

Evaluating the direct and indirect effect of climate and human activities on long-term vegetation greening in China

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Abstract

Understanding the long-term characteristics of vegetation variations and their relationship to climate and human activities is important for regional sustainable development and ecological construction. Herein, the normalized difference vegetation index (NDVI) was selected as a proxy, related method and algorithm were applied to obtain the nonlinear characteristics of long-term interannual NDVI in China. Partial least squares-structural equation modeling was employed to separate the effects of climate and human activities on vegetation greening. Further, geographically weighted regression was applied to explore the spatial correlations among comprehensive forces and vegetation growth and achieve the partitioning of driving forces. The results suggested that vegetation growth in China experienced an abrupt change in 1995, there was obvious vegetation browning during 1990–1995, and noticeable vegetation recovery from 1996 to 2018. Climate was a directly main driving force for vegetation increasing in China. The positive effect of climate was the most obvious in south China, with a path coefficient of 0.348. However, climate was significantly negative to vegetation growth in northwest China (-0.049). Improving socio-economic conditions had a slightly negative impact on vegetation greening, while ecological policy played a direct and obvious role in promoting vegetation growth, especially in northwest China, with a path coefficient of 0.295. Furthermore, ecological policy would directly affect the microclimate in northwest China, strengthen the restraint effect of water resources on vegetation, and then indirectly hinder vegetation increasing. Therefore, the implementation of ecological policies should be adjusted according to regional climatic conditions, to avoid the traditional way of increasing forest (grassland) area, and reduce the contradiction between water, soil and vegetation. Actually, the indirect effect of socio-economic conditions and ecological policy on vegetation growth was far greater than its direct impact in some cases; therefore, research attention should be paid to the indirect effects of driving forces on vegetation growth

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