Spatial Distribution Characteristics of Fractional Vegetation Cover and Its Influencing Factors in the Upper Yellow River: Postprint

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Abstract

Using MODIS1M NDVI data from 2000–2015, the annual maximum Fractional Vegetation Cover (FVC) in the upper Yellow River basin was calculated to understand its spatial distribution and change characteristics. Simultaneously, a statistically-based Geographical Detector model was employed, considering non-climatic environmental factors, climatic environmental factors, and human activity factors, using corresponding proxy variables to conduct a quantitative study on the influencing factors of FVC spatial distribution in the upper Yellow River basin. The study revealed: FVC in the upper Yellow River basin was predominantly improving overall, with minimal changes in spatial distribution characteristics; In terms of single factors, precipitation (q-value of 0.669) was the primary influencing factor on FVC spatial distribution in this region, while the effects of other factors exhibited regional variations; The interactive effects of precipitation with soil type and land use patterns (q-values of 0.777 and 0.775) played a dominant role in FVC spatial distribution in the study area, with the influence of soil type and land use only manifesting under specific elevation and precipitation conditions; Overall, climatic environmental factors > non-climatic environmental factors > human activity factors; human activities, in conjunction with environmental factors such as precipitation, could more comprehensively explain FVC spatial distribution; Ecological restoration efforts in the study area should focus on the efficient utilization of precipitation and improvements in land use patterns.

Full Text

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Abstract

The ecosystem in the upper reaches of the Yellow River is fragile, and it is affected by the unique ecological environment and relatively simple vegetation types. The distribution of fractional vegetation cover (FVC) and its driving factors provide a reference for local vegetation protection. In this paper, the monthly data of MODIS 1M NDVI (2000-2015) were used to calculate the maximum FVC in the upper reaches of the Yellow River and analyze its distribution and characteristics. Moreover, the corresponding proxy variables were used to quantitatively study the affecting factors of FVC by using the geographical detector (Geodetector) model based on the statistics theory and considering the topographical, geological and climatic factors as well as human activities. The study showed that: The FVC in the upper reaches of the Yellow River was improved. The spatial distribution of FVC was stable even if there was a slight fluctuation; The distribution of FVC was mainly affected by annual precipitation. There were some regional differences in the effects of other factors, for example, the distribution of FVC in the southwest of the study area was subject to the joint effect of topography and pressure, the effects of topographic factors in the central and northeast regions were relatively low, and the FVC was mainly subject to precipitation, humidity, land use types, soil types and underlying surface; The interaction between the annual precipitation and the soil types and land use types was dominant to affect the spatial distribution of FVC; Holistically, the factors affecting the spatial distribution of FVC were in an order of climatic environment factors > non-climatic environmental factors > human activities. The interaction of human activities with environmental factors (such as precipitation) could be used to fully explain the spatial distribution of FVC; In the ecological restoration in this area, the full utilization of precipitation and the improvement of land use ways should be focused on.

Keywords: fractional vegetation cover (FVC); spatial stratified heterogeneity; affecting factor; Geodetector; upper reaches of the Yellow River

Fig. 1 Geographical location and topography of the study area

Fig. 2 Direct determinants and their proxy variables concerning the FVC spatial distribution in the upper reaches of the Yellow River

References

[3] YANG Shengtian, LIU Changming, SUN Rui. The vegetation cover over last 20 years in Yellow River Basin[J]. Acta Geographica Sinica, 2002, 57(6): 679-684.

[5] ZHANG Dongsheng, ZHANG Wenzong, YU Jianhui, et al. Analysis of influencing mechanism of residents' livability satisfaction in Heshun region, China[J]. International Journal of Geographical Information Science, 2010, 24(1): 107-127.

[9] WANG Jinfeng, XU Chengdong. Geodetector: Principle and prospective[J]. Acta Geographica Sinica, 2017, 72(1): 116-134.

[12] SHRESTHA Anil, LUO Wei. Analysis of groundwater nitrate contamination factors[J]. Catena, 2016, 145: 321-333.

[15] ZHAO Yingshi. Principles and Methods of Analysis of Remote Sensing Application[M]. Beijing: Science Press, 2013.

[16] CHANG Kang-Tsung, ZHANG Kangcong, CHEN Jianfei. Introduction to Geographic Information Systems[M]. Beijing: Science Press, 2016.

[22] LIU Junhui, ZOU Zhangxin, GAO Jixi, et al. Response of vegetation to climate change and human activity based on NDVI in the Three-River Headwaters region[J]. Acta Ecologica Sinica, 2011, 31(19): 5495-5504.

Note: Figure translations are in progress. See original paper for figures.