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Urban land expansion and arable land loss in China—a case study of Beijing–Tianjin–Hebei region

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Abstract

With significant economic development in the last decade in China, urban land has increasingly expanded and encroached upon arable land in the last decade. Although many papers have analyzed the characteristics of urban land expansion, relatively less attention has been paid to examining the different expansion features of different-tier cities at a regional level. This paper analyzes the spatio-temporal differences of urban land expansion and arable land loss among different-tier cities of the BTH (Beijing–Tianjin–Hebei) region in China in the 1990s, and identifies social, economic, political and spatial factors that led to these differences. Based on urban land change data determined by interpreting Landsat Thematic Mapper (TM) imagery, it was found that the urban land area in the BTH region expanded by 71% between 1990 and 2000. Different-tier cites, however, had enormous differences in urban development, such as speed of urban land expansion, speed of urban land per capita growth, and so on. These differences were closely related to rapid economic development, strict household registration systems, urban development guidelines (*chengshi fazhan fangzhen*), and national land use policies. Of all the new urban land, about 74% was converted from arable land, and there was a general tendency for smaller cities to have higher percentages. One of the important reasons for this result is that urban land is highly correlated with arable land in spatial distribution.

Keywords: China; The BTH region; Urban land expansion; Arable land loss; Different-tier cities

Introduction

China is a country with vast population and scarce land per capita (Yang and Li, 2000; Albersen et al., 2002). In 2000, its population reached 1.26 billion (NBSC, 2001a), about one-fifth of the world average level. The arable land area was 128 million ha, equivalent to only 0.11 ha per capita, and less than half of the world's average of 0.23 ha (TMLR, 1999). This limited availability of arable land has been exacerbated by population growth and by arable land losses. In the last decade, China's population has annually increased by about 12.5 million (NBSC, 1991–2001a). Meanwhile, its arable land area has decreased dramatically. According to the monitoring data of the Ministry of Land and Resources, a total cropland area of nearly 10 million ha (0.70 million ha per year) was converted into built-up, forest/pastures and horticultural lands or destroyed by disasters in the years between 1987 and 2000. Considering the area added by land reclamation and rehabilitation of abandoned lands, it was estimated that a total net cropland area of about 4.5 million ha (0.31 million ha per year) was lost in the same period. This quick farmland loss is generally due to the combined effect of rapid economic development, population growth, urbanization, agricultural restructuring, the government-stimulated conversion of marginal croplands (to forest and pastures[1]), and natural hazards and land degradation (Yang and Li, 2000; Ding, 2003). Among the factors affecting farmland decline, urban land expansion has been perceived as the crucial one, because of not

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[1] Because of soil erosion, desertification, flooding, and water shortages, the Chinese government launched some plans to convert arable land to forest and grassland in order to protect the natural environment (*tuigeng huanlinhuancao*) in ecologically fragile regions, for instance, the Sloping Land Conversion Program.

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only its resultant loss of arable land but also, maybe more important, its great impact on the farmers in highly populated urban fringes. Due to encroachment of urban land onto farmland, it was estimated that each year, 1.5 million farmers lost their farmlands in the last decade (Lu et al., 2003).

China, as a developing country on the fast track, has been experiencing a rapid urban growth over the last four decades, especially since the implementation of the reform and opening-up policy in 1978 (Longley, 2002). In 2000, the proportion of urban population in China reached 36.22% (NBSC, 2001b). It was still, however, far behind the world average of 48% (CAM and EBUDC, 2003). With China's entry into the World Trade Organization (WTO) and the government's promotion of urbanization, there is no doubt that synergetic effect of global and local forces will continue to transform urban China (Jiang, 2003). One of the consequences is that urban development will encroach upon more cultivated land, especially the fertile and productive croplands in the eastern part of China due to the high population density and advanced level of economic development. Thus, the conflict between decrease of arable land and population increase attracts the special attention of many scholars at home and abroad (Cai et al., 2002; Boland, 2000; Tania et al., 2001; She and Xie, 2000; Anderson and Yang, 1998).

Recently, many papers have examined the characteristics of urban land expansion and the consequent arable land loss at different scales (Shen et al., 2001; Tania, 2001; Yeh and Li, 1999; Fazal, 2000; Verburg, 1999; Verburg, 2000; Zhang, 2000; Skinner et al., 2001), but relatively less attention has been paid to the differences of urban land expansion and the resultant arable land loss around different-tier cities. China was a planned economy before 1978. Although it entered a new era of market economy after 1978, many policies still have obvious features of the planned economy. These include urban–rural migration policy, and urban development guidelines (*Chengshi fazhan fangzhen*). The effects of these policies on urban development vary among different-tier cities, so they may exhibit diverse rates of economic development and characteristics of land expansion.

Bearing this context in mind, this paper divides all cities and towns of the study region (Beijing–Tianjin–Hebei Region) into three tiers, in terms of administrative divisions. Through this kind of city classification, it is easy to achieve the aims of the paper, which include better understanding of the conversion characteristics from arable to urban land of the BTH region, and probing some factors exerting influences on this land conversion of different-tier cities, such as land use policy and household registration. Of course, this paper also examines urban land growth and arable land loss of the region as a whole.

Study area and database

Study area

The study area is located in the northeastern coast of mainland China, which includes Beijing Municipality, Tianjin Municipality and Hebei Province (the BTH Region) (Fig. 1). Beijing and Tianjin are directly under the jurisdiction of the central government. Beijing is the capital and the second largest city of China, and the host city of the 2008 Olympic games. Tianjin is the third largest city and the second port city after Shanghai in China. This region has a long history of industrial and urban development, boasting the famous Jingjintang (Beijing Tianjin and Tangshan) Industrial Belt, and therefore the urban system of this region is more full-grown in China (Zhou, 1995).

The area of the BTH region is 214,900 km^2, accounting for 2.2% of the total of China. As one of the three

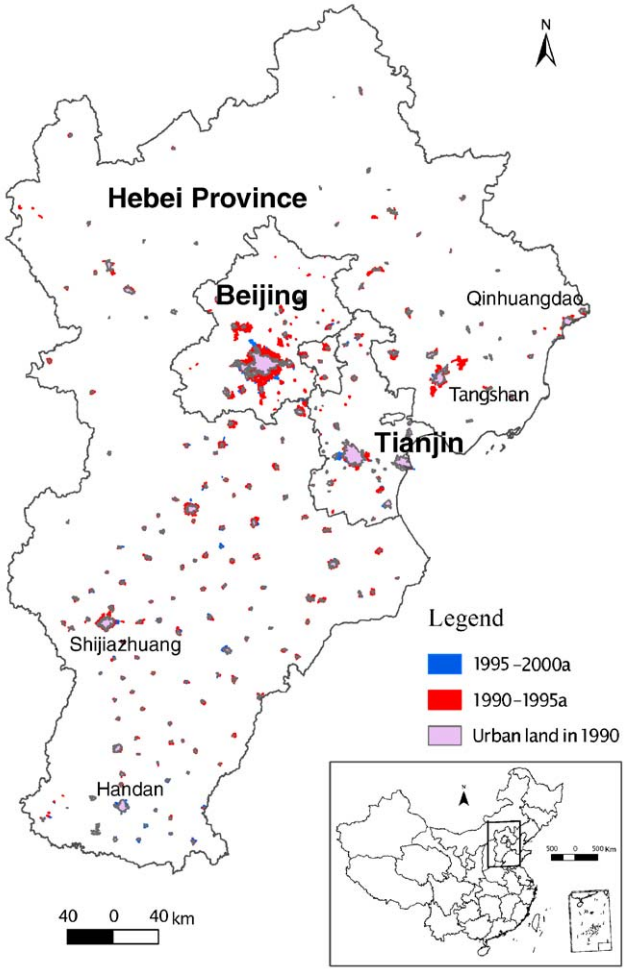

Fig. 1. Urban land expansion in the BTH region in different periods in the 1990s.