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Analysis of Shanghai Landscape Pattern Based on Landscape Index Analysis Method

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Abstract

With the development of society, people gradually realize the importance of landscape pattern to the city, and the urban land use affects the urban landscape pattern. This study takes Shanghai as an example to study the characteristics of Shanghai's landscape index. First, the land use is classified by the supervised classification algorithm, and the corresponding landscape pattern indicators are calculated using Fragstats software 4.2, and then suggestions for the sustainable development of Shanghai are given. It was concluded that: (1) The separation degree of various land use types in Shanghai is at a relatively high level, and the integrity of land use is poor; (2) In the next development planning, attention should be paid to the degree of aggregation of patches of different land use types, so as to improve the integrity and scale of land use types, which is more conducive to urban development; (3) It is recommended to plan rationally according to the specific distribution of greenland, improve the utilization degree, and reduce the waste of greenland. Redundant greenland can be converted into urbanland.

Keywords

Landscape pattern indicator; Land use type; Landscape features; Shanghai.

1. INTRODUCTION

Landscape pattern refers to the spatial structure characteristics of the landscape, and is the specific manifestation of the heterogeneity of the landscape. Spatial heterogeneity is one of the important attributes of the landscape [1]. Land use landscape changes with the constraints of the natural environment and the intervention of human activities, and is the most common and important type of landscape in nature [2]. The research on land use types has gradually become a hot spot of academic research, and many scholars have also conducted various researches [3-6].

As one of the largest cities in China, the study of Shanghai's landscape pattern is of great significance to the planning of future urban development. In this study, by classifying the types of land use in Shanghai and calculating the landscape index with Fragstats 4.2 software, we can obtain the landscape pattern of Shanghai, analyze and give suggestions for urban development.

2. METHODS AND DATE

2.1. Research Methods

The land use types in Shanghai are divided into water, greenland, urbanland and farmland by the supervised classification function of arcgis software. Guaranteed classification accuracy above 85% can be used for research. The obtained classification results were calculated by Fragstats 4.2 software for landscape index. Combined with the situation of the study area, six

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landscape indices were selected for analysis from two levels of type and landscape, Refer to the literature for the meaning and calculation method of each landscape index [7].

2.2. Research Data

Shanghai is located between 120°52' to 122°12' east longitude and 30°40' to 31°53' north latitude, the center point of China's north and south coasts, and the confluence of the Yangtze River and Huangpu River into the sea. It borders the East China Sea in the east, Hangzhou Bay in the south, and Jiangsu and Zhejiang provinces in the west, as shown in Fig.1. Landsat TM images used in this research were downloaded from Geospatial Data Cloud (http://www.gscloud.cn/).

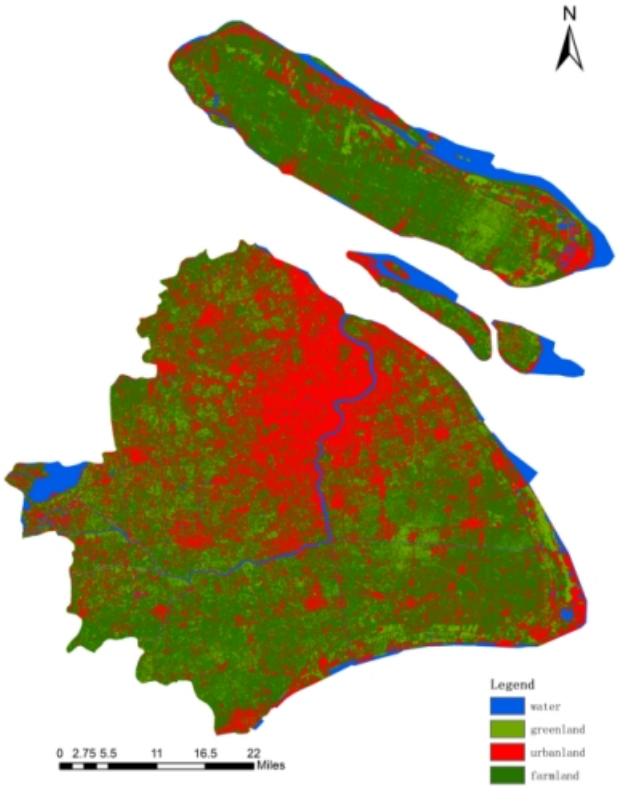

Figure 1. Classification of land use types in Shanghai in 2005

2.3. Landscape Pattern Indicators Selection

After a large number of data inquiries combined with the actual situation of the study area, we selected the landscape pattern index [8-9]. At the landscape level and class level, TA, NP, LPI, ED, AREA_MN, SPLIT were used for land use gradient analysis.

3. RESULTS AND DISCUSSIONS

3.1. Land-level Analysis Results

By analyzing the land-level landscape index of Shanghai (see Table 1), we can obtain that the total area of land use classes in Shanghai exceeds 720,000 ha, the number of patches exceeds 720,000, and the largest patch area accounts for 12.37%. The average patch area in Shanghai is 2.672 ha. The patch size varies greatly by type, and the edge density also reaches 150.41 m/ha. The patch structure is relatively complex, and the Splitting Index is 38.84%, indicating that the

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patch is relatively compact. Generally speaking, there are more patches of land use types in Shanghai, and the patch area varies greatly, and the patches are more complex and compact.

Table 1. Landscape index land-level analysis results

type	TA	NP	LPI	ED	AREA_MN	SPLIT
land-level	721831.4	270148	12.3707	150.4097	2.672	38.8412

3.2. Class-level Analysis Results

After landscape pattern index analysis, the information of different class-level pattern indicators were obtained, as shown in Table 2. It is not difficult to see that farmland has the largest area of the four land use types, followed by urbanland and greenland and the area of water is the least. The greenland has the largest number of patches and the smallest average patch area. At the same time, the patches show the strongest dispersion. The largest patch accounts for only 0.33% of the greenland area, indicating that the greenland plate is small and has a high degree of fragmentation. Water is the land use type with the fewest patches, and the average patch area is the second highest after farmland. The patch edge density in water area was the lowest among the four land types, implying that the water patch structure was relatively simple. Farmland is the land type with the largest average patch area, reaching 8.13 ha, and the largest patch ratio is 5.65%. At the same time, it is also the land use type with the highest density at the patch edge, reaching 132.37m/ha. It shows that the average area of farmland patches is larger and the structure is more complex. Although the dispersion of the four land use types is high, urbanland is the land use type with the lowest degree of separation, and the largest patch ratio is also the highest at 12.37%. Due to the characteristics of urbanland, its patch edge density is also larger, reaching 91.23m/ha. Therefore, the urban land patches are more complex and relatively concentrated.

Table 2. Landscape index class-level analysis results

type	CA	NP	LPI	ED	AREA_MN	SPLIT
water	44573.85	12831	1.5136	7.7056	3.4739	2813.71
urbanland	210581.9	73301	12.3707	91.2348	2.8728	64.305
greenland	94135.68	138184	0.3317	69.5077	0.6812	41087.13
farmland	372540	45832	5.649	132.3712	8.1284	101.8828

3.3. Discussions

Through the analysis of the landscape pattern, we can intuitively get the urban development status, and then give suggestions for the next development planning of the city. Through the analysis of the landscape pattern in Shanghai, it can be seen that the size of various types of landscape patches in Shanghai is quite different and presents a high degree of separation. The distribution of various types of land in Shanghai is uneven, and it is not easy to form a scale in the process of urban development. In the next development planning, attention should be paid to the degree of aggregation of patches of different land use types, so as to improve the integrity and scale of land use types, which is more conducive to urban development. Through the analysis of landscape structure, it can be seen that greenland has the most patches, and should be reasonably planned according to the specific distribution to enhance the degree of utilization and reduce the waste of greenland. The redundant greenland should be developed and transformed into urbanland.

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4. CONCLUSION

Based on the analysis of the land use types in Shanghai in 2005, the following conclusions are obtained:

(1) The separation degree of various land use types in Shanghai is at a relatively high level, and the integrity of land use is poor;

(2) In the next development planning, attention should be paid to the degree of aggregation of patches of different land use types, so as to improve the integrity and scale of land use types, which is more conducive to urban development;

(3) It is recommended to plan rationally according to the specific distribution of greenland, improve the utilization degree, and reduce the waste of greenland. Redundant greenland can be converted into urbanland.

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