

Theory and practice of ecological city construction

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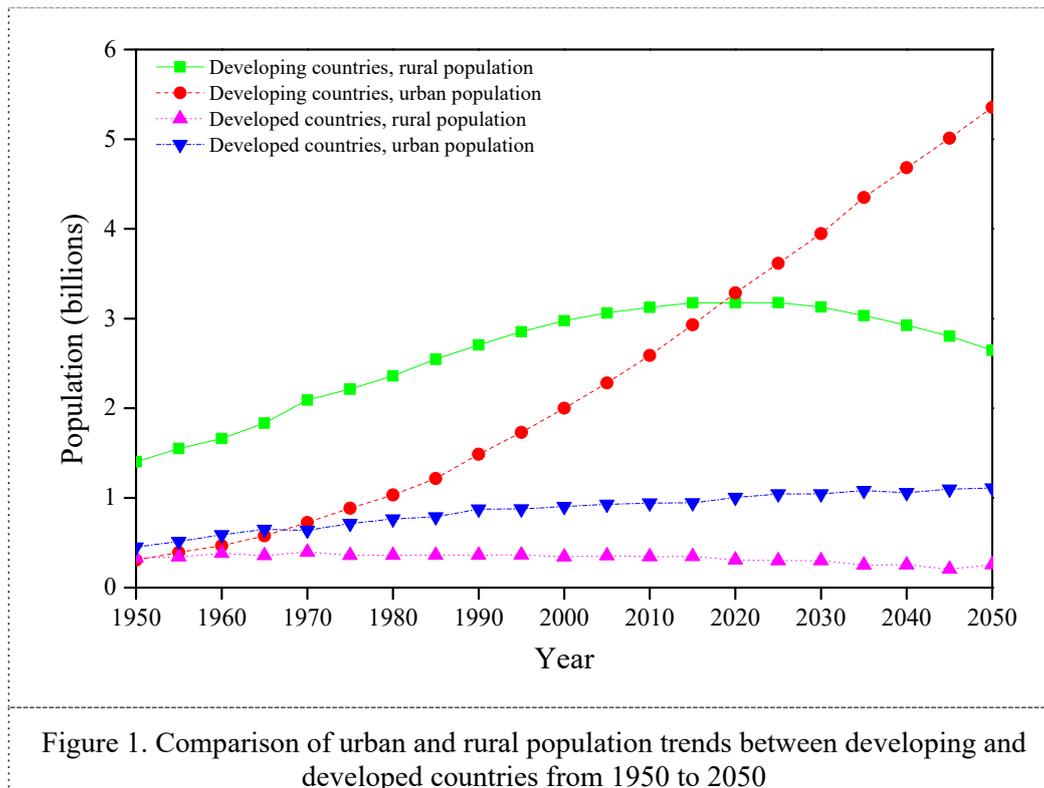
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Abstract. This paper reviews the emergence of the idea of ecological city; expounds the concept, connotation, and characteristics of ecological city; and summarizes related practical research. The purpose of this paper is to provide suggestions for the future construction of ecological city through the study of ecological city theory and practice. This paper aims to explore the driving factor and construction of an ecological city, strengthen the combination of theory and practice and the systematization and integrity of theory and method, and create a well-rounded atmosphere of ecological city.

1. Introduction

A city is a product of the development of a society. More than 50% of the world's population currently live in cities. This number continues to increase. By 2050, two-thirds of the world's people are expected to live in cities^[1]. Figure 1 shows a comparison of urban and rural population trends between developing and developed countries from 1950 to 2050. Urbanization has brought excellent quality of life and rich economic foundation to human beings, but it has also caused depletion of resources, environmental pollution, ecological destruction, and other ecological problems, as well as housing stress, traffic congestion, reduced green space, and other "urban diseases"^[2]. Thus, urban planners urgently need theoretical direction that masters the principles of urban development and the constraints they accept, with particular attention to environmental carrying capacity. This work analyzes favorable conditions and constraints and present the development of theoretical guidance of ecological city. This work also provides the referential value of the contribution of ecological city construction.





2. Generating process of ecological city theory

Ecological city theory can be traced back to the concept of “harmony between human being and nature” in ancient China. The traces of ancient European cities and ancient villages of the Indians in the Southwestern United States were also found along with the embryonic form of ecological city. The idea of the “Garden City” mentioned by British social activist Ebenezer Howard (1898) in his writing “Garden Cities of Tomorrow” is the source of modern ecological city theory. In his works, he discussed basic theorems on the constructive methods of limiting and expanding the scale of urban units^[3, 4]. The town of Letchworth, England, which was designed by Howard in 1903, is a model based on the theory of a pastoral city^[3]. As the first person to systematically study regional planning, British biologist Patrick Geddes (1915) studied urban construction planning using ecological city theory^[4]. Sir Leslie Patrick Abercrombie (1944) applied Geddes’ theory to his masterpiece entitled the “Greater London Plan”^[2]. Lewis Mumford (1961), Professor of Urban Planning in the University of Pennsylvania, considered that cities follow a cycle of urban growth, development, and extinction^[5]. Famous British landscape designer and planner Ian Lennox McHarg (1969) explored the natural and human factors of urban evolution using superposition technology from a multidisciplinary point of view^[6]. The “Man and the Biosphere Programme” (MAB) (1971) was the first to introduce the concept of “ecological city” initiated by United Nations Educational, Scientific and Cultural Organization^[6]. The “Declaration of the United Nations Conference on the Human Environment” was published in the Stockholm Conference on human environment (1972), which considered that “human settlement and urbanization must be planned to avoid adverse effects on the environment and to achieve the best social, economic and environmental benefits for all”^[7]. The Urban Ecology Organization (1990) organized the first International Conference on Ecological Cities in Berkeley. Some academic activities and conferences were then organized to continuously improve the theoretical basis of ecological cities. These programs expanded the influence and appeal of ecological city in the world and popularize the idea of ecological city planning, design, and construction^[8]. In 1992, the United Nations Conference on Environment and Development held a global high-level forum on future ecological city^[9]. Since then, the idea of ecological city has been generally concerned and

accepted by the world, and the construction of ecological city has formally moved toward the stage of implementation.

3. Concept, connotation, and characteristics of ecological city

3.1 *Concept of ecological city*

The continuous development of urban civilization facilitates our gradual understanding of the concept of ecological city. MAB noted that ecological city creates a kind of optimal environment, which can fully integrate technology and natural human activities from natural ecology and social psychology and induce human creativity and productivity by providing a high level of material and lifestyle. The concept of ecological city was developed and perfected with the development of urban ecological transformation and urban ecological theory^[6].

Former Soviet biologist O. Yanitsky (1987) elaborated the concept of ecological city by stating that “ecological city is an ideal urban model, in which technology and nature are fully integrated, and human creativity and productivity are maximized. Residents' physical and mental health and environmental quality are protected to the maximum extent, material wealth, energy, efficient use of information, ecological virtuous circle of an ideal habitat”^[10]. In the same year, American ecologist Richard Register pointed out in his study that “an ecological city is an ecologically sound city, a compact, dynamic, energy-efficient and harmonious settlement with nature”^[11]. Chinese scholar Rusong Wang (1987) summed up the ecological city idea as “ecological city is an ecological virtuous circle of human settlements by social, economic, natural coordinated development, material, energy, and efficient use of information established on the basis of ecological principles”^[12]. Australian architect Downton (1992) believed that “an ecological city is a city that achieves ecological balance between man and man, and between human beings and nature, and points out the creation of a dynamic living environment and the construction of a healthy economy consistent with ecological principles. Promoting social equity and improving social welfare is the key to ecological city construction”^[13].

3.2 *Connotation of ecological city*

The diversity of the concept of ecological city leads to a different understanding of the connotation of ecological city. From the point of view of ecological philosophy, the essence of ecological city is to realize harmony between man and man, and man and nature. From the point of view of system theory, ecological city is a social–economic–natural compound ecosystem with reasonable structure and stable function. From the perspective of ecological economics, the demand for natural resources in the social and economic development of ecological cities is within the range of ecological carrying capacity and environmental capacity. From the point of view of sociology, an ecological city is not only the ecological transformation of natural environment but also the ecological transformation of human society, which includes education, science and technology, culture, morality, law, and system, among others. From the point of view of regional space, an ecological city is an unenclosed urban–rural complex based on a certain region. That is, the relationship between a city and its periphery tends to be integrated, thereby forming unity of mutual benefit and symbiosis and realizing regional sustainable development.

3.3 *Characteristics of ecological city*

According to the concept and connotation of ecological city, an ecological city is different from a traditional city with distinct ecological characteristics.

(1) Health and harmony

Given its reasonable ecological structure, harmonious ecological order, and perfect ecological function, an ecological city can provide normal and stable ecological services as a healthy and harmonious region within the ecosystem, the outside environment, and its subsystems.

(2) Efficiency and vitality

An ecological city pursues high utilization and value added of the whole function of a system. This finding means that everyone can be properly provided for by making the most use of things and making full use of one's ability.

(3) Continuity and equity

An ecological city requires rational and fair allocation of resources by emphasizing on the sharing of technology, resources, information, and economy. Coordination of development and protection is responsible for the future development of a region, thereby forming its sustainable development. An ecological city should be responsible for the future development of a region to facilitate sustainable development.

This analysis suggests that an ecological city is formed by the organic combination of economic development, social progress, and environmental protection. The ideal regional form of ecological virtuous circle is the urban model of sustainable development.

4. Practice of Ecological City Construction

Under the guidance of the concept of ecological city, the construction of an ecological city in various countries has made rapid progress and achieved rich results. The "Shadow Plan" of Adelaide, Australia describes the ecological city construction and development plan in detail from 1836 to 2136 through six plans. The distribution of the six plans represents the stage goal of the city's ecological city construction and puts forward the very concrete construction measures^[14]. Cleveland, United States, has a clear agenda of an ecological city, which includes a range of specific goals and guidelines, such as air quality, climate change, energy, green buildings, green space, infrastructure, government leadership, neighborhood communities, public health, smart growth, regional perspective, transportation options, water quality, and waterfront construction. The goal of the project is to build a green city along the Great Lakes^[15]. From the beginning of planning, Chiba New City in Japan has taken the establishment of an ecological city as its main goal. The principle of its planning highly respected the original natural landforms and lakes, rivers, and mountain forests, which are carefully planned in urban areas. With the corresponding landscape design, closely combined with a number of public exchange activities and facilities, a dozen of landscapes with different sizes and characteristics and uniform distribution in urban open parks were formed^[15]. The "Ecological City 1997–1999" in Copenhagen, Denmark is a comprehensive project with very rich content. This project attempts to establish a model project in urban areas with clear objectives that include the development of implementation methods and environmental objectives. The content of the project revolves around achieving its goal^[16]. Erlangen, Germany strengthens landscape planning and environmental planning in urban planning; attaches importance to the protection of ecological areas, such as forests and valleys; and makes more green spaces and green corridors throughout the city based on the idea of sustainable development. This project adopts integrated transportation policy and saves resources and energy, among others^[17]. Curitiba, Brazil has become a model for sustainable urban planning through the construction of public transit-oriented urban development planning, social welfare projects, and environmental education for citizens^[16, 17].

5. Conclusions

This work points out ecological city construction in the perspective of the rules of economic, social, and ecological construction by elaborating on the concept, connotation, characteristics, and practice of ecological city. According to the research results, the construction of an ecological city should emphasize the city's return to nature, improve the utilization ratio of resources and energy, and fully consider the rationality of the economic and social development growth and the appropriateness of the city's outward expansion. The ecological city construction research focuses on the practical problems in each city, which has obvious practicability and pertinence. The concrete problem is analyzed concretely through the complete research mode of "putting forward the problem–project research–practice application–theory promotion." Thus, theory and practice are closely linked together.

However, the research and practice of ecological city construction still have many problems, which can be explored and expanded in the following aspects.

(1) Through the study of the development course of the ecological city system, the driving factors and construction approaches of urban ecologicalization should be widely and deeply explored

(2) The combination of theoretical research and practice should be strengthened to make the plan conform to the local characteristics and set up specific and feasible construction objectives.

(3) The ecological consciousness of the people should be strengthened and the role of community service and nongovernmental organizations should be given full emphasis to actively guide the general public to participate in the activities of ecological city construction. Finally, a well-rounded ecological city construction atmosphere should be developed.

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