

## LAND COVER CHANGE MONITORING OF TYPICAL FUNCTIONAL COMMUNITIES OF SICHUAN PROVINCE BASED ON ZY-3 DATA

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### ABSTRACT:

According to the function, land space types are divided into key development areas, restricted development areas and forbidden development areas in Sichuan Province. This paper monitors and analyses the changes of land cover in different typical functional areas from 2010 to 2017, which based on ZY-3 high-score images data and combined with statistical yearbook and thematic data of Sichuan Province. The results show that: The land cover types of typical key development zones are mainly composed of cultivated land, forest land, garden land, and housing construction land, which accounts for the total area of land cover 87%. The land cover types of typical restricted development zone mainly consists of forest land and grassland, which occupy 97.71% of the total area of the surface coverage. The land cover types of the typical prohibition development zone mainly consist of forest land, grassland, desert and bared earth, which accounts for the total area of land cover 99.31%.

### 1. INTRODUCTION

Land space in Sichuan province is divided into key development zones, restricted development zone and prohibition development zone (Liu, 2016a and Fan, 2015a). The main functional areas is an important area protecting natural and cultural resources in Sichuan province, is important soil and water conservation area and important drinking water source protection area. Under the premise of strict protection of the ecological environment, rational develop advantages and characteristics of tourism resources, develop eco-tourism industry, control strictly the interference of human factors on the natural ecology, prohibit the development activities which does not comply with the main functional areas targeted, guide population transfer gradual and orderly, reach the achievement of pollutant "zero emissions", improve environmental quality, enhance capacity for sustainable development (Pei, 2010a).

This paper takes the main functional area of Sichuan Province as the research object, based on the ZY-3 image, combined with statistical yearbook and special data, to monitor the changes of surface coverage of key ecological function areas in Sichuan province, which is very important significance for us to learn about the current situation of regional ecological civilization, maintain regional ecological security, prompt the relationship between environment and economic development policies and promote the construction of the main functional area of the national construction pilot demonstration (Wang et al., 2017a).

### 2. RESEARCH AREA OVERVIEW

Key development zones include 89 counties (cities, districts) of the 19 cities (districts) in Chengdu plain, the southern of Sichuan, and the northeast of Sichuan, and the western of

Sichuan, as well as the connected 50 punctate development towns (Zhang et al., 2010a). Among them, Chengdu plain is a national level key development zone, which main function positioning is the important economic center in the West, the national comprehensive transportation hub, the business logistics center and the financial center, and a base of advanced manufacturing industry, scientific technological innovation industrial base and agricultural products processing base.

Restricted development zone includes ecological function areas and agricultural products producing areas. Among them, the national level key ecological function areas includes Ruergai prairie wetland ecological function areas, Sichuan-yunnan forest biodiversity and ecological function areas, qinba biodiversity ecological function areas and others, a total of 25 regions. There is no doubt that such wide coverage is of rich biodiversity.

Prohibition development zone is an important protection area of natural and cultural resources, is also a key ecological function area needing special protection, which prohibits any other industrialization and urbanization development, including national level and provincial level two parts (Wang et al., 2017a and Sun et al., 2015a). The national prohibition development zone include national nature reserve, world cultural and natural heritage, national scenic area, national forest park, national important wetlands, national wetland park and national geological park; The provincial prohibition development zone include provincial and lower levels of various types of natural and cultural resource protection area, important drinking water sources, and other prohibited development area which to be determined by provincial People's Government (Nie et al., 2010a and Li et al., 2013).

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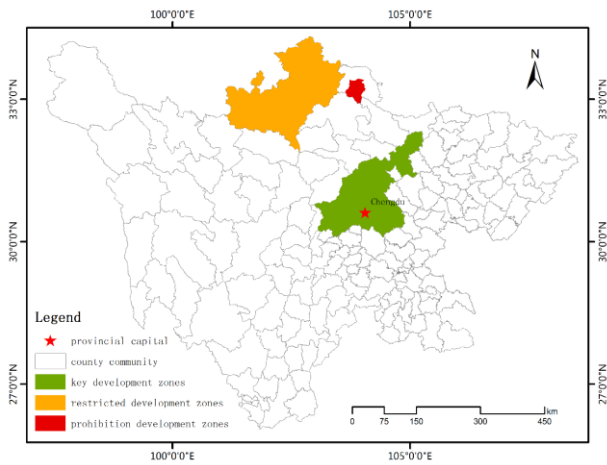


Figure 1. Regional location

### 3. DATA AND METHOD

#### 3.1 Data Source

ZY-3 high resolution remote sensing image data are derived from the first national survey of national geographical conditions, DEM, DOM, 1:5 million scale, the administrative division and other data are derived from the Sichuan geo information bureau.

#### 3.2 Method

Based on the ZY-3 orthographic image, surface coverage data production is performed by means of full manual acquisition or human-computer interaction interpretation.

### 4. RESEARCH RESULT

Vegetation Types	2010		2017	
	Area (km <sup>2</sup> )	Proportion (%)	Area (km <sup>2</sup> )	Proportion (%)
Cultivated land	9299.32	39.52	7858.38	33.40
Garden land	1743.39	7.41	2414.25	10.26
Forest land	7915.10	33.64	7898.44	33.57
Grass land	773.23	3.29	1056.47	4.49
Housing construction land	2090.34	8.88	2298.01	9.77
Road	208.97	0.89	314.97	1.34
Construction land	160.37	0.68	290.37	1.23
Artificial digging pile	341.06	1.45	372.20	1.59
Desert and bared earth	380.81	1.62	372.70	1.58
Waters	615.75	2.62	652.55	2.77
Wetland				
Total	23528.34	100.00%	23528.34	100.00%

Table 1. The surface cover type of key development zones

The monitoring results show that: the surface cover types of typical key development zones are mainly composed of cultivated land, forest land, garden land, and housing

construction land, which accounts for the total area of land cover 87%. The area of cultivated land and forest land reduced significantly from 2010 to 2017, and the area of garden, grassland, housing construction land and construction land increase greatly.

Vegetation Types	2010		2017	
	Area (km <sup>2</sup> )	Proportion (%)	Area (km <sup>2</sup> )	Proportion (%)
Cultivated land	191.26	0.66	191.09	0.66
Garden land	1.28	0.00	1.20	0.00
Forest land	6801.38	23.63	6801.68	23.63
Grass land	21466.08	74.57	21324.34	74.08
Housing construction land	34.38	0.12	42.01	0.15
Road	0.84	0.00	1.57	0.01
Construction land	7.46	0.03	11.15	0.04
Artificial digging pile	5.06	0.02	7.07	0.02
Desert and bared earth	156.68	0.54	152.85	0.53
Waters	121.38	0.42	252.84	0.88
Wetland				
Total	28785.9	100.00%	28785.8	100.00%

Table 2. The land cover type of restricted development zone

The surface cover types of typical key restricted development zone mainly consists of forest land and grassland, which occupy 97.71% of the total area of the surface coverage. From 2010 to 2017, the area of cultivated land, forest land reduced sharply, while garden land, grassland, housing construction land and structure area were increased greatly.

Vegetation Types	2010		2017	
	Area (km <sup>2</sup> )	Proportion (%)	Area (km <sup>2</sup> )	Proportion (%)
Cultivated land	5.34	0.38%	3.73	0.27%
Garden land	0.03	0.00%	0.04	0.00%
Forest land	918.37	65.50%	920.78	65.67%
Grass land	153.18	10.93%	152.26	10.86%
Housing construction land	2.40	0.17%	2.82	0.20%
Construction land	0.57	0.04%	0.75	0.05%
Artificial digging pile	0.31	0.02%	0.11	0.01%
Desert and bared earth	319.59	22.79%	319.32	22.78%
Waters	2.25	0.16%	2.23	0.16%
Wetland				
Total	1402.05	100.00%	1402.05	100.00%

Table 3. The land cover type of prohibition development zone  
 The cover types of the typical important prohibition development zone mainly consist of forest land, grassland,

desert and bared earth, which accounts for the total area of land cover 99.31%. From 2010 to 2017, the area of cultivated land, grassland, desert and bared earth decreased greatly, but the area

Land cover transfer matrix is mainly used to show the mutual transformation between land cover types. The statistics of land cover transfer are shown in the following table:

of forest land, housing construction land and structure were increased greatly.

<b>2017 2010</b>	Cultivated land	Garden land	Forest land	Grass land	Housing construction land	Road	Construction land	Artificial digging pile	Desert and bared earth	Waters Wetland	Total
Cultivated land	7596.57	802.84	142.69	231.50	177.40	48.05	110.31	133.97	2.86	54.97	9301.15
Garden land	94.46	1497.37	31.69	39.27	29.25	7.98	12.40	28.39	0.32	2.41	1743.55
Forest land	69.58	74.97	7582.00	87.94	32.98	7.38	5.99	28.54	16.72	8.86	7914.96
Grass land	22.49	12.14	81.18	488.19	65.92	8.89	17.10	35.45	17.99	24.45	773.78
Housing construction land	35.33	10.38	17.51	63.49	1887.63	11.75	15.90	46.12	0.26	1.11	2089.48
Road	0.07	0.07	0.27	0.80	0.83	205.71	0.57	0.66	0.00	0.02	208.99
Construction land	16.52	8.00	2.36	8.16	16.89	1.51	100.46	5.64	0.06	0.87	160.47
Artificial digging pile	13.63	4.76	20.21	74.32	83.51	21.05	25.40	79.54	6.74	12.58	341.73
Desert and bared earth	0.87	0.20	19.67	28.93	0.31	0.20	0.43	3.01	304.39	21.48	379.49
Waters Wetland	11.29	2.19	2.16	31.67	3.27	2.64	1.50	9.10	23.22	527.70	614.74
Total	7860.82	2412.92	7899.73	1054.27	2297.98	315.14	290.07	370.41	372.55	654.44	23528.33

Table 4. The land cover transition matrix of key development zones

The results showed that: The type of surface cover varies greatly; The largest change in arable land occurs, and the main

flow is arable land to the garden, house construction land, artificial excavation sites and structures.

<b>2017 2010</b>	Cultivated land	Garden land	Forest land	Grass land	Housing construction land	Road	Construction land	Artificial digging pile	Desert and bared earth	Waters Wetland	Total
Cultivated land	189.41	0.00	0.05	0.33	1.22	0.00	0.11	0.09	0.00	0.02	191.25
Garden land	0.06	1.20	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	1.28
Forest land	0.13	0.00	6794.63	4.62	0.07	0.02	0.04	0.29	0.77	0.87	6801.44
Grass land	1.38	0.00	6.26	21431.67	6.81	0.69	4.16	2.18	5.75	6.87	21465.77
Housing construction land	0.09	0.00	0.00	0.57	33.68	0.00	0.03	0.03	0.00	0.00	34.41
Road	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.00	0.84
Construction land	0.00	0.00	0.00	0.68	0.02	0.00	6.86	0.02	0.00	0.01	7.58
Artificial digging pile	0.00	0.00	0.00	0.50	0.19	0.00	0.08	4.21	0.02	0.04	5.03
Desert and bared earth	0.00	0.00	0.49	12.77	0.03	0.01	0.00	0.10	137.19	6.12	156.70
Waters Wetland	0.00	0.00	0.32	10.95	0.00	0.01	0.00	0.16	9.14	100.90	121.48
Total	191.08	1.20	6801.75	21462.09	42.04	1.57	11.28	7.07	152.87	114.82	28785.77

Table 5. The land cover transition matrix of restricted development zone

The results showed that: The total conversion of surface cover in the Zoige Grassland Wetland Ecological Function Zone is 85.18 km<sup>2</sup>. Generally, the transfer between different types of land is small, and the land cover type is stable.

2017 2010	Cultivated land	Garden land	Forest land	Grass land	Housing construction	Construction land	Artificial digging pile	Desert and bared earth	Waters Wetland	Total
Cultivated land	3577206.12	11812.08	1339605.34	209741.72	152896.59	5507.93	21467.40	0.00	21539.95	5.34
Garden land	0.00	31431.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Forest land	49897.38	0.00	915539702.90	2676304.52	47291.94	9602.62	3296.87	45471.26	0.00	918.37
Grass land	80008.64	0.00	3687704.43	148976353.30	132994.51	188453.00	18361.34	97135.87	2573.72	153.18
Housing construction	15828.51	0.00	6263.78	21164.32	2354165.17	649.76	0.00	0.00	0.00	2.40
Construction land	0.00	0.00	7019.97	11939.35	22438.24	525640.11	0.00	0.00	0.00	0.57
Artificial digging pile	2123.59	0.00	12083.96	100418.72	106691.51	20712.41	70583.40	0.00	0.00	0.31
Desert and bared earth	0.00	0.00	187350.29	253967.13	0.00	0.00	0.00	319146747.40	0.00	319.59
Waters Wetland	0.00	0.00	0.00	13473.59	0.00	0.00	0.00	33791.25	2207170.54	2.25
Total	3.73	0.04	920.78	152.26	2.82	0.75	0.11	319.32	2.23	1402.05

Table 6. The land cover transition matrix of prohibition development zone

The results showed that: The transitions between land cover types are more frequent, mainly reflected in the conversion between forest land, farmland, and grassland.

## 5. CONCLUSIONS

Based on the characteristics of different main functional areas, the paper selects the typical main functional areas in Sichuan Province and uses the two-phase remote sensing image ZY-3 with better than 2.5m resolution to extract the ground cover type data, and combines the basic geographic information data and various professional statistical data. , carry out targeted monitoring and statistics and analysis. The scope of monitoring of the selected main functional areas was about 57000 km<sup>2</sup> which is typical. Among them, the typical key development zone is 24000 km<sup>2</sup>, the typical restricted development zone is 28700 km<sup>2</sup>, and the typical banned development zone is about 0.4 million km<sup>2</sup>. The research results can provide data support for ecological and environmental protection.

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