

The Research on Land-Use Change and Ecological Environment Effect of Urban Landscape in China

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Abstract

The rapid expansion of urban construction land has become the major characteristic of urban land-use change in China today. Meanwhile, the rapid urbanization process has led to the great changes of urban landscape in China, and it also has had certain impacts on environmental factors such as climate, soil, hydrology, biodiversity, etc., then it has made the overall ecological environment deteriorated. This study is based on the summary and analysis of research on land-use change and ecological environment effect of urban landscape in recent 20 years in China, and it aims at providing scientific bases and theoretical supports for the planning and construction of urban landscape, the sustainable land-use of city and the protection of ecological environment in China.

Keywords

Urban Landscape, Ecological Environment Effect, Urbanization, LUCC

1. Introduction

The two major international projects, the International Geosphere-Biosphere Program (IGBP) and the International Human Dimensions Program (IHDP), cooperated to create the research topic “Land-Use and Land-Cover

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Change, LUCC” in 1995 [1], and they launched the Global Land Project (GLP) jointly again in 2005 [2]. The research on land-use change and ecological environment effect gradually became a hot spot in international research [1] [2].

In China, the area of land is large, the territorial resources are rich, the economic development is rapid, the changes of urban land-use are great, and the ecological environment effect is obvious. Thus, it is particularly important to launch the research on urban landscape change and process in China. Besides, with the urbanization process speeding up in China, the construction land of urban landscape expands unceasingly, so the urban ecological environment is affected seriously, and the comprehensive ecological environment effect becomes deteriorated. Therefore, how to improve the quality of the urban ecological environment and do further research on impact on land-use changes of urban landscape has become one of the important topics in academia. This thesis analyzed the changes and ecological environment effect of urban landscape in recent 20 years in China, summed up the research situation, contents and prospect in this field, summarized the relationship between land-use change of urban landscape and ecological environment effect. The different land-use types make different contribution values to ecological environment effect, and the land-use change has an essential influence on ecological environment problems. It is not only useful to provide scientific bases and theoretical supports for the land-use planning of urban landscape and the management decision-making of ecological environment, but also for the sustainable land-use of urban landscape and the protection and construction of ecological environment.

2. Results and Analysis

2.1. The Present Research Situation of LUCC and Ecological Environment Effect of Urban Landscape

Different land-cover types have different ecological system structures and community composition. The land-use change affects the biodiversity directly, and changes the characteristics of water circulation and the structure of ecosystems, by land-cover change. Then it influences the function of the ecosystem in different scales. From 2005 to today, the results based on the domestic academic database (CNKI, WANFANG, VIP) and the foreign academic database (Springer) about China in these fields showed that the published papers are more than 100 per year in domestic core journals and foreign academic journals, and the influences on international journal expand year by years (Figure 1 and Figure 2). The research on land-use change and ecological environment effect of urban landscape has gradually been further and made obvious achievements in China. The specific research mainly embodies in the following respects: the research on quantity changes and transfer types of LUCC [3], the research on driving mechanisms of LUCC [4], and the research on single environmental factor affected by LUCC [5], the research on comprehensive ecological effects of LUCC [6].

2.2. The Contents of Research on LUCC and Ecological Environment Effect of Urban Landscape

2.2.1. The Research on Quantity Changes and Transfer Types of LUCC of Urban Landscape

The expansion speed of urban construction land-use was the fastest of all in the process of urbanization, thus led

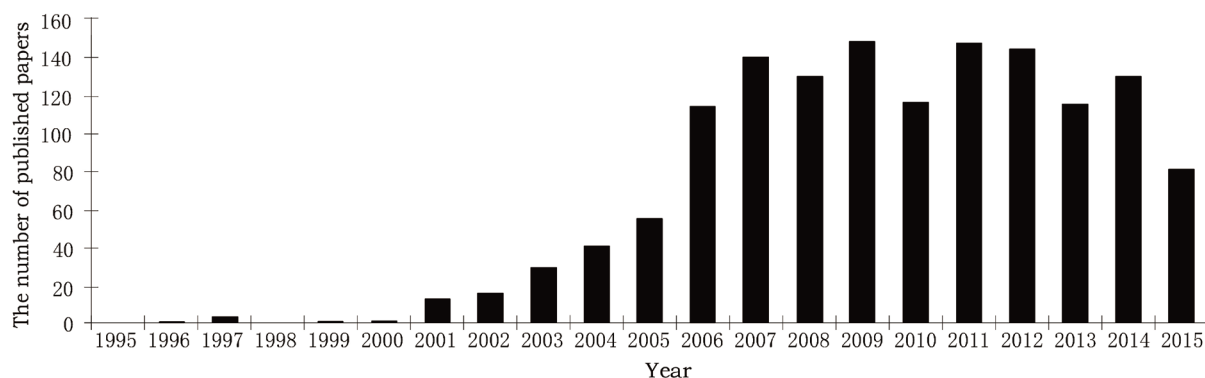


Figure 1. The number of published papers about LUCC of China in domestic academic journals.

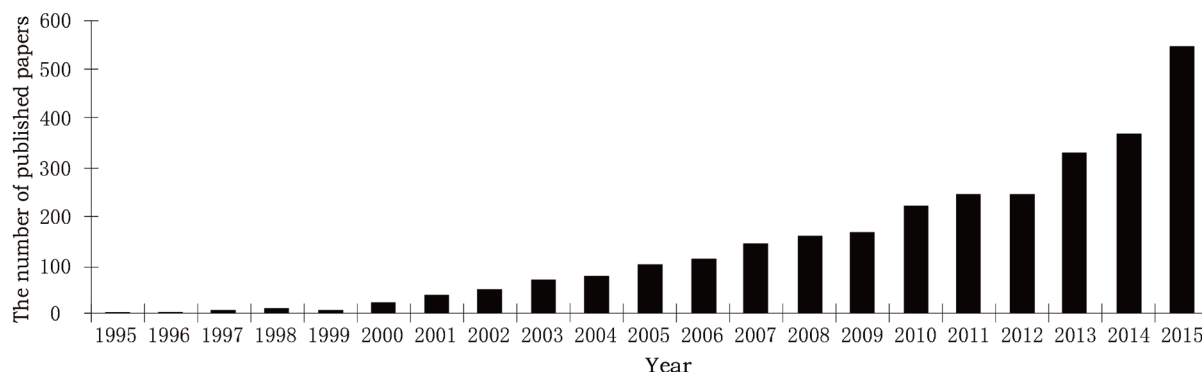


Figure 2. The number of published papers about LUCC of China in foreign academic journals.

to transferring from the other types of land-use. The present research methods of land-use change of urban landscape were mainly based on the remote sensing image data, and combined with GIS technology to make a quantitative or spatial analysis on land-use change of urban landscape [7]-[10]. In the research on land-use change of Suzhou-Wuxi-Changzhou from 1980 to 2000, Tu X.S. [7] pointed out that cultivated land reduced heavily due to a large number of urban and rural construction land expansion, in addition, the types of land-use change tended to be diversification, the system of land-use tended to be complex disorder and accelerated evolution. In the research on land-use change of Xi'an city from 1980 to 2000, Zhong Y. [8] pointed out that, in the urban landscape, the areas of construction land, forestland and park land have increased largely, but the areas of grassland, cultivated land, waters and unused land have decreased heavily, and the structure of land-use was simplified. Among which are construction land and forestland. Meanwhile, Wu X.Q. [9] also found that the urban construction land would expand continually with an average annual increase as 10.7 km^2 in the future, and a large number of cultivated lands would be occupied, by the process simulation method using the SLEUTH mode to compare the land-use changes of Shenyang city from 2005 to 2030. Furthermore, many domestic papers [10] were pointed out that the urban construction land expanded sharply and occupied the other types of land (especially the cultivated land), which had become the major characteristic of land-use change in the urban landscape.

2.2.2. The Research on Driving Mechanisms of LUCC of Urban Landscape

The research on driving mechanisms of urban landscape land-use change from China mainly focused on revealing the reasons, the internal mechanism and the process of land-use change [11]-[14]. In the driving mechanism analysis of land-use change of Shenzhen city, Shi P.J. [11] pointed out that the speedy expansion of urban land-use was the most important driving factor, such as the growth of population, the opening of policy, the influx of foreign capital, the development of tertiary industry and so on. In the research on driving mechanisms of land-use change of Daqing city from 1988 to 2007 by using the panel data model, Dong J. [12] pointed out that the higher agricultural labor productivity and industrial output value, the more agricultural land-use and natural land-use transformed into urban land-use. In the driving force analysis of land-use change of Shanghai city from 1994 to 2006, Shi L.J. [13] pointed out that the prominent characteristic of land-use changes of Shanghai are the growth of population, the development of economy, and the policy, promoted a large number of cultivated land to transform into urban construction land. In the research on driving mechanisms of land-use change of Kunshan city by constructing the driving force model, He M. [14] pointed out that the main driving factors of land-use change from Kunshan were the development of economy and the growth of population, followed by scientific-technical progress. Accordingly, the driving mechanism of land-use change of urban landscape was relatively complex, the main driving factors of different regions were different, and these researches could provide useful information to predict the results and trends of land-use change in the future.

2.2.3. The Research on Single Environmental Factor Affected by LUCC of Urban Landscape

The single environmental factor affected by land-use change of urban landscape mainly referred to regional climate, soil, hydrology or biodiversity. In the research on thermal environment influence of land-use change of Dongguan city, Deng Y.J. [15] pointed out that the urban construction land had the largest thermal effect and contribution indexes, and it was the most concentrated land of high-temperature across the region. In the analy-

sis of soil functions affected by suburban land-use change of Zhengzhou city, Lu Q.L. [16] pointed out that the producing functions of soil evolved into the bearing functions of soil on most of the urban construction land, meanwhile most of the ecological functions of soil would disappear forever. In the research on watery environment affected by land-use change of Wuxi city, Shen S.Y. [17] pointed out that the decrease of water area, the increase in impervious surface area, the increase in surface runoff with serious water pollution during the period of rainfall, all affected by land-use change. In addition, the urban land-use change had a serious influence on biodiversity. For example, in the research on diversity of green space plant communities in the central city of Shanghai, the result of Da L.J. [18] showed that the highest frequency of community was formed by only 5 species in the central city, and the species abundance of communities in the central city was less than in the suburbs. Above all, the land-use change of urban landscape had some negative influences on the single environmental factor, the present researches mainly focused on revealing and analyzing the process and results of influences, to emphasize the importance of eco-environmental protection in the process of urbanization.

2.2.4. The Research on Comprehensive Ecological Effect of LUCC of Urban Landscape

The comprehensive ecological effect of land-use change of urban landscape was based on the service function of urban ecosystems to evaluate the ecological environment effect comprehensively by assigning quantitative values of the types of land-use of urban landscape [19]-[22]. In the analysis of comprehensive ecological effect of suburban land-use change of Beijing city, Wan L. [19] pointed out that the ecological value index was generally stable, the comprehensive ecological effect maintained relatively stable in the research area over a ten-year period. In the analysis of ecological environment effect of land-use change of Suzhou city from 1980 to 2005, Zhang F.Y. [20] pointed out that the eco-environmental quality index decreased continuously in the research area, and the speed of decrease was faster and faster, then the comprehensive quality of eco-environment was becoming more and more bad. In the research on ecological effect of town land-use of Beijing by using the comprehensive evaluation of ecological service value, Hou L.G. [21] pointed out that the massive reduced area of cultivated land and forest land led to the decrease of ecological service value in the area, and the comprehensive ecological effect weakened rapidly. In the analysis of ecological environment effect of land-use change of Linyi city from 1990 to 2009, Ma Q.S. [22] pointed out that the decrease of comprehensive ecological value and the weak ecological service function of the area were the results of these changes of the forestland and cultivated land to the construction land. Therefore, the change of land-use types of urban landscape had significant influences on the urban eco-environmental quality, especially the decrease of ecological environment indexes caused by the expansion of construction land. If there were no other types of land-use contributed to the ecological environment, the environmental quality of entire city would tend to be deteriorated continuously and the ecological environment would be worse and worse.

3. Conclusion and Prospects

With the rapid development of urbanization in China, the construction land expansion is the fastest in all the urban land-use types, and the others have been increased or decreased slightly. Then the ecological environment has been severely affected making, the overall ecological environment worsening. The main driving factor for different study areas of land-use change is also different. This study has summarized and analyzed the research on land-use change and ecological environment effect of urban landscape in recent 20 years in China, and put forward prospects for the future research. Firstly, due to the accumulation of land-use change of urban landscape, the accuracy of data processing and the complexity and diversity of different research areas, the data of quantitative analysis methods and processing techniques need to improve further. The data processing function of high-definition remote sensing image and the interpreting technology of land types need to be improved to assure the accuracy of research results and the reliability of trends forecast. Besides, the interaction mechanism between land-use change and environmental factors is relatively complicated, so the research of China in this field mainly focused on the single environmental factor, such as climate, soil, hydrology or biodiversity etc., affected by regional land-use change [23]-[27], but the research on comprehensive ecological environment effect of regional land-use change need to be improved. Finally, the great changes of global environment make people pay close attention to the sustainable development of urban land-use in recent years, but the combination of present research and sustainable theory is not enough, while the sustainable evaluations are relative lack. In a word, the researches on land-use change of urban landscape mainly relate to the changes in time or space and

the transfer of land types, but the researches on the change of land-use quality and changing the output ability of unit land through technical reform are lacking.

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