



Spatial and temporal change in urban-rural land use transformation at village scale—A case study of Xuanhua district, North China



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ARTICLE INFO

Article history:

Received 26 October 2015

Received in revised form

1 July 2016

Accepted 4 July 2016

Available online 15 July 2016

Keywords:

Land use transformation
Urban-rural transformation
Land use
Urbanization
China

ABSTRACT

This paper aims to investigate the spatial patterns, temporal processes and driving mechanisms of urban-rural land use transformation (URLUT). Empirical study of Xuanhua district of Hebei province from 1996 to 2012 showed that urban-rural land use transformation index (URLUTI) decreased linearly with increasing distance to central downtown (DCD), and the gap between central and edge areas increased during 1996–2012. Spatial autocorrelation showed an accelerating clustered pattern, and the hot spots shifted from decentralization to centralization and then back to decentralization. Industrialization and urbanization were the basic driving factors of URLUT, and local, regional and national social and economic transformation deeply and widely affected its development. The study highlights that the regional development should implement correct urban-rural transformation strategy and plan according to its location and nature resources conditions, and obey the spatial laws of urban-rural transformation for improving the efficiency of land use and promoting urban-rural integration. Furthermore, the government's intervention to economic development should be reduced and let the market play more roles in the allocation of resources.

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1. Introduction

Since the enactment of social and economic reforms in 1978, China has experienced dramatic and rapid development as urbanization levels increased from 17.9% in 1978 to 52.6% in 2012. If the current trend holds, China's urban population could reach one billion in the next two decades (Bai et al., 2014). In 1996, at the beginning of the Ninth Five-Year Plan, the Chinese government proposed urbanization as an important way to solve “Three Agriculture-related Issues” including issues of farmer, agriculture and countryside. Thus, the average annual urbanization rate remained 1.37% from 1996 to 2013 (Zhou, 2006). During this period, Chinese urbanization entered a rapid development stage that caused a series of social, economic and environmental problems. These problems include a faster urbanization rate of land than of population (Lu, 2007), the over-consumption of ecological

resources (Yao et al., 2011, 2012), the depopulation of rural areas (Li et al., 2014; Liu, 2007), hollowed villages (Liu et al., 2010; Long et al., 2009), and the decline of rural economic, industrial, and environmental conditions (Li et al., 2015; Liu et al., 2014a). To slow and eliminate these problems, the Chinese government promulgated the “National New Urbanization Plan (2014–2020)” to transform the urbanization model (Lu and Chen, 2015; Yao et al., 2014). This was the first specialized urbanization plan at the national level (Liu et al., 2014b).

Under this background, urban-rural development transformation (URDT) was proposed to coordinate industrialization, urbanization, information and agriculture modernization. URDT is a comprehensive human process of complex interactions between urban and rural areas, and it was supposed to be of great importance in promoting the new national urbanization plan and coordinating urban-rural development (Liu and Yang, 2015). Urban-rural land use transformation (URLUT), however, plays the most important role in URDT, as land resources are the physical basis of social and economic development (Liu et al., 2008). URLUT is a dynamic processes of land use morphology accompanied with social and economic reforms (Grainger, 1995; Long, 2012). It is also an important research approach for the study of Land Use and Land

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Cover Change (LUCC) (Long, 2006), which was proposed by the International Geosphere–Biosphere Program (IGBP) and the International Human Dimensions Program on Global Environment Change (IHDP) in 1995. From then on LUCC has been becoming an advanced international subject related to integrated application of geographic research (Global Land Project, 2005). Grainger first proposed the URLUT in research on national forest land use morphology (Grainger, 1986, 1995), URLUT research has been extended across China and substantial achievements were made. These studies mainly focused on the theory (Long, 2006) and empirical research of URLUT (Liu and Yang, 2015; Liu et al., 2014b), and also consideration of integrated studies of URDT (Liu and Yang, 2015; Liu et al., 2014b), land use consolidation (Long, 2003), and rural development transformation (Li and Long, 2014; Long, 2012, 2013).

As URLUT reflects the spatial results of human' social and economic activities, and county/district was the most basic unit of social and economic organization, county/district scale spatial patterns and temporal processes of URLUT can be used to reveal Chinese urbanization, urban-rural development transformation, and sustainability development. Thus, this paper aims to answer these questions through a case study: what are the spatial patterns and temporal processes of URLUT at county/district scale? How do local and regional social and economic development affect county/district URLUT? Taking the Xuanhua district as an example, this paper analyzes the spatial patterns, temporal processes, and driving mechanisms of URLUT at village scale. This paper firstly reviewed the theoretical and practical background of URLUT, then a section related to details of study area, data, and methods followed; finally, in the sections of results discussion and conclusion, the analytical outcomes presented in four sub-sections including spatial pattern evolution, spatial distribution rules, spatial autocorrelation and spatial clustering, and in the section of driving factors analysis, the drivers of URLUT evaluated.

2. Research basis: urbanization and urban-rural transformation in China

2.1. Urbanization in China

Chinese urbanization has been lagged behind industrialization in the past decades, as the government cherish and protect urban other than despise it. For one thing, the number of urban people was rigidly restricted by implementing household registration system; for another thing, the central planning development and state-led industrialization model caused city industrialization tendency, and the mutual linkages between industrialization and urbanization was greatly restrained (Wang et al., 2016).

As the enlarged gap between industrialization and urbanization endangered the social development and stability, the Chinese government implemented the social and economic reforms in 1978. Cities opened the accesses to the rural areas and the world. Then, Chinese urbanization experienced a rapid development stage, and catch up with the industrialization pace.

The remained restraints on urbanization has been slowed down the cities' development pace, even though some reforms have been implemented. Chinese urbanization faced serious issues like food security (Yang et al., 2000), urban sprawl (Jiang et al., 2016), open space loss (McDonald et al., 2010), and environmental degradation (Stern et al., 1996). Meanwhile, this urbanization process also caused rural migration (Liu and Liu, 2010; Liu et al., 2010), hollowed villages (Liu et al., 2010), arable land fallow (Long et al., 2009), socio-economical declined (Li et al., 2015) in wide rural areas. These urban and rural problems desiderate to be solved by implementing new urbanization policies and development model, and finally

break the urban and rural dual structure and integrate urban and rural development.

2.2. Urban-rural transformation

For a long time in history, urban and rural were treated as two separated issues with little consideration of their interrelations (Roberts, 1978). Mutual linkages, however, do exist between urban and rural areas, trough flows of people, capital, technology and information (Tacoli, 1998). Neoliberalism, based on free market, free trade, and personal property, prevailing in developing countries, however, broke the isolation between urban and rural areas, and encouraged industrialization and urbanization (White, 1988). In this process, urban and rural areas transformed to be closely connecting systematic components.

Just like the household registration system prevented country people turning to urban residents, China has for a long time maintained the urban-rural dual structure by implementing urban biased policies (Li et al., 2014). As the enlarged urban-rural disparities affecting the social and economic development and stability, the Chinese government started to promote rural development and loosen barriers between urban and rural areas.

Under this background, China has been undergoing dramatic urban rural transformation in the past 30 years, such as increasing agricultural productivity, migration of rural labor, rapid industrialization and urbanization. On the one hand, cities grew rapidly by drawing rural labors and raw materials; on the other hand, rural areas provided wide spaces for the fast increasing urban capital. Finally, self-organization processes established positive feedbacks between urban and rural areas, and gradually approach the integration status.

3. Materials and methods

3.1. Study area

Xuanhua is one of the municipal districts of Zhangjiakou city, Hebei province of Northern China. It is 28 km away to southeast of downtown Zhangjiakou. Yingshan Mountain is located to the north of downtown Xuanhua, and the Yanghe River is located to the south. Xuanhua includes the townships of Hexizi, Chunguang, and Houjiamiao, along with the town-level enclave of Pangjiabao. Major roads including G6, G110, Zhangxuan Road, Zhonglou Avenue, and Xuanfu Avenue cross Xuanhua district from southeast to northwest, while the Liuchuan River divides the district into two parts at the western margin of the downtown area (Fig. 1). In 2012, the urbanized area was 38.61 km², and the cultivated land area was 44.88 km², accounting for 13.9% and 16.2% of the total area, respectively. That same year, the urban population was 0.34 million, which accounted for 90.16% of its total resident population. Primary, secondary and tertiary industries, respectively, produced 0.29 billion, 8.5 billion and 5.59 billion in 2012, accounting for 2%, 59.2%, and 38.8% of the gross domestic product (GDP), respectively. The per capita GDP, the per capita annual income in cities and towns, and the per capita net income of rural residents in Xuanhua were 38495 yuan, 19744 yuan and 7850 yuan, respectively.

Xuanhua District, located in the northwest of the Beijing-Tianjin-Hebei Metropolitan Region, is an important component of the Capital Economic Circle and plays a supporting role in the development of the Bohai Rim Region. Xuanhua district is a critical pivot of the regional location, 150 km east of Chinese capital Beijing, 247 km east of the Tianjin New Port, 180 km west of the "coal sea" city Datong in Shanxi province, and 169 km north of the land port city Jining in Neimenggu province. As a result, Xuanhua district connected Chinese east coastal economical city agglomeration and

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