059            |
|                | 17 and under 17| 1.583        | 0.444         | 0.244                       | 0.895            |
|                | 18-29          | 1.795        | 0.421         | 0.335                       | 1.038            |
|                | 30-39          | 1.882        | 0.422         | 0.328                       | 1.132            |
|                | 40-49          | 1.568        | 0.408         | 0.286                       | 0.874            |
|                | 50-59          | 1.644        | 0.407         | 0.291                       | 0.946            |
|                | 60 and above 60| 1.537        | 0.401         | 0.267                       | 0.869            |
| education      | primary school and below | 1.842 | 0.434 | 0.316 | 1.092 |
|                | junior         | 1.443        | 0.421         | 0.267                       | 0.755            |
|                | senior         | 1.763        | 0.412         | 0.306                       | 0.674            |
|                | bachelor       | 1.764        | 0.420         | 0.325                       | 1.019            |
|                | master and above| 1.756  | 0.411         | 0.307                       | 1.038            |
| marital status | unmarried      | 1.772        | 0.430         | 0.327                       | 1.015            |
|                | married        | 1.698        | 0.411         | 0.296                       | 2.821*           |
|                | else           | 1.704        | 0.377         | 0.283                       | 1.044            |
|                | very bad       | –            | 0.214         | –                           | 2.648*           |
|                |                |              |              |                             | 0.242            |

Table 2. The difference of analysis of urban forestry demand of Beijing citizens
3.2. Difference analysis of Shanghai's urban forestry demand

As shown in table 3, according to the results of questionnaire data analysis in Shanghai, it can be seen that: (1) There was no significant difference between male and female on the three demands. (2) There were differences in education and culture demand among people of different ages, significant differences in recreation demand, but no significant differences in health demand. It can be seen that the younger the people are, the higher the recreation demand is. (3) There was no significant difference between people with different educational backgrounds on the three demands. (4) Different marital status had differences in health demand, education and culture demand, and unmarried demand was higher than married demand, and there was no significant difference in other demands. (5) People with different health conditions had different education and culture demand, while there were no significant differences in other demands.

Table 3. The difference analysis of urban forestry demand of Shanghai citizens

| variable          | property level | total demand | health demand | education and culture demand | recreation demand |
|-------------------|----------------|--------------|---------------|------------------------------|-------------------|
|                   |                | mean         | mean          | mean                         | mean              |
| gender            | male           | 3.484        | 0.510         | 1.292                        | 1.683             |
|                   | female         | 3.380        | 0.493         | 1.257                        | 1.630             |
| age               | 17 and under 17| 3.722        | 0.498         | 1.343                        | 1.882             |
|                   | 18-29          | 3.555        | 0.499         | 1.292                        | 1.764             |
|                   | 30-39          | 3.272        | 0.483         | 1.159                        | 1.630             |
|                   | 40-49          | 3.564        | 0.519         | 1.379                        | 1.666             |
|                   | 50-59          | 3.268        | 0.519         | 1.282                        | 1.467             |
|                   | 60 and above 60| 3.376        | 0.480         | 1.186                        | 1.710             |
| education         | primary school and below | 3.198       | 0.460         | 1.218                        | 1.519             |
|                   | junior         | 3.497        | 0.511         | 1.304                        | 1.682             |
|                   | senior         | 3.382        | 0.562         | 0.796                        | 1.164             |
|                   | bachelor       | 3.586        | 0.513         | 1.348                        | 1.725             |
|                   | master and above| 3.344       | 0.518         | 1.282                        | 1.545             |
| marital status    | unmarried      | 3.574        | 0.511         | 1.337                        | 1.726             |
|                   | married        | 3.412        | 1.407         | 2.529*                       | 1.473*            |
|                   | else           | 2.843        | 0.400         | 0.901                        | 1.541             |
| healthy status    | very bad       | 4.309        | 0.441         | 1.180                        | 2.689             |
|                   | bad            | -            | -             | -                            | -                 |
|                   | normal         | 3.447        | 1.147         | 0.500                        | 2.197*            |
|                   | good           | 3.358        | 0.497         | 1.251                        | 1.610             |
|                   | very good      | 3.662        | 0.527         | 1.397                        | 1.737             |

Note: * represents a significance level of 0.05, ** represents a significance level of 0.01

3.3. Difference analysis of Guangzhou's urban forestry demand

As shown in table 4, according to the results of questionnaire data analysis in Guangzhou, it can be seen that: (1) There was no significant difference between males and females in various demands. (2) People
of different ages had significant differences in health demand, but had no significant differences in other demands, among which the demand of people between 40 and 49 years old were higher than those of other ages. (3) People with different educational backgrounds had significant differences in education and culture demand, while other demands were not significant. Generally speaking, people with higher educational backgrounds had higher education and culture demand. (4) People with different marital status had significant differences in health demand and had differences in education and culture demand and no significant differences in other demands. (5) People with different health conditions had significant differences in recreation demand, as well as in the total urban forestry demands. Generally speaking, the healthier people are, the higher their recreation demand is.

Table 4. The difference analysis of urban forestry demand of Guangzhou citizens

| variable            | property level | total demand | health demand | education and culture demand | recreation demand |
|---------------------|----------------|--------------|---------------|------------------------------|------------------|
|                     |                | mean         | F             | mean                         | F               | mean                        | F               |
| gender              | male           | 3.687        | 0.458         | 0.557                        | 0.700           | 1.141                       | 0.351           | 1.988                       | 0.213           |
|                     | female         | 3.915        |               |                              |                 |                             |                 | 2.125                       |                 |
| age                 | 17 and under 17| 3.568        |               |                              |                 | 1.143                       |                 | 1.886                       |                 |
|                     | 18-29          | 3.886        |               |                              |                 | 1.268                       |                 | 2.037                       |                 |
|                     | 30-39          | 3.816        | 0.464         | 0.553                        | 4.836**         | 1.187                       | 0.745           | 2.077                       | 0.290           |
|                     | 40-49          | 4.195        |               |                              |                 | 1.288                       |                 | 2.270                       |                 |
|                     | 50-59          | 3.763        |               |                              |                 | 1.102                       |                 | 2.083                       |                 |
|                     | 60 and above   | 3.808        |               |                              |                 | 1.178                       |                 | 2.076                       |                 |
| education           | primary school | 4.163        |               |                              |                 | 1.284                       |                 | 2.274                       |                 |
|                     | and below      | 3.667        |               |                              | 0.605           | 1.106                       | 0.599           | 2.011                       |                 |
|                     | junior         | 3.686        |               |                              | 0.551           | 1.131                       | 4.715**         | 2.006                       | 0.229           |
|                     | senior         | 3.690        |               |                              | 0.554           | 1.250                       | 0.593           | 2.093                       |                 |
|                     | bachelor       | 3.921        | 0.613         |                              | 0.579           | 1.244                       |                 | 2.096                       |                 |
|                     | master and     | 3.932        |               |                              |                 |                             |                 |                             |                 |
|                     | above          | 3.932        |               |                              |                 |                             |                 |                             |                 |
| marital status      | unmarried      | 3.586        |               |                              |                 | 1.128                       |                 | 1.928                       |                 |
|                     | married        | 3.932        | 1.496         | 0.591                        | 6.238**         | 1.229                       | 3.461*          | 2.112                       | 0.421           |
|                     | else           | 4.016        |               |                              |                 | 1.254                       |                 | 2.172                       |                 |
| healthy status      | very bad       | 3.396        |               |                              |                 | 1.155                       |                 | 1.714                       |                 |
|                     | bad            | 2.683        |               |                              |                 | 0.921                       |                 | 1.314                       |                 |
|                     | normal         | 4.051        | 3.159*        | 0.558                        | 1.942           | 1.188                       | 1.860           | 2.305                       | 3.625**         |
|                     | good           | 3.905        |               |                              |                 | 1.251                       |                 | 2.061                       |                 |
|                     | very good      | 3.307        |               |                              |                 | 1.138                       |                 | 1.574                       |                 |

Note: * represents a significance level of 0.05, ** represents a significance level of 0.01

4. Conclusion
It is found that there is no gender difference in the demand for urban forestry in Shanghai and Guangzhou. Only men and women in Beijing have different education and culture demand, and women's education and culture demand are slightly higher than men's. Beijing has the most profound cultural deposits among the three cities, and many parks are historical relics, such as the Temple of Heaven and the Ditan park which are the places for worshiping ancestors and praying for good harvest in the Ming and Qing dynasties. The city parks in Shanghai and Guangzhou are mostly used for recreation, but they lack the function of history and culture education compared with that in Beijing. In addition, women are more likely to take care of their families and children in the family. Urban forest, as a natural educational place, allows children to be influenced by history and culture in a natural and pleasant environment. Therefore, compared with men, women in Beijing have a higher demand for urban forestry education and culture.

Unmarried citizens in the three cities generally have higher education and culture demand than
married people. Unmarried citizens are mainly students, and their desire for scientific research or intellectual curiosity may be the main reason for the high education and culture demand.

In different cities, people of different ages have different demands for urban forestry. Beijing citizens lay particular stress on education and culture demand, among which those aged between 18 and 39 have the highest education and culture demand. Beijing has a large number of universities, and the number of people receiving undergraduate and graduate education is much higher than that of Shanghai and Guangzhou. Besides, students from all over the country wish to visit the historical and cultural green parks in textbooks, such as the Summer Palace, The Old Summer Palace and The Palace of King Gong. Therefore, people at this age have a high demand for urban forestry education and culture. Shanghai citizens lay particular stress on the demand for rest and entertainment, among which the teenagers and the elderly have the highest demand. As an international metropolis, Shanghai has high recreational nature and complete recreational facilities in urban parks, which are more attractive to young people. Elderly people have more leisure time, so urban parks can provide good places for them to rest and socialize. Guangzhou citizens lay particular stress on health demand, among which the elderly people's health demands are the most intense. Paying attention to healthy life is an indispensable part of traditional culture in Guangzhou. Since ancient times, under the influence of local living habits, middle-aged and elderly people in Guangzhou pay more attention to health preservation and pursue a healthy life. Therefore, in the construction of urban forestry, more consideration should be given to meet the health needs of local citizens.

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