Research on Accessibility of Green Infrastructure Based on GIS: A Case Study of Kunhou Neighborhood Planning

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Abstract: The outbreak of the COVID-19 pandemic in early 2020 has made necessary a re-examination of public health issues and the adoption of life-changing design strategies. By combining quantitative and qualitative methods, the structure and function of community green space can be better evaluated. This study selects the Kunhou neighborhood in Wuhan as the site and proposes to analyze the daily health service function of the community's green infrastructure. Through GIS spatial analysis, this study evaluates the accessibility of green infrastructure and medical facilities and discusses the ideal green space form based on health indicators. Statistical analyzes were used to visualize the relevance of accessible green infrastructures and medical facilities within walking distance. The findings show that the Kunhou neighborhood is lacking access to green infrastructure for daily activities. The research findings provide a bridge between public health indicators and community space planning and offer design suggestions for green infrastructure planning.

Keywords: Accessibility, green infrastructure, community health, GIS, urban planning.

INTRODUCTION

High-Density Urban Communities in China

Chinese urban communities have the characteristics of high building density, high building plot ratio, high population density, and insufficient green space (Li *et al*., 2005). At the same time, the public space in the community is too limited and the greening rate is low, which is not supportive of residents' outdoor activities. Table **1** shows the indicators for the green space system in Wuhan in 2020. In high-density cities, public green infrastructures can improve the natural and ecological benefits of urban areas and provide space for public outdoor activities (Liu *et al*., 2019). From the perspective of ecological benefits, green space maintains biodiversity, improves the city's adaptability to climate changes, and diminishes air pollution (Hoek *et al*., 2013). The pathogens of infectious diseases are mainly transmitted through droplets, aerosols, water bodies, and dust in the air. The community green space system functions as an "air filter", blocking the transmission path of infectious diseases, purifying the air, and killing bacteria (Elsaid *et al*., 2021). For atmospheric pollution prevention, green plants (such as cedar and camphor) possess strong dust retention capabilities (Wang & Kong, 2016). In addition, green plants can also purify the pollutants in the soil (Gratão *et al*., 2005).

The social and economic functions of green space include providing outdoor space and improving urban public health conditions (Keniger *et al*., 2013). The green space system serves as the functional unit for the daily activities of social groups. The residents in the community will choose to walk through the green space, which not only helps them get exercise but also reduces the use of vehicles (Grazulevicienej *et al*., 2015).

Literature Review

Based on the selected literature for review, the relation between the spatial value of green space and healthy communities is explained from four perspectives in this study: morphological value, cultural value (Huang 2021), ecological value (Huang 2016), and temporal value. Morphological value measures the spatial form characteristics of green space with regard to distribution pattern, proximity, geometric characteristics, accessibility, etc. (Liu *et al*., 2019; Peng *et al*., 2010). For example, FRAGSTATS can be used for analyzing the spatial patterns of green space and making categorical maps (McGarigal, 2002). The cultural value measures the traditional cultural behaviors and customs within the community and the quality of life of residents (Schüle *et al*., 2017). Safe social distance standards are adopted (Larcher *et al*., 2021; Sorokowska *et al*., 2017), and the physical and mental health of residents are emphasized (Sugiyama *et al*., 2016). Ecological value measures the quality of physical elements such as water and air, and acoustic, light, and thermal environments (Saloma *et al*., 2021). Technical measures are suggested in rainwater utilization, ventilation, noise reduction, lighting, and temperature regulation (Liu *et al*., 2019) to enhance the vitality and resilience of communities. The way to

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Table 1: Indicators for Green Space System Planning in the Urban Area of Wuhan in 2020

Code	Category	Planned area (ha)	Proportion of green space in urban construction land	Green area per capita (m^2/person)	Number of patches
G1	Parkland	7204.6	16.85	16.8	217
G2	Production green space	908.2	2.12	1.80	95
G3	Protective green space	3015.3	7.05	5.97	529
G4	Attached green space	3834.3	8.97	7.59	65245
G5	Other green space	2564.8	35.0	5.08	N/A

Note: Part of the data in the table is from the "Summary of Green Space Planning Indicators in the main urban areas" in the "Wuhan Urban Green Space System Planning (2003-2020)". The outline of this plan can be accessed at: http://ylj.wuhan.gov.cn/zwgk/zcwj/wjjd_12317/202104/t20210426_1676063.shtml.

improve the value of temporal considerations is to use the cross-peak module in the provision of the green space function to reduce the frequency of crowd crossing and improve the efficiency of space use. This article explores the impacts of green space value on community health and explores the life-changing design strategies for the community. The green space is not only intended to provide daily health services for residents but also to offer efficient control in the possible occurrence of emergent public health events and extreme weather.

The research on landscape metrics and health indicators for urban green space has been ongoing. In this study, indicators of green space are used to bridge the health impacts on community residents and green space design (Liu *et al*., 2019; Wu, 2019; Peng *et al*., 2010; Lee *et al*., 2014). Table **2** summarizes the health indicators selected from the landscape metrics in published literature and classifies them into two categories based on their influence on the spatial form of green space or the physical behavior of residents.

In this research, accessibility is selected among other indicators in Table **2** as the focused criterion of the value of green space. Accessibility refers to the relative difficulty of getting to the landscape source from the community, and its related indicators include the distance and time to reach the green space (Zhang *et al*., 2020). Accessibility is an important indicator for urban green space systems. It quantitatively evaluates the convenience of reaching a specific park green space from a certain point and is closely related to the service radius and scope of the park. Although accessibility is not the decisive factor in urban residents' quality of life, accessibility is positively correlated with urban spatial quality and residents' happiness. The accessibility of green space not only provides residents with outdoor activities and daily health services, but also plays a certain role in prevention, mitigation, and response to public health events (Kessel *et al*., 2019).

Aim and Scope

Covid-19 has imposed life-changing impacts on our everyday life, so future planning should take into account the long-term benefits of all ages in an aging society (Burke, 2021). Due to the high density of buildings and roads near the Kunhou neighborhood, the green patches nearby are too scattered. This paper analyzes the green infrastructure resources surrounding the Kunhou neighborhood by highlighting the accessibility analysis on ArcGIS, to provide a reference for the construction of urban green space. The framework of this research is composed of three sections: 1) field investigation and GIS-based spatial analysis methods; 2) spatial distribution results of green space and medical resources in buffer zones; 3) design suggestions for the neighborhood.

METHODS

Study Area and Data Sources

Wuhan, located in the center of China, is a national historical and cultural city and an important transportation hub in China. The Kunhou neighborhood, which is composed of traditional lanes and alleys, is in the Jiangan District of Wuhan City. This research collects multi-type, multi-scale, and multi-source data of amenities near the Kunhou neighborhood, including shapefiles of buildings, green space, roads, and bodies of water. POI data of medical facilities in Wuhan were downloaded from the Tianditu web page (https://www.tianditu.gov.cn/).

Table 2: Summary of Health Indicators of Urban Green Space from Published Literature

Categories	Impacts for health	Health indicators	Descriptions	Reference
Spatial form	Increase green space area	Green coverage rate	Measure the proportion of each type of green space in the base area.	Liu *et al*., 2019
		Green space per capita	The average area of public green space occupied by each resident in the city (%).	Wu, 2019
		Number of patches	The total number of green patches in the base.	Peng *et al*., 2010
Physical behavior	Promote physical activity	Accessibility	The relative difficulty to go from the community to the landscape source, and its related indicators include the distance and time to the green space, etc.	Lee *et al*., 2014; Tamosiunas *et al*., 2014
		Availability	Total number of green spaces within a certain distance.	Schüle *et al*., 2017
		Visibility	Percentage of greening that can be seen at a certain place.	Larkin & Hystad, 2019
	Enhance social interactions	Social distance	Four kinds of distance (intimate distance, personal distance, social distance, and public distance).	Sorokowska *et al*., 2017

During the mapping process, the base map from OpenStreetMap (OSM) was adopted and the shapefiles were shown on QGIS. The green infrastructure in this study includes different scales of green spaces, such as linear greenways (lanes), patches of greenways (small or medium size parks), and large areas of green space (urban parks). Figure **1** presents the site analysis of the Kunhou neighborhood in the urban textures of Wuhan. The neighborhood is surrounded by Victory Street, Yiyuan Road, Zhongshan Avenue, and Eryao Road, and enjoys a distance of 320 meters from the river-beach park in Hankou.

Field Investigation

During the field investigation, we identified seven different communities in this neighborhood block, including Kunhou, Qingxiang, Guangxing, Tongde, Siyi, Shouchun, and Yanqing. The photographs of typical scenes in the lanes and alleys were taken and attached to specific locations on the map (Figure **2**). With attention paid to the folk cultures in Wuhan, the residents' common activities in the lanes were recorded and categorized, including weaving, strolling, airing clothes, etc. Their spatial distribution in the lanes was mapped in spots and shown in the diagram of community plans.

Spatial Analysis on GIS

This research uses the buffer analysis on QGIS to explore the accessibility of nearby green infrastructure and medical facilities. The geometric centroid of the community is used as a service point (Zhang *et al*., 2020) and a service area is an extension of the path analysis to a destination. By establishing a service area, paths in all directions centerd on the service point are generated, and the ends of the paths are connected to form a ring. The lowest traffic cost is the optimization goal of the route, and impedance is the basis for calculating cost. Generally, the geometric length of line elements is used as impedance. The distance represented by the cumulative length is the traffic cost, and sometimes the unit time consumption is also used as impedance (Song & Niu, 2019). The circular service area generated by the GIS platform is used to divide the urban area into circles according to different service radii, and then determine the overall accessibility range from the centroid of the community (Kessel *et al*., 2019).

Using the Network Analyst tool in Arc Toolbox, three circular buffer zones are generated at a predefined distance from the Kunhou neighborhood (Zhang *et al*., 2020). The time of walking distance was set as

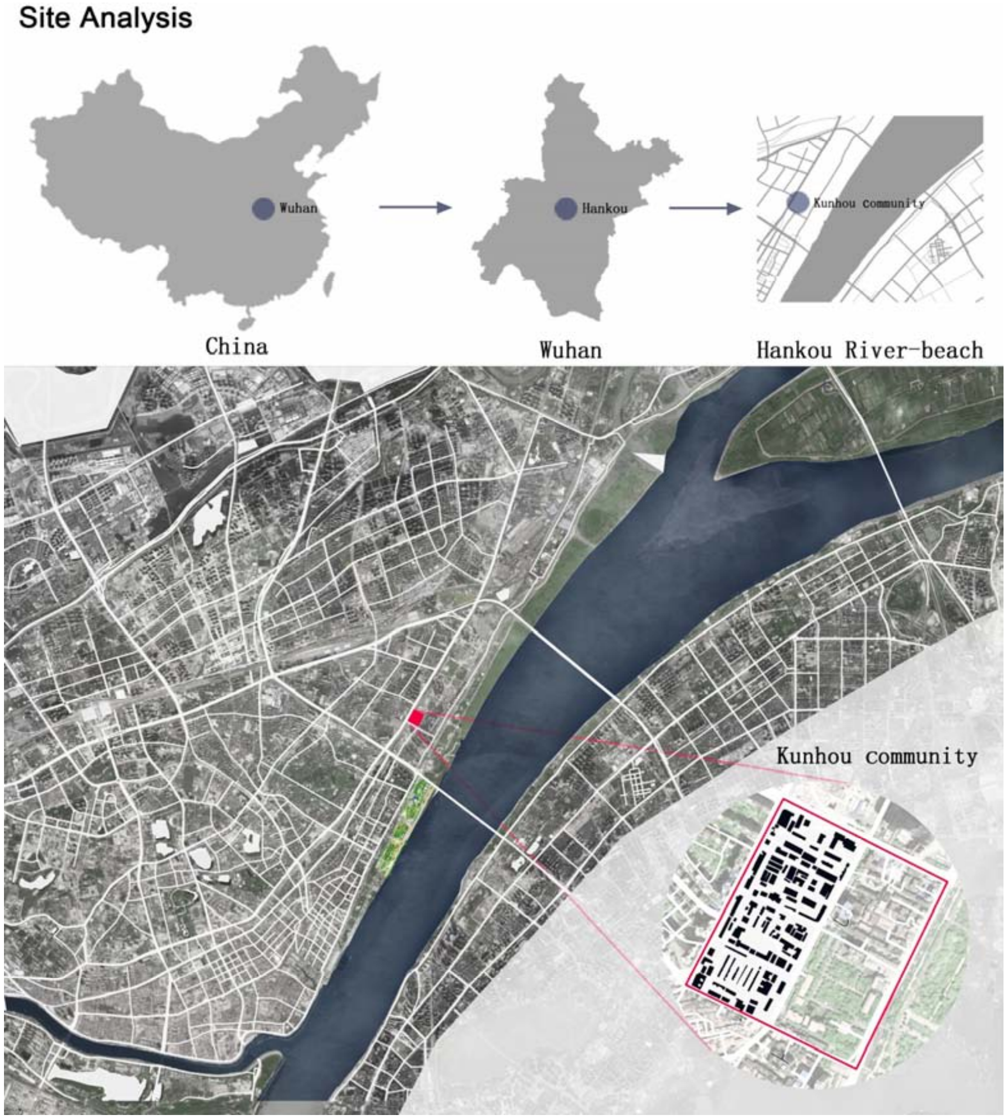

Figure 1: Site analysis for the Kunhou neighborhood. Source: Author.

5 minutes, 10 minutes, and 20 minutes, and assuming that the general walking speed of pedestrians is 8 m/min, the radii of the circular buffer zones related to these three walking distances are 400 meters, 800 meters, and 1600 meters. With these parameters input in the “buffer analysis” tool on QGIS, the buffer zones surrounding the neighborhood were created and visualized on a map. The coverage area of green space and the count of medical facilities in each of these buffer zones were calculated to discuss their accessibility.

Online Text-Mining for Perceptions of the Residents

From the perspective of cultural value, this study explored the residents' attitudes toward the lifestyle in the neighborhood based on web travel notes. The online texts were captured from multiple sources such as news reports, interviews, documentation, and social media blogs published on Weibo, the Little Red Book, and Dianping. Most of the respondents are old people who are living or used to live in the community. Within a time frame from 2010 to 2023, 138 pieces of online texts about the residents' perception and evaluation of the Kunhou Neighborhood were collected and a notepad was constructed to record and analyze each piece of note. The residents are found to be concerned with the community infrastructures, living conditions, local customs, intangible culture, and emotional experiences. In the general processing of the travel notes on ROST-CM6 (ROST Content Mining 6 tool), after obtaining the word division results, word frequency analysis, semantic network analysis, and sentiment distribution analysis were conducted to further investigate the connotations (Yang *et al*., 2022; Chen *et al*., 2023).

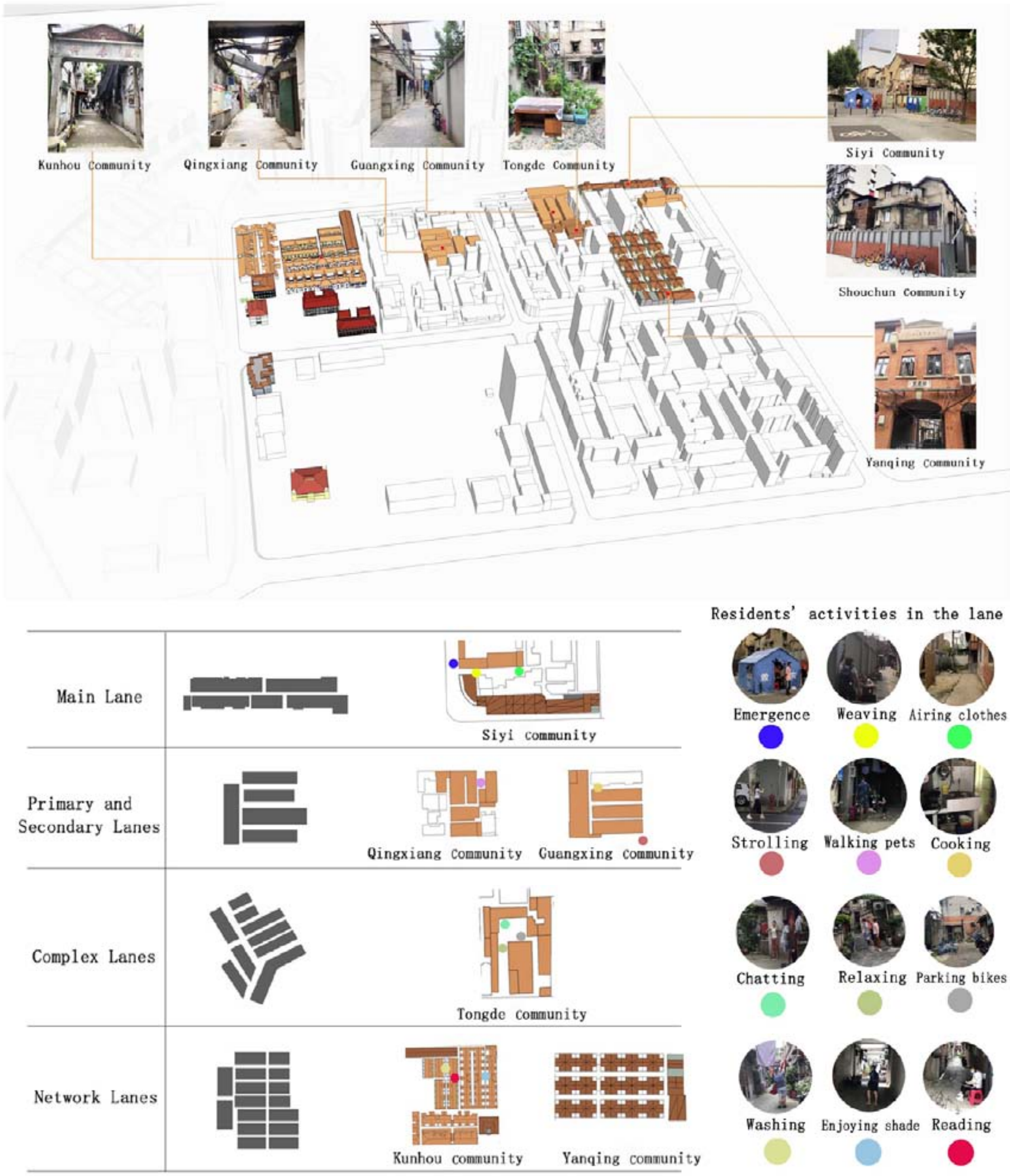

Figure 2: Lane types and behavior map of the six communities in the neighborhood. Source: Author.

RESULTS

The In-Site Phenotype of the Lanes and Behavior Mapping

The phenotype forms of the lanes in the six communities are examined and can be categorized into four types: main lanes, primary and secondary lanes, complex lanes, and network lanes (Figure **2**). According to the field investigation, the in-site characteristics of these lanes are summarized below.

1. The spatial layout of the Siyi community is identified as the main lane.
2. There are primary and secondary lanes in the Qingxiang and Guangxing communities.
3. The Tongde community shows a complex lane layout.
4. The Kunhou and Yanqing communities present complex lane layouts.

There is a high percentage of elderly people among the residents, and their common daily activities in the lane area include medical care, weaving, airing clothes, strolling, walking pets, cooking, chatting, relaxing, parking bikes or motorcycles, washing, enjoying shade,

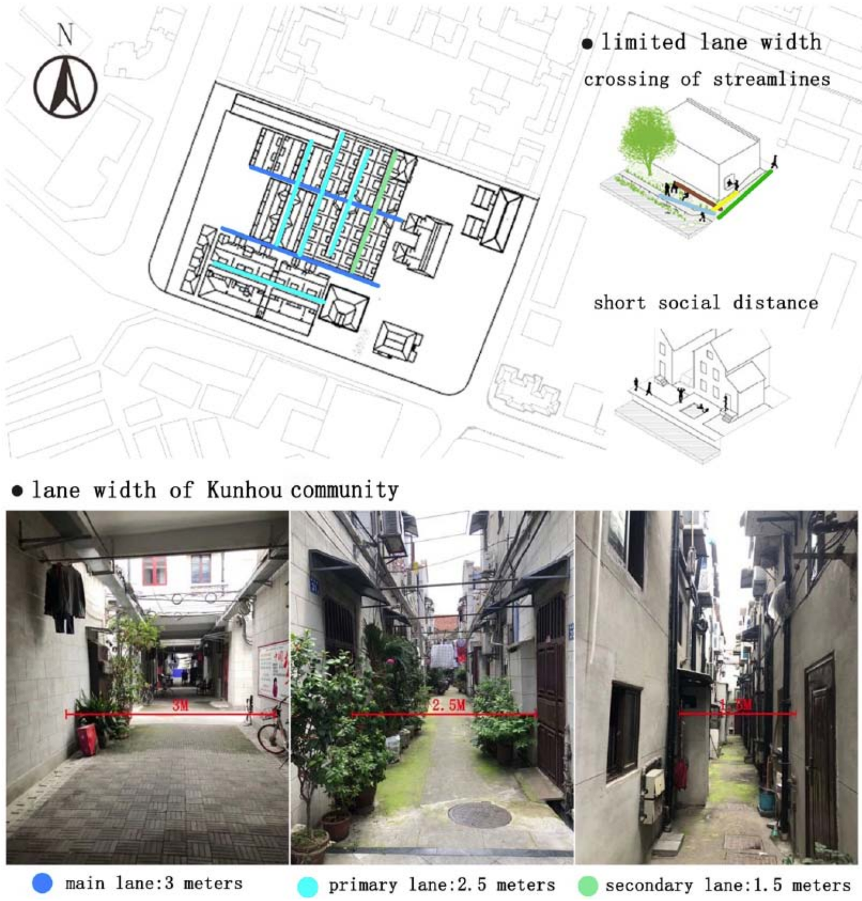

Figure 3: Social distance in the public lanes of the Kunhou community. Source: Author.

and reading, etc. As shown in Figure **2**, spots of twelve colors are used to show the distribution of these popular activities in the lane area of the six communities. Few plantings can be seen in the public lanes and private courtyards, and little green space is found in the neighborhood.

A detailed field investigation was conducted in the Kunhou community, and the lane widths were measured and shown in Figure **3**. There are a total of two main lanes, four primary lanes, and one secondary lane in this community. According to the measurement of lane width: 1) the main lane is 3 meters wide; 2) the primary lane is 2.5 meters wide; and 3) the width of the secondary lane is 1.5 meters. The limited lane width is the probable cause for the crossing of pedestrian streamlines and short social distance for the walking or riding residents.

Accessibility and Buffer Analysis

Using the buffer analysis on QGIS, the spatial distribution of green space and medical facilities surrounding the neighborhood are shown in Figure **4**. In the 5- and 10-minute walking distance, residents can walk to the river-beach park, and in the 20-minute walking distance, residents can access Jiefang Park for leisure and sports. As shown in Table **3**, in the buffer zone of 400 meters, the coverage area of green patches is 0.19824 m^2, and the count of medical facilities is only 9 (Figure **5**). In the buffer zone with 800 meters' radius, the area of accessible green space is 0.73598 m^2, and there are 30 medical facilities. As for the buffer zone with a radius of 1600 meters, the area of green space is larger (3.53325 m^2), and the number of medical facilities is 156.

The relationships between green space area/number of medical facilities and walking distance were explored on MATLAB, and the polynomial fitting curves with a degree of two were created. Figures **5a** and **b** show the linear models of polynomial fitting, and the values of R^2 of both regressions are 1, indicating that the fitting results were excellent. A significant increase in the area of accessible green spaces is statistically related to higher walking distance from the neighborhood; this trend has also been observed in the increase in the number of accessible medical facilities.

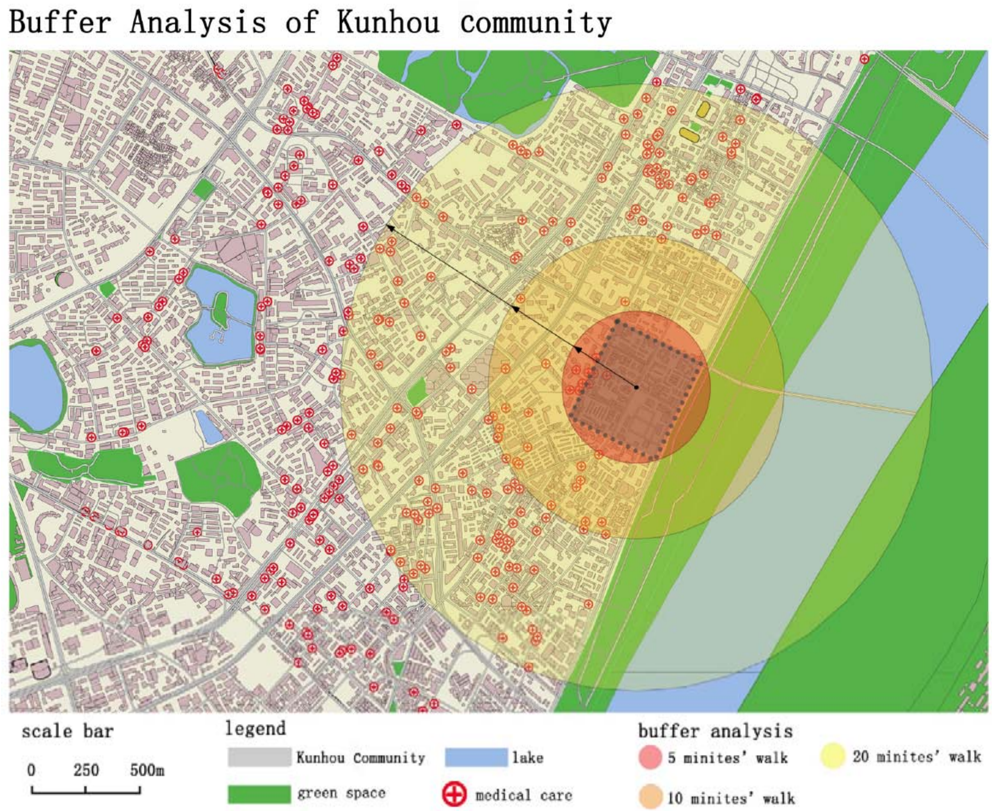

Figure 4: Buffer analysis of green space and medical facilities around the neighborhood. Source: Author.

Table 3: Buffer Analysis Results of Green Space and Medical Facilities

Walking distance	Buffer (m)	Area of green spaces[a] (m^2)	Number of medical facilities
5 min	0 - 400	0.19824	9
10 min	0 - 800	0.73598	30
20 min	0 - 1600	3.54425	156

A: Green space in this study refers to the public parks with green areas in them.

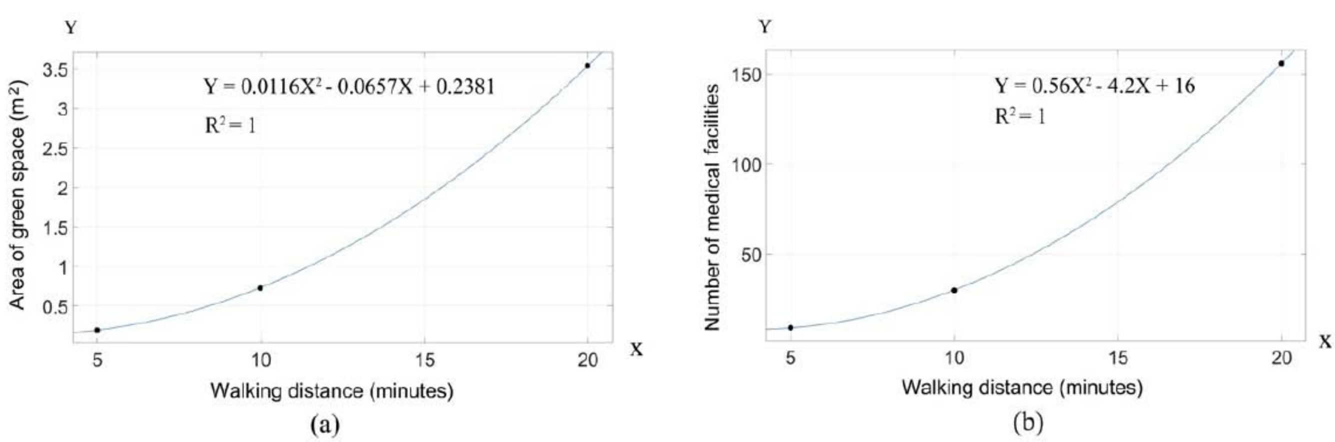

Figure 5: The polynomial plot of buffer analysis indicators on MATLAB. Source: Author.

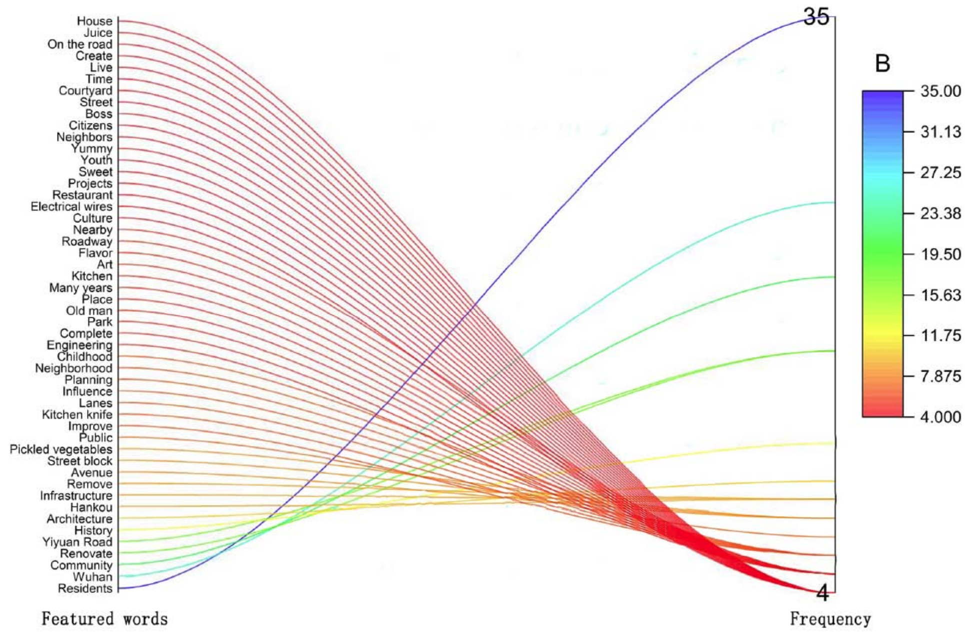

Figure 6: Word frequency analysis. Source: Author.

However, the coordinated analysis of the map, table, and polynomial plot in this section suggests the relative lack of green space and medical facilities in the five minutes' buffer zone of the neighborhood, and the access to the urban park means a longer walking distance, which is both effort-consuming and time-consuming. Furthermore, the community expresses a need for additional green spaces in and around this neighborhood as well as green corridors to connect the scattered green patches near the neighborhood. Meanwhile, more medical facilities should be provisioned and distributed in the five-minute buffer zone of the neighborhood.

Perception Analysis of the Residents

Based on the frequency analysis on ROST CM6, the top 50 feature words concerning the residents' perceptions were presented in a parallel plot (Figure **6**). This ranking can provide a reference for visualizing the weight of different aspects and comprehending the attitudes and perceptions of the residents. The top-ten ranked feature words in the axis are comprised of residents (word frequency = 35), Wuhan (word frequency = 25), community (word frequency = 21), renovate (word frequency = 17), Yiyuan Road (word frequency = 17), history (word frequency = 12), architecture (word frequency = 10), Hankou (word frequency = 9), and infrastructure (word frequency = 9) and remove (word frequency = 9). The results demonstrated the importance of tactile and approachable subjects in the residents' experiences, such as community, renovation, and infrastructure, while indicating an inclination to respect the history and culture of the neighborhood.

The semantic network analysis has a clear hierarchical structure with the words residents, community, and improve as the core, which extends to peripheral words. "Residents" as the core word was closely associated with other attributes such as daily, restaurants, shops, community, public, renovate, history, infrastructure, basic, and slow. The residents' feelings in Figure **7** can be categorized into three aspects: 1) daily life in the neighborhood, such as the living habits, community service, food and cooking, local shops, and the students' schooling; 2) memory of the community, including the cultural context, one hundred years' history, and old life in the past; and 3) renovation on the buildings, including the urban planning policies, upgrading of the infrastructure, renovation of the façade, financial support, engineering projects, and public art exhibition. Figure **6** and Figure **7** both highlighted residents as the paramount part of the perceptual data and shared similar heated topics on community service, public infrastructure, living habits, and renovation plans. Therefore, the residents' real demands surrounding the daily life in the community should be taken into account by urban management sectors and the architectural social, and cultural elements should be integrated into the community planning.

For an in-depth understanding of the residents' emotions, the travel notes were evaluated according to

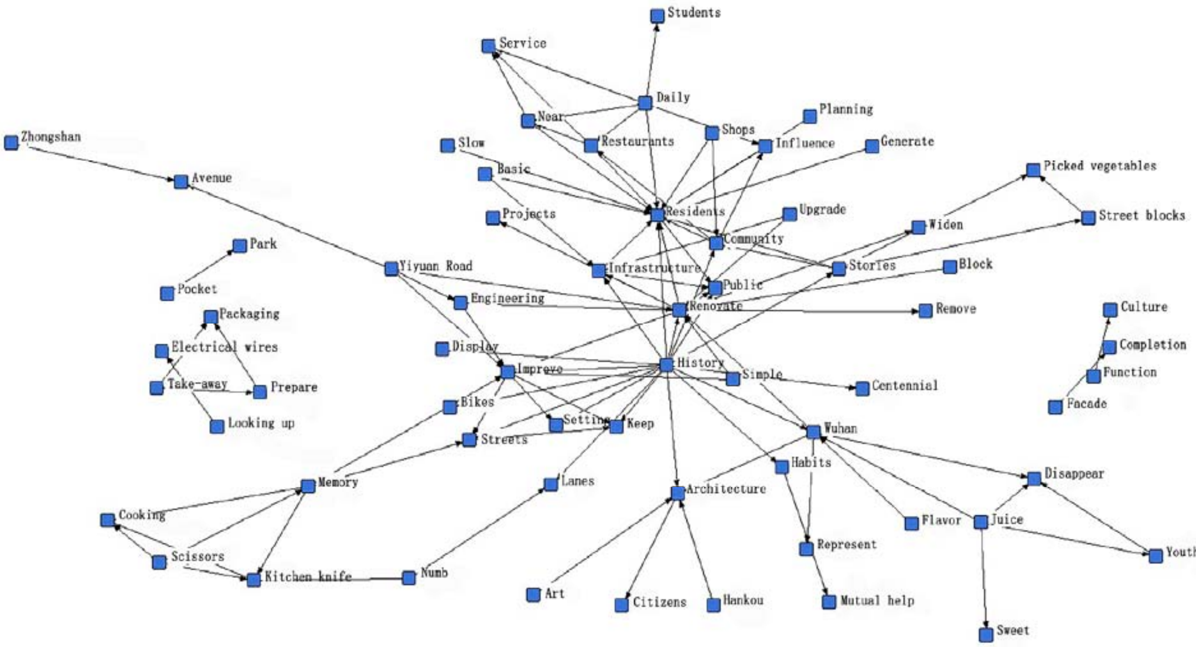

Figure 7: Semantic network diagram. Source: Author.

a sentiment dictionary on ROST CM6 and were divided into three scales: positive, neutral, and negative (Yang *et al*., 2022; Chen *et al*., 2023). According to the sentiment analysis in Table **4**, the majority of emotional responses are positive (65.94%), while the neutral and negative emotions accounted for 16.67% and 17.39%, respectively. The positive emotions are mainly distributed in the average subsection (50.72%) while the average division of the negative emotions accounts for 15.22% of all responses. The sentiment analysis results are dominated by positive emotions, and the negative emotions only take up a small proportion. The negative attitudes are centered around basic living facilities, public spaces, sanitary conditions, and repair funds in the community. More attention should be put into the life quality enhancement, public facilities renovation, old building reconstruction, and financial investment.

DISCUSSION

Design Suggestions for the Kunhou Neighbourhood

Neighborhood Unit Planning

The theory of "neighborhood unit" proposed by Clarence Perry advocates that the unit surrounded by urban roads is the cell of residential planning (Mehaffy

Table 4: Sentiment Distribution Analysis of Online Texts

Emotional Classification		Positive Emotion	Neutral Emotion	Negative Emotion
Analysis results	Quantity (Pieces)	91	23	24
	Proportion (%)	65.94%	16.67%	17.39%
Average	Quantity (Pieces)	70		21
	Proportion (%)	50.72%		15.22%
Moderate	Quantity (Pieces)	13		3
	Proportion (%)	9.42%		2.17%
Height	Quantity (Pieces)	8		0
	Proportion (%)	5.80%		0.00%

Note: The segmentation standard of positive emotion is: average (from 0 to 10), moderate (from 10 to 20), and height (above 20); the segmentation standard of negative emotion is: average (from -10 to 0), moderate (from -10 to -20), and height (below -20); the neutral emotion is not divided into sections.

et al., 2915). Each "neighborhood unit" is equipped with a certain number of public buildings to manage the population density. Its internal traffic can ensure the operation of the community service. In general, the traffic is divided by internal and external roads; external roads enable traffic to the rest of the city. The influence factors of green infrastructure distribution in the neighborhood are the density of the residents, connectivity of greenery, land use, transportation infrastructure, etc. (Tamosiunas *et al*., 2014). The "neighborhood unit" can be adopted to improve the accessibility and aggregation of green space in the Kunhou neighborhood and provide residents with more outdoor green space.

Pocket-Park Design

This "5-minute service circle of urban green space" plan proposed by the Wuhan government has improved the coverage and accessibility of pocket parks (Li *et al*., 2021). The service radius of urban parks is projected to cover more than 90% of residential land, and citizens can enter the park within a 5-minute walk of their communities. To improve the residents' walking experience, pocket parks are built to

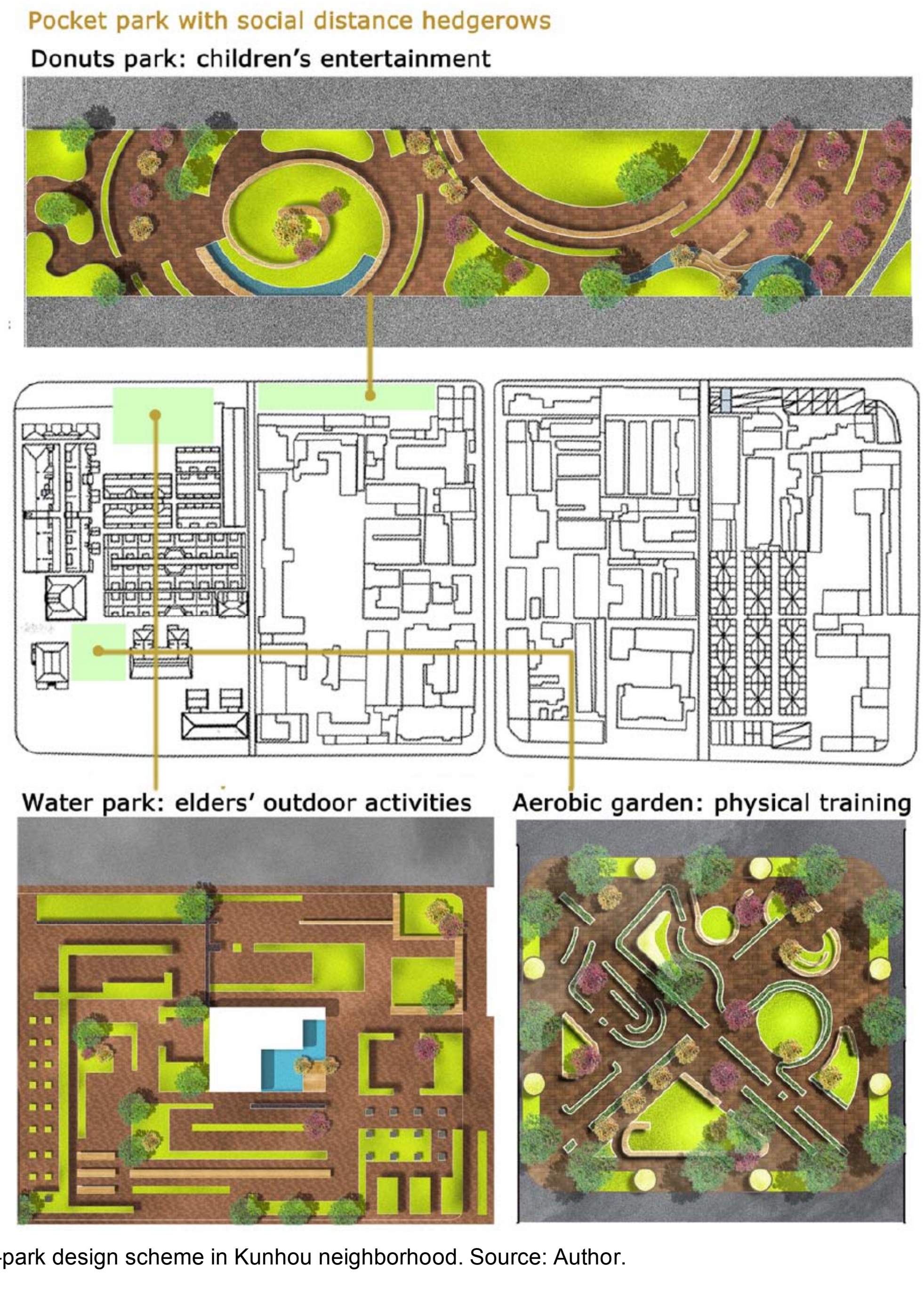

Figure 8: Pocket-park design scheme in Kunhou neighborhood. Source: Author.

help the residents stay away from the vehicle lanes, and noise and dust are expected to be reduced. The types of green plants in the pocket park should be rich, and the forms of green plants should be coordinated with the seating, lighting facilities, and ground pavement in the environment.

Under the pocket-park plan, green lanes should be built in the Kunhou community to form a connected green space network (Figure **8**). To address the daily activity requirements of residents of all ages, multiple parks are proposed to be built in the free space of the community. Soft landscape elements including plantation, water bodies, benches, and floor coverings are coordinated to form geometric patterns. A “donuts park” in the northeast of the community is proposed for children’s entertainment and leisure; a “water park” in the north of the community is designed for the elders’ outdoor activities; and an “aerobic garden” in the southwest of the community is designed for physical training and outdoor leisure. Linear green lanes also have the function of a traffic corridor, which assists in the accessibility and use efficiency of urban traffic facilities and municipal infrastructure (for example, sewage drainage facilities and rainwater collection systems).

Green Network Construction

A four-level network of greenways is also advised to be constructed in this community, with specific design considerations for each level of the network (Figure **9**). In the four-level green network, the scale of the first level to the fourth level ranges from macro to micro. The green networks at all levels complement each other and work together in the community environment. Compared to traditional spatial networks, the green network embodies higher health values and improves the area ratio, aggregation, accessibility, visibility, and accessibility of community green space. In the context of a healthy city, as the connection between the living

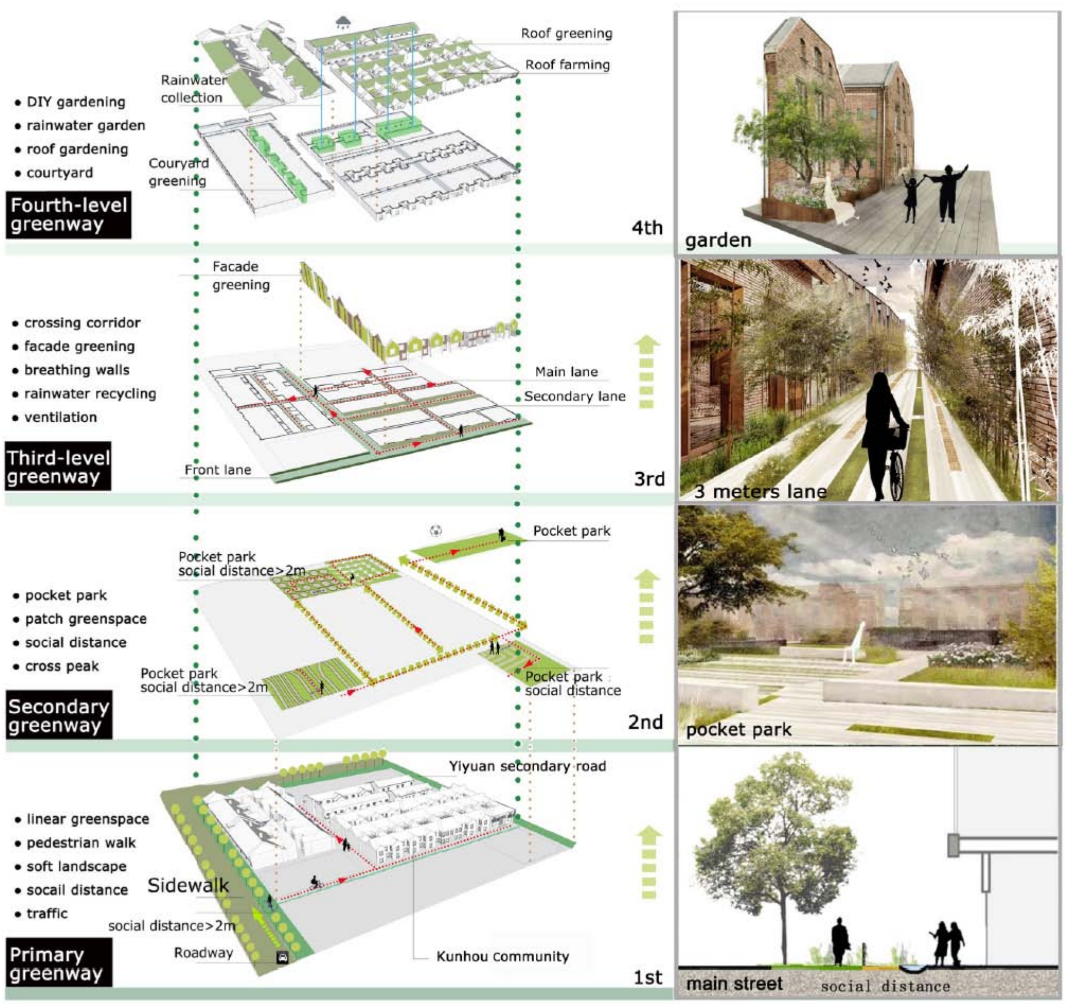

Figure 9: Four-level green network design for the Kunhou community. Source: Author.

environment and the community becomes increasingly close, this green network can create more resilient and sustainable human habitats in the city.

Among them, the daily behavior of residents is mainly concentrated in the primary and secondary green networks. In the primary greenway, the social distance is expected to be over 2 meters, and a soft landscape is recommended to be built in the linear walkways outside the community. Designers can comprehensively adopt scattered layouts, linear layouts, circular layouts, and radial layouts to optimize the spatial form of patch green space, reducing the possibility of human infection with diseases. In the secondary greenway, the free public space should be utilized, and pocket parks and green patches of variable themes should be built to promote cross-peak design. The design proposal for the third-level greenway (3 meters wide) is the façade greening, rainwater recycling, and ventilation in the lane area. Finally, for the fourth-level greenway which refers to private courtyards and roofs, greening is expected in multiple forms, such as DIY gardening, rainwater gardening, roof greening, and roof farming, and from vertical and horizontal dimensions to increase greening coverage. Apart from horizontal greenery planning, vertical greening can be used to indicate social distance in narrow and long lanes, provide shading, increase air humidity, and adjust the microclimate. At the same time, the green barrier formed by vertical greening reduces noise pollution and alleviates mental problems. Roof greening could not only improve the value of spatial morphology through a variety of plant configurations but also increase the frequency of physical activity among residents. In terms of water resources, rainwater will be collected and purified through the infiltration and storage capacity of green space to alleviate the ponding phenomenon after rainstorms and efficiently use the rainwater in community space. Meanwhile, to promote the attendance and interaction of residents of all ages, participatory design, interdisciplinary design, and universal design are advisable for the public space in this community.

Rethinking the Urban Green Space Planning in Wuhan

The current urban green space system and water bodies in Wuhan is presented in Figure **10**. The development of industrialization has led to the gradual deterioration of the ecological environment in Wuhan in recent years, and there exist expectations in the planning of public green space (Xiao *et al*. 2016). Green spaces are cut apart by urban construction, and the city and landscape have not formed a comprehensive pattern. Within the main urban area, there is a significant difference in the area ratio of greening between administrative regions. The greening rates in Wuchang and Hankou are much higher than those in Hanyang, with a lack of greenery connectivity between administrative regions and an unreasonable layout of green space (Zhang *et al*., 2022). At the same time, the green belt on the Hankou River Beach is quite narrow and long, and the landscape shape index is too large, leading to insufficient ecological effects.

According to the regulations, an ideal green park has a service radius of 300 meters, and citizens can enter the park within 5 minutes after going out (Li *et al*., 2021). However, the service radius of each patch is not large enough to cover the communities. Transforming unused land and micro spaces in the city into pocket parks will improve the coverage and accessibility of green space, as well as emergency control functions. The planning of urban green space should also be coordinated with transportation and municipal infrastructure to improve the accessibility and efficiency of the green space system (Anguluri & Narayanan, 2017). Currently, the green space in major cities in China is mainly composed of blocks and patches. Linear green corridors should be built to connect with the scattered patches, so that the green space system can extend to the corners of the city, forming an urban green network.

Limitations and Future Research

There are three limitations of this research and further research is required to address these aspects. Firstly, community-focused research shows an emphasis on accessibility, and a comprehensive analysis of health impacts should include other health-related landscape metrics, such as availability, proximity, desirability, etc. (Zhang *et al*., 2020). Based on the internal correlation between different health indicators, the composition, shape, configuration, and other spatial attributes of green space should be integrated. A systematic review of health indicators is necessary and methods like meta-analysis could be used for quantitative analysis. Secondly, the residents' state of mind and interactions in the lanes should be taken care of, and surveys and experiments can be conducted to collect their emotional responses. A larger number of participants and deeper contact are good for finding out their behavior habits. Thirdly, this

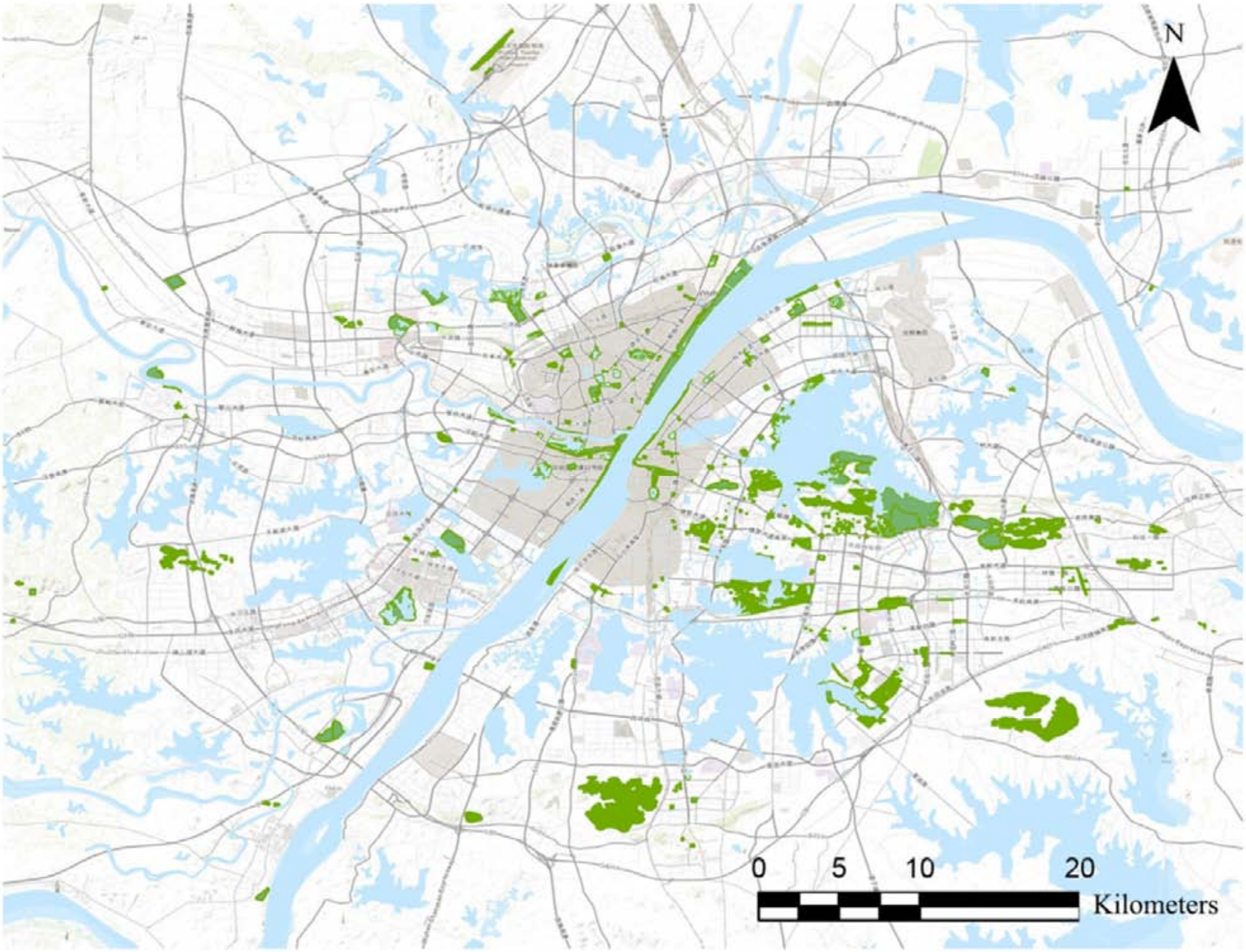

Figure 10: Spatial distribution of green space and water bodies in Wuhan urban area in 2023. Source: Wuhan Urban Green Space from Tianditu (accessed in April 2023); Topographic base map on ArcMAP (One of the operable Desktop software of ArcGIS).

research doesn't investigate the statistical correlation between the impacts of disease and the urban green space. Therefore, the effects of diseases on the spatial configuration of the green system should be further discussed and summarized.

CONCLUSION

Using the spatial analysis methods on GIS, this paper not only studies the accessibility of green space near the Kunhou neighborhood in Wuhan but also analyzes the accessibility of medical facilities. The research results help transform the current spatial form of the green space in this neighborhood. It is important to consider the relationship between accessibility and the quality of urban green space and to study how the green space can be renovated from the perspectives of social distance, accessibility, and connection. This paper proposes to improve the accessibility of green space by building a green space network, thus improving the comfort and health of residents. Facing the long-term planning goal in urban communities, architects and urban planners should put forward strategies to renovate green space and public infrastructures and address the real-life demands of local citizens.

In the planning and design of future urban green space, we need to integrate "health awareness" and “life-changing influence” into the design and clarify the role of urban green space provision in promoting urban health. The life-changing aims include: 1) improving the spatial patterns of green space and utilizing high-value green space forms; 2) extending to urban corners and building a complete and continuous green spatial network; and 3) establishing a spatial planning mechanism for a healthy urban green space system. In general, scientific actions need to be taken to transform the urban green space from aspects of physical forms, cultural connotations, and ecological benefits for stronger adaptability and sustainability, and to provide stable health services and security for citizens.

DISCLOSURE STATEMENT

The authors declare that they have no competing interests in this paper.

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