Spatiotemporal Evolution of Vegetation Cover and Surface Moisture Conditions on the Loess Plateau Since the Grain for Green Project: Postprint

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Abstract

Based on MODIS and Landsat data from 2000–2014, and utilizing the Temperature Vegetation Dryness Index (TVDI) to reflect surface moisture conditions, this study analyzes the spatiotemporal variation characteristics of surface moisture conditions and vegetation cover and their interrelationships on the Loess Plateau since the implementation of the Grain for Green Project. From 2001 to 2014, the Normalized Difference Vegetation Index (NDVI) on the Loess Plateau increased at a rate of 6.3% • (10a)-1, while the Temperature Vegetation Dryness Index (TVDI) decreased at a rate of -4.5% • (10a)-1. Both vegetation cover and surface moisture conditions exhibited increasing trends, with a spatial distribution characterized by 'high in the southeast and low in the northwest,' generally indicating a positive spatial correlation between the two. From the perspective of TVDI and NDVI trends, vegetation cover and surface moisture conditions on the Loess Plateau demonstrated an overall increasing trend. Spatial distribution patterns revealed that vegetation cover changes were largely consistent with surface moisture condition changes, though regional differences persisted. From the perspective of correlation coefficients, vegetation cover and surface moisture conditions on the Loess Plateau displayed a positive correlation. In terms of the correspondence between change trends, during the 14-year period, changes in vegetation cover and surface moisture conditions in the mountainous regions along the northeast-southwest axis of the Loess Plateau were conducive to ecological environment improvement. Plain areas with intense human activity were highly unfavorable for ecological environment improvement. Notably, key regions of the Grain for Green Project represent critical areas for future monitoring and management of ecological environment changes to prevent secondary degradation.

Full Text

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Abstract

Based on MODIS and Landsat data from 2000 to 2014, this study utilized the Temperature Vegetation Drought Index (TVDI) to reflect surface humidity and analyzed the spatiotemporal variations of vegetation cover and surface humidity on the Loess Plateau since the implementation of the Grain for Green Project. The results indicate: (1) From 2001 to 2014, the growth rate of Normalized Difference Vegetation Index (NDVI) in the Loess Plateau was 6.3% • (10a) ^{1}, while TVDI decreased at a rate of -4.5% • (10a) ^{1}. Both vegetation cover and surface humidity showed increasing trends, with vegetation coverage exhibiting a spatial pattern of high values in the southeast and low values in the northwest, and a positive correlation was observed between surface humidity and vegetation cover. (2) According to the changing trends of TVDI and NDVI, both vegetation cover and surface humidity in the Loess Plateau demonstrated increasing trends, with spatial changes in vegetation cover largely consistent with variations in surface humidity, though regional differences existed. (3) Correlation coefficients revealed a positive correlation between vegetation cover and surface humidity in the Loess Plateau. From the perspective of changing trends, the 14-year variations in vegetation cover and surface humidity in the northeast-southwest zone of the Loess Plateau were beneficial for ecological environment improvement, while intense human activities in plain areas were unfavorable for ecological restoration. It is worth paying attention to the key areas where the Grain for Green Project is implemented because they are critical for monitoring and managing the ecological environment change in the future so as to avoid degrading again.

Keywords: vegetation cover; surface humidity; spatiotemporal evolution; Grain for Green Project; Loess Plateau

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