Land Use Dataset of the Sub-urban Area in Xi'an (2015)

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Abstract: The urban fringe is a transitional area between the urban built-up and rural areas. It is characterized by an interlaced state of land use and a fragmented landscape caused by the invasion of urban construction land into agricultural land. This dataset classified and interpreted Landsat Thematic Mapper (TM) images of the Xi'an urban area and its adjacent areas in 2015, referring to the Google Earth images in the same period to obtain the land use data. In combination with the spatial development trend of urbanization in Xi'an, we selected the proportions of construction land and farmland, and a landscape fragmentation index of each block in Xi'an to determine the boundary of the urban fringe (sub-urban area), and obtained a land use dataset of the urban fringe in Xi'an (2015). The results showed that the urban fringe of Xi'an included 25 blocks, belonging to the Baqiao, Chang'an, Yanta, and Weiyang districts and Fengdong New Town, and the land use types were mainly construction land, farmland, forest land, and other land uses. This dataset is archived in .shp format and consists of 14 data files, with a data size of 8.11 MB (compressed to one file, 4.78 MB). The research paper based on the dataset was published in *Acta Geographica Sinica* (Vol. 73, No. 6, 2018).

Keywords: urban fringe; land use; Xi'an; block; Acta Geographica Sinica

1 Introduction

In recent years, with China's rapid urban expansion, the functional space of transportation, industry, and housing has spread to the suburbs of cities. However, the increase of urban construction land is mainly from the assimilation of farmland in the suburban areas (urban fringe), which has resulted in the urban fringe at the junction of the urban and rural areas becoming severely and profoundly affected by urban spatial expansion[1–2]. Under this background, the urban fringe has been deeply affected by the continuous spatial reconstruction and has frequently experienced a functional transformation. It has become the most unstable

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[2] Huang, X. J., Wang, C., Hu, K. L., *et al*. Land use classification dataset covering Xi'an suburban area (2015) [DB/OL]. Global Change Research Data Publishing & Repository, 2019. DOI: 10.3974/geodb.2019.04.08.V1.

and sensitive area in many cities, and is also the region where urban–social conflicts are particularly prominent. Because of its transitional, ambiguous, and dynamic characteristics[3], the boundary of the urban fringe is usually difficult to be defined accurately, which hinders the precise governance of cities. Therefore, it is of great significance to scientifically define the spatial scope of the urban fringe and grasp the dynamic changes of land use in the urban fringe to maintain a healthy and orderly urbanization.

As a significant consequence of urbanization, land use change is not only a typical feature of the urban fringe, but is also an important index for defining the spatial scope of the urban fringe area. An interlaced state of land use and a fragmented landscape caused by the invasion of urban construction land into agricultural land are the main characteristics of the urban fringe[4]. This dataset took Xi'an as the research area, and classified and interpreted Landsat TM images of the Xi'an urban area and its adjacent areas in 2015 to obtain land use data. By combining this information with the spatial development trend of urbanization in Xi'an, we selected the proportion of construction land, the proportion of farmland, and a landscape fragmentation index of each block in Xi'an to define the boundary of the urban fringe of Xi'an, and obtained a land use dataset of the urban fringe in Xi'an (2015). This dataset not only provides a method for defining the urban fringe, but also provides a reference for land use planning and urban development in the study area.

2 Metadata of Dataset

The name, authors, geographical region, year, data file, data publisher, data sharing policy, etc. of the dataset[5] are listed in Table 1.

Table 1   Metadata summary of the "Land use classification dataset covering Xi'an suburban area (2015)"

Items	Description
Dataset full name	Land use classification dataset covering Xi'an suburban area (2015)
Dataset short name	LU_UrbanFringe_XiAn
Authors	Huang, X. J., X-9862-2019, College of Urban and Environmental Sciences, Northwest University, huangxj@nwu.edu.cn Wang, C., College of Urban and Environmental Sciences, Northwest University, 592364561@qq.com Hu, K. L., College of Urban and Environmental Sciences, Northwest University, 1505566206@qq.com Wang, B., College of Urban and Environmental Sciences, Northwest University, 1500633823@qq.com
Geographical region	Xi'an city (33°25′12″N–34°27′00″N, 107°24′00″E–109°29′24″E)
Year	2015 Data format .shp Data size 4.78 MB (after compression)
Data files	Boundary data of the urban fringe in Xi'an; Land use data in the urban fringe of Xi'an
Foundations	National Natural Science Foundation of China (41971178, 41401138); Shaanxi province (SKLESS201807)
Data publisher	Global Change Research Data Publishing & Repository, http://www.geodoi.ac.cn
Address	No.11A, Datun Road, Chaoyang District, Beijing 100101, China
Data sharing policy	*Data* from the Global Change Research Data Publishing & Repository includes metadata, dataset (data products), and publications (in this case, in the *Journal of Global Change Data & Discovery*). *Data* sharing policy includes: (1) *Data* are openly available and can be free downloaded via the Internet; (2) End users are encouraged to use *Data* subject to citation; (3) Users, who are by definition also value-added service providers, are welcome to redistribute *Data* subject to written permission from the GCdataPR Editorial Office and the issuance of a *Data* redistribution license; and (4) If *Data* are used to compile new dataset, the 'ten percent principal' should be followed such that *Data* records utilized should not surpass 10% of the new dataset contents, while sources should be clearly noted in suitable places in the new dataset [6]
Communication and searchable system	DOI, DCI, CSCD, WDS/ISC, GEOSS, China GEOSS

3 Data Development Method

3.1 Raw Data

The urban fringe boundary data in this dataset were from the Shaanxi Bureau of Surveying, Mapping and Geoinformation, and the land use data were from Landsat TM images in the Geospatial Data Cloud (http://www.gscloud.cn)[7] and Google Earth images. All data were in 2015.

3.2 Algorithm Principle

(1) We adopted Landsat TM remote sensing images and Google Earth images as the main data sources. After image fusion, geometric correction, and image clipping, we overlayed the administrative boundary data of each block to Landsat TM images and digitalized the land use status of each block in Xi'an city and its adjacent areas using a human-computer interactive visual interpretation method. We then divided the land use types into four categories: construction land, farmland, forest land, and other land, and obtained a vector map of land use in Xi'an city.

(2) Based on the land use data, we determined the proportions of construction land and farmland in each block. Then we converted the vector data of land use into raster data and input it into Fragstats 4.2 software to calculate the fragmentation index of construction land and farmland of each block.

(3) In combination with the spatial development trend of Xi'an urbanization, land use status, the proportions of construction land and farmland, and a landscape fragmentation index of each block, we defined the boundary of the urban fringe, and finally obtained a land use dataset of the urban fringe in Xi'an.

4 Results

4.1 Data Products

The land use dataset of the urban fringe in Xi'an (2015) consists of two parts: (1) boundary data of the urban fringe in Xi'an (.shp); and (2) land use data in the urban fringe of Xi'an (.shp). The spatial distribution results are shown in Figure 1.

4.2 Results

Figure 1   Land use status of the urban fringe in Xi'an in 2015

The urban fringe area of Xi'an includes 25 blocks, belonging to the Baqiao, Chang'an, Yanta, Weiyang districts, and Fengdong New Town, with a total area of 1,425.22 km². Compared with the core areas that have fully realized urbanization, these 25 spatial units still have certain amounts of farmland, and the agricultural and urbanized spaces are intertwined and mixed. The statistical information regarding the land use in each block is given in Table 2.
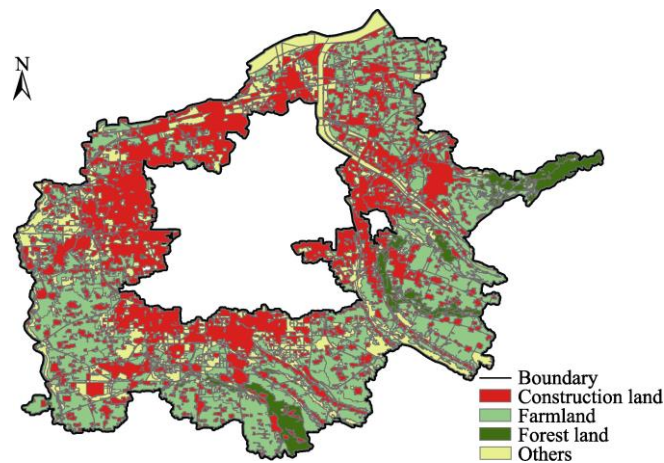
Table 2 Area of different land uses in the urban fringe in Xi'an (km^2)

Municipal district	Block	Farmland	Construction land	Forest land	Other land
	Hongqi	8.29	27.36	8.38	10.67
	Xiwang	24.71	20.13	4.62	9.20
	Hongqing	32.05	24.99	22.92	6.00
Baqiao	Dizhai	37.18	16.80	7.64	3.15
	Baqiao	19.11	29.69	0.41	12.88
	Xinzhu	23.59	25.45	0	10.29
	Xinhe	37.11	23.16	0	15.78
	Weiqu	12.92	44.09	0	18.76
	Guodu	18.06	44.00	0.67	25.30
	Xiliu	38.47	10.93	0.03	2.15
	Duqu	36.85	12.00	0.95	7.77
	Dazhao	39.93	15.10	0.94	7.86
Chang'an	Xinglong	23.58	20.19	0.15	10.40
	Huangliang	20.48	6.93	0.64	0.55
	Wangqu	27.88	12.94	20.38	2.39
	Wuxing	24.21	8.26	0.92	4.35
	Paoli	36.31	9.26	4.39	12.59
	Dengjiapo	0.82	16.12	0.04	6.33
Yanta	Yuhuazhai	2.63	24.88	0.28	5.68
	Liucunbao	14.68	30.89	0.01	8.45
Weiyang	Hancheng	2.59	32.48	0	9.24
	Caotan	3.78	28.70	0	28.43
	Sanqiao	2.03	39.66	0	7.25
Fengdong New Town	Doumen	26.69	30.31	0.38	17.98
	Wangsi	7.45	18.20	0.08	14.02

The main land use types in the urban fringe of Xi'an in 2015 were farmland and construction land, with an area of 521.40 km^2 and 572.52 km^2, accounting for 38.05% and 41.78% of the total area, respectively. Dazhao block had the largest farmland area (39.93 km^2). The farmland area in Hongqing, Dizhai, Xinhe, Xiliu, Duqu, and Paoli blocks also exceeded 30 km^2. However, the area of construction land in Weiqu, Guodu, LiucunBao, Hancheng, and Sanqiao blocks exceeded 30 km^2. The largest forest land area was in Hongqing block (22.92 km^2). Forest land was also relatively abundant in Hongqi, Xiwang, Dizhai, and Wangqu blocks. The other land area of Caotan block was 28.43 km^2, with most of the land being a large water area.

From the perspective of the proportion of land use, the proportion of construction land was the largest in Sanqiao block (>80%). The proportion of construction land in Hongqi, Weiqu, Guodu, Dengjiapo, Yuhuazhai, Liucunbao, and Hancheng was also over 50%. This indicated that these areas were strongly influenced by urbanization and might transfer to urban built-up areas rapidly. In contrast, the proportion of farmland in Huangliang, Xiliu, Wuxing, and Duqu was still over 50%, indicating that the urbanization process was relatively slow due to the far distance from the urban center.

This dataset is based on Landsat TM images, with a resolution of 30 m. The resolution of the images is slightly coarse. Even with the assistance of Google Earth images, there are still some errors in the results. In addition, the dataset only classifies land use types into farmland, construction land, forest land, and other land, the classification of which is comparatively general. There are still some areas of water and grassland in the urban fringe, and there are numerous types of construction land. To determine land use changes in the urban fringe in Xi'an more intuitively and accurately, multi-period SPOT and Landsat TM images, with higher resolution, should be used for land use interpretation in the future. This will enable an assessment of exactly what type of construction land that the farmland has been converted

into in the urban fringe and will enable the dynamic changes of land use to be determined, and thus provide a reference for future urban land planning.

5 Discussion and Conclusion

The urban fringe is located between the two systems of the "city" and "countryside". It is the most sensitive, influential, and rapidly changing area during the process of urbanization. The most prominent feature of the urban fringe is that the land use situation is complex and changes rapidly, which makes urban land use planning difficult. We adopted Google Earth images to help to classify and interpret Landsat TM images of the Xi'an urban area and its adjacent areas in 2015 to obtain that land use data. By combining this information with the spatial development trend of urbanization in Xi'an, we selected the proportions of construction land and farmland, and a landscape fragmentation index for each block in Xi'an to determine the boundary of the urban fringe, and finally obtained a land use dataset of the urban fringe in Xi'an (2015). From the results, it was apparent that the closer the block was to the city center, the more severely it was affected by urbanization. A large area of farmland in these blocks had been transformed into urban construction land, and the degree of landscape fragmentation was also higher. The blocks far from the city center were relatively weakly affected by urbanization, and still had a high proportion of farmland. The development of this dataset provides a method to determine urban fringe areas. In addition, the dataset itself also provides support for relevant research and urban land use planning in Xi'an.

Author contributions

Huang, X. J. designed the development of the dataset; Wang, C. and Hu, K. L. collected and processed data; and Wang, B. wrote the data paper.

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