

Research on the Vegetation Index Change in Yulin City under the Background of Ecological Project Implementation

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Abstract

Based on the data of MOD13A1, the characteristics of the temporal dynamic changes of vegetation in Yulin City in the past 20 years are analyzed, and the factors affecting the changes of the vegetation index are explored. The maximum value synthesis method is used to obtain the average value of NDVI for each year in Yulin City, and the influence of precipitation and temperature on the vegetation index is analyzed in combination with meteorological data. The results show that the vegetation index of Yulin City from 2000 to 2019 was between 0.11 and 0.22, showing a significant upward trend in time distribution, with an overall rising rate of 0.044/(10a); From 2000 to 2019, human activities and hydrothermal conditions affect the vegetation index, in which human activities are the dominant factor. In summary, the vegetation index of Yulin City is showing an upward trend, and the national policy of returning farmland to forest and grassland has made great achievements and improved the overall ecological environment of Yulin City.

Keywords

Yulin City, NDVI, MOD13A1, National policy.

1. Introduction

Vegetation is an important medium for energy exchange, water cycle and carbon cycle on the earth's surface, and plays an important role in global energy balance and climate change [1]. Vegetation is also an indicator of the stability of the regional ecosystem, which has the functions of improving the climate, fixing water and soil, and reducing pollution [2]. In addition, the vegetation in arid areas is extremely sensitive to climate change and water and heat conditions. Therefore, exploring the process of regional vegetation change has important guiding significance in improving the ecological environment and the utilization of biological resources [3].

The Loess Plateau is one of the most vulnerable areas in my country's ecosystem. In the early years, due to excessive land reclamation, vegetation coverage declined significantly, and problems such as soil erosion and land desertification became increasingly prominent [4]. After years of implementation of the project of returning farmland to forest and grassland, the ecological environment of the Loess Plateau has been continuously improved [5]. Yulin City is a typical area of ecological conversion of farmland on the Loess Plateau. It is located in the central and southern part of the Loess Plateau. Under the background of ecological conversion of farmland, the vegetation coverage of Yulin City has undergone tremendous changes.

However, affected by natural factors and human activities, the ecological environment of Yulin City is still fragile. Therefore, probing the dynamic changes of vegetation in Yulin City and its relationship with precipitation and temperature is of great significance for guiding the coordinated development of the social economy and ecological environment of Yulin City. This study takes Yulin City as the research area, based on MODIS13 NDVI data, comprehensively uses the maximum value synthesis method to analyze the dynamic changes of the vegetation index in Yulin City from 2000 to 2019, and combines the meteorological factors such as precipitation and temperature in the research area to explore the impact. The factors of vegetation change in this area provide a scientific reference for the ecological and environmental protection of the region.

2. Data sources and research methods

2.1. Data sources

The MOD13A1 data selected in this study contains NDVI data from January to December 2000 to 2019 (data missing in January 2000), and the data comes from the American Aviation Administration (<https://ladsweb.modaps.eosdis.nasa.gov/search/>), the rank number is h26v05. Two images can be obtained every month, and the average value of the two is used as the vegetation index of the month. The meteorological data comes from the China Meteorological Data Network (<https://data.cma.cn/>). There are 10 national meteorological stations in the study area, namely Shenmu Station (53651), Yulin Station (53646), Jingbian Station (53735), Hengshan Station (53740), Suide Station (53754), Dingbian Station (53725), select the daily precipitation and temperature data of each meteorological station from 2000 to 2019, and obtain the monthly average of precipitation and temperature in the study area through sorting and calculation annual average.

2.2. Research methods

Maximum Value Composites (MVC) can minimize the interference of factors such as water vapor and air pollution, and is widely used in the study of the dynamic changes of vegetation index. This paper uses the MVC module of ENVI5.3 software to synthesize the NDVI value of Yulin City from 2000 to 2019.

3. Results and analysis

3.1. Temporal change characteristics of vegetation index in Yulin City

Figure 1 shows the inter-annual change trend of NDVI in Yulin City from 2000 to 2019. From 2000 to 2019, the average annual NDVI of Yulin City was between 0.11 and 0.22, showing a significant growth trend as a whole, with a growth rate of 0.044/(10a) and R^2 of 0.8304. Among them, there were minimum points in 2012 and 2015. The reason is that since 1999, Yulin City began to implement the project of returning farmland to forest and grassland. Humans planted large areas of woodland and grassland, which increased the vegetation coverage of Yulin City, and made Yulin City a significant increase in vegetation index from 2000 to 2019. The appearance of the minimum point may be related to the change of hydrothermal conditions, which requires further analysis and research.

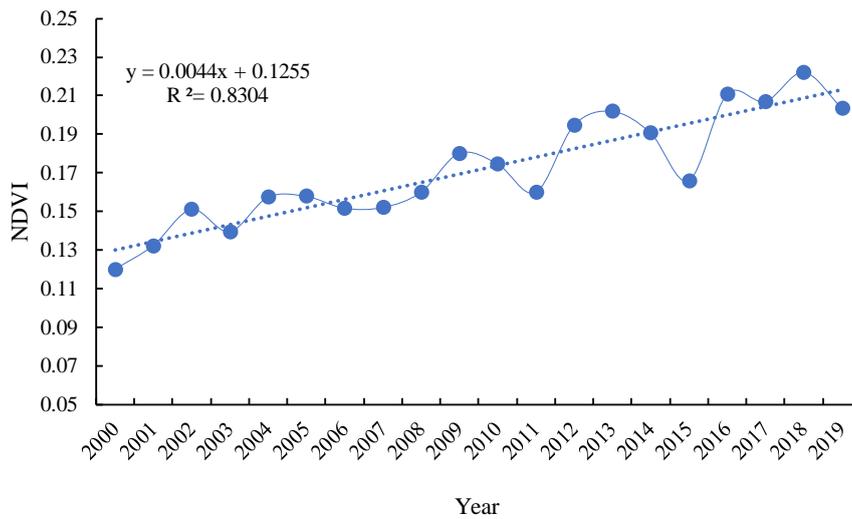


Figure 1: Interannual variation trend of NDVI in Yan'an City from 2000 to 2019

3.2. Analysis of influencing factors of vegetation index

3.2.1. The relationship between NDVI and natural factors

Analyzing the inter-annual distribution of NDVI and temperature and precipitation in Yulin City from 2000 to 2019 (Figure 2), it is found that the correlation between NDVI and temperature and precipitation from 2000 to 2012 was poor, and there was a negative correlation between temperature and NDVI. The reason was 1999 Yulin City began to implement the project of returning farmland to forest and grassland. During this period, human activities are the dominant factor in determining the status of the vegetation index and are less affected by natural factors. From 2013 to 2019, the change trend curve of the vegetation index in Yulin City was basically consistent with temperature and precipitation, and the three showed extremely low values at the same time in 2015, indicating that after 2013, the main factor affecting the growth of vegetation in Yan'an is water and heat conditions.

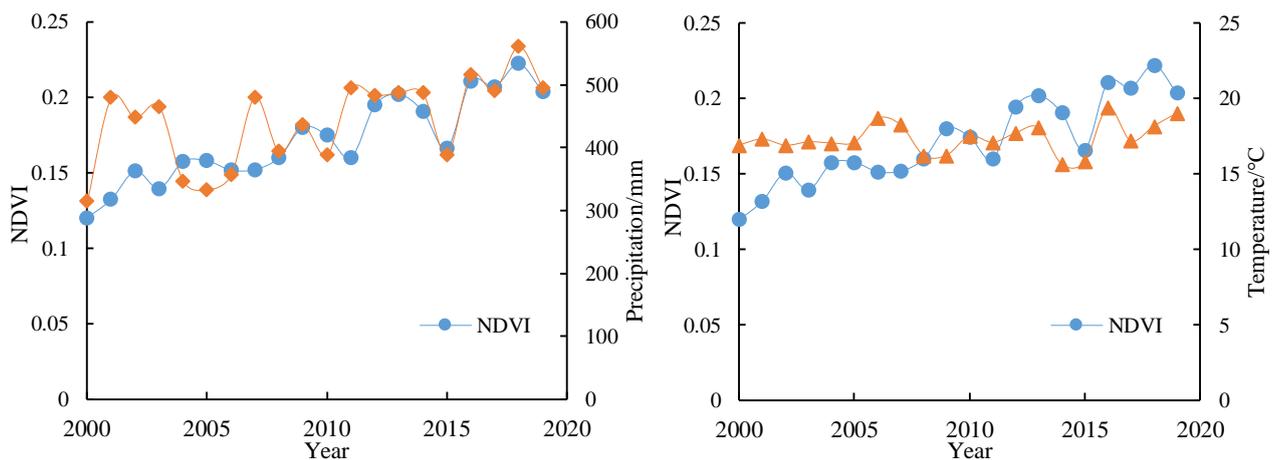


Figure 2: Variation curve of NDVI and annual rainfall and annual temperature in Yulin from 2000 to 2019

3.2.2. The relationship between NDVI and human activities

Since the end of the 20th century, the state has implemented projects to prevent soil degradation and soil erosion, such as returning farmland to forests and grasslands, flood diversion and silting land, and treatment of steep slopes. Yulin City actively responded to the national project and implemented an ecological policy of returning farmland according to land use types and natural environmental conditions. After the implementation of the ecological

conversion project, the ecological environment of Yulin City gradually turned to benign, ensuring the stability of the natural surface, and the comprehensive management of soil erosion increased by more than 25%. Effectively promote the growth of woodland and grassland, and the vegetation index of Yulin City has been significantly improved. However, there are still some areas of Yulin urban area and the surrounding cities of counties where the vegetation is seriously degraded. The reason is the rapid development of urbanization. Therefore, in order to ensure the stability and quality of human living environment, the government and people need to continue to maintain the ecological environment. We will not relax our protection efforts, follow the path of coordinated development of the social economy and the ecological environment, and regard the restoration of vegetation as a long-term commitment.

4. Conclusion

The vegetation index of Yulin City from 2000 to 2019 was between 0.11 and 0.22, showing a significant upward trend in time distribution, with an overall rising rate of 0.044/(10a). The vegetation index of Yulin City is affected by both natural factors and human activities. Among them, the NDVI increased rapidly due to the impact of the government's conversion of farmland to forest and grassland from 2000 to 2019. During this period, human activities were the dominant factor in determining the status of the vegetation index. The main factor affecting the growth of vegetation in Yulin City is water and heat conditions.

Acknowledgements

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References

- [1] Zhao Juchao, Zhu Yanhui, Duan Guohui, et al. Analysis of vegetation change characteristics in Xishuangbanna from 2001 to 2015 based on MOD13Q1 data. *Chinese Journal of Ecology*, Vol. 38 (2019) No. 4, p. 1083-1092.
- [2] He Liheng, Zhou Yinkang, Yang Qiang. Analysis of temporal and spatial changes and characteristics of vegetation coverage in Yulin City from 2000 to 2013. *Arid Land Resources and Environment*, Vol. 29 (2015) No. 11, p. 174-179.
- [3] Li Jianfei, Li Xiaobing, Zhou Yi. Spatio-temporal changes and influencing factors of NDVI in the growing season in Ulan Qab City from 2000 to 2015. *Arid Zone Research*, Vol. 36 (2019) No. 5, p. 1238-1249.
- [4] Sun Rui, Chen Shaohui, Su Hongbo. Spatiotemporal changes in vegetation NDVI of different land cover types on the Loess Plateau from 2000 to 2016. *Advances in Geography*, Vol. 38 (2019) No. 8, p. 1248-1258.
- [5] Sun Xiaobing. Research on land use change and landscape sustainability in Yulin City under the background of ecological conversion of farmland [D]. Northeast Agricultural University, 2017.