

Urban spatial development and land use in Beijing: Implications from London's experiences

TAN Minghong¹, GUY M. Robinson², LI Xiubin¹

1. Institute of Geographic Science and Natural Resources Research, CAS, Beijing 100101, China;
2. Centre for Rural Health & Community Development, University of South Australia, 111 Nicolson Avenue, Whyalla Norrie, South Australia 5608, Australia

Abstract: Beijing is facing a huge challenge to manage the growth of its built-up area whilst also retaining both productive arable land and land for conservation purposes in order to simultaneously realize the three aims of economic development, protecting arable land and generating environmental improvements. Meanwhile, London, as a world city with more than 200 years of industrialization and urbanization, has accumulated rich theoretical and practical experiences for land use planning in a major urban area, such as the creation of Garden Cities, a designated Green Belt and New Towns. This paper firstly analyzes the main characteristics of the spatial distribution of the built-up area, arable land and conservation land in Beijing. Then, some of the key aspects of urban fringe planning in the London region are examined. Lastly, several implications from the experience of London are provided with respect to land-use planning for Beijing, concentrating on a re-appraisal of land-use functions around Beijing, measures to improve the green belt, the development of small towns to house rural-urban migrants and urban overspill, and effective implementation of land-use planning.

Keywords: Beijing; London; land-use planning; Green Belt; New Towns

1 Introduction

Urbanization is one of the main driving forces of land use change in metropolitan regions in the developing countries. With city size increasing, a number of distinctive socio-economic and ecological problems have been produced, such as transportation congestion, environmental pollution and housing shortages (Alig *et al.*, 2004; Portnov and Pearlmutter, 1999; Weber and Puissant, 2003). These problems spur land demand through redevelopment of city centres, suburbanization and urban sprawl, as more residents seek better housing conditions and more living space. As a result, nearly every large city in the world is facing the problem of how to strike a balance between urban growth and protection of rural environments.

During the last 30 years, China has witnessed very rapid economic growth and dramatic

Received: 2010-02-03 **Accepted:** 2010-08-25

Foundation: National Natural Science Foundation of China, No.40971112; No.40971062

Author: Tan Minghong (1970–), Ph.D and Associate Professor, specialized in the study on land use and urban development.
E-mail: tanmh@igsnr.ac.cn

urbanization (Jiang *et al.*, 2010). Moreover, in the next 20–30 years, urbanization is likely to maintain a high rate. Urbanization and industrialization have resulted in remarkable land use changes, which can be characterized by the growth of the built-up area and losses of farmland and land reserved for recreation and conservation (Cai, 2000; Liu *et al.*, 2003; Tan *et al.*, 2005; Long *et al.*, 2007).

As China attempts to feed its 1.3 billion residents largely from its own resources, halting the loss of farmland to stabilize domestic food supply has been government policy for many years and especially since the 1990s. In 1994, *Basic Farmland¹ Protection Regulations* were promulgated by the State Council of the People's Republic of China, which emphasised that governments at the county level should guarantee a total quantity dynamic equilibrium of basic farmland (TQDEBF). The Land Administration Law of the People's Republic of China of 2004 requires that the 'People's governments of all provinces, autonomous regions and municipalities should strictly implement the general plans for the utilization of land and annual plans for land use, and adopt measures to ensure no reduction of the total amount of cultivated land within their jurisdictions.'

Furthermore, the growing concern about environmental problems and demands for conservation land also exert huge pressures on arable land. Implementation of the government's policy of 'green for grain' from 1998 onwards (Wang *et al.*, 2007) has led to massive land conversion from arable land into forest or grassland. Thus, the conflicts between growth of the built-up area, arable land protection, and demand for increase of conservation land are getting increasingly acute.

Beijing is the capital of China and the economic centre of North China. Its GDP increased about three-fold and the permanent population rose from 8.7 million to about 15.4 million from 1978 to 2006 (BSIN, 2008; Wu *et al.*, 2006). Consequently, Beijing has incurred more and more socio-economic and environmental problems related to land use (Hu and David, 2001; Wu, 2000). Firstly, housing prices are rising quickly, due to increasing demand for living space and massive rural-urban migration resulting from rapid urbanization. Secondly, built-up areas are expanding quickly at the expense of conservation land and arable land, especially owing to rapid growth of industrial land in rural areas and construction of many new economic development zones (*kaifa qu*). Thirdly, other urban problems are serious in the city due to the large city size and high urban population density, such as congestion and shortage of green land per capita.

To solve its own urban problems, the United Kingdom (UK) has accumulated rich theoretical and practical experiences. After World War II, London was also facing similar problems to those of Beijing today, such as a booming demand for housing, a need for farmland protection, rising urban pollution and deteriorating quality of the rural environment (Grayson, 1990). The main solution to these problems has been to check the sprawl of large built-up areas, to protect the surrounding countryside and to house urban overspill and rural migration through developing a series of planning initiatives, such as Green Belts and New Towns (Meller, 1997). These solutions may possess some policy implications for Beijing's urban planning and land use.

Based on studying the urban growth process of the London Metropolitan Area related to land use and analyzing the features of current land use in Beijing, this study attempts to pro-

¹ Basic Farmland mainly refers to the fertile arable land used for food, cotton and oil production.

vide some implications for Beijing's land use from London's experience. After the introduction, the paper introduces the Beijing study area and relevant data, before the features and problems of present-day land use in the Beijing region are analyzed, focusing on the spatial distribution of the built-up area, arable land and conservation land. Next development processes in the London region are discussed in relation to land use, paying attention to the roles of Green Belt, New Towns and the long-established towns and villages in the processes of urban development and land use change. Lastly, several implications which may be helpful for land-use planning for Beijing are examined.

2 Study area and data

The study area in Beijing refers to the Beijing Municipality (simply called Beijing subsequently) (Figure 1), which is a provincial administrative unit with 18 districts/counties. In the Municipality, the areas of mountain and plain are 9071 km² and 6361 km² respectively. According to the Fifth Census of China in 2000 the total numbers of residents were 13.56 million (excluding an estimated 1.7 million 'floating' population living in urban areas for less than six months a year).

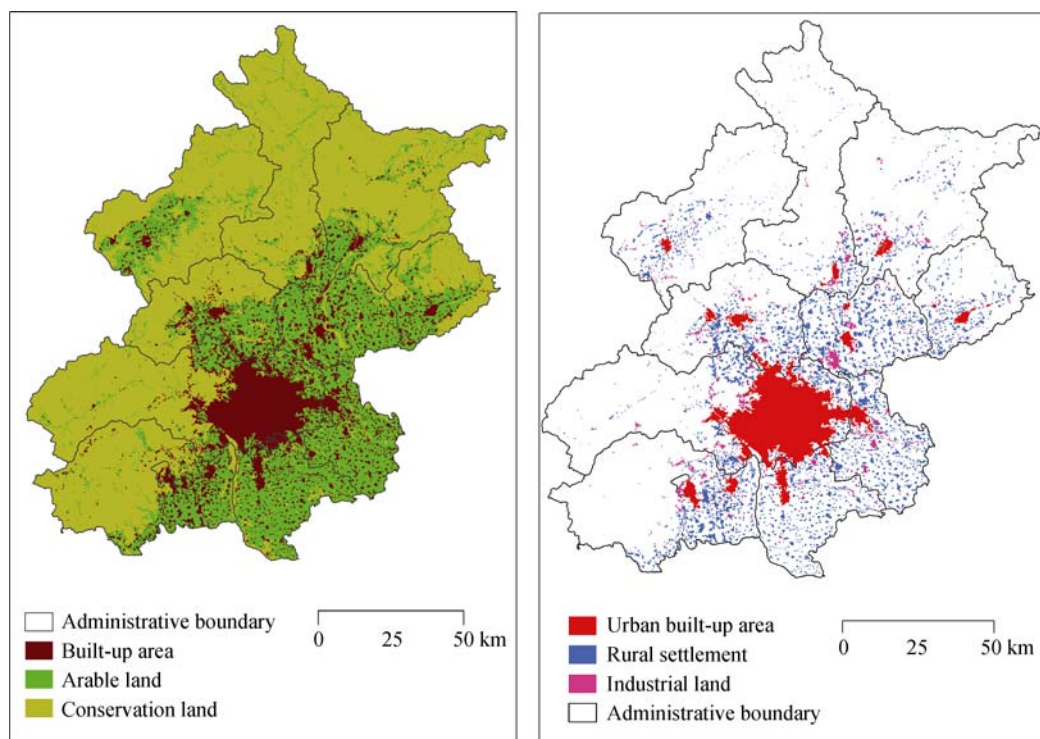


Figure 1 Spatial distribution of main land use types in Beijing in 2000

Source: Data Center for Resources and Environmental Sciences (CRES), Chinese Academy of Sciences (CAS). Conservation land includes forest and grassland, water and non-use land. And built-up area refers to residential area and land for stand-alone industrial and mining sites.

This study utilises the 1:100,000 digital land-use map of Beijing in 2000 obtained from CRES, CAS, which is based on the Landsat Thematic Mapper (TM) remotely sensed data of 2000. The original map recognises various categories of land use: arable land, forest, grass-

land, residential area and land for stand-alone industrial and mining sites, water, and unused land.

One of the important reasons for using Beijing's land use data of 2000 is that the fifth population census of China was also taken in this year. Based on these data, further studies can be developed, such as calculating the amount of arable land per capita, and urban land per capita. Another reason is that the most recent population census in the UK was finished in 2001, and so near-contemporaneous population data can be used to make a comparative study between London and Beijing.

In this study the 'Metropolitan Area' of London refers to Greater London plus counties adjacent to the Metropolitan Green Belt (see Figure 2). The Metropolitan Area covers 6279 square miles (about 16,262 km²), and in 2001, the population was 13.95 million (Wendell Cox, 2008).

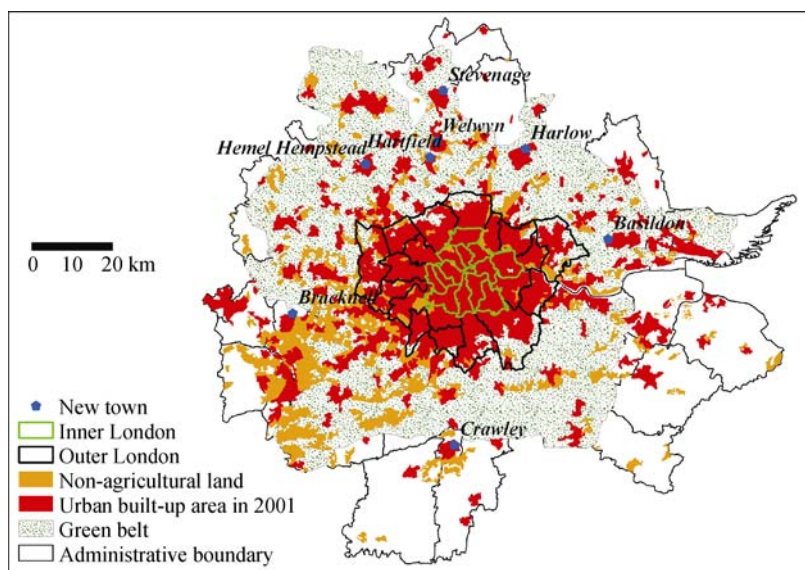


Figure 2 Main land use types and new towns in London's Metropolitan Area

Note: Non-agricultural land refers to 'Soft' uses where most of the land could be returned relatively easily to agriculture, including golf courses and private parkland. Urban land refers to 'Built-up' or 'Hard' uses with relatively little potential for a return to agriculture, including housing, industry, commerce, education, transport, religious buildings, and where it is unfit for all forms of agricultural production (EFRA, 1988).

The data on London's urban land in 2001 is taken from Magic, an Internet source. Urban land refers to areas of built-up land with an associated population of 1000 and a minimum area of 20 hectares and is extracted from the Ordnance Survey 1:10,000 scale maps, as at 1st April 2001. The map of the Green Belt was provided by the Department of Communities and Local Governments (DCLG, 2006) (Figure 2).

3 Land use in Beijing

In Beijing, conservation land is concentrated in mountainous areas in the city's hinterland, while rural settlements, urban built-up areas and arable land are mainly distributed in the plains (Figure 1).

Like the rest of China, one of major challenges that Beijing is now facing is how to allo-

cate arable land, built-up area and conservation land, in order to simultaneously realize the three aims of economic development, environmental improvement, and arable land protection (Figure 3). In particular, in order to realize the total quantity equilibrium of basic farmland, Beijing has to reclaim new arable land in some ecologically fragile areas (for instance, in mountain areas and wet lands), because some farmland is being converted into forest and grassland due to the grain for green policy in other ecologically fragile areas. In the plains farmland is being lost to built-up areas due to industrialization and urbanization.

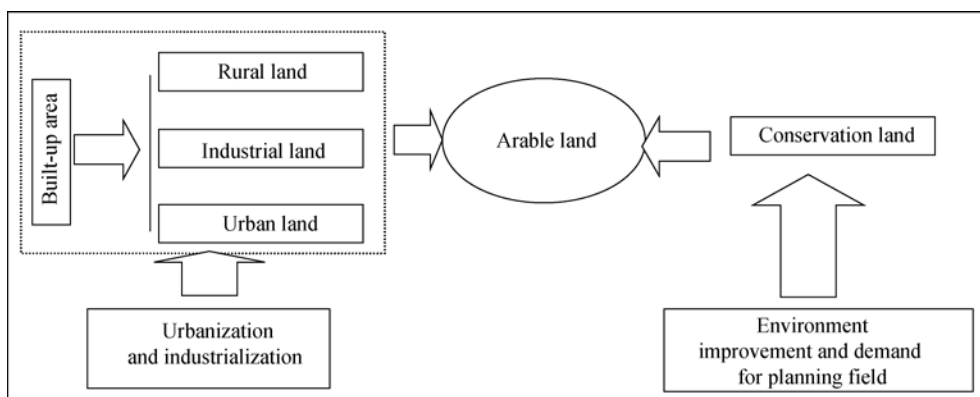


Figure 3 Land use conflicts in Beijing

3.1 Built-up area

Based on the discussion above, three types of land use are analyzed herewith: the built-up area, arable land and conservation land (Figure 1). The built-up areas include three subclasses of land use, i.e. urban land, rural settlement and industrial land (Figure 1). Here, rural settlement includes farmers' residential land and nearby rural industrial land, whilst industrial land refers to stand-alone industrial and mining land.

Rural settlement growth

In 2000, 77% of the population lived in urban areas, but there were still 3.06 million rural residents who lived in rural areas in Beijing. The area of rural settlement land was 843 km², which represented 13.2% of the area of the plains. The settlement area per capita was 275 m² and on average each rural settlement consisted of about 1200 persons. According to the 2000 Census, household size was around 2.9 persons in Beijing, so each rural settlement comprised about 414 households. In sum, most of rural settlements had quite a large population (>1000 inhabitants) and these settlements were dispersed across the plains (Tan *et al.*, 2007).

Urban built-up area

In 2000, Beijing's urban land covered 1028 km², which represented 16.2% of the area of the plains and the urban population was 10.5 million (PCOTS, 2002), with a very high urban population density (more than 10,000/km²), excluding the floating population who lived in Beijing less than six months a year.

Industrial land

The area of industrial land was 316 km². In the plains, industrial land, together with urban built-up areas, encroaches on arable land and conservation land. In the mountain areas, industrial activities, especially mining, destroy the original land cover, which quickly results in some environmental problems, such as soil erosion, landslips and debris flows. Moreover,

industrial land is expanding quickly. For instance, for different kinds of new development zone (*Kaifa Qu*), such as industrial parks (*Gongye Yuan*), high-technology zones, and economic development zones, the total planning area of industrial land was 346 km², only 122 km² of which had completed land development by 2006, with the rest waiting for exploitation in the near future (BSIN, 2008).

In addition, industrial land near to rural settlements is defined as a part of the rural settlement. So, industrial land cannot be shown simply in the sub-class of industrial land in Figure 1. In recent years, many enterprises have been attracted into Beijing's rural areas in the pursuit of lower land rents. In 2006, the number of rural enterprises was approaching 158,000, and the number of employees had reached about 1.4 million. However, due to lack of strong planning controls (Lin and Li, 2007), rural industrial land is growing rapidly at the expense of farmland.

3.2 Arable land

In Beijing, arable land per capita is very low. In 2000, the area under arable land was 4566 km², and arable land per farm household was only 0.43 ha. The individual parcels of arable land are very small, firstly because arable land is divided into small parcels by urban land expansion, building development zones, and construction of transportation infrastructure. Secondly, the household responsibility system requires the committee of any administrative village (*Xingzheng Cun*) to divide arable land according to household size. This leads to land fragmentation, which decreases the efficiency of farming operations and causes low labour productivity.

3.3 Conservation land

The mountain areas in the northern and western parts of the city region are zoned as Beijing's ecology belt according to Beijing's Urban Master Plan for 2004–2020. However, conservation land is being destroyed by the process of farmland reclamation, and some industrial activities including mining and quarrying.

In the plains, some land has been zoned as Green Belt, which covers about 993 km² (Figure 4). However, the Green Belt has been seriously encroached on by the expansion of the built-up area. By 2000, between 25% and 40% of the Green Belt had become built-up area (depending on the source consulted) (Ouyang *et al.*, 2005).

4 Land use for London

4.1 London's development process in terms of land use

London has a long history of industrialization and urbanization. By the 1850s, a cheap public transportation system, including railways, trams and buses had been constructed, which fostered decentralization and development with a lower population density than before, especially with the advent of the underground system later in the century (Clout, 1986; Levinson, 2008). From 1914 to 1939, the built-up area expanded threefold, while the population grew from 6.5 to 8.5 million (Ratcliffe, 1989).

In the aftermath of World War II, a large number of industrial activities were developed across the London region (Manners, 1986). At the same time, housing shortages continued to

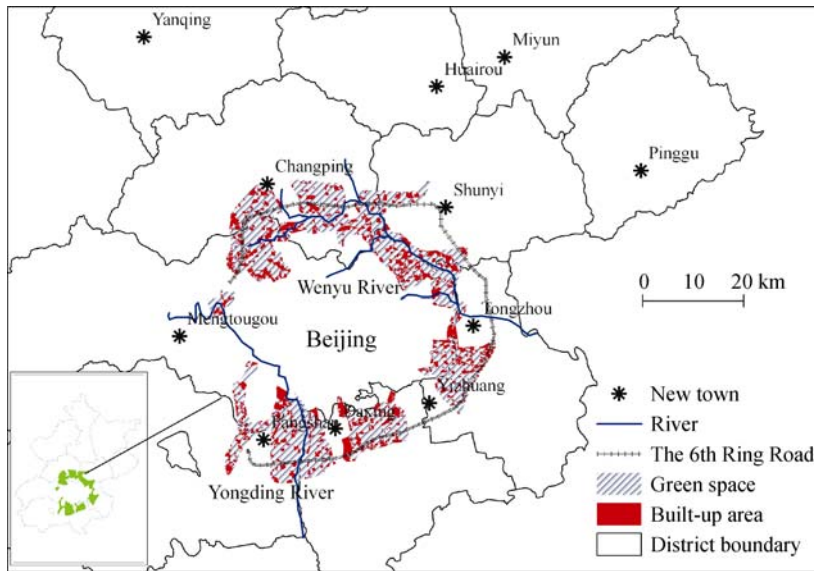


Figure 4 The location of new cities and Green Belt in Beijing’s Urban Master Plan for 2004–2020
 Note: The map is drawn according to the Master Plan for 2004–2020

be acute due to war-time damage and increasing population in the Metropolitan Area. In 1951, there was an excess of households over dwellings in the London conurbation of about 350,000 (Thomas, 1970). Moreover, the government felt it was very important to ensure national food supplies by expanding agricultural output (Robinson, 1988). Like present-day Beijing, it was also necessary for London to strike a balance between farmland protection and increase in the built-up area to accommodate the growing population (Figure 5). In addition, protection of green space was deemed important for securing public access to the countryside and avoiding serious environmental problems.

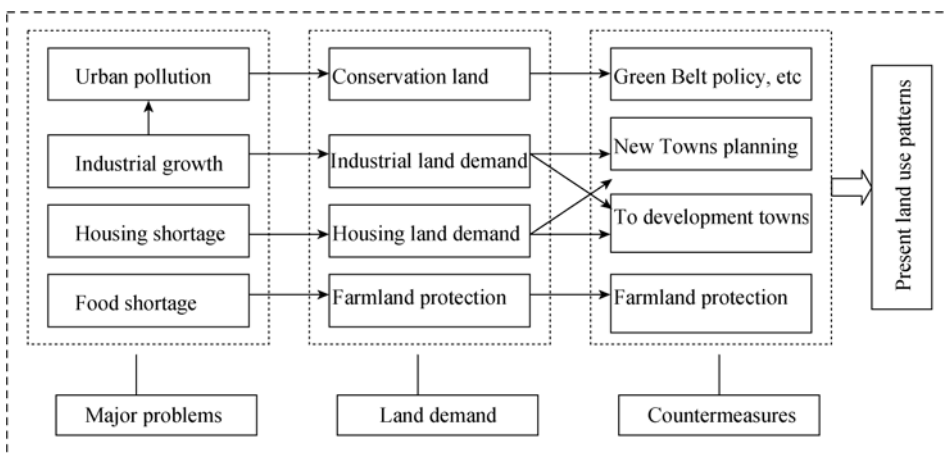


Figure 5 Land demands and the countermeasures in London Metropolitan Area after 1945

In order to contain the physical expansion of large built-up areas and to protect the rural environment, a series of planning acts were implemented in the early post-war period, such as the Town and Country Planning Acts, the Distribution of Industry Acts, and the National Parks and Access to Countryside Act (Figure 5) (Clout, 1986; Manners, 1986). Among the

Acts, the most famous is the 1947 Town and Country Planning Act, which introduced development control by making development subject to planning permission and instituting a statutory planning system (Cullingworth, 1969). As a part of new legislation, the policies of Green Belt designation and New Town planning were put forward, which have imposed further effects on the land use pattern of London's rural-urban fringe.

4.2 New town development

The creation of new towns has been the very pinnacle of what modern planning could achieve on the behalf of the people (Meller, 1997). In 1946, the New Towns Act provided the legislative framework for new town development, ultimately producing 32 new towns throughout the UK, eight of which are in the vicinity of London (Figure 2) (Wannop, 1999).

The objectives of building new towns include: to be self-contained, to house urban over-spill, and to absorb rural and urban population and secondary industry (Ratcliffe, 1989). Around London, eight new towns were initiated between 1946 and 1949 to house urban overspill from the metropolis (Table 1). In 2001, the total population of the eight new towns was about 7.5% of Greater London and approached 599 900, well above the initial target of 380,000 (Table 1). Some new towns have formed a special character. For instance, Bracknell has been successful in attracting high-tech industries and become home to companies such as Panasonic, Fujitsu, Dell and Hewlett-Packard.

Table 1 New towns in London and their population (1000)

Year	New town name	2001 population	Population in year of designation	Initial target	Ratio of 2001 population and initial target
1947	Crawley	100.5	9.1	60	1.7
1946	Stevenage	81.5	6.7	50	1.6
1947	Harlow	88.3	4.5	60	1.5
1947	Hemel Hempstead	83.1	21	60	1.4
1948	Hatfield	32.3	8.5	25	1.3
1948	Welwyn Garden City	43.5	18.5	50	0.9
1949	Basildon	99.9	25	50	2
1949	Bracknell	70.8	5.2	25	2.8
	Total	599.9	98.5	380	1.6

Note: Data are from (Clapson, 1998; Wannop, 1999) and the Census of British in 2001

4.3 Green Belt

In the UK, "the Green Belt policy was first introduced nationally in 1955, with the production of amended advice in 1957, 1984 and 1988" (Elson, 1993). After developing for more than 50 years, the Green Belt policy has held an important position within city planning and gained widespread support (Munton, 1983). The objectives of the Green Belt are diverse: 1) to check the unrestricted sprawl of large built-up areas; 2) to safeguard the surrounding countryside from further encroachment; 3) to prevent neighbouring towns from merging into each other; 4) to preserve the special character of historic towns; and 5) (added in the mid-1980s) to assist in urban regeneration (Elson, 1986; Ratcliffe, 1989). Of course, these objectives have been adjusted within the particular development context. And Green Belt boundaries have also been altered over time, e.g. to accommodate the building of new mo-

torways and the expansion of London Heathrow Airport.

The Green Belt is currently facing major challenges, because there are various conflicting demands for land, including urban sprawl, industrial development and housing demand, and there is a complex and fragmented pattern of land ownership and occupation (Munton, 1983). All these make it more difficult to implement Green Belt planning. But, as a whole, the objectives of protecting farmland and shaping urban expansion have been met during the last 50 years in the Metropolitan Area. In London's Green Belt, the built-up area, from 1947 to 1969, only increased by 2.51% of the total area (Munton, 1983; 1986).

In addition, some people think the policy has some negative effects on urban economic development (RSA, 1989). One of the typical criticisms is that it is too rigid to face new urban and environmental challenges. As a result, urban development tends to leapfrog over the Green Belt, which has been linked to higher car use and longer car journeys. Another is that it has prevented development in the rural-urban fringe that would have helped to tackle the chronic shortage of housing in the London region (Amati and Yokohari, 2006). Even so, many people believe that it is the very stability and durability of the Green Belt that explains why this planning measure retains public confidence and support (Gallent *et al.*, 2006).

The Green Belt policy has a close relationship with the creation of new towns and the development of planning in general. Both the creation of Green Belts and the establishment of new towns essentially represent parts of a single design (Hardy, 1991), which is used to shape the expansion of cities on a regional or sub-regional scale, and not just an attempt to combat the forces of growth, and which have allowed the worst excesses of scattered development to be avoided (Elson, 1993).

4.4 The established towns and villages

From 1891 to 2001, population in the counties adjacent to the Green Belt increased from 0.6 million to 6.8 million (Balchin, 1999). And from 1951 to 2001, population in the metropolitan zone increased by 2.9 million. The established towns or villages housed about 2.4 million new population, while the eight new towns only housed about 0.5 million (Figure 6). Likewise, of the 140 000 who moved from the conurbation of Merseyside between 1966 and 1971, only 11.4% moved to new towns (Wannop, 1999). Hence, compared with new towns,

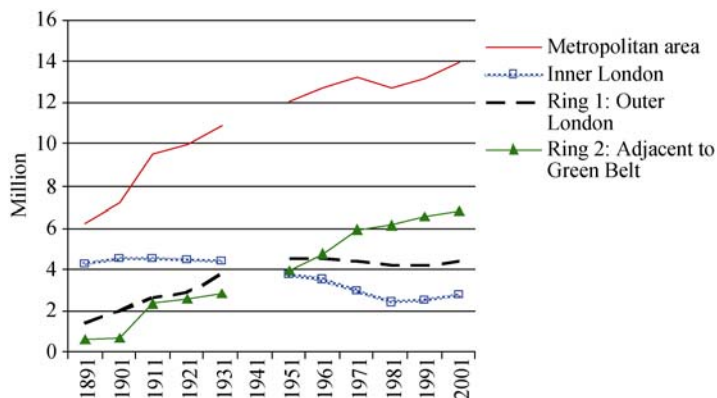


Figure 6 Population changes in different parts in London Metropolitan Area, 1891–2001

Note: Adjacent to Green Belt county populations include outer London population before the creation of GLA (the Greater London Authority) (first evident in the 1971 census). Data are from (Demographia, 2008)

the established towns and villages have played a more important role in housing overspill. However, the significance of the established towns and villages in providing housing and various economic functions is often ignored by policy-makers and planners. One of the reasons is these towns and villages cannot mark the achievement of government or planners as obviously as new towns (Greed, 1996).

4.5 Present land use for London

In the Metropolitan Area, urban land occupied 17.9% of the surface area in 2001. Overall, urban land 'patches' are more regular compared with Beijing (Figure 2). Greater London covers an area of 1645 km², about 80% of which was urban built-up area in 2001. Industrial land is largely excluded from the Green Belt, and mainly distributed in particular adjacent towns.

In the whole Metropolitan Area, urban population density was 868 persons/km² in 2001 (Wendell Cox, 2008), which is much lower than that of the plains of Beijing. From inner to outer London, population densities decrease. In 2001, they were 9156, 3414, and 468 persons/km² respectively in inner London, outer London, and adjacent to the Green Belt.

5 Implications from London

Because of vast differences between the two countries, such as social and political systems, cultural backgrounds, economic levels and natural environments, it is not the aim of this study to make an absolute comparison between Beijing and London. Rather, the main aim of this paper is to obtain several implications for Beijing's land use from the process of land use development and planning in the London Metropolitan Area.

5.1 Re-appraisal of land functions around Beijing

In Beijing, expansions of built-up areas encroach on arable land, especially rural industrial land, economic development zones and office buildings for government and public units (*Shiye danwei*). In order to finish the task of total quantity equilibrium of arable land, local authorities have to reclaim land in some environmentally fragile regions. However, with the worsening environmental problems, reclamation must be forbidden. So, it will be impossible to realize the aim of total quantity equilibrium of basic farmland, due to the vast land demand for housing, commerce and industry and conservation land.

In the UK, farmland is an important component of the Green Belt because farmland has a similar function to other green land in environmental protection. Moreover, because the vital need is for open space that urban residents use for recreation and amenity (Whyte, 1968), to develop some farmland for recreational use has become one of the important choices of farmers around London while the most productive land (Land Use Capability Grades 1 and 2 and Sub-grade 3a) is more strictly protected (EFRA, 1988). Especially since the mid-1980s, various measures have been taken to curb production growth to prevent costs associated with food storage and disposal as part of reforms to the EU's Common Agricultural Policy (Lowe *et al.*, 2002). This has encouraged farmers to leave some fields fallow and some limited conversion of arable land into forest or grassland.

For Beijing and other larger metropolitan areas in China, is it necessary to persist with the

strict basic farmland protection policy of TQDEBF? It may be appropriate to convert some arable land in fragile areas into forest or grassland, which can provide not only some recreational space for the urban population, but will also improve the urban environment.

5.2 To improve the Green Belt policy

In Beijing's Urban Master Plan for 2004–2020, the Green Belt (which covers about 993 km² in the plains) is designed by the city's government (Figure 4). The Belt is composed of several parts. One part was zoned along the Wenyu and Yongding rivers in order to protect riparian environment; another part is formed by nine pieces of wedge-shaped green space which are used to prevent new towns from merging into each other or into Beijing; the remainder of the Green Belt is distributed along the Sixth Ring Road to construct a beautiful roadside landscape. In sum, the intentions of the Green Belt include prevention of built-up areas merging into each other, protection of river environment and construction of roadside landscape.

At present, there are dense patches of built-up areas in Beijing's Green Belt. Moreover, six new towns, which will have priority for economic development, are located in the vicinity of the Green Belt (Figure 4) and are likely to further destroy its integrity. In order to more effectively protect the Green Belt and also to improve the urban environment in Beijing, the following aspects deserve more attention.

Firstly, it is very important to explicitly define the intentions of the Green Belt. For defining the purposes of the Green Belt in Beijing, lessons can be learnt from the UK experience, maybe through modifying them in accordance with the particular needs of Beijing. For instance, provision of space for recreation may be one of the important functions of the Green Belt around the city, because at present there are not enough open spaces and playing fields for urban residents who live in the inner city due to the high density of the urban population. In the tourist seasons, popular attractions around Beijing become extremely crowded, which seriously affects retention of the natural environment.

Secondly, the boundaries of Beijing's Green Belt on the ground need further study and clearer designation. The boundary of the existing Green Belt is derived from Beijing's Urban Master Plan for 2004–2020. In this Plan, reference to the Green Belt involves less than 200 words and is written as a part of a section on '*Green Construction in the Plains*'. The boundary of the Green Belt is very simply explained and mapped as shown in Figure 6, but it is extremely difficult to locate on the ground. In the UK, detailed Green Belt boundaries are laid out in local plans (at the borough level) (DCLG, 2006) and some readily identifiable objects are recommended to be used to define the scope of Green Belts, such as roads, hedges, streams or belts of trees. At present, the boundaries of Beijing's Green Belt on the ground need further study and clearer designation.

Thirdly, land use permitted in the Green Belt should be clearly stated, which will help local authorities, farmers and developers to understand and implement the policy, and to properly use land. In Beijing, the Green Belt is still only a planning concept without more concrete contents, thus the Green Belt cannot be maintained against increasing growth pressures.

Fourthly, it is necessary to coordinate the conflicts between Beijing's government and local governments with respect to land-use planning. Local governments often use land auc-

tions to attract investment and create job opportunities to develop the local economy and increase local fiscal income. Thus, the objectives of local governments with respect to land use are often different from the goals of Beijing's government of designating Green Belt to help improve the environment of the rural-urban fringe. Because local economic motivations are involved, restrictions on development in the Green Belt are easily ignored. This has also happened in Japan as discussed above.

In sum, the Green Belt policy in Beijing needs to be further improved in many aspects, such as clear establishment of the intention, designation of boundaries, and limitations on the use of land. In addition, institutional factors, such as a system for coordinate conflicts of aims of land use between Beijing's government and local governments.

5.3 To develop established towns and villages to house rural-urban migrants and urban overspill

Beijing's Urban Master Plan includes an intention to establish eleven 'new towns', of which ten are pre-existing administrative centres of counties or districts and are governed by the corresponding county/district governments. Yizhuang town is the only brand new one, and it does not possess its own development authority. In addition, the Urban Master Plan divides Beijing into four zones (or large districts) (Table 2). Six of the 11 new towns are located in the New Zone of Urban Development, and the remaining five in an Ecological Preservation Development Zone. In the future, the New Zone of Urban Development will become the main area of urban growth in which its six new towns will develop quickly. This may lead to dramatic growth of the built-up area and urban population of the city if the six new towns are merged into the larger built-up area (Figure 4). This has become the case for Seoul in South Korea where the new towns of Yeongdong, Jamsil and Yoido, with target populations

Table 2 Beijing's regional divisions and population (1000) in different regions, 2006

Zone	Non-agricultural population	Agricultural population	Temporary residents	Target population in 2020
Core Zone of Capital Function	2253	0	404	–
Urban Function Extended Zone	4697	385	3189	–
Chaoyang	1596	149	1306	–
Fengtai	866	130	804	–
Shijingshan	352	0	154	–
Haidian	1883	106	925	–
New Zone of Urban Development	1389	1635	1332	4300
Fangshan	364	394	161	600
Tongzhou	286	351	242	900
Shunyi	223	339	219	900
Changping	269	223	355	600
Daxing	247	328	355	600
Yizhuang			0	700
Ecological Preservation Development Zone	715	902	244	1357
Mentougou	174	65	81	250
Huairou	111	163	70	350
Pinggu	169	228	26	257
Miyun	158	271	45	350
Yanqing	103	175	22	150

Data are from (BSIN, 2008). The data of target population is from the (Beijing Municipal Commission of Urban Planning, 2009)

of 600,000, 250,000 and 180,000 respectively (Lee, 1987), have become completely merged into the larger built-up area.

Additionally, the eleven new towns have already attained a significant size: in 2006, the numbers of non-agricultural residents and temporary residents of each administrative centre surpassed 200,000 (Table 2), each surrounded by densely settled rural areas. The target for the total population of the new towns around Beijing in 2020 is 5.76 million according to the Urban Master Plan, with the target populations of Tongzhou and Shunyi at 0.9 million each (Table 2). London's new towns were mainly built on the basis of existing small villages being expanded to house overspill or industrial activities from the capital. And the population of these towns is small. Crawley, the biggest one, had only about 100,000 in 2001 (Table 1). Furthermore, there are no obvious differences between new towns and pre-existing urban areas in terms of population. Thus, around the Metropolitan Area, towns are very evenly distributed and the population of all towns is not large (Figure 2). This may provide an inspiration for new town development in Beijing. It may be better to develop some new towns on the basis of large rural settlements to attract rural population in their catchments or house overspill from the city centre which will be helpful for alleviating urban problems.

5.4 To guarantee that planning to be properly implemented

Over the last 50 years, most objectives of Green Belts and New Towns in the UK have largely been achieved because planning has been systematically implemented. Like the UK, China has also adopted a top-down planning system. In Beijing, land use plans at the district or county level are checked by the Beijing Municipal Bureau of Land and Resources and approved by the Beijing city administration. However, some plans, including land use and urban planning, have not been implemented consistently in China because of many complicated factors. In the future, the following aspects may be worthy of more attention in order to better realize the key objectives of land-use planning.

Firstly, it is necessary to get rid of the contradictions between different plans. In Beijing, there have been different kinds of planning, including the Beijing Environmental Plan, mainly produced by the Beijing Municipal Environmental Protection Bureau; the Beijing Urban Master Plan by the Beijing Municipal Construction Commission; and the Beijing Land Use Master Plan by the Beijing Municipal Bureau of Land and Resources. Since the plans are made according to the documents of different government departments, there are various differences or contradictions between these plans, such as data resources used and basic aims. This sets up a barrier to the implementation of planning. Hence, local authorities need to coordinate these plans and endeavour to remove the contradictions between different departments.

Secondly, it is important to establish some systemic legislation or acts referring to planning of urban development and land use, and guarantee their endurance and continuity which is necessary for farmers, developers and local authorities to be familiar with and understand the legislation or acts. In the UK, The Town and County Planning Act in 1990 has become the main foundation for land use planning and legal rules of urban planning and development control, because the Act has retained its endurance and continuity. For instance, the development plans and development control system of The Town and County Planning Act in 1947 were operated without any significant changes for over 20 years (Ratcliffe,

1989), although this was a highly dynamic era after World War II. Then, to meet changing circumstances, this Act underwent a number of alterations, but its essential nature was retained – requiring local authorities to develop Local Plans to outline what kind of development is permitted. The New Town and Country Planning Act in 1990 has become the main foundation for land use planning and legal rules of urban planning and development control.

Thirdly, it is necessary to rethink the role of local government in the process of land development. In China, rural people cannot directly sell their land-use rights for construction land to land developers. Local government expropriates land from farmers at a low price and sells it at a much higher price to real estate developers, from which it can gain much profit. Thus, local government plays two roles in the process of land development, i.e., administrator and salesman. This encourages local government to convert agricultural land into construction land, and thus amending existing plans becomes what the new leaders of local government firstly want to do in order to legally develop more construction land, which destroys continuity in planning. So, local government should not play the role of businessman in the conversion of agricultural land into construction land.

6 Conclusions

This paper has examined the main characteristics of present-day land use in Beijing and the main characteristics of urban development related to land use in London, endeavouring to obtain some implications for planning in Beijing.

One of the challenges that Beijing is now facing is how to allocate arable land, built-up area and conservation land. In urban areas, urban population density is very high (more than 10 000/km²) and urban problems are serious. These will greatly spur urban land expansion. In rural areas, there are a large number of rural settlements, which are evenly distributed in the plains but with poor basic infrastructure. In 2000, the area of rural settlement land was 843 km², and settlement area per capita was 275 m². And rural industrial land is expanding rapidly at the expense of arable land.

In the process of London's development, in order to solve similar urban problems that Beijing is facing now, a series of innovative planning measures were introduced, including the Green Belt, New Towns and well-regulated development controls. During the last 50 years, the fundamental aims of the Green Belt around London have mostly been realized, including protecting farmland and countryside, preventing towns from merging into each other and shaping urban expansion. Likewise, for the eight new towns as a whole in the London Metropolitan Area, the target population (380.0 thousand) had been substantially exceeded by 2001. However, it is notable that the established towns and villages have played a more important role in housing overspill.

In order to solve urban and rural problems, Beijing also has plans to establish both Green Belt and new towns, though not without difficulties. Firstly, within the Green Belt dense patches of built-up areas have been permitted to develop. Furthermore, six new towns, which will have priority for development, are located in or very near to the Green Belt according to Beijing's Urban Master Plan for 2004–2020. These may destroy the integrity of the Green Belt.

Secondly, 11 new towns have already gained substantial urban population. According to the Plan, the total population of the new towns for Beijing is planned to reach 5.76 million in

2020. Seven new towns are very near to and easily merged into a pre-existing large built-up area. If this occurs, it will have a dramatic impact on the growth of the built-up area and cause more urban problems. Thus, one of the aims of designing New Towns and Green Belt, to contain the expansion of the large built-up area, will not be achieved. According to the experience of London's development, it may be more effective and a better method to increase infrastructure investment and develop the established towns and villages to house overspill and attract rural-urban migrants, which can significantly alleviate problems in the capital city itself.

Last but not least, it is very important to guarantee that planning is effectively implemented, which is extremely difficult to achieve!

Acknowledgements

The authors thank Professor Nigel Walford, Mr Robert Gant, Dr Edgar Samarasundera and Dr Colin Marx from Kingston University in the UK for their excellent comments on the original draft of this paper.

References

- Alig R J, Kline J D, Lichtenstein M, 2004. Urbanization on the US landscape: Looking ahead in the 21st century. *Landscape and Urban Planning*, 69: 219–234.
- Amati M, Yokohari M, 2006, Temporal changes and local variations in the functions of London's green belt, *Landscape and Urban Planning*, 75: 125–142.
- Balchin P, 1999. Housing. In: Cullingworth B (ed.). *British Planning*. London: The Athlone Press, 14–30.
- Beijing Municipal Commission of Urban Planning, 2009. *Beijing Planning of 11 New Towns*, <http://www.bjghw.gov.cn/ghzt/index.asp>
- BSIN (Beijing Statistics Information Net), 2008. *Beijing Statistical Yearbook of 2007*, <http://www.bjstats.gov.cn/tjnj/2007-tjnj/>.
- Cai Y, 2000. Problems of farmland and conservation in the rapid growth of China's economy. *Resources Science*, 22(3): 24–28.
- Clapson M, 1998. *Invincible Green Suburbs, Brave New Towns*. Manchester: Manchester University Press.
- Clout H, 1986, London in transition. In: Clout H, Wood P (eds.). *London: Problems of Change*. Harlow: Longman Group (FE) Limited, 23–32.
- Cullingworth J B, 1969. *Town and Country Planning in England and Wales: The Changing Scene*. London: George Allen & Unwin Ltd.
- DCLG (Department for Communities and Local Government), 2006. *Planning Policy Guidance 2: Green Belts*, <http://www.communities.gov.uk/publications/planningandbuilding/ppg2>
- EFRA (Department for Environment Food and Rural Affairs), 1988. *Agricultural land classification of England and Wales*, <http://www.defra.gov.uk/rds/publications/technical>
- Elson M, 1993. *The Effectiveness of the Green Belt*. London: HMSO.
- Elson M J, 1986. *Green Belts: Conflict Mediation in the Urban Fringe*. London: William Heinemann Ltd.
- Gallent N, Andersson J, Bianconi M, 2006. *Planning on the Edge: The Context for Planning at the Rural-urban Fringe*. London and New York: Routledge.
- Grayson L, 1990. *Green Belt, Green Fields and the Urban Fringe: The Pressure on Land in the 1980s--A Guide to Sources*. London: London Research Centre.
- Greed C, 1996. *Introducing Town Planning*. London: Longman.
- Hardy D, 1991. *From New Towns to Green Politics*. London: Chapman & Hall.
- Hu X H, David DK, 2001. The emergence of affluence in Beijing: Residential social stratification in China's capital city. *Urban Geography*, 22(1): 54–77.

- Jiang F, Liu S, Yuan H *et al.*, 2007. Measuring urban sprawl in Beijing with geo-spatial indices. *Journal of Geographical Sciences*, 17(4): 470–478.
- Lee T I, 1987. New Town Planning and Development in Korea. In: Phillips D R, Yeh A G O (eds.). *New towns in East and South-east Asia: Planning and Development*. Hong Kong: Oxford University Press, 109–125.
- Levinson D, 2008. Density and dispersion: The co-development of land use and rail in London. *Journal of Economic Geography*, 8(1): 55–77.
- Lin J, Li Y, 2007. Study on land consolidation potential of rural residential area in Beijing, China. *Land Science*, 21(1): 58–65.
- Liu J, Liu M, Zhuang D, 2003. Study on spatial pattern of land-use change in China during 1995–2000. *Science in China (Series D)*, 46(4): 373–384.
- Long H, Heilig G K, Li X *et al.*, 2007. Socio-economic development and land-use change: Analysis of rural housing land transition in the transect of the Yangtse River, China. *Land Use Policy*, 24: 141–153.
- Lowe P, Buller H, Ward N, 2002. Setting the next agenda? British and French approaches to the second pillar of the Common Agricultural Policy. *Journal of Rural Studies*, 18(1): 1–17.
- Manners G, 1986. Decentralized London, 1945–1975. In: Clout H, Wood P (eds.) *London: Problems of Change*. Harlow: Longman Group (FE) Limited, 42–51.
- Meller H, 1997. *Towns, Plans and Society in Modern Britain*. Cambridge: Cambridge University Press.
- MLRC (The Ministry of Land and Resources), 2002. *The Report of China's Land and Resources*. Beijing: Dizhi Press, 7–18.
- Munton R, 1983. *London's Green Belt: Containment in Practice*. London: George Allen & Unwin.
- Munton R, 1986. The metropolitan green belt. In: Clout H, Wood P eds., *London: Problems of Change*. Harlow: Longman Group (FE) Limited, 128–143.
- Ouyang Z, Wang R, Li W *et al.*, 2005. Ecological planning on green belt surrounding a megacity, Beijing. *Acta Ecologica Sinica*, 25(5): 965–971. (in Chinese)
- PCOTS (Population Census Office Under the State Council, National Bureau of Statistics of China). National Bureau of Statistics of China, 2002. *Tabulation on the 2000 Population Census of the People's Republic of China*. Beijing: China Statistics Press.
- Portnov B A, Pearlmutter D, 1999. Sustainable urban growth in peripheral areas. *Progress in Planning*, 52: 239–308.
- Ratcliffe J, 1989. *An Introduction to Town and Country Planning*. Tiptree, Essex: Anchor Press Ltd.
- Robinson G M, 1988. *Agricultural Change: Geographical Studies of British Agriculture*. Edinburgh: North British Publishing.
- RSA (Regional Studies Association), 1989. *Beyond Green Belts: Managing Urban Growth in the 21st Century*. London: Jessica Kingsley Publishers.
- Tan M, Li X, Xie H *et al.*, 2005. Urban land expansion and arable land loss in China: A case study of Beijing-Tianjin-Hebei region. *Land Use Policy*, 22(2): 187–196.
- Tan M, Zhu H, Liu L *et al.*, 2007. Spatial patterns of built-up areas around Beijing. *Acta Geographica Sinica*, 62(8): 861–869. (in Chinese)
- Thomas D, 1970. *London's Green Belt*. London: Faber and Faber Limited.
- Wang X, Lu C, Fang J *et al.*, 2007. Implications for development of grain-for-green policy based on cropland suitability evaluation in desertification-affected North China. *Land Use Policy*, 24: 417–424.
- Wannop U, 1999. *New Towns*. In: Cullingworth B (ed.), *British Planning*. London: The Athlone Press, 213–230.
- Weber C, Puissant A, 2003. Urbanization pressure and modelling of urban growth: Example of the Tunis Metropolitan Area. *Remote Sensing of Environment*, 86: 341–352.
- Wendell Cox, 2008. *Southeast England Population by Area from 1891*, <http://www.demographia.com/dm-lonarea.htm>.
- Whyte W H, 1968. *The Last Landscape*. New York: Doubleday Anchor.
- Wu F, 2000. China's recent urban development in the process of land and housing marketisation and economic globalisation. *Habitat International*, 25: 272–289.
- Wu Q, Li H, Wang R, Paulussen J *et al.*, 2006. Monitoring and predicting land use change in Beijing using remote sensing and GIS. *Landscape and Urban Planning*, 78: 322–333.