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Research on Green Space Ecosystem Services under the Guidance of Healthy City Orientation

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ABSTRACT

In recent years, rapid urbanization has brought about high-intensity construction and development activities, which have seriously impacted the urban ecological environment. Chinese cities have entered a new era that emphasizes the connotation and quality of urban development, social welfare, and the quality of life for residents. Residents' pursuit of a beautiful ecological environment and a social form that is suitable for both living and production is increasing. With the implementation of the "Healthy China" strategy, healthy cities, as an important aspect of this strategy, should conform to the requirements of the times. The proposal of the healthy city strategy has pointed out a new development path for cities in the new era. Urban green spaces are important spatial carriers for residents' healthy lives, the material basis of urban complex ecosystems, and indispensable spatial places for healthy urban development. Therefore, one of the key issues facing the construction of healthy cities and ecological civilization is to maximize the value of urban green space ecosystem service functions.

KEYWORDS

Healthy City; Green Space Ecosystem Services; Research Review.

1. RESEARCH BACKGROUND

1.1. The Conflict between the Built Environment of Cities and Public Health Has Become Increasingly Prominent.

The original intention of urban planning is to provide a comfortable and pleasant urban living environment for city residents. Previous studies have shown that factors such as genetic predisposition and lifestyle can have an impact on residents' health, and there is also a close correlation with the built environment of cities. The built environment is an important carrier of residents' public health, and as a spatial reflection of urban planning and construction, its role cannot be ignored. Major events in the history of urban construction, such as Howard's theory of the garden city, Corbusier's theory of the modern city, and Wright's vision of the broadacre city, are all closely related to "urban public health responses" and "healthy development." The hope is to optimize the built environment through improved planning of living, working, and leisure spaces, creating an urban environment that contributes to improving residents' physical activity and public health.However, the differences in the main health issues presented at different stages of development have become increasingly apparent with the urbanization and industrialization process. Since China's reform and opening up, the urbanization process has advanced rapidly, with the urban population growing from 665.57 million in the sixth national census to 901.99 million in the seventh national

census in 2020, and the urbanization rate increasing from 49.68% to 63.89%, with an average annual increase of 1.39%. The balance between urban development and the sustainability of urban resources and the environment has gradually been disrupted, leading to environmental degradation, housing shortages, and other "urban diseases" that affect the healthy and sustainable development of cities, and public health issues have become increasingly prominent. Chronic diseases such as hypertension, obesity, and diabetes are endangering the health of urban residents and the development of the social economy. At the same time, along with changes in modern lifestyles and habits, modern people generally lack physical activity, have less time for exercise, and rely heavily on motor vehicles, which are also the main reasons for triggering health problems in the population.In recent years, phenomena such as air pollution and smog in many cities have caused the urban built environment and health issues to attract significant attention from governments, urban management departments, and the public. According to the national report on urban ecological environment released in 2019, 338 cities above the prefecture level implemented new air quality standards monitoring, and only one-third of them met the standards.

1.2. The Development Trend of Healthy Cities under the Context of New Urbanization

In response to the negative impacts of rapid urbanization on the urban environment and human health, the concept of "healthy city" was first proposed by the World Health Organization at the "Super Health Care for Toronto 2000" conference held in 1984. In 1985, after the Lisbon Conference, the true exploration of healthy city construction began, reinterpreting the city from a new perspective. It required that all aspects of urban planning, construction, and management should focus on crowd health, enabling people to work healthily and live actively, and integrating healthy environments, populations, and society into the city. Meeting the needs of the urban public is not only the basic essence of building a healthy city but also the fundamental goal of urban spatial governance and quality improvement. In the early stages of urban construction in China, due to the dominance of economic growth and limited attention to the environment, the trend of urban gray development was significant. In the 1990s, with the increase in urban problems and the awakening of environmental awareness, China introduced the concept of healthy cities, began to study the construction of healthy cities, and jointly established healthy city pilots with the WHO. However, due to a large population base and relatively weak infrastructure, this pilot project is still in its initial stage. Since the 18th National Congress of the Communist Party of China, China has invested a significant amount of funds in ecological construction. In 2015, ecological civilization construction was officially included in the national five-year plan, and the five major development concepts were proposed at the Central Urban Work Conference in December, emphasizing the urgent need to address urban illnesses and fully considering the actual situation of urban construction in China, striving to achieve the transformation from gray to green urban development and from industrial civilization to ecological civilization in the new era. Promoting positive interactions between environmental health and social health and providing a good spatial atmosphere for residents' healthy lives has become an important research topic in the field of planning.

1.3. The Construction Demand of Healthy Urban Green Space Ecosystem

At present, with the increasing level of urbanization, the pressure of sustainable development is gradually increasing. According to relevant studies, the overall degree of ecological quality destruction in China has slowed down, but the ecological environment is still in continuous deterioration, and the service capacity and level of the ecosystem are declining. At the same time, with the continuous improvement of people's material living standards, urban residents' requirements and expectations for the ecological environment have increased, and the contradiction between insufficient ecological supply and increasing demand has become increasingly strong. As a semi-natural medium between the natural system and the urban system, urban green space is an important

bearing object of ecological civilization in the city. Urban green space system not only has the functions of urban life and production, but also plays an important role in ecosystem services in the ecological sense. Green space system planning with all kinds of green space as the planning object is an important means to guide and control urban green space, and also an important starting point to achieve high-quality development and ecological civilization construction. Taking park green space as an example, it not only has the function of improving regional microclimate, providing residents with sports and leisure places, but also has made significant contributions to protecting residents' physical and mental health and improving urban beautification. Therefore, it is of great theoretical and practical significance to examine the importance of the service function of urban green space ecosystem and find out the main problems and possible optimization ways of urban green space in the context of health, so as to rationally plan and improve urban green space and promote the healthy development of the city.

2. RESEARCH SIGNIFICANCE

2.1. Theoretical Significance

At present, China's ecosystem service function value mainly takes the city as a comprehensive whole, and studies the different types of land use function value respectively, but there are few researches on the ecosystem service function of urban green space, which is a relatively vague concept. The important point of urban green space is that it can improve residents' healthy life and regional environment. Therefore, taking urban green space as the starting point, reasonable quantitative calculation of different ecological service functions of urban green space through the classification of green space is helpful to build a set of ecosystem service evaluation system suitable for urban green space and form the basis for objective evaluation of urban green space.

2.2. Practical Significance

The research of green space system mainly focuses on the plant community system at micro scale or the spatial layout of green space at macro scale, and the quantitative evaluation of the service function of green space at mesoscale is relatively rare. Based on the concept of healthy city, a health-oriented green space ecosystem service evaluation system was established. Enrich the interactive response system between urban environment and residents' health under the concept of healthy city, improve the gain of urban green space to urban residents, and realize the goal of local city governments to create national ecological garden cities.

3. DEFINITION OF RELEVANT CONCEPTS

3.1. Healthy City

The constitution of the World Health Organization (WHO) points out that health is not only the absence of physical discomfort and disease, but also that people have good feelings in material and spiritual, emphasizing that "disease-free" is not equal to "health". The "health status" of human individuals and groups is closely related to the surrounding material environment, spiritual environment, social environment and cultural environment, and its influencing factors are many. To investigate the health status of people or groups, it is necessary to make a comprehensive evaluation from three dimensions: social, physiological and psychological, including social environment, physiological, emotional, mental and other indicators. With the further deepening of the concept of health, the meaning of health has also expanded. A healthy city is a city that focuses on people's health in all aspects of urban planning, construction and management, ensures the healthy life and work of the general public, and becomes an organic integrated development of healthy people, healthy

environment and healthy society necessary for the development of human society. In order to achieve the purpose of promoting public health, efforts should be made to improve the health of the urban environment, optimize the external environment and improve the internal environment. Based on the global problem of "urban disease", the health of citizens is affected. The concept of "healthy city" was first proposed at the Toronto Conference in 1984, and people began to pay attention to the impact of urban environment on the health status of urban residents. In this context, WHO launched the Healthy Cities Campaign, which aims to comprehensively improve the social and physical environment that affects the health of urban residents. At the same time, the WHO also stipulates that a healthy city should be able to continuously improve the physical and mental environment of its residents, achieve resources and equality. The concept of healthy city breaks through the traditional concept of health and makes the public realize that only on the basis of a healthy environment can people's needs for survival and life be met.

The concept of healthy city originated from the research on public health, and its evolution has roughly experienced the narrow health concept led by public health theory, the big health concept led by health determinants theory and the broad health concept led by national strategy, while health determinants and health promotion are the important theoretical basis of healthy city.

(1) The narrow health concept led by public health theory.

The earliest attention to public health came from the study of British scholar Chadwick in 1842, who first systematically studied the health and living conditions of British workers. In 1844, in response to a series of urban health problems caused by the Industrial Revolution, the United Kingdom took the lead in establishing the "Town Health Association", which led the early British public health revolution to intervene and improve urban public health conditions by regulating building sunshine, ventilation and other ways. Founded in Geneva in 1920, the League of Nations Health Organization promotes the fight against epidemics and the improvement of public health conditions worldwide. In 1948, the World Health Organization (WHO) was formally established and stated that "health is a state of good physical, mental and social fitness". In this period, the concept of health was limited to the field of public health, and the main content was to optimize public environmental health and strengthen population health services.

(2) It is a big health concept dominated by the determinants of health theory.

The World Health Organization (WHO) proposed the concept of "healthy city" in 1984, and made a conceptual description of the elements and goal state of "healthy city" in the Ottawa Charter (1986) and "Healthy City: Promoting Health in the Context of cities" (1986). For example, the 1986 Ottawa Charter on Health Promotion provides a place-centred framework for health promotion. The first healthy city building programs were launched in developed countries (i.e., Canada, the United States, Australia and many European countries). However, the specific object, boundary, goal, method, procedure, guarantee and evaluation of healthy city construction are not clear, and lack of universal standards and guidance guidelines.

The WHO's definition of a healthy city was put forward in 1994, that is, "a healthy city should be an organic combination of healthy people, healthy environment and healthy society, and should be able to continuously improve the environment, expand community resources, so that city residents can support each other to maximize their potential." With the deepening of the understanding of the determinants of health, the concept of modern healthy city gradually matured in the 1980s and 1990s, that is, a healthy urban ecosystem includes not only the health integrity of the natural environment and residents, but also the health of the social environment. Under the influence of this concept, various types of healthy city movements have been launched around the world, of which the "Healthy Cities Project" in Europe has been the most influential, and its healthy cities network has covered about 1,400 cities around the world.

(3) The broad health concept led by the national strategy.

In the 21st century, with the rapid advancement of industrialization and urbanization, human society is faced with new challenges brought by aging population and changes in disease spectrum, ecological environment and lifestyle, etc. From the perspective of improving the health and well-being of the whole people, many countries have put forward the construction goals and implementation strategies of healthy cities at the national strategic level, believing that health is not only a state of development. It is also an important governance capacity to integrate urban health issues into the social, economic and political agendas of governments, focusing on promoting health equity across the board, creating a supportive environment, and health impact assessment. The concept of health in the new era puts more emphasis on health, promotes health equity, takes health as an important consideration in the formulation and implementation of various public policies, and strives to minimize various health hazards.

Influenced by the "healthy city Movement", the planning field gave birth to the concept of healthy city planning, which later developed into one of the basic objectives of planning. The concept of healthy city planning should take people's health needs as the basic value, improve the attention to public health, promote the integration of health concept and urban construction, and implement the obligations and responsibilities of urban planning for public health.

3.2. Urban Green Space

Urban green space has a clear definition in China's green space design code, that is, the main form of vegetation, plays an important role in improving urban ecology and protecting the environment, can provide residents with leisure and recreation places, and has a beautifying effect on the city. Urban green space has diversified ecological service value, and its service has the characteristics of public goods, becoming an important part of urban public service facilities and urban infrastructure. Urban green space has a great impact on residents' activities, and can meet the needs of residents' life and production, so the proportion of urban green space should be increased as much as possible in the urban land use environment.

As for the classification of urban green space, there is no unified classification method in the world. China's "urban green space Classification Standard" issued in 2002 as an urban green space management standard, urban green space is clearly divided into park green space (G1), production green space (G2), protected green space (G3), attached green space (G4) and other green space (G5) 5 categories. In 2017, it deepened this standard and established the Urban Green Space Classification Standard (CJJ/T85-2017), which integrated other green space types while adding regional green space, and remained five types of green space system, changing production green space and other green space into square green space and regional green space.

3.3. Green Space Ecosystem Services

ecosystemservices (ES) are ecosystemservices that provide products or services to humans indirectly or directly. The United Nations Millennium Assessment (MA, 2005) assumes that the function of ecosystem services is related to the benefits that humans derive from the ecosystem, a definition that implies that both natural and artificial ecosystems are included in the ecosystem. Green space ecosystem service research takes urban green space as the basic research object, including four service attributes of culture, regulation, support and supply, and studies its functional value in regulating hydrology, purifying air, maintaining soil, providing energy, regulating urban microclimate and providing social and cultural services. In order to realize the sustainable development of regional ecology, it is necessary to focus on coordinating the relationship between the supply and demand of ecological service system, and it is of great significance to improve urban space and environmental quality by measuring it in a quantitative way.

4. RESEARCH REVIEW

4.1. Healthy City Research

The Western industrial revolution and the rapid development of industry had a negative impact on the environment, and the poor urban living environment led to the outbreak of epidemics. In the 1970s, the World Health Organization (WHO) put forward the "principle of health for all" in the Declaration of Almaty, and took the lead in putting forward the concept of "Healthy City" in 1984. In 1994, the concept of "healthy city" was clearly defined as an organic synthesis of healthy residents, environment and society based on the coordination of material, political and spiritual civilization. Researchers at home and abroad have conducted in-depth studies on the construction and planning paths of healthy city projects. Hancock and Duhl (1986) believe that healthy cities have continuity and innovation, can spontaneously improve the social and living conditions within cities, and urban residents respect each other and can give full play to their potential. Colin et al. (1997) believe that a healthy city is not only the healthy life and work of urban residents, but also the health and integrity of the social and economic system. Barton H (2013) and other scholars scientifically evaluated the fourth stage of the European healthy City project and found that most of the cities with better construction conditions were those emphasizing multi-faceted cooperation. At the same time, the concept of health was integrated into urban policies and systems, and the goal of healthy city was emphasized from the upper level and implemented step by step. Toronto is the first pilot healthy city in Canada. Macfarlane R.G et al. (2015) summarized the experience of its healthy city construction. For example, the government has launched a number of public health promotion policies, improved the urban transportation network, and advocated urban residents' self-organization to deal with health challenges. Sallis JF (2016) believes that urban design implementation plays a role in promoting the concept of health. In order to enhance the health and sustainability of the overall urban environment, it is necessary to examine the city from a systematic and comprehensive perspective.

From the perspective of China's healthy city related policy development, since the introduction of the concept of healthy city in 1989, the construction of healthy city has kicked off, and the healthy city construction process in decades can be divided into three stages:

The first is the initial exploration stage from 1989 to 2002, the second is the rapid promotion stage from 2003 to 2014, and the third is the comprehensive development stage from 2015 to now. The healthy city in China has experienced a stage from scratch, the construction means have changed from single to rich, and the construction system has gradually diversified.

From the perspective of theoretical research on healthy cities in China, when the concept of healthy cities was just introduced into China, domestic scholars' research was mainly based on the reference and summary of foreign theories and practices, and then the pilot work of healthy cities made the practical experience gradually rich. The development process can be divided into four stages: experience summary, factor research, layout research and construction index evaluation.

First, healthy city is gradually transformed from theoretical concept to concrete practice. Chen Haisu et al. (2016) analyzed the design rules of healthy urban space in Britain, France and the United States, combined with China's planning conditions, and added relevant planning guidance and regulation control rules in the overall urban environment, living environment, community space and transportation system. Zhang Yalan et al. (2017) analyzed the spatial design guidelines of major American cities such as Los Angeles and New York, and made in-depth reflections on how to absorb foreign planning elements related to health concepts for their own use. Sun Peijin et al. (2019) conducted an in-depth study of urban design guidelines in many European and American countries, systematically analyzed their planning purposes from different types and levels, and thought about China's urban design, with a view to providing references for domestic healthy city construction planning.

The second is the research on the influencing factors of healthy city. Wang LAN et al. (2016) studied the impact of urban land use, road traffic system, urban green space system and urban spatial form on urban health, and believed that there are two ways to solve urban diseases, one is to reduce pollution, the other is to promote renewal. Liu Zhengying (2016) proposed six strategies, including health equity and health security, aiming at the following three aspects: urban residents' behavior, social environment characteristics and urban health risks. Duan Yuyan (2017), starting from people's health needs, emphasizes the integration of health concepts into park landscape design, and carries out healthy design for park ecological services and public service facilities. Chen Ming et al. (2019) proposed relevant strategies for urban street targeting atmospheric particulate pollutants, including three aspects of air pollution flow control, drainage and aggregation. Xia Lianhua (2019), based on the evaluation index system of healthy cities, constructed the urban development level of capital cities of all provinces in China, and proposed strategies from the social, natural and economic levels to improve the health level of cities. Ma Ming et al. (2019) studied the relationship between public behavior, urban environment and urban health level, and proposed an optimization path for urban environment improvement, providing a theoretical basis for health-oriented planning and design. Zhang Shuyun et al. (2020) discussed the factors affecting urban health in urban waterfront space from the perspective of urban water relationship, emphasizing residents' health, and proposed targeted solutions.

The third is the study of healthy urban spatial layout. Song Jinjing (2015) evaluated the living space status of the elderly in Changchun City and proposed spatial planning and design solutions to their unhealthy problems from the aspects of social communication and psychological needs. Yang Yuwen et al. (2020) analyzed the theoretical mechanism, scientific basis, key indicators and other characteristics of urban waterfront space in terms of health, and proposed urban open space planning and design suggestions to provide theoretical and practical basis for the construction of healthy urban waterfront space. Wang Min et al. (2021) integrated recreation demand and factors affecting green space health into green space ecological network planning, and tried to explore how to realize the synergistic coupling of green space ecology and recreation functions from the aspects of source identification, resistance surface construction, green corridor route selection, and complex green space network optimization.

The fourth is the evaluation of healthy city construction index. Chen Zhaojiao et al. (2013) The healthy City project is a long-term systematic project with multi-sectoral cooperation. Regular evaluation is of great significance to evaluate the project effect, find existing problems, make timely improvements and promote the sustainable development of healthy city projects. The evaluation of healthy city can be divided into initial effect, middle effect and long term effect. Wen Qiuyue et al. (2018) systematically evaluated the content, characteristics and problems of China's healthy city indicators, providing baseline data and reference for other Chinese cities to develop healthy city indicators and evaluation systems. Shen Bingjie et al. (2018) sorted out and summarized the current methods used to construct evaluation index system in multi-indicator comprehensive evaluation, analyzed the characteristics and applicable scope of various methods, understood the current research progress of methodology for the construction of evaluation index system, and provided methodological reference for the construction of comprehensive evaluation index system for healthy cities and healthy towns. Li Hongxing et al. (2018) developed guidelines for the construction and evaluation of healthy villages and towns based on health determinants and health promotion theories, and proposed definitions and connotations, construction and evaluation principles, methods and indicators. The principles of index inclusion are scientific, applicability, sensitivity and accessibility, and pilot evaluation is carried out to verify accessibility. Chen Lu (2020) studied and formulated a healthy village evaluation index system suitable for the development of Hainan, providing scientific guidance and evaluation basis for the construction of healthy villages in Hainan, and helping to promote the construction of healthy Hainan.

In the process of exploring the development of healthy cities, scholars at home and abroad gradually take the people-oriented concept as the basic value, and realize the healthy development of cities and residents on the basis of people-oriented. A healthy city should include two dimensions of city and residents' health, including factors such as city economy, humanity, society, natural environment and residents' behavior and characteristics. To sum up, how to conduct comprehensive research on two dimensions and multiple indicators of healthy cities with systematic thinking is the key to building healthy cities.

4.2. Research on the Correlation between Green Space System and Healthy City

The development of a healthy city is closely related to the regulation of ecosystem functions, which promote and restrict each other. In recent years, more and more studies have been conducted on the interaction between green space ecosystems and healthy cities.

Research on the relationship between urban green space and public health has focused on interdisciplinary fields such as urban and rural planning, environmental science, landscape design, and ecology. For example, quantitative research on the relationship between urban green space layout and environmental benefits, quantitative evaluation of the environmental benefits of green space structure, and the conclusion that the most important factor to improve the health benefits of urban green space is: "maximize the proportion of green space, reduce the existence of green patch fracture". Irvine et al. (2013) pointed out that the main reasons for residents to use urban green space are entertainment, leisure, recreation and other activities. Javadi Reza (2021) defines the benefits of green ecosystem as services that provide a healthy environment, and the improvement of thermal comfort of green space can improve the quality of green space services. Jiang Bin et al. (2015) summarized and analyzed the impact of green landscape on public health, which can promote physical activity, relieve psychological pressure and improve social health, and put forward a concise theoretical framework and some important topics to be explored. Xiao Yu et al. (2015) studied the impact of particulate matter on urban health environment from the aspects of inhaling particulate matter into green space system and improving urban climate. Tan Shaohua et al. (2018) analyzed the relationship between the environmental elements of urban parks and people's health from the perspective of people's perception and behavior, and put forward suggestions for optimizing the environment of urban parks, such as paying attention to the use of natural elements such as plants and water to create a positive space atmosphere. Based on the principles of universal sharing, portable access, quantity and quality assurance, and ecological protection in urban green space planning and design, Zhao Ming (2021) takes measures such as the construction of green space communication platform to redesign road green space, enrich public green space, and give full play to the role of urban green space in promoting residents' health.

4.3. Research Review

Through the collection of relevant researches of domestic and foreign scholars, it can be seen that domestic and foreign researches on healthy city and ecosystem services have adopted different methods in multiple fields and carried out multi-scale studies. From the aspects of concept, connotation extension and application practice, in-depth studies have been carried out on the methods and approaches to improve green space ecosystem services under the construction of healthy city. The methods of estimating the value of green space ecosystem services are also constantly updated. At the same time, the coupling effect of urban green space system on healthy urban construction has been widely concerned by the academic community, and the related studies are gradually increasing, but there are still some supplementary points. In conclusion, the research on green space ecosystem services under the guidance of healthy cities has important theoretical and practical significance, and provides strong support for promoting the construction of healthy cities and the optimization of green space ecosystem services.

5. SUMMARY

With the continuous advancement of the global urbanization process, urban environmental problems are becoming increasingly prominent, and residents' pursuit of health and high-quality living environment is becoming more and more intense. As an important part of urban ecosystem, green space ecosystem plays an irreplaceable role in maintaining urban ecological balance, improving urban environment and promoting residents' health. Therefore, the research on green space ecosystem services under the guidance of healthy city has broad development prospects and important practical significance.

In the future, the research on green space ecosystem services under the guidance of healthy cities will focus on the following aspects:

First, in-depth research on the comprehensive benefits of green space ecosystem services In addition to ecological benefits such as air purification, noise reduction, and climate regulation, which have been extensively studied, future studies will further explore the comprehensive benefits of green space ecosystems in terms of mental health, social interaction, and cultural inheritance. The quantitative evaluation and mechanism analysis of these benefits will provide a more comprehensive and scientific basis for urban green space planning and management.

Second, strengthen the spatial-temporal dynamics of green space ecosystem services With the continuous change of urban development, the supply and demand of green space ecosystem services are also changing dynamically. Future research will pay more attention to the spatio-temporal dynamic characteristics of green space ecosystem services, and real-time monitoring and analysis of the changing trend and influencing factors of green space ecosystem services through remote sensing, GIS and other technical means will provide technical support for the dynamic management and optimization of urban green space systems.

Third, promote interdisciplinary research on green space ecosystem services The study of green space ecosystem services involves many disciplines such as ecology, environmental science, urban planning and sociology. Future research will pay more attention to interdisciplinary cooperation and exchange, form more comprehensive and in-depth research results by integrating theories and methods of different disciplines, and promote the innovative development of green space ecosystem service research.

Fourth, focus on public participation and social governance of green space ecosystem services The ultimate beneficiaries of green space ecosystem services are urban residents, so public participation and social governance play an important role in the study of green space ecosystem services. Future research will pay more attention to the mechanisms and models of public participation and social governance, and promote the sustainable development of urban green space ecosystem by improving residents' awareness and participation in green space ecosystem services. In conclusion, the study of green space ecosystem services under the guidance of healthy cities is a subject with broad prospects and far-reaching significance, which is worthy of further research and exploration.

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