

Explore Vegetation Coverage of Shandong Province based on Remote Sensing

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Abstract

Aiming at the exploring of vegetation coverage in Shandong province, this paper provided a method based on remote sensing. Firstly, the Landsat8 OLI image was selected to be the data resources, and then, the remote sensing image of Shandong Province was separated from the original image by using vector data as a tool. And then, Using the method of band match, the NDVI value of Shandong Province was calculated, and then the FVC value of Shandong Province was obtained using the formula. The FVC distribution map of Shandong Province was plotted using resampling method. Finally, the vegetation coverage of each category was calculated using pixel statistical method. The research results of this article can provide effective reference for environmental protection and sustainable development in Shandong Province.

Keywords

Vegetation Coverage; Remote Sensing; Band Match; Shandong Province.

1. Introduction

Vegetation is one of the most important natural resources, it not only provides oxygen and improves the environment quality, but also is an important component of natural landscape, protecting vegetation is one of the core tasks of environmental protection and sustainable development. Accurate and dynamic monitoring of vegetation coverage change is the foundation for vegetation protection. Traditional vegetation coverage change monitoring methods rely on artificial field surveys and surveying, which have the drawbacks of slow operation speed and high work intensity. Satellite remote sensing technology can use the multispectral sensors carried by satellites to scan the research area, and quickly extract vegetation information based on the image data returned by the sensors, greatly improving work speed and reducing work intensity. Therefore, using satellite remote sensing technology to monitor vegetation resources is a expecting method.

2. General situation of Shandong Province



Figure 1. Map of Shandong province

Shandong is a province of China, in Chinese, it is called as “LU” in short, it is the hometown of the famous Chinese philosopher and educator Confucius. It is a coastal province in East China, located along the eastern coast of China, between 34 ° 22.9 ' -38 ° 24.01 ' N and 114 ° 47.5 ' -122 ° 42.3 ' E, it borders Hebei, Henan, Anhui, and Jiangsu provinces from north to south. The land area of the province is 155800 square kilometers, with a permanent population of 101.6279 million by the end of 2022. Map of Shandong province can be showed as [Figure 1](#).

3. Data and Methods

3.1. Data

In order to observe the surface resources of earth, humans have launched a large number of artificial satellites. Among these satellites, the land series satellites launched by the United States are the most technologically mature representatives. The images collected by the currently in satellite landsat8 of this series cover the global surface, and the images are divided according to the row and column number. The data used in this article is based on the image data collected by Landsat 8. According to the geographical location of Shandong Province, the corresponding images are downloaded from the cloud platform as the data source. Property of Landsat8 image bands shown in [Table 1](#).

Table 1. Property of Landsat8 image bands

Band Name	Bandwidth(μm)	Resolution(m)
Band1 Coastal	0.43-0.45	30
Band2 Blue	0.45-0.51	30
Band3 Green	0.53-0.59	30
Band4 Red	0.64-0.67	30
Band5 NIR	0.85-0.88	30
Band6 SWIR1	1.57-1.65	30
Band7 SWIR2	2.11-2.29	30
Band8 Pan	0.50-0.68	15
Band9 Cirrus	1.36-1.38	30
Band10 TIRS1	10.6-11.19	100
Band11 TIRS2	11.5-12.51	100

3.2. Methods

Plant leaf tissue strongly absorbs blue light (470nm) and red light (650nm), while strongly reflects green and infrared light. The sponge tissue in the center of the leaf and the tissue on the back of the leaf reflect strong near-infrared radiation (NIR, 700-1000nm). From red light to infrared light, the reflectance of bare ground is higher but the increase is small. The higher the vegetation coverage, the smaller the red light reflection, and the greater the near-infrared light reflection. Red light absorption quickly reaches saturation, while near-infrared light reflection increases with increasing vegetation. So, any mathematical transformation that enhances the difference between Red and NIR can serve as a vegetation index to describe vegetation conditions. In this article, NDVI(Normalized Difference Vegetation Index) was used as core factor to express the vegetation, the calculation of NDVI can be represented by formula 1

$$NDVI = \frac{(NIR-Red)}{(NIR+Red)} \quad (1)$$

After obtaining the NDVI values of Shandong Province, we further used FVC to express the vegetation coverage in Shandong Province, and the calculation of FVC can be expressed using formula 2.

$$FVC = \frac{NDVI - NDVI_{soil}}{NDVI_{veg} - NDVI_{soil}} \tag{2}$$

In general, the NDVI_{soil} value is the closest value to the cumulative percentage of NDVI of 5%; The NDVI_{veg} value is the closest value to the cumulative percentage of NDVI at 95%.

4. Results and Discuss

Using the Landsat8 images of 2020 as the basic data, the FVC results of Shandong Province were calculated. Using ArcGIS as the mapping tool, the FVC map was obtained, which is shown in Figure 2.

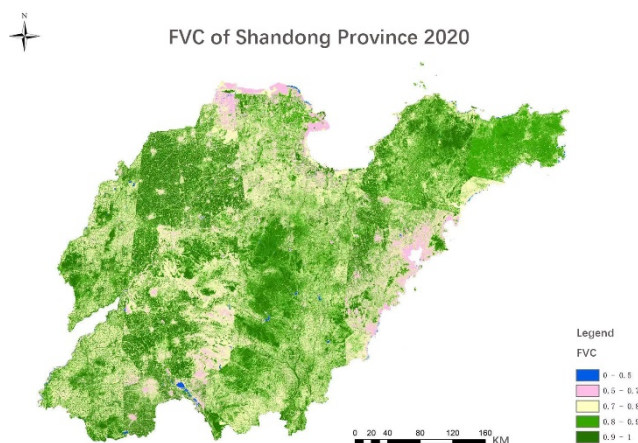


Figure 2. Map of FVC(2020)

Using the pixel statistics function in ArcGIS, based on the spatial resolution of Landsat8, we can calculate the area of each vegetation coverage category, and their results are presented in Table 2.

Table 2. Statistics of FVC(2020)

FVC	Area(Km2)
0-0.5	328.29
0.5-0.7	11822.66
0.7-0.8	61711.1
0.8-0.9	47001.72
0.9-1.0	37756.94

5. Conclusion

According to the work of this article, we can draw the following conclusions:

- (1) Landsat8 images covered the whole earth, so it is can be used to research natural phenomenon all over the earth.
- (2) When using Landsat8 images to study global natural phenomena, the key to determining the accuracy of the results lies in the resolution of the image, which includes three aspects: spatial resolution, spectral resolution, and temporal resolution. Therefore, when the accuracy requirement is not too high on a large scale, its effect is very good.
- (3) After the research in this article, the results show that the distribution of vegetation coverage in Shandong Province is relatively uniform, indicating that its environmental protection, especially the effectiveness of vegetation protection, is very good, laying a good foundation for the sustainable development of Shandong Province.

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