



Rural settlement land dynamic modes and policy implications in Beijing metropolitan region, China



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ABSTRACT

Rapid urbanization has transformed the landscape and function of rural areas in the periphery of the metropolitan regions of China. As a consequence of urbanization, more than 900,000 Chinese villages have disappeared during the past decade. However, the landscape patterns and factors driving rural-urban conversion have long been neglected. Using medium-resolution Landsat TM (Thematic Mapper) data for 1978, 1988, 2000, 2005, and 2008, and socio-economic data, the spatio-temporal dynamic patterns of rural settlements in the Beijing metropolitan region were analyzed. During the past 30 years, Beijing has experienced a 33.6% increase in rural settlement land and a 34.8% decline in its rural population. The amount of rural settlement land per capita has increased dramatically. Following urban expansion, the major source of rural settlement land was cropland. Three modes of edge-expansion, dispersion, and urban encroachment were distinguished to study the dynamic pattern of rural settlements. Edge-expansion was the most common development type, and the proportion of land areas experiencing this dynamic mode was highest during the rapid expansion of rural settlement land. Rural settlement land initially developed around urban land, and then expanded to peripheral regions and remote villages. The expansion of rural settlement land and urban encroachment tended to be concentrated within 3 km of the urban center, and extended around the new urban development zone (NUDZ). This study investigated the dynamic modes of rural settlements and the drivers of a digital elevation model (DEM), such as distance to cropland, water bodies, roads and the urban center in the Beijing metropolitan region. The distance to water bodies had more impact on rural settlement land expansion than the distance to cropland. Urban expansion was influenced more by the distance to a road than the expansion of rural settlement land. To assist in the integration of urban citizens and farmers, the central government has implemented the “harmonious society”, “building a new countryside”, “scientific development” and “neo-urbanization” policies. In the Beijing metropolitan region, a scientific process of rural development planning is fundamental to reconsolidate the rural settlement land.

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Introduction

In 2008, 7.21×10^8 people still lived in the rural areas of China, which accounted for 54.3% of the total population (National Statistics Bureau of People's Republic of China, 2009). The large size of this rural population means that one out of seven people on Earth is living in a rural settlement in China (Dumreicher, 2008). These residents live in basic administrative units including town governments, township governments, and village committees under county governments. There were 1.92×10^4 town governments and 1.5067×10^4 township

governments in 2008 and 6.401×10^5 village committees in 2006 (National Statistics Bureau of People's Republic of China, 2007, 2009). However, the number of villages has declined substantially during the past decade in China as a result of rapid urbanization (China News-week, Nov. 5, 2012). Many young adults in the rural regions have moved to the cities, leaving behind communities of old people and children. These villages are often referred to as “empty villages” or “hollowed villages” (Chen, Sun, & Liu, 2010; Liu, Liu, & Zhai, 2009). There is even some concern over who will produce grain for the Chinese people in the future. Some people have attempted to protect the traditional culture in the rural villages. The villages (*Nongcun*), agriculture (*Nongye*), and farmers (*Nongmin*) are of great importance to the sustainability of China. To decrease the gap between urban citizenship and farmers, the central government has implemented

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policies specifically referred to as “scientific development outlook”, “harmonious society”, “construction of new socialist countryside” and “neo-urbanization”. In 2003, the policy “scientific development outlook” was proposed at the third plenary session of the 16th Communist Party of China (CPC) national congress. The policy referred to balances in urban and rural development, regional development, economic and social development, harmonious development between humans and nature, and national development and foreign open policy. It required local governments not only to try to ensure economic development but also to implement rural development and sustainable development. In 2004, the Central Committee of the CPC proposed to build a “harmonious society”. This referred to the democratic and legal system, fairness and justice, honesty and friendship, a vibrant and dynamic society, safety and order, and harmony between humans and nature. It required the local government to ensure harmonious development between humans and the environment. In 2005, the fifth plenary session of the sixteenth CPC central committee proposed a plan to construct the “new socialist countryside”. This policy targeted product development, high standards of living, rural civilization, clean and tidy villages and democratic management. In 2012, Prime Minister Li Keqiang proposed the “neo-urbanization policy”. It emphasized the quality of urbanization and economized land and energy. The policy encouraged farm workers to migrate to cities and towns. The urbanization process should connect with agricultural modernization. The central government hoped to stimulate economic and social development and construct a harmonious society in the rural regions.

The major functions of rural settlements are living, farming, and forest production (Erickson, Ryan, & De Young, 2002). For a long time, most residents of rural China were farmers; however, the landscape and function of rural settlements in China has changed dramatically. In some regions farmers have become a minority because of rural-to-urban migration. Farmers are increasingly leaving the industry, and many have become temporary workers in cities. This functional transformation of rural settlements has resulted in a general decrease in the importance of the primary sector of farming within rural communities.

The development of rural settlement land has changed the rural environment dramatically. Land development has been limited by the availability of land property. Current land development patterns have been strongly influenced by past development patterns, agricultural suitability, transportation, natural amenities, and economic and recreational characteristics (Gude, Hansen, Rasker, & Maxwell, 2006). The localization of rural settlements has always been strongly dependent on natural resource exploitation (Domon, 2011). The proportion of homes built on highly productive soils has remained consistently high (Gude et al., 2006). Because of the influence of early settlement patterns, newer homes will continue to be built near productive soils and water.

As the capital of China, Beijing is the second-largest city in China, with a total metropolitan population of 16.95 million in 2008 (Beijing Statistics Bureau, 2009), accounting for 1.28% of the national population. Among this population, about 14.39 million people (84.9%) lived in urban areas and 2.56 million people lived (15.1%) in rural areas. The urban expansion and dynamic pattern of the Beijing metropolitan region have been studied extensively (He, Okada, Zhang, Shi, & Zhang, 2006; Qi et al, 2004). The rapid urbanization process has transformed the landscape and functions of Beijing. However, the patterns and driving factors of rural settlement dynamics have long been neglected (Tian, Yang, & Zhang, 2007).

This study considers the patterns and driving factors of rural settlement dynamics in the Beijing metropolitan region. Have rural settlements expanded or declined? What are the major dynamic modes of change in rural settlements? Which factors have

impacted on the dynamic modes of change in rural settlement? Our study will assist policy-makers in developing future land use policy for the Beijing metropolitan region.

China's rural policy and rural settlement dynamic modes

As a consequence of rapid economic and social development, China's gross domestic product (GDP) per capita reached US\$3405 in 2008 (NBSC 2009). However, the income gap between the rural and urban population has widened from 2.57 to 1 in 1978 to 2.81 to 1 in 2008 (NBSC 2009). This large gap between the income of rural and urban residents has resulted in the immigration of farmers into urban areas. Young adults have immigrated into the urban areas from rural regions. To decrease the income gap and increase social stability, the central government has implemented the “scientific development outlook”, “harmonious society”, “construction of new socialist countryside”, and “neo-urbanization” policies. The central government anticipates that industries will support agriculture and cities will support the rural areas.

After 1978, the rural areas were transformed dramatically in the Beijing metropolitan region. Rapid economic and social development changed the rural landscape. With the immigration of farmers into urban areas, the rural landscape has also been dramatically transformed.

Although there have been studies made of the different types of urban expansion, very few have considered rural settlement dynamics (Tian, Jiang, Yang, & Zhang, 2011; Tian et al., 2005; Tian, Liu, & Zhang, 2002; Tian, Qiao, & Zhang, 2012; Tian, Wu, Ouyang, & Quan, 2011; Tian, Yang, & Xie, 2007; Tian, Yang, & Zhang, 2007). There are three basic modes of urban expansion, i.e., infilling, edge expansion, and spontaneous or outlying growth (Berling-Wolff & Wu 2004; Liu, Li, Chen, & et al, 2010; Xu et al., 2007). Other types of urban growth are recognized, such as linear development, large-scale projects, and clustered branches (Camagni, Gibelli, & Rigamonti, 2002; Wilson, Hurd, Civco, Prisløe, & Arnold, 2002). Linear development can be defined as a road-influenced form of urban expansion, and clustered branches can be defined as the formation of rural settlements.

Very few infilling and large-scale project modes of urban expansion have occurred in the rural settlement dynamics of China. We defined three modes of rural settlement dynamics that were important in China, i.e., edge-expansion, dispersion, and urban encroachment (Fig. 1). Edge-expansion is defined as a new patch of urban land, spreading in parallel strips from an edge (Forman, 1995) (Fig. 1a). If a new patch is isolated from an old patch, then the situation is defined as *dispersion* expansion (Fig. 1b). Urban encroachment is the conversion of a rural settlement into urban land (Fig. 1c). The rapid expansion of Chinese cities has resulted in the encroachment of urban land into surrounding villages (Liu et al., 2010). Of the three modes, edge-expansion is considered to be the most compact mode of rural settlement expansion. Dispersion is considered to be a diffusion pattern of rural settlement expansion. Urban encroachment is considered to encompass both urban expansion and rural reduction. It indicates that the urbanization process is ongoing.

The three modes have been used to study the spatial and temporal dynamics of rural settlement land. We study the impact of rural land policies on land use.

Study area, data sources, and methodology

Study area

Beijing, the capital of China covers an area of 16,808 km². Since 1949, the city has been the national capital of the People's Republic of China. Two thirds of the Beijing metropolitan area is composed of

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