China’s Cities Need to Grow in a More Compact Way

Jingzhu Zhao,*† Yu Song,† Lina Tang,† Longyu Shi,† and Guofan Shao‡,‡

†Key Lab of Urban Environment and Health, Institute of Urban Environment, Chinese Academy of Sciences, 1799 Jimei Road, Xiamen 361021, China
‡Department of Forestry and Natural Resources, Purdue University, 715 West State Street, West Lafayette, Indiana 47907, United States

Since the 1990s, China has undergone astonishing economic growth, and its extensive urbanization has become one of the most striking development signatures anywhere in the world. With the world’s largest urban population, China’s urbanization experience provides meaningful insights on future urban development in other countries.1 Because China has an extremely low per-capita land area, constructing compact urban forms is regarded as one of the most important considerations for China’s sustainable city development.2 This is because, in general, a compact city can help better utilize public transport services, strengthen urban community multifunctionality, increase the quality of city life, reduce energy consumption, and improve the urban environment.3 The question is, however, are China’s cities developing toward a more compact form?

We assessed the compactness of 35 major cities in China in 2000 and 2007 by using a normalized compactness index (NCI) \((0 < \text{NCI} < 1)\), which is defined as a ratio of Thin et al.’s compactness \((T)\) for a given city over the maximum compactness \((T_{\text{max}})\) for a hypothetical round-shape city.4 NCI is independent of the dimension of a target city, and the greater its value, the more compact a city. The 35 major cities in this paper include 26 provincial or autonomous-region capital cities, four municipalities, and five cities specifically designated in the state plan (or state-plan cities) (Figure 1), the same cities as studied by Zhao.2 The geographic extents of the 35 cities ranged from 34 to 550 km\(^2\) in 2000 and 65 to 1289 km\(^2\) in 2007. The populations of urban-district residents in the 35 cities ranged from 0.57 to 11.36 million in 2000, and from 0.75 to 17.69 million in 2007.

In 2000, NCI values ranged from 0.048 (Guangzhou) to 0.257 (Jinan) (Figure 1). The mean of NCI values for the 35 cities was \(0.131 \pm 0.060\) (standard deviation). The skewed distribution of NCI values in 2000 showed that the majority of cities in China were relatively noncompact. Among the 12 cities with the lowest NCI values, 8 were low-population cities. Beijing’s NCI value was 0.112 and Shanghai’s was 0.130, and their NCI values ranked 26th and 18th, respectively.

In 2007, NCI values ranged from 0.052 (Nanjing) to 0.335 (Shijiazhuang) (Figure 1). The mean of NCI values for the 35 cities was \(0.145 \pm 0.066\) (standard deviation). The skewed distribution of NCI values in 2007 showed that the majority of China’s cities were still relatively noncompact. Low- and high-population cities were almost evenly distributed within each NCI class, with the exception of the largest NCI class. Beijing’s NCI value increased to 0.131 whereas Shanghai’s remained unchanged, and their NCI values ranked 20th and 21st, respectively.

Between 2000 and 2007, the change in NCI values varied tremendously among the 35 cities (Figure 1). Although there was a slight increase in the mean of NCI values, 12 cities experienced negative changes in NCI values. This was particularly the case for larger cities. Among the 12 cities with the lowest NCI values in 2000, 11 cities experienced a positive change in NCI value, including 8 smaller cities (Figure 1). Four out of the five state-plan cities saw their NCI values increase. The state-plan cities are the pioneers of China’s economic reform and recent urban planning in those cities seems to have helped them develop toward greater compactness. For example, Xiamen is a rising state-plan city5 and was ranked the most sustainable city in China.2

The less-populated cities are likely to have more open areas within the urban landscape, where land is suitable for development. Filling up the urban gaps automatically increases city compactness. As population continues to grow, urban development has to take place beyond the existing city limit and urban sprawl may jeopardize the city’s compactness. Beijing, Shanghai, and Chongqing, three mega cities and municipalities, are good examples of “unlimited” urban sprawl without enhanced compactness. This fact is critically important because many local cities tend to follow the urban-growth models of Beijing and Shanghai in their urbanization processes. It is worth noting that China has experienced an increase in per-capita urban area in the past decade, indicating
that land use has become less efficient over time and that there is a need for compact-city development in China. Expansion in urban living space and increase in city compactness both can help improve life quality in China. However, an acceleration in the compactness of China’s cities is needed in the future to ensure that land is used economically and sustainably.

**AUTHOR INFORMATION**

**Corresponding Author**

*Phone: +86-592-6190999; e-mail: jzhao@rcees.ac.cn.

**ACKNOWLEDGMENT**

This research was supported by the Chinese Academy of Sciences (KZCX-2-YW-453; 08I4021D10).

**REFERENCES**
