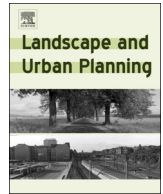




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Research Paper

Do local factors or teleconnections control urbanization? The shifting balance in a Chinese megaregion

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ABSTRACT

Numerous studies have investigated the local driving forces of expansion of developed land in a single city, or in comparisons of several cities. Few studies, however, have examined both the local and distant or “tele” drivers. We take the Beijing-Tianjin-Hebei (BTH) urban megaregion as a case study to investigate the local and tele driving forces of expansion of developed land from 1984 to 2010. We pose two research questions at an urban megaregion scale: (1) What are the effects of local and tele driving factors on expansion of developed land; (2) Does the relative importance of these two kinds of factors change through time? We examined the expansion of developed land, and classified the potential driving factors into local and tele variables, and detected their effects on expansion of developed land for three periods, 1984–1990, 1990–2000, and 2000–2010. The results showed that the BTH megaregion experienced a rapid and significant expansion of developed land during 1984–2010, with an increase of 9970.60 km², or an annual rate of 276.96 km². The local and tele driving factors both affected the expansion of developed land. Overall, local drivers were dominant in the process of urbanization for BTH. However, over that time period, the effect of local driving factors decreased, while that of tele driving factors increased. This study extends the understanding of expansion of developed land in a holistic view by including both local and tele drivers, and provides quantitative insights into the issue of urban planning and management in urban megaregion.

1. Introduction

Expansion of developed land is one of the most important components of urbanization and has been a focus of much global research worldwide (Bryan et al., 2016; Grimm et al., 2008; Ibrahim Mahmoud, Duker, Conrad, Thiel, & Shaba Ahmad, 2016). With the rapid growth of urbanization, the total global urban area will continue to rise in the coming decades (Seto, Fragkias, Güneralp, & Reilly, 2011). Especially in developing countries, developed land area is projected to triple from 2000 to 2050 (Angel, Parent, Civco, Blei, & Potere, 2011). However, the expansion of developed land has simultaneously resulted in serious environmental problems locally and globally, such as heat island effects (Zhou, Huang, Pickett, & Cadenasso, 2011; Zhou, Qian, Li, Li, & Han, 2014), farmland fragmentation (Deng & Srinivasan, 2016; Shrestha, York, Boone, & Zhang, 2012), loss of habitat (Peng, Chen, Liu, Lü, & Hu, 2016; Syphard, Clarke, Franklin, Regan, & McGinnis, 2011), air pollution (Han, Zhou, Li, & Li, 2014), and reduction in ecosystem services (Peng, Liu, Wu, Lv, & Hu, 2015; Peng, Shen, Wu, Liu, & Wang, 2016;

Zank, Bagstad, Voigt, & Villa, 2016), among others. Given such pronounced trends, in order to mitigate the adverse ecological influences and facilitate urban sustainability, it is necessary to investigate and better understand the complex dynamic of urbanization.

To date, a large body of research has investigated the driving forces of expansion of developed land on local scales, which were generally divided into four categories: physical, socioeconomic, the proximity to existing developed land, and policy factors (Li, Zhou, & Ouyang, 2013). First, the natural environment conditions (e.g., topography, geographic location and precipitation) determine the basic survival requirements of humans and the foundation of expansion of developed land, such as the distribution of water, soil, temperature, and so on (Ye, Zhang, Liu, & Wu, 2013). Second, socioeconomic factors, such as the population size, GDP, distances to socioeconomic centers, and distances to main roads (Li, Peng, Liu, & Hu, 2017; Shu, Zhang, Li, Qu, & Chen, 2014) also play quite important roles in the expansion of developed land. Third, the neighborhood factor of proximity to developed land cannot be ignored (Tan et al., 2014), because the probability of expansion of developed

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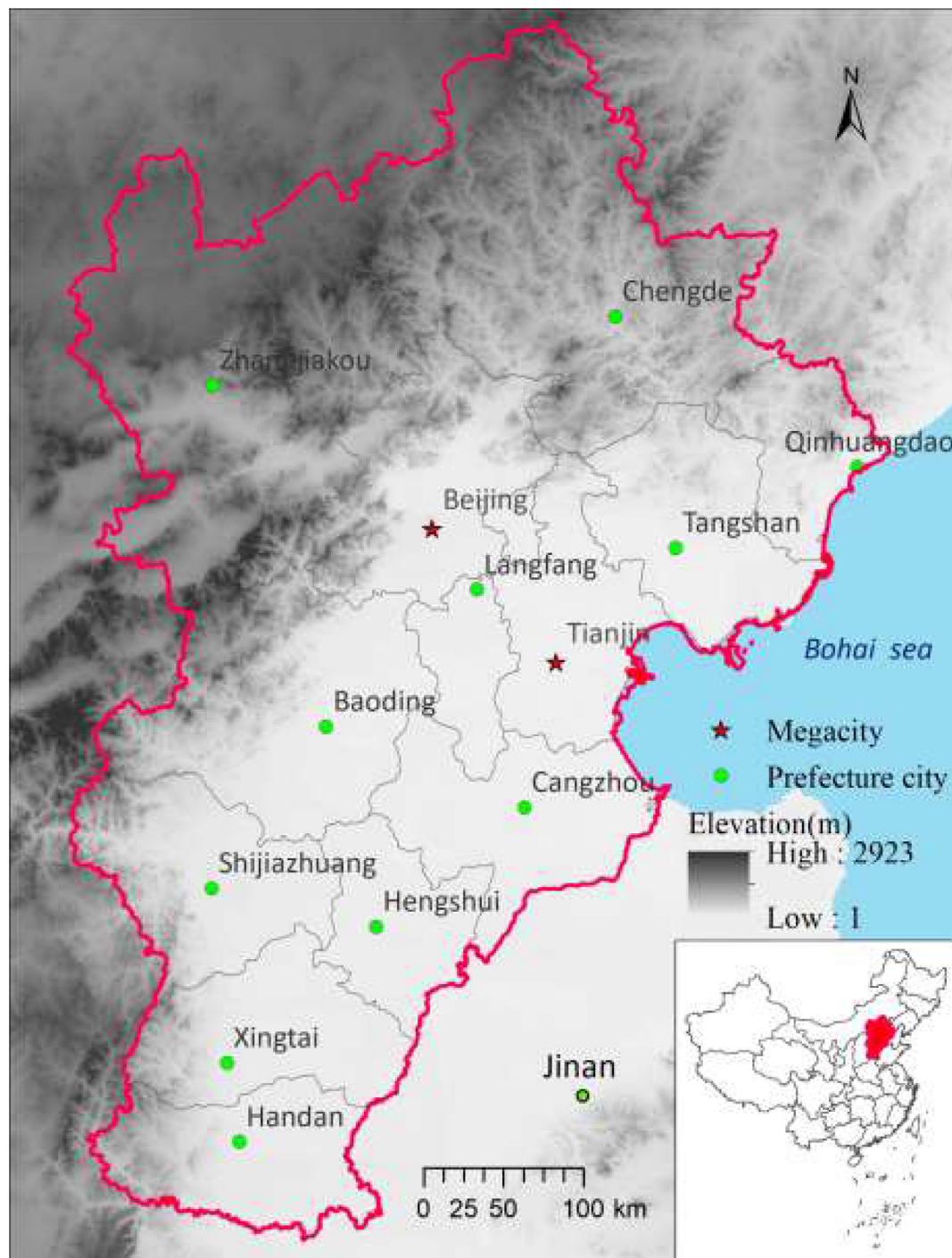


Fig. 1. Location of the study area and its topography.

land will be increased by the presence of existing developed land nearby (Reilly, Mara, & Seto, 2009). Finally, the specific urban development policies in different areas can affect the expansion of developed land differently (Kuang, Chi, Lu, & Dou, 2014; Long, Gu, & Han, 2012). For example, the establishment of ecological conservation zones showed mostly negative effects on expansion of developed land. Together, these examples convincingly show that expansion of developed land can be driven by processes that exist on local scales; however, the literature has not usually considered teleconnections, that is, distant influences on urban development (Liu et al., 2013). In fact, the influence of distant, or tele driving factors on land change is now growing and widespread (Meyfroidt, Lambin, Erb, & Hertel, 2013). With the

increasing economic and population mobility between cities, especially within urban megaregions (Pickett & Zhou, 2015), the driving forces of development in a city usually extend beyond its local administrative boundary (Gu, 2011). For example, the closely integrative infrastructure network makes the Northeastern Urban Megalopolis in the U.S. (“Boswash”) become the most intensive urban megaregion in the world, linked by highway, rail way, channel, and power networks (Leven, 1978). Similarly, Shanghai port and Shenzhen port in China have positive impacts on the economic development and land change in their hinterlands beyond their administrative boundaries (Zhang & Feng, 2011).

In order to explicitly describe the complex effects on developed

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