Frontiers of Architectural Research (2016) 5, 290–300

Available online at www.sciencedirect.com

Frontiers of Architectural Research

www.elsevier.com/locate/foar

RESEARCH ARTICLE

Urban growth: Changes, management, and problems in large cities of Southeast China

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Received 20 January 2016; received in revised form 14 April 2016; accepted 20 April 2016

KEYWORDS
Urban growth;
Urban planning;
Land use planning;
SLEUTH;
Megacity;
Nanjing

Abstract
Compared with medium-sized cities, megacities play an increasingly important role in the rapid urbanization process in China. Owing to the expanding scale of large cities, urban sprawl leads to unsustainable practices that cause ecological, social, and environmental problems. Urban planning and land use planning are major driving forces of land use and land cover change in China. However, the goals of these two types of planning are different, and coordinating them is a challenge for local government decision makers. Thus, we use the SLEUTH model to simulate the implementation scenarios of future urban growth in Nanjing in the Jiangsu province of China. Using the scientific simulation data of the model, we contrasted the alternative futures of the two planning types for local government decision makers to achieve sustainable urban planning. The objective of our study is to explore the problems and possible solutions for urban management in the context of a megacity in China. The results of our study confirm the value of SLEUTH, which provides extensive exploratory knowledge in evaluating the effects of possible local government decisions.

1. Introduction

In the 21st century, large cities in China are confronted with great challenges related to environment and development. China has its own strategy for urban growth that is different from urban growth management in developed countries. The local government depends on urban planning and land use planning to manage urban growth. The urban and rural planning law is formulated to strengthen urban and rural planning administration; harmonize urban and rural spatial layout; improve people's living environment and promote the integrated, harmonious, and sustainable development of

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Peer review under responsibility of Southeast University.

http://dx.doi.org/10.1016/j.foar.2016.04.002

urban and rural society and economy. Most construction activities follow urban and rural planning. However, this situation leads to current development problems in large cities in terms of the following aspects. First, the urban planning is periodically affected by leadership changes. Second, the changing adjustment of administrative area influences the sequence of construction (Chen et al., 2009). Third, the management and control objectives of land use are not the same in different administrative sections. Fourth, the inflexible management system cannot adapt to the economic and social development of the expanded city (Qiu, 2006).

Two types of planning have a potential effect on the construction of cities: urban planning and land use planning. Urban planning, is laid down by the urban planning bureau of a particular city. If the population of a city is over 0.5 million, the urban planning, which is supervised by the local government, needs to be approved by the State Department of China (Figure 1). If the city population is less than 0.5 million, the plan needs to be approved by the government at a higher level. The land use planning of the city is laid down by the land use management sector of the local government and needs approval by the Land and Resources Bureau of China. Compared with land use planning, the city urban planning has the force of law while the other has not.

The central planning practice in China is helpful for the compact urban form, but it presents a challenge to farmland protection and does not address unsustainable environmental practices (Xi et al., 2012). Scientifically setting the urban planning is critical for urban growth management in China's political system. The SLEUTH urban growth and land cover change model is an effective decision-support tool to analyze and provide rich exploratory knowledge for evaluating the effects of possible local government decisions (Clarke et al., 1997, 2007; Dietzel and Clarke, 2007; Jantz et al., 2010). Under the SLEUTH model, the simulation of Asian cities always obtains a lower correlation value because of the changing policies of urban development; this condition is different from that of North American or European cities, whose simulations provide a high correlation[1] (Silva and Clarke, 2002), Still, the model can simulate most implementation scenarios in Northeast China and West China except the displacement, shrinkage, and disappearance of urban and rural construction land (Xi et al., 2012).

To explore the potential effects of implementing the urban planning and land use planning on urban space development and to provide decision support to local decision makers and land managers, the SLEUTH model was used to conduct simulation experiments with the objective of revealing the potential changes and problems in urban growth management. In this case study of Nanjing, we focus on exploring the management problems and solutions related to construction activities based on simulation data.

[1]The high correlation (comparative score) means that the prediction of the model based on the initial seed year of the present urban pattern using refined values is highly similar to actual conditions.

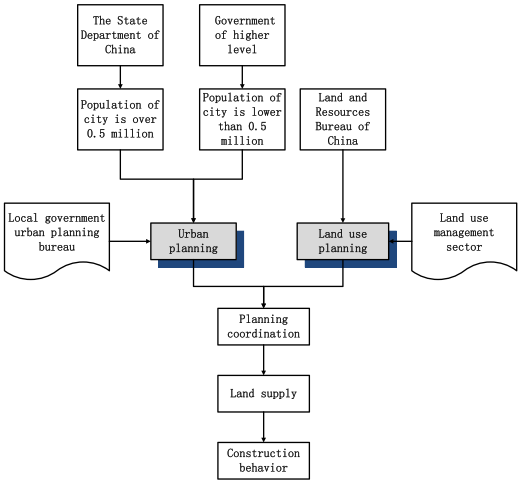

Figure 1. Relationship of urban planning and land use planning in China (Author's illustration).

2. Materials and methods

According to the urban scale grade in China, a large city is one with a population between 1 million and 5 million, and a megacity has a city population that exceeds 10 million. Nanjing, the capital city of Jiangsu province and the political, economic, and cultural center of the province, has a population of approximately 10 million. It is also one of the most important cities among the large cities of Southeast China (Figure 2). The characteristics of urban growth in large cities of Southeast China focus on the high speed of urban growth and its measure to control urban growth to achieve the goal of sustainable development. We believe that the urban growth process in Nanjing represents the characteristics of large cities in Southeast China. Thus, we simulate the urban growth of Nanjing in our case study.

2.1. Introduction to Nanjing

Nanjing, the capital city of Jiangsu province, is located in the lower reaches of Yangtze River Southeast of China. For almost 2000 years, Nanjing has witnessed some of the most significant events in Chinese history, including its position as national capital during the Six Dynasties (220–589 CE) and the Southern Song Dynasty (1127–1279 CE), the onset of the Ming Dynasty in 1368 by Zhu Yuanzhang who made Nanjing capital for almost two decades (Figure 3).

Nanjing has jurisdiction over 11 districts, covering an area of 6582 sq. km. and having a population of about 82 million in 2013. Nanjing is an important industrial base that produces electronics, automobiles, chemicals, and a number of special products as the leading factors and having 36 industrial trades, over 200 industrial branches, and more than 2000 categories of products. The city is also a major international commercial port in the Yangtze delta region, second only to Shanghai. The total turnover of retail sales of social consumer goods in 1995 amounted to 24 billion yuan, placing Nanjing among 10 major cities in the country. The monetary market plays an important controlling role in the economic operations of the city.