Research on Key Technologies of Eco-city Construction Planning

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Abstract. As one of the main forms of urbanization in my country, urban construction is the process of building original natural or semi-natural ecosystems into urban artificial ecosystems from the perspective of ecology. It is the construction and replacement of ecosystem types and the process of encroachment. Urban planning must pay particular attention to the forward-looking nature of its ecological planning. While truly enhancing the city's overall ecosystem service capabilities, it also prevents new ecological and environmental problems from being induced. Through theoretical analysis of the characteristics of ecosystem changes in the process of urban construction, combined with typical cases, several key issues in urban ecological planning have been summarized and condensed, and corresponding planning strategies and techniques have been proposed, with a view to providing ecological solutions for large-scale urban development in my country. Provide theoretical support for environmental protection work.

Key words: Ecological city, urban planning, urban construction, key technology.

1. Introduction

The construction of a low-carbon eco-city is one of the important measures for my country's economic transformation in the stage of rapid urbanization. Unreasonable urban land development continues to interfere and encroach on the natural ecosystem, cutting off the original ecosystem process, resulting in a decline in ecosystem services, and in turn endangering the ecological security of the new and old urban areas and the entire region. Therefore, in the process of urban construction, it is necessary to comprehensively examine the overall urban planning, ecological system conservation and environmental management issues in the construction process, strengthen the awareness of ecological safety and ecological civilization of urban residents, and improve the efficiency of land and resource utilization in the process of urbanization To prevent urbanization from destroying the ecological environment, try to avoid the road of "destruction first, repair later", and promote the healthy development of urbanization in my country [1]. Based on the characteristics of urban ecosystems in my country, the analysis of typical urban cases, and the practical experience of urban ecological planning, this article explores the characteristics of changes in the urban ecosystem's position, and explores the responsibilities and implementation methods for improving the ecological functions of cities. The development of ecological environment planning provides theoretical support and experience.
2. Research objects and methods

2.1. Data analysis
The data collection of this study adopted the questionnaire survey method. Currently, participatory research methods have been successfully applied in forestry, grassland management, and ecological environment protection, such as comprehensive function evaluation of nature reserves and research on sustainable land use models [2]. In recent years, it has been gradually applied to land use planning and low-carbon ecological city construction. Based on the above objectives and methods, the research is problem-oriented, and mainly reflects respondents’ plans for large-scale green buildings and low-carbon decolonization of existing communities from three aspects: “necessity”, “methodology” and “problems” The perception, recognition, and importance of construction, and for the reconstruction of the urban microcirculation system, follow the "problem-technology-practice" mentality, from "key technical issues", "macro theoretical understanding", and "specific technology The four aspects of "cognition" and "key technology practice" reflect the perception, recognition and importance of the interviewees on the low-carbon eco-city microcirculation system.

2.2. Questionnaire design
The questionnaire was distributed at the International Green Building Conference. A total of 160 questionnaires were distributed and 141 valid questionnaires were returned. The sample size covers relevant practitioners in the fields of management, construction, building materials, planning, municipal administration, engineering, and energy in various provinces and cities across the country, with an average working life of about 10 years. Software such as Excel and SPSS are used for data collection and processing.

3. Results

3.1. Interviews on the differences between low-carbon ecological planning and traditional planning technologies and methods
The author believes that there is a big difference between low-carbon ecological planning and traditional planning, and the importance of the difference mainly exists in the following 7 aspects: control method, planning goal, guiding ideology, information technology, planning process, planning content, Security system, etc. The results show that traditional planning has statutory control methods, such as the master plan, the control plan, and the revision detailed planning stage. However, the low-carbon ecological planning at this stage has no legal constraints, so it is difficult to implement low-carbon ecological planning like traditional urban planning [3]. And implementation; as far as its guiding ideology is concerned, it is mainly to strengthen the overall consideration of greening, pay more attention to the impact of green in building construction, and emphasize that financial subsidies should be in place; planning goals, low-carbon ecological planning emphasizes energy consumption and urban planning The impact of construction on the ecological environment; planning content includes a variety of regulatory planning content: planning process, focusing on front-end control, and more emphasis on the scientific and rational urban planning methodology; control methods, incorporating more green control technologies, green Indicators etc.

This research divides low-carbon ecological planning technologies into energy utilization planning, green transportation planning, urban safety planning, land intensive use and low impact, resource utilization planning, greening system planning, and physical environment planning. Most of the interviewees (91.6%) believe that the technical means division system is relatively reasonable. The research team asked the interviewees to rank the importance of the technical means of low-carbon ecological planning (Figure 1), in descending order of the selected frequency: energy utilization planning (63.3%), green transportation planning (59.2%) , Urban safety planning (57.1%), land intensive use and low-impact development planning (49.0%), resource utilization planning (46.9%), greening system planning (30.6%), others (such as cultural planning) (18.4%), physical Environmental
planning (14.3%). It shows that energy utilization planning occupies an important position in urban development and construction at this stage, and transportation is also an important aspect of the construction of liveable happiness in local cities. However, some interviewees also pointed out that there are overlapping parts in the classification of some planning technologies.

Figure 1. Awareness of low-carbon ecological planning technical means

3.2. Low-carbon ecological construction of existing communities
At this stage, there is no mature and recognized practice for low-carbon and ecological construction of existing communities in China. Therefore, the public's awareness of the connotation of low-carbon construction in existing communities is particularly important, providing a basis for future low-carbon construction. Respondents believe that the content of the low-carbon ecological construction of existing communities is as follows (Figure 2): energy system construction, environmental remediation, preservation of historical marks, and building renovation and protection [4]. And the ranking of the importance of low-carbon construction in existing communities is as follows: energy system construction, environmental remediation, historical imprint preservation, building renovation and protection, demolition and resettlement. In addition, some respondents (12%) believe that “residential low-carbon life education” is also an important part of the low-carbon ecological construction of existing communities.
4. Discussion

4.1. The formation and relative stability of urban ecosystem

Every city has its own unique natural resources and ecological resource grade, supplemented by landscape pattern, architectural style, traffic network, economic culture, population and other elements, which are coupled to form a networked urban ecosystem. This system relies on uninterrupted logistics, energy flow, population flow, information flow and currency flow to maintain normal functioning, realize the evolution of growth, development and self-renewal, and gradually stabilize. Changes in any of these elements will cause changes in the overall sustainable development capabilities of the system. If an urban system maintains sufficient flexibility and each element has sufficient flexibility space, sustainable urban development can be achieved. Generally speaking, for cities with sustainable development capabilities, the basic areas of the urban ecosystem are relatively stable and balanced. For example, the ecological system of the ancient city of Lijiang in my country, under the ecological background, hydrological environment and terrain conditions that can be relied on, has formed a certain city scale, population scale, aboriginal social space and land use model in terms of ecological wisdom construction and operation management ideas [5]. The special ecosystem of the city has allowed the ancient city culture to be passed down to this day. The urban ecosystem can be regarded as a dynamic equilibrium system from the perspective of urban structure, function, and development and evolution law [8]. Such a dynamically balanced system is bound to have the characteristics of continuous renewal and change of spatial pattern, scale, life cycle, and internal and external relations. In other words, changes in any one of the many elements that make up the urban ecosystem will more or less cause local and even overall changes in the urban ecosystem. Changes in a certain element within the city, such as building urban parks or expanding the central business district, will bring unforeseen changes to the landscape pattern and traffic flow of a relatively stable existing urban ecosystem. The changing trends of the various elements of the urban ecosystem are not synchronized, or even move towards each other, which will lead to insufficient ecosystem support functions, decline in regulatory functions, and aggravate the "urban disease" situation. The “heat island phenomenon” and urban waterlogging caused by the increase of impermeable surface, the “garbage siege” phenomenon with insufficient garbage disposal facilities, the lack of urban flora and fauna and the reduction of biodiversity that local species do not pay attention to, make the city sustainable Development is seriously threatened.

4.2. Stimulate the potential of urban ecosystem service improvement

Cities should take more of the role of ecosystem service providers and provide leisure services for urban residents to achieve the quality of ecosystems that urban residents pursue in their daily
recreation. In view of my country's existing urban ecosystem problems and the vision of promoting the overall transformation of the ecosystem through cities, this article summarizes the current ecological cities in my country's pull indicators for the overall urban ecosystem functions by combing related cases (Table 1).

Table 1. Analysis of the indicators that ecological city construction can pull on the overall urban ecosystem.

| Theme                          | Serial number | Indicator name                                      | Enhance the potential of the overall urban ecosystem |
|--------------------------------|----------------|-----------------------------------------------------|------------------------------------------------------|
| Ecological function            | 1              | Ecological land ratio/%                             | Significantly improved                                |
|                                | 2              | Wetland coverage rate/%                             | Significantly improved                                |
|                                | 3              | Greening rate/%                                     | Small increase                                       |
|                                | 4              | The average ecological service value increases the relative value | Significantly improved                                |
|                                | 5              | Per capita public green area/(m²/person)            | Significantly improved                                |
|                                | 6              | Service radius of park green space (500m)          | Significantly improved                                |
|                                | 7              | Mitigating heat island effect                       | Small increase                                       |
| Environmental protection and construction | 8              | Air quality                                         | Small increase                                       |
|                                | 9              | Water quality                                       | Small increase                                       |
|                                | 10             | Noise environmental quality                         | Significantly improved                                |
|                                | 11             | Water quality compliance rate of centralized drinking water source/% | Significantly improved                                |
|                                | 12             | Concentrated treatment rate of domestic sewage/%    | Significantly improved                                |
|                                | 13             | Domestic waste classified collection rate/%         | Significantly improved                                |
|                                | 14             | Clean energy usage rate for daily life/%           | Significantly improved                                |
|                                | 15             | Renewable energy utilization rate/%                 | Significantly improved                                |
|                                | 16             | Comprehensive utilization rate of waste/%          | Significantly improved                                |
|                                | 17             | Green rainwater infrastructure ratio/%              | Significantly improved                                |
|                                | 18             | Central heating penetration rate in built-up areas/% | Significantly improved                                |
| Population socioeconomic       | 19             | Population density/ (10,000 people/km²)            | Minor explanation                                    |
|                                | 20             | Percentage of investment in environmental protection in fixed asset investment/% | Significantly improved                                |
|                                | 21             | Annual per capita disposable income of urban residents/(yuan/person) | Small increase                                       |
|                                | 22             | Satisfaction rate of the public to the environment/% | Significantly improved                                |

It can be seen from Table 1 that urban construction attaches great importance to protecting and optimizing the ecological space pattern, and has increased the restoration of urban ecology. By improving indicators such as wetland and woodland, it will try to expand the total amount of
ecological space and seek to improve the urban ecological system. Function. The improvement of indicators is an inevitable strategy for many cities that are already in short supply of ecological land in existing urban areas. It has become an inevitable strategy to seek outward expansion and integrate surrounding forests, wetlands and other ecological land into urban areas [6]. This process requires a comprehensive ecological planning and jumps out of the existing ecological system in the urban area to fully understand all the ecological environment elements that may be affected. If we take the area of built-up urban areas in the future as the denominator and the area of ecological land in the future as the numerator, this requires that while the denominator increases, the increase in the numerator should be much greater than the increase in the denominator, so as to ensure that urban ecology and environmental protection planning can be multi-directional Requirements.

4.3. Micro circulation technology for low-carbon ecological city construction
The micro-circulation technology system of low-carbon ecological cities mainly includes eight aspects: micro-degradation, micro-energy, micro-impact, micro-regeneration, micro-transportation, micro-entrepreneurship, micro-green space and micro-control. These eight microcirculation aspects are not only interrelated, but also include their own different content systems. The questionnaire is divided into the interviewee's degree of understanding of the microcirculation system; ranking of the importance of the microcirculation system technology; and technical knowledge of specific methods and problems.

4.3.1. Micro degradation. Microdegradation is an effective treatment method for urban waste, and its goal is to reduce the impact of various urban wastes on urban survival and development. At present, the content of microdegradation research mainly includes two parts: water cycle and garbage cycle. Its specific technologies include waste resource treatment, organic waste treatment, biological filter technology, biogas fermentation technology, construction of an ecological drainage system with source separation, zero discharge of industrial wastes and waste management.

4.3.2. Micro energy. Micro energy is a new energy system, an energy cycle system that combines energy consumption and energy supply. Its technologies include: comprehensive utilization of renewable energy, geothermal energy, geological energy storage, distributed energy, microgrid.

4.3.3. Micro impact. Micro-impact means that the urban planning and construction mode does not change the surface water runoff distribution as much as possible, does not interfere with the original ecologically sensitive areas, and does not interfere with the surface and groundwater system as much as possible to plan and construct the city. Its technologies include: rain flood Management, low-impact development model, urban waterlogging treatment technology, constructed wetland.

4.3.4. Microrehabilitation. Its core connotation is the organic renewal of the old city, and its specific technologies include: organic renewal technology, ecological construction of the old city, and green buildings.

4.3.5. Micro traffic. The modern urban transportation system ensures smooth traffic circulation and low energy consumption emissions between residents' homes and workplaces. Its technologies include: green transportation planning, slow transportation planning, public bicycle rental, and walking systems.

4.3.6. Micro entrepreneurship. It generally refers to the employment mode of starting a business at a relatively small cost, or in a small area, with small investment, quick results, and can be copied or expanded in batches. The content includes low-carbon industrial layout and wireless cities.

4.3.7. Micro green land. Its contents include: landscape planning, three-dimensional greening, green corridors, and evaluation of the ecological functions of urban green spaces.
4.3.8. **Micro-control.** Micro-control refers to the establishment of a digital low-carbon ecological community. It is an urban management mechanism based on a digital platform. Its content includes: digital management, community autonomy, public management policies, etc.

5. **Conclusion**

The role of the government in low-carbon ecological construction is mainly the policy leader, and its work content should focus on energy-saving equipment, low-carbon infrastructure, green building construction, low-carbon transportation system construction, green space creation, community environmental improvement, and humanistic spirit. The improvement of the style and appearance, etc.; and the understanding of the microcirculation technology system for low-carbon ecological city construction and the degree of importance at this stage will provide a certain reference for the development of the future low-carbon ecological city construction technology system.

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