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Explore Vegetation Coverage of Qichun County by Satellite Remote Sensing

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Abstract

In view of the requirement for exploring vegetation coverage of Qichun County, in this study, Landsat8 satellite image data was selected as the basic data resources. After preprocessed the image data, the Normalized Difference Vegetation Index (NDVI) of Qichun County was obtained by using the band calculation method, and then, the pixel dichotomy method was used to obtain the Fractional Vegetation Cover (FVC) of Qichun County. The results show that there are 241.87 square kilometers, 458.70 square kilometers, 1113.57 square kilometers, 581.39 square kilometers and 5.80 square kilometers of non vegetation coverage areas, low vegetation coverage areas, medium vegetation coverage areas, higher vegetation coverage areas and high vegetation coverage areas in Qichun County, respectively, accounting for 10.07%, 19.10%, 46.37%, 24.21% and 0.25% of the county area.

Keywords

FVC(Fractional Vegetation Cover); Satellite remote sensing; Image process; Qichun county.

1. INTRODUCTION

Surface vegetation is not only the most basic surface feature form, but also one of the most important biological species. For human production and life, vegetation plays an important role in improving ecology, regulating climate, conserving water and providing people with rest and appreciation. Protecting and optimizing vegetation is an important work to ensure the sustainable development of cities. The premise of vegetation protection and optimization is to accurately survey the current situation of vegetation coverage. The traditional survey work generally uses surveying and mapping methods to obtain the corresponding spatial information through field survey and measurement, so as to calculate the vegetation coverage in the interior industry. This method has shortcomings such as high work intensity, uncontrollable field risks, and difficult to ensure accuracy. To solve these problems, this study uses remote sensing satellite images as the basic data, through the digital processing of remote sensing satellite image data and information extraction to survey the surface vegetation coverage of Qichun County.

2. SITUATION OF STUDY AREA

Qichun County is a county under the jurisdiction of Huanggang City, Hubei Province, China, it is the hometown of Li Shizhen, a famous medical scientist in the Ming Dynasty. It is located in the southeast of Hubei Province, north of the middle reaches of the Yangtze River, with an area

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of 2398 square kilometers. It is an important part of the Wuhan city circle. As of November 1, 2020, there were 792101 permanent residents. The administrative region of Qichun County is shown in Figure 1.

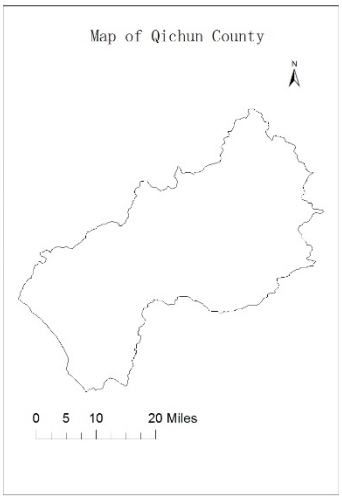

Figure 1. Map of Qichun County

3. DATA AND RESEARCH METHOD

3.1. Data Acquisition and process

In order to explore various natural resources including vegetation, many countries have launched a large number of resource exploration satellites, among which Landsat Series satellites launched by the United States are typical representatives. The data used in this paper is mainly Landsat8 OLI images. According to the naming rules of the strip numbers of Landsat8 OLI images and the geographic location of Qichun County, the images of Qichun County are distributed in 122 column and 39 row. After the strip numbers of the target area are determined, the geospatial data cloud can be obtained from the open data acquisition platform (http://www.gscloud.cn/). Retrieve and download the corresponding Landsat8 OLI image according to the column and row number. After the original image is downloaded, it needs to be preprocessed including radiometric calibration, atmospheric correction, geometric correction and other steps, and then the image data of the study area is cut out from the original strip data using the vector boundary data of the study area. The Landsat8 OLI remote sensing image of Qichun County obtained after preprocessing and cutting is shown in Figure 2.

Figure 2. Landsat8 OLI Image of Qichun County

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3.2 Calculation and treatment method

Because a specific surface feature has a specific reflectivity to the spectrum of different wavelengths, it is necessary to use this reflection feature of a specific surface feature to perform a corresponding ratio operation between different wavebands, which can highlight a specific surface feature more, so as to achieve the extraction of the surface feature. Because of the cell structure of its leaves, plants show the characteristics of high reflectance in the near-infrared band and strong absorption in the red light band. Based on this feature, Normalized Difference Vegetation Index (NDVI) can be used to extract the vegetation information in Landsat8 images. The NDVI calculation formula is shown in Formula (1).

$$\mathrm{NDVI} = \frac{(P(NIR)-P(RED))}{(P(NIR)+P(RED))} \tag{1}$$

P (NIR) is the reflectance value of near-infrared band, and P (RED) is the reflectance value of red band. In ENVI5.3 software, use Band Math tool input formula (1) and configure corresponding bands to get the NDVI distribution of Qichun County, and the calculation results are shown in Figure 3.

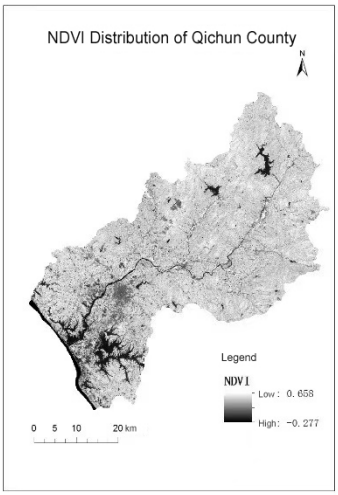

Figure 3. NDVI Distribution of Qichun County

After obtaining the NDVI value of Qichun County, the FVC (Fractional Vegetation Cover) of Qichun County can be calculated by pixel dichotomy. The pixel dichotomy method assumes that the information observed through remote sensing sensors can be expressed as the information contributed by the color vegetation and the information contributed by the non vegetation part. Therefore, FVC can be expressed by formula (2).

$$\mathrm{FVC} = (\mathrm{NDVI} - NDVI_{soil})/(NDVI_{veg} - NDVI_{soil}) \tag{2}$$

In formula (2), $NDVI_{soil}$represents the NDVI value of the area without vegetation coverage, $NDVI_{veg}$ represents the NDVI value of pure vegetation area. Similarly, the FVC result of Qichun County can be obtained by using Band Math tool input formula (2) in ENVI5.3. Its distribution is shown in Figure 4.

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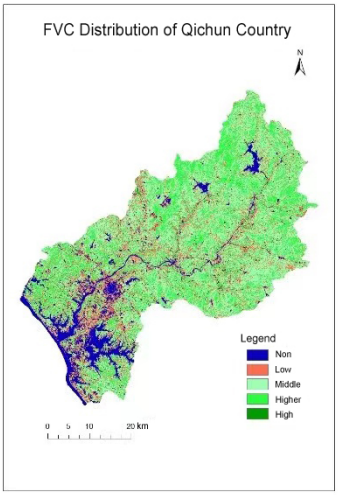

Figure 4. FVC Distribution of Qichun County

4. RESULTS AND DISCUSSIONS

According to the FVC results of Qichun County, the number of pixels corresponding to non vegetation area, low vegetation area, middle vegetation area, higher vegetation area and high vegetation area of Qichun County can be calculated by using the computer statistics tool of ENVI5.3. The area of each area and its proportion in the area of the whole county can be calculated according to the spatial resolution of Landsat8 near infrared band and infrared band. The relevant calculation results are shown in Table 1.

Table 1. Regional Information of Vegetation Coverage at All Levels in Qichun County

Region	Pixels	Range (km2)	Ratio (%)
Non vegetation coverage	268747	241.87	10.07
Low vegetation coverage	509665	458.70	19.10
Middle vegetation coverage	1237295	1113.57	46.37
Higher vegetation coverage	645992	581.39	24.21
High vegetation coverage	6453	5.80	0.25

Based on the analysis of image map, the vegetation free areas in Qichun County are mainly the Yangtze River in the south of the county and its tributaries Qihe River, Chixi Lake and Honghu Lake, and Huayuan Reservoir and Datong Reservoir in the north; The low vegetation area is mainly the central area of the county and the main roads in the county; The middle vegetation area is mainly the center of each township, and the higher vegetation area and the higher vegetation area are mainly distributed in the northern mountain and forest areas.

5. CONCLUSIONS

Satellite remote sensing image is an objective and true record of the earth's surface. Landsat8 satellite image has good spatial resolution and appropriate band combination. Using its image to carry out band operation can quickly obtain the quantitative results of the county's surface vegetation coverage, greatly reduce the field workload, and greatly improve the work efficiency. It is a good choice for natural resources census, as the spatial resolution and spectral resolution of relevant satellite images continue to improve, they will be further used in the breadth and

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depth of natural resources census in the future. At the same time, as the temporal resolution of images improves, they can also be dynamically monitored at a more refined time series level.

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