10.18686/eph.v2i2.4139

# Study on Vegetation Coverage Based on Binary Pixel Model

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***Abstract:*** Vegetation coverage (FVC) is an important indicator of ecosystem change and provides an indicator for the study of land cover change. In this paper, taking Zhengzhou City as an example, the 2015 Landsat 8 OLI remote sensing images were used as data sources, normalized vegetation index (NDVI) was used as a parameter to extract information from the study area, and the pixel binary model was used to calculate vegetation coverage. The results showed that the vegetation cover was higher in the west and lower in the east, and some forest land was changed into cultivated land from west to east.

***Keywords:*** Landsat 8 OLI remote sensing image; Land cover type; Pixel binary model

## Introduction

Vegetation coverage refers to the percentage of the vertical projected area of vegetation on the ground in the total area of the statistical area, and is a comprehensive quantitative index of the surface status of plant communities [1]. FVC can objectively reflect the basic situation of regional vegetation cover and changes. Therefore, in many scientific studies, FVC is often taken as a basic measurement parameter, which is also an important influencing factor of environmental change. Meanwhile, FVC and its changes are also important parameters for evaluating soil erosion, land desertification and hydrological monitoring [2]. Normalized vegetation index is a quantitative value calculation result that receives spectral information from the surface of objects and reflects the status of surface vegetation from remote sensing sensors, which can effectively reflect the green information of vegetation. This vegetation index is more sensitive to vegetation growth characteristics, and can eliminate shadow and radiation interference of terrain and community, with a wide detection range and high sensitivity. It can also attenuate solar altitude Angle and atmospheric noise, and is commonly used for regional scale vegetation classification and vegetation coverage research [3].In order to improve the estimation accuracy of vegetation coverage (FVC), scholars at home and abroad have proposed a number of improved methods for binary pixel models, the essence of which is to improve the selection of □□□ and □□□ parameter values. Since the foliage of vegetation has strong absorption characteristics in visible and red wavelengths, and strong reflection characteristics in near-infrared wavelengths, most scholars use this feature of vegetation to reflect the spectral characteristics of surface vegetation cover with vegetation index [4]. Shi Liangliang et al. [5] selected Landsat7 remote sensing data as the data source and used the pixel binary model to obtain the vegetation coverage of Lushan County in the earthquake region when studying the spatio-temporal changes of vegetation coverage.

## 1. Study area and data source

The data in this paper are collected from geospatial data cloud (http://www.gscloud.cn). Landsat8 OLI satellite image of Zhengzhou City in September 2015 (image number LC81240362015257LGN00) was selected, and the orbital number was 124-36. Imaging was performed on September 14, 2015. Landsat8 satellite data includes a total of 11 bands, with an imaging width of 185*185km, and a panchromatic band ground resolution of 15m in the image band data.

## 2. Land cover type classification

Remote sensing image preprocessing includes: atmospheric correction, image fusion, Mosaic, cropping, etc. Then, maximum likelihood supervised classification is used to classify the pixels in the study area according to the maximum similarity of the pixels in neighboring areas, and the images are divided into five types of surface objects: construction land, forest land, agricultural land, water body, and other five types. (Figure 1)

## 3. Vegetation cover calculation

In this paper, the normalized vegetation index is used as the parameter to reflect the vegetation cover status. Firstly, the NDVI value is calculated by using the cropped image, and the regional NDVI image is obtained. In the calculated NDVI image, through statistical analysis

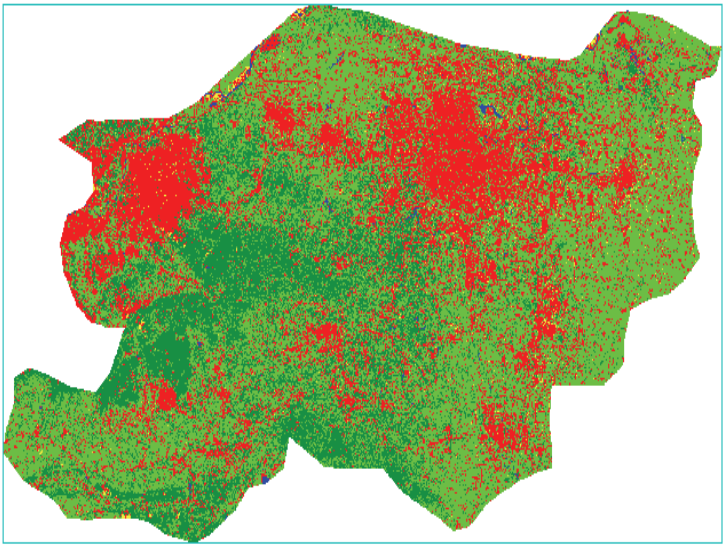

**Figure 1. Maximum likelihood supervised classification results**

of NDVI values, it can be found that the DN values of some pixels are out of the normal range and belong to the error pixel, which is caused by the error of reflectance data of some occluding pixels in the process of atmospheric correction. Before extracting information from NDVI images, abnormal pixel values need to be removed or changed to remove outliers.

### 3.1 Make land mask documents

By making mask files, the area of interest of each type of ground object is processed independently, the image content in the area of interest remains unchanged, and the images outside the area of interest are uniformly classified as background values. By making mask files for each land type, this paper is convenient for statistical analysis of NDVI values of various ground objects, so as to accurately measure vegetation coverage.

### 3.2 Calculate NDVIsoil and NDVIveg

3.2.1 Statistically analyze the DN value range of various ground objects, click ENVI statistical tool Computer Statistics, and select the NDVI image with outliers removed from the Compute Statistics Input File panel. Click Select Mask Band to select the mask file of a type of surface object, click OK, select the display histogram and confirm.

3.2.2 Select the confidence interval in the statistical chart displayed, and select the minimum and maximum value of NDVI. The method of selecting the confidence interval this time is that the NDVI value with the cumulative number of pixels reaching five digits is taken as the minimum and maximum value of NDVI, and the confidence interval of various ground objects is determined.

3.3.3 Generate the parameter file of the minimum and maximum NDVI values, click the Band Math function, and enter the NDVIsoil numerical calculation formula on the panel:

$$b1*a+b2*b+b3*c+b4*d+b5*e \tag{3.1}$$

In the formula, b1-b5 represents the mask files of various ground objects, and a-e represents the minimum NDVI values of corresponding ground objects. After the formula input is completed, click OK. On the pop-up panel, b1-b5 select the mask file data respectively, and click OK after selecting the file output path. Then select the maximum NDVI value of various ground objects to calculate NDVIveg and output the parameter file.

### 3.3 Band operation

By band calculation, the difference between NDVI and NDVIsoil with outliers removed was divided by the difference between NDVIveg and NDVIsoil to get the FVC value. Click the Band Math function and Enter the band calculation formula under Enter an expression:

$$(b1-b2)/(b3-b2) \tag{3.2}$$

### 3.4 Outlier of vegetation coverage removal

Click on the Band Math function and Enter the criteria under Enter an expression:

$$0>b1<1 \tag{3.3}$$

After entering the formula, click OK, select the FVC result file represented by b1 under the Available Bands List, select the FVC result file whose output is outlier processing, and click OK to obtain the FVC image with NDVI value between 0 and 1. (Figure 2)


**Figure 2. Vegetation coverage map**

## 4. Conclusion

The west and south of Zhengzhou are mountainous and hilly terrain, with low urbanization degree, small population, and high vegetation coverage. In the mountainous area, forest land is the main cover, and the coverage ratio is high. There are a small number of towns and cities in the southwest, so there is a concentrated distribution of crop vegetation around the residential areas. In the central and northeastern part of the urban area is the urban center with low vegetation coverage, basically no forest and agricultural land cover, and most of the land surface is covered by buildings, which also shows that the urbanization process will indeed have an impact on the environment and vegetation cover. The vegetation coverage in the eastern region is higher than that in the central urban area, and the main vegetation coverage type is agricultural land, which is because the eastern region is less mountainous and hilly, belonging to the North China Plain, suitable for agricultural development. The experimental results show that it is feasible to use the pixel binary model to monitor vegetation coverage, and the vegetation normalization index as an evaluation parameter can better express the regional vegetation coverage.

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**Fund Project:** Basic Scientific Research Project (Youth Project) of the Department of Education of Liaoning Province, "Key Technology Research on the characteristics of Temporal and Spatial changes of Urban Heat Island Effect" (LJKQZ20222333).

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