NDVI-BASED VEGETATION DYNAMICS AND ITS RESPONSE TO PRECIPITATION CHANGES IN THE HEXI CORRIDOR OF CHINA FROM 2000 TO 2019

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Abstract. To explore the response relationship of vegetation dynamic change characteristics, clearness vegetation and precipitation changes in the Hexi Corridor, China. This paper analyzed the NDVI between 2000-2019 using linear regression slope method based on long time series MODIS data. The annual NDVI values of the Hexi Corridor range from 0.15 to 0.22. The vegetation overall showed an upward trend in the last 20 years, with an average slope from 0.0125/10a. But there was significant variability in the trend of inter annual changes, as compared from 2000 to 2009, the rate of exponential increases in vegetation in the Hexi Corridor slowed in 2010-2019, and the average slope of changes in vegetation cover decreased from 0.0139/10a to -0.006 8/10a. The variation trend of NDVI is basically consistent with precipitation. The positive and negative correlation between NDVI and precipitation account for 61.58% and 38.42% respectively. The positive correlation region is mainly located in the central and southwest regions with relatively rich vegetation. The regions with negative correlation are mainly in the northern and northeastern desert areas, where there is no vegetation cover. It shows that the relationship between vegetation index and precipitation in Hexi Corridor is relatively close in areas with abundant vegetation.
Keywords: *MODIS, spatiotemporal evolution, Hexi Corridor, linear regression slope method*

Introduction

Precipitation is one of the key factors in plant growth and has a significant impact on the growth and development of vegetation. Vegetation plays an important role in terrestrial ecosystems and can visually characterize the regional ecological environment status. Vegetation change can reflect the degree of influence of various factors on vegetation in natural, artificial and economic ecosystems, and is an important reference data for the study of ecological environment change (Li et al., 2023; Sun et al., 2019). With the continuous upgrading and improvement of meteorological stations, rainfall, precipitation intensity and other meteorological elements can be monitored in real time, providing more accurate and timely data support for water resource management and agricultural production. With the continuous progress of satellite remote sensing technology, high-resolution satellite images provide detailed surface information, which can be used to infer the health of vegetation, the degree of cover, growth status and chlorophyll content by analyzing the spectral characteristics of vegetation (Chen et al., 2020; Lu et al., 2023). Vegetation index is a numerical value calculated based on remotely sensed data to assess the condition and growth of vegetation, and its application not only provides timely and accurate information about the ecological environment, but also positively influences decision-making and actions in environmental protection, climate change adaptation, and sustainable development (Yu et al., 2022). NDVI (Normalized Difference Vegetation Index) (Wang et al., 2021) is a

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commonly used tool to estimate the density and health status of vegetation cover by analyzing the reflectance of different bands in remote sensing data (Zhou and Zhang, 2023). By monitoring the changes in NDVI, the changes in land cover, including forest cover, agricultural land use, and urban expansion, can be analyzed to provide a basis for land planning and resource management (Huang et al., 2023). Mou Yuhang et al. studied vegetation cover changes based on remote sensing data, with a special focus on the impact of climate change on vegetation cover, and showed that increasing temperatures and changes in precipitation patterns significantly affect the spatial and temporal distribution of vegetation cover (Mou et al., 2023). Bianlin et al. developed a vegetation index monitoring method based on multi-source remote sensing data for tracking seasonal changes and long-term trends in vegetation cover, and the study emphasized the key role of vegetation index in monitoring climate change and ecosystem health (Bian et al., 2018). Luan et al. (2018) utilized satellite remote sensing data and ground observation data to quantify the evolution pattern of vegetation index, and the results showed that the apparent trends in vegetation cover are closely linked to climate, land use and other factors. Using high-resolution remote sensing data, He et al. (2022) investigated the spatial and temporal evolution characteristics of vegetation growing season in different regions and the impact of these changes on ecosystems and agriculture. In recent years, relevant researchers have conducted many studies on the spatial and temporal evolution patterns and drivers of vegetation indices. However, there are fewer studies on analyzing trends in vegetation change, and the correlation analysis of precipitation and temperature is not detailed (Ding et al., 2016; Ouyang et al., 2023; Li et al., 2021).

Climate is a key factor influencing the status of surface vegetation cover, and the study of climate-vegetation interactions has become an important part of global ecological change research. At present, the normalized vegetation index (NDVI), as an important indicator of regional vegetation cover, is widely used in the study of large-scale vegetation change and its relationship with climate (Cai et al., 2014; Fensholt et al., 2012; Jia et al., 2014). Therefore, NDVI is utilized to explore the regional vegetation cover change and its response to climate factors, so as to understand the influence of natural and anthropogenic factors on ecological changes (Zhu et al., 2022). In recent years, most studies on the vegetation NDVI have focused on the spatial and temporal evolution patterns of this indicator at the regional scale (Beck et al., 2011; Ma et al., 2023), with relatively few studies based on the spatial and temporal variations of NDVI and its drivers' responses during the vegetation growth period (Zhen et al., 2022). This dataset can effectively reflect the regional distribution and change of vegetation cover on both spatial and temporal scales, which is of great significance for the monitoring of vegetation change, the rational use of vegetation resources and other fields related to ecology and the environment (Wang and Yang, 2017).

The Hexi Corridor is at the intersection zone of my Qinghai-Tibet alpine zone and arid-semi-arid zone, which is one of the very fragile ecosystems in China, with an arid-semi-arid climate, and few studies have been conducted on the evolution pattern of the vegetation cover in the region and its response to climatic factors (He et al., 2021). Therefore, this study took the vegetation index of the Hexi Corridor region from 2000 to 2019 as the research object, and utilized MOD13A1 data, based on MRT tools to process the NDVI data within the research time period accordingly, to explore the spatial and temporal evolution patterns of vegetation cover in the region in the long time series and the NDVI data were processed based on ENVI 5.3 and ArcGIS 10.8 platform

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to investigate the temporal and spatial evolution of vegetation cover in the area and the trend of change in the long time series, and analyze the corresponding mechanism of climate factors, so as to scientifically evaluate the change of ecological environment quality in the area, and qualitatively analyze the effectiveness of ecological restoration projects, and to provide reference for the subsequent high-quality development of the Middle and Upper Yellow River and the ecological restoration policy.

Data and methods

Study region

The Hexi Corridor is located in northwestern Gansu Province, China, with geographic coordinates between 37°20′~40°53′N, 92°53′~103°51′E, altitudes between 800 and 3500 m, a width of about 100-200 km from north to south and a length of about 1120 km from east to west, and a long and narrow strip of land with a north-west-south-east orientation. It starts from the Ussuri Mountains in the east, neighbors Xinjiang Uygur Autonomous Region in the west, connects to Qinghai in the south, and reaches Inner Mongolia Autonomous Region in the north. Its terrain is flat and geographically favorable, surrounded by mountain ranges, making it a major route from the Northwest to the Central Plains and an important passage on the Silk Road (Lian et al., 2023).

The Hexi Corridor is located in the inland hinterland, with high terrain in the north and low terrain in the south, with complex and varied topography; the northern mountainous areas are mostly made up of low mountainous residual hills, the central area is a river alluvial plain, and the southern part of the area is made up of high mountains and valley bottoms. The main types of landforms include the Gobi Desert, grasslands, and open basins. The main vegetation types in Hexi Corridor are temperate desert steppe in the eastern section, temperate and warm temperate desert in the central and Western sections. The main vegetation of temperate desert steppe includes Gobi Stipa desert steppe and desert Stipa desert steppe; The main vegetation types in temperate desert include Haloxylon ammodendron and naked fruit trees. The distribution of forests in Hexi Corridor is relatively small, mainly including Populus euphratica and Elaeagnus angustifolia forests along the lower reaches of Heihe River and Shiyang River, and a small Picea crassifolia forest located on the shady slope of Dahuang mountain. The main river is the Yellow River, and the Hexi Corridor extends along the Yellow River, with flat and open terrain, and the Shule River, the Hei River and the Shiyang River are located in the region. It has a typical continental climate with hot and dry summers and cold and dry winters, with a large temperature difference between day and night. The annual precipitation is about 150 mm, which is concentrated in the summer, the average annual temperature is 6.6~9.5℃, and the frost-free period is about 140~170 days. The region is also rich in natural resources, such as mineral resources and wind energy resources (Li and Zhang, 2023).

Data sources

Precipitation data

Meteorological data were obtained from the China Meteorological Data Network (https://data.cma.cn/), and there are eight national meteorological stations in the study area, namely Usheling, Minqin, Wuwei, Yongchang, Zhangye, Gaotai, Jiuquan, and

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Maweishan stations (*Fig. 1*). Daily precipitation and temperature data from 2000 to 2019 were selected from each meteorological station, and the eight meteorological stations were categorized into the western part of the Hexi Corridor (Mazongshan station), the central part of the Hexi Corridor (Zhangye, Gaotai, and Jiuquan stations), and the eastern part of the Hexi Corridor (Wusheling, Minqin, Wuwei, and Yongchang stations) according to geographic locations, and the anomalies were processed and the missing values were supplemented to obtain the average annual rainfall and gas in the study area. The spatial distribution data of annual precipitation in the Hexi Corridor were collected by the resource and environmental science and data center of the Chinese Academy of Sciences (https://www.resdc.cn/). The dataset is based on the daily observation data of meteorological elements at more than 2400 stations in China, and is produced through statistical sorting and spatial interpolation.

MODIS data products

This study is based on the annual vegetation index dataset of China from 2000 to 2019, which was obtained from the Center for Environment and Science, Chinese Academy of Sciences (https://www.resdc.cn/). This dataset is based on 1-km satellite remote sensing images such as SPOT/VEGETATION and MODIS (Moderate-resolution Imaging Spectroradiomete), and the annual NDVI time-series dataset generated using the maximum value synthesis method, which has been widely used in studies such as monitoring vegetation dynamics changes, land use/cover change detection, macro-vegetation cover classification, and estimation of NPP at various scales of regions (Luan et al., 2018). In this study, ENVI5.3 software was utilized for projection transformation and regional cropping to obtain 20 years of NDVI data in the study area.

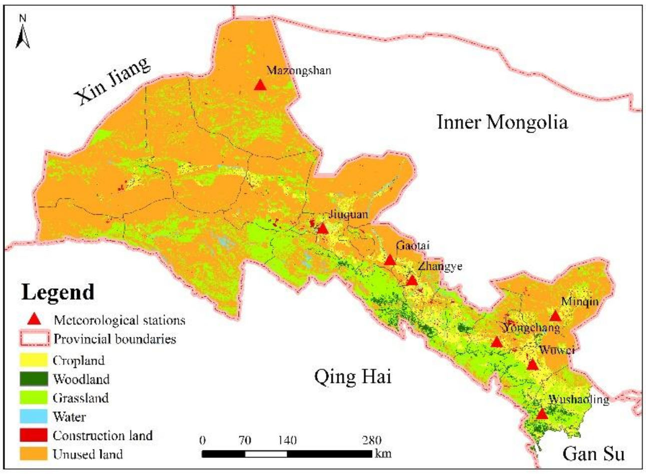

Figure 1. *Distribution of land use types and meteorological stations in the Hexi Corridor*

Research methods

The slope of the linear regression

Linear regression slope is a parameter change trend that can be modeled at the pixel scale, and is widely used in the study of vegetation index change in long time series.

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Slope of image regression of long time series NDVI is calculated as follows (*Eq.1*), if Slope is positive, it means that the vegetation index has an upward trend over time, and if it is negative, it means that the vegetation index has a downward trend over time, and the greater the absolute value of the slope, the more obvious the change of the vegetation growth condition is (Chen et al., 2020).

$$Slope = \frac{n * \sum_{i=1}^{n} i * NDVI_i - \sum_{i=1}^{n} i \sum_{i=1}^{n} NDVI_i}{n * \sum_{i=1}^{n} i^2 - (\sum_{i=1}^{n} i)^2} \tag{Eq.1}$$

where: Slope is the slope of the NDVI trend; n is the number of years in the monitoring time period, this study divided nearly 20a into 2 time periods, 2000-2009 and 2010-2019, and n took the value of 10; $NDVI_i$ denotes the vegetation index of the i year. When Slope > 0 indicates that the vegetation growth tends to improve, and Slope < 0 indicates that the vegetation growth tends to degrade status (Wang and Yang, 2017).

Correlation between NDVI and Precipitation

The correlation between the indicators was studied through the correlation coefficient, which was calculated as follows:

$$R_{xy} = \frac{\sum_{i=1}^{n} [(x_i - \bar{x})(y_i - \bar{y})]}{\sqrt{\sum_{i=1}^{n} (x_i - \bar{x})^2 \sum_{i=1}^{n} (y_i - \bar{y})^2}}$$

where R_{xy} is the correlation coefficient of the x and y variables, x_i is the NDVI in year i, y_i is the rainfall in year i, $\bar{x}$ is the multi-year average NDVI, $\bar{y}$ is the average of multi-year rainfall, and n is the number of years.

Results and analysis

Characteristics of spatial and temporal distribution of NDVI in Hexi Corridor

NDVI temporal distribution characteristics

In this paper, the NDVI of the study area in the last 20 years was calculated by using the maximum value synthesis method, and the results can better respond to the evolution of vegetation cover and the best growth condition of the Hexi Corridor in 2000-2019. The interannual trend of NDVI in the Hexi Corridor was simulated by one-way linear regression (*Fig. 2*). As can be seen from *Figure 2*, the annual NDVI values in the study area fluctuated from 0.15 to 0.22 and showed a gradual upward trend as a whole, with large fluctuations in individual interannual changes. Among them, the average annual NDVI value in 2001 was the lowest in the study period, and the increasing trend was maintained from 2002 to 2012. In 2004 and 2009, NDVI was the lowest value in this time period. Combined with the climatic conditions, it can be found that the precipitation in 2009 was the lowest in the last 20 years, and the lack of precipitation led to the deterioration of vegetation growth; from 2012 to 2016, the NDVI in the study area showed a significant downward trend, and the precipitation in the study area plummeted in 2013, which affected the growth of plants. However, with the increase of precipitation, NDVI showed an upward trend

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again. In the overall analysis, the NDVI values in the Hexi Corridor showed an increasing trend from 2000 to 2019, with ups and downs in individual years. The reason for the change is that the fluctuation of precipitation in the study area led to the fluctuation of NDVI values, coupled with human measures such as ecological and environmental management of the Hexi Corridor and the construction of water conservancy projects, which made the vegetation cover of the study area maintain an overall upward trend.

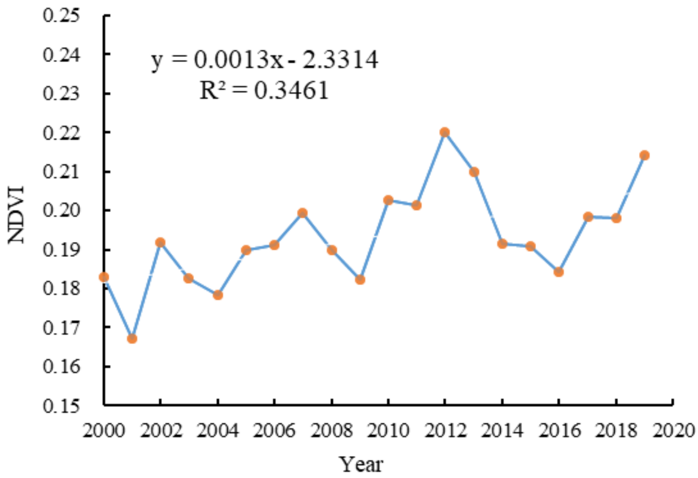

Figure 2. *Interannual variation of NDVI in the Hexi Corridor from 2000 to 2019*

NDVI spatial distribution characteristics

In this study, the NDVI of each year from 2000 to 2019 was accumulated year by year and then averaged as the NDVI of the Hexi Corridor for 20 a. According to the relationship between the NDVI and vegetation cover, the study area was divided into six classes as shown in *Table 1*. The results of the spatial distribution of NDVI in the Hexi Corridor region are shown in *Figure 3*, presenting the characteristics of high in the southeast and low in the northwest, and the results are basically the same as the topographic and geomorphological characteristics of the region. The high and dense vegetation zones are mainly distributed in the central and southeastern parts of the study area, accounting for 10.9% of the area of the study area. The central part of the area is mainly basins and plains, with water and heat conditions suitable for the growth of vegetation, and the main land-use types are arable land and grassland, while the southern part of the area is dominated by high mountains and valleys, which is one of the main pasture areas in Gansu Province, and the land-use types are mainly grassland. The medium vegetation zone is distributed in the central part of the study area, accounting for 3.8% of the study area, which is located in the area with poor precipitation conditions and low vegetation cover. The low-vegetation zone, very low-vegetation zone and no-vegetation zone are located in the northwestern part of the corridor, accounting for 85.4% of the area of the study area, and are situated in the northern mountainous terrain and Alxa Plateau, which are dominated by the Gobi and desert, with a serious lack of precipitation and extreme evapotranspiration, resulting in a fragile ecological environment.

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***Table 1.** NDVI classification and vegetation cover delineation*

Level	Value range	Vegetation status
I	≤ 0.2	No vegetation cover
II	0.2 ~0.3	Very low vegetation cover
Ⅲ	0.3~0.4	Low vegetation cover
Ⅳ	0.4~0.5	Moderate vegetation cover
Ⅴ	0.5~0.6	High vegetation cover
Ⅵ	> 0.6	Dense vegetation cover

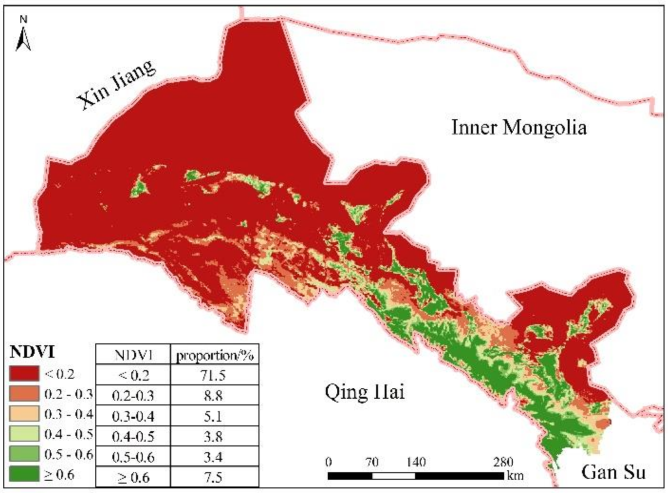

***Figure 3.** Spatial distribution of annual mean NDVI values in the Hexi Corridor from 2000 to 2019*

Characteristics of NDVI dynamics in Hexi Corridor

Figure 4a, b represents the distribution of linear regression slopes of NDVI in the Hexi Corridor in 2000-2009 and 2010-2019, respectively, and *Table 2* shows the distribution of NDVI slopes in 2000-2009, 2010-2019 and 2000 -2019 NDVI slope percentage and area. As can be seen from *Figure 4* and *Table 2,* the trend of changes in the vegetation index of the Hexi Corridor in each time period was significantly different. During 2000-2009, the average slope of vegetation cover change in the Hexi Corridor was 0.013 9/10a, and the vegetation in the Hexi Corridor generally showed a slow upward trend. Among them, the moderately improved area accounted for 16.4% of the total area, mainly distributed in the plains or basins in the central region; 54.4% remained basically unchanged; 29.3% was degraded, mainly distributed in the southeastern Wuwei City, mainly because of the outward expansion of urban construction from 2000 to 2009, and neighboring cropland or forest and grassland were occupied by construction land, which made the vegetation cover suffer a certain degree of destruction, resulting in the vegetation index being damaged. degree of destruction, resulting in a decrease in the vegetation index. During 2009-2019, the average slope of vegetation cover change in the Hexi Corridor was -0.006 8/10a, and the trend of vegetation cover change in the study area had obvious geographical differences, among which the areas with improved vegetation cover

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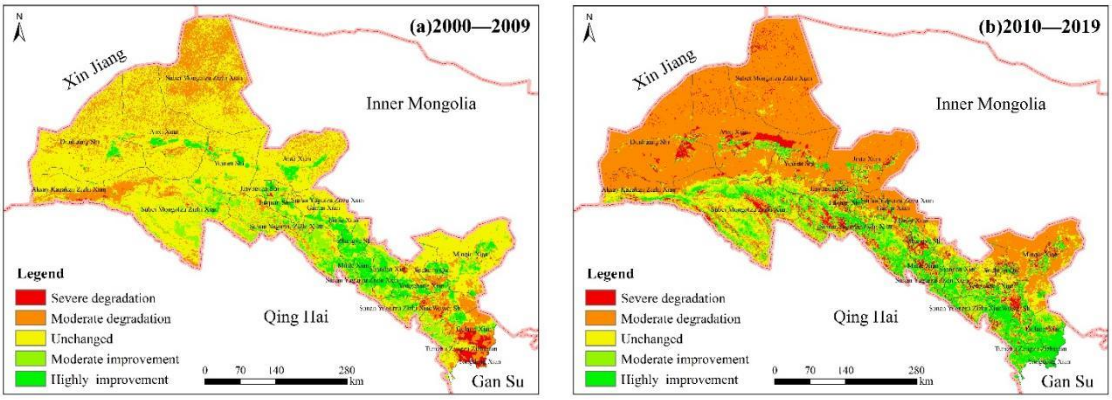
accounted for 20.4% of the study area, mainly distributed in the plains, basins and areas along the two sides of the Huangshan River in the corridor; 10.6% of the areas were basically The main reason for the degradation is that the precipitation in the region is unevenly distributed during this period, which affects the growth of vegetation and leads to the decrease of vegetation index.



(a) 2000-2009 (b) 2010-2019

Figure 4. *Spatial distribution of NDVI linear regression slope in from 2000 to 2009 and 2010 to 2019*

Table 2. *Proportion and area of different NDVI slopes in the River Corridor from 2000 to 2019*

NDVI variance tread	Slope range	2000-2009	2010-2019	2000-2019
		Proportions (%)	Proportions (%)	Proportions (%)
Severe degradation	< -0.007 79	1.4	6.4	0.3
Moderate degradation	-0.007 79~-0.000 98	27.9	62.6	45.9
Basically unchanged	-0.000 98~0.00 394	54.4	10.6	32.8
Moderate improved	0.003 94~0.009 25	10.8	10.6	15.7
Highly improved	> 0.009 25	5.6	9.8	5.3

Comparing the rate of change of NDVI in the two time periods of 2000-2009 and 2010-2019, the average slope decreased from 0.013 9/10a to -0.006 8/10a. From the linear regression slopes of NDVI in the Hexi Corridor in 2000-2019 distribution map (*Fig. 5*) and *Table 2*, it can be seen that the vegetation cover in the study area generally showed an increasing trend in the past 20 years, with an average slope from 0.012 5/10a, in which the areas with improved vegetation cover accounted for 21.0% of the study area, most of which were moderately improved areas, mainly distributed in the central and eastern parts of the corridor; 32.8% of the areas were basically unchanged, mainly in the southwestern and northeastern areas of the corridor; and there were 46.2% of the area is degraded, mainly in the western and northwestern areas.

Relationship between vegetation index and precipitation response

Figure 6 represents the change curve of annual precipitation in the eastern, central and western parts of the Hexi Corridor, from which the curve shows that the change process

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of precipitation in the eastern, central and western parts of the Hexi Corridor has a high degree of consistency, but there is an obvious gap between the levels of the three, which is significantly correlated with the distribution of vegetation in the Hexi Corridor. *Figure 7* shows the curve of NDVI and annual precipitation in Hexi Corridor from 2000 to 2019. It can be seen from the figure that the variation trend of NDVI in the past 20 years is relatively consistent with the fluctuation trend of precipitation, indicating that the relationship between vegetation index and rainfall in the Hexi Corridor is relatively close. The main reason is that the Hexi Corridor is a world-famous arid area with little rainfall and harsh vegetation growth conditions. The vegetation growth in the Hexi Corridor is greatly affected by precipitation. In order to further explore the correlation between NDVI and precipitation, the correlation between NDVI and annual precipitation from 2000 to 2019 was calculated based on the spatial distribution data of NDVI and precipitation (*Fig. 8*). The positive correlation and negative correlation between NDVI and annual precipitation accounted for 61.58% and 38.42% respectively. The regions with positive correlation are mainly located in the middle and southwest of the corridor, where vegetation is relatively abundant. The regions with negative correlation are mainly in the northern and northeastern desert areas, where there is no vegetation cover, and the correlation between precipitation and NDVI is weak.

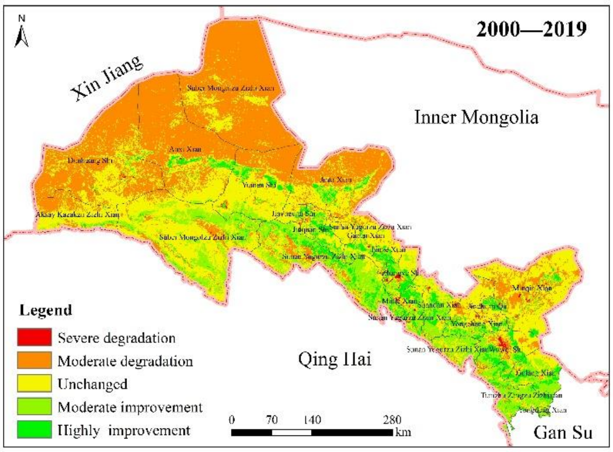

Figure 5. *Spatial distribution of NDVI linear regression slopes in the Hexi Corridor from 2000 to 2019*

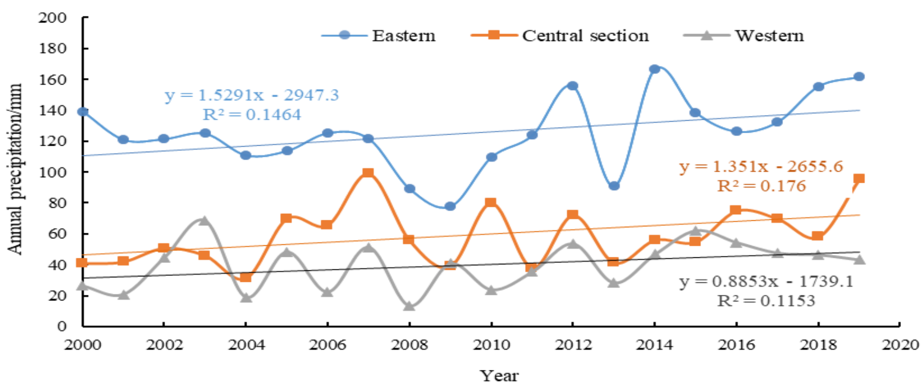

Figure 6. *Curves of annual precipitation changes in different areas of the Hexi Corridor from 2000 to 2019*

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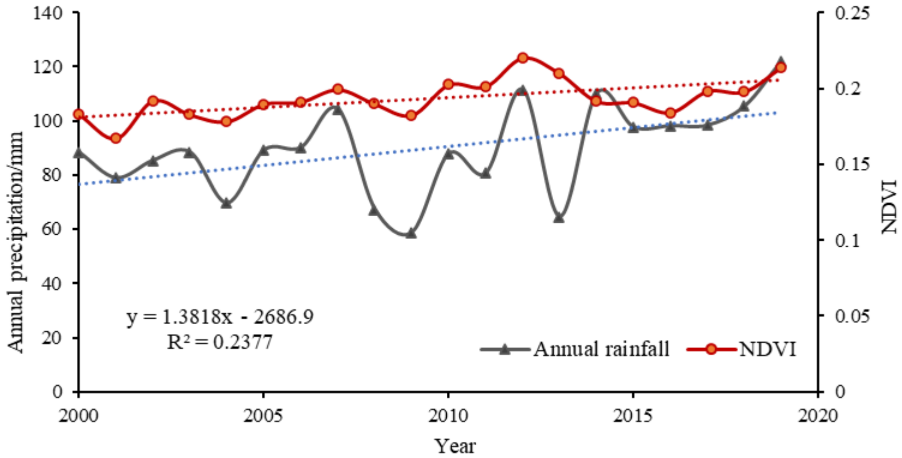

Figure 7. *Curves of NDVI versus annual precipitation in the Hexi Corridor from 2000 to 2019*

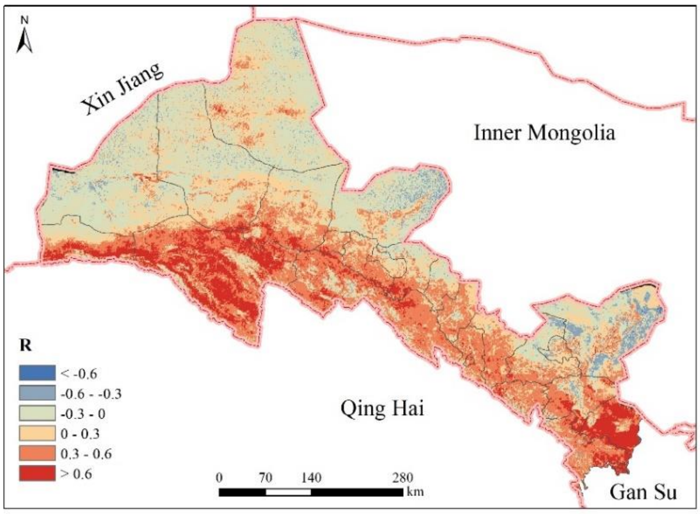

Figure 8. *The Correlation coefficients of annual precipitation with NDVI from 2000 to 2019*

Discussion

In recent years, with the development of remote sensing technology and continuous observation of satellite data, the study of the dynamic change of vegetation index has received wide attention, and the use of normalized vegetation index (NDVI) to assess the spatial distribution and change trend of vegetation has become a research hotspot. As early as in the 19th century, some scholars proposed the relationship between climate and vegetation based on the correlation between climate and vegetation growth (Charney, 1975), and among the many climate factors, the effects of precipitation and temperature on vegetation are very significant (Lkhagvadorj et al., 2019; Gang et al., 2019). In arid and semi-arid regions, vegetation is more strongly affected by precipitation, for example, Huang et al. (2019) showed that the effect of precipitation on the NDVI of vegetation was greater than that of temperature in the study of vegetation cover dynamics in the Loess Plateau, and related studies in grassland areas also showed the same results (Wang et al., 2020). This study area is in the arid and semi-arid region,

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and among the studies in similar regions, Erdene et al. (2016) studied the change of vegetation cover in the West Ordos National Nature Reserve from 2001 to 2013, which showed that precipitation was the main influence factor for the increase of vegetation NDVI. The overall NDVI value of vegetation in the study area was not high, which was mainly related to the vegetation type, with desert grassland and steppe desert occupying most of the area. The temperature in the study area decreased slightly during 20a, but the overall change was not significant, so there was no significant correlation between NDVI and temperature.

In this paper, on the basis of existing studies, we analyzed the temporal and spatial evolution of the normalized vegetation index (NDVI) in the Hexi Corridor during 2000-2019 using long time-series MODIS remote sensing data, and carried out the study of vegetation change at the image metric scale by applying the linear regression slope method, The correlation between NDVI and precipitation in the study area was also explored with the spatial distribution data of precipitation. It was found that during the period of 2000-2019, the changes of NDVI in the Hexi Corridor were influenced by both precipitation conditions and ecological and environmental management projects and showed an upward trend, which demonstrated the effectiveness of the national ecological policies of constructing desert oases, returning ploughland to forests and grasslands, and building wind and sand prevention forests, and was consistent with the results of existing related studies (Lv et al., 2022). In the results of the study, NDVI and precipitation have more obvious correlation, but the change of vegetation index is relatively lagging compared with precipitation, which is consistent with the results of related studies (Chen et al., 2020; Wang et al., 2023). The NDVI is closely related to climatic, anthropogenic and other factors, and are the result of a combination of natural and social factors (Sun et al., 2015; Yang and Yang, 2016).

At present, this study only analyzed the pattern of spatial and temporal evolution of vegetation index in terms of precipitation conditions, without introducing other climatic and social factors and lacking quantitative analysis of them. Due to the limitation of spatial and temporal resolution of remote sensing image data, this study has not analyzed the vegetation changes of different land use types in the Hexi Corridor, and it is necessary to quantitatively analyze the impacts of natural and social factors on the changes of vegetation indices in the subsequent studies.

Conclusion

(1) The change process of precipitation in the eastern, central and western parts of the Hexi Corridor has a high degree of consistency, but there is an obvious gap between the levels of the three, which is significantly correlated with the distribution of vegetation in the Hexi Corridor. The trend of NDVI in the last 20 years is basically consistent with precipitation, and there is a more significant positive correlation between the two ($R = 0.24$), indicating that the relationship between the vegetation index of the Hexi Corridor and rainfall is relatively close, mainly due to the fact that the Hexi Corridor is a globally famous arid area with little rainfall and more demanding conditions for vegetation growth, and the growth of the vegetation in the Hexi Corridor is greatly affected by precipitation.

(2) In the past 20 years, the vegetation index in the study area generally showed an upward trend, with an average slope from 0.012 5/10a, but the interannual trend of change has obvious variability, and the rate of growth of NDVI in the Hexi Corridor

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slowed down in 2010-2019 compared with that in 2000-2009, with localized decreases. The average slope of NDVI change decreased from 0.013 9/10a to -0.006 8/10a. the main reason is the phenomenon of vegetation degradation in the western and northwestern unutilized land affected by the natural environment.

(3) The variation process of precipitation in the eastern, central and western regions of the Hexi Corridor is highly consistent, but the level gap between the three regions is obvious, which has obvious correlation with the spatial distribution of vegetation in the Hexi corridor. The variation trend of NDVI in recent 20 years is basically consistent with the fluctuation trend of precipitation. The positive correlation and negative correlation between NDVI and annual precipitation account for 61.58% and 38.42% respectively. The regions with positive correlation are mainly located in the middle and southwest of the corridor, where vegetation is relatively abundant. The regions with negative correlation are mainly in the northern and northeastern desert areas, where there is no vegetation cover, and the correlation between precipitation and NDVI is weak. It shows that the relationship between vegetation index and rainfall in Hexi Corridor is relatively close in regions with abundant vegetation. The main reason is that Hexi Corridor is a world-famous arid area with little rainfall and harsh vegetation growth conditions. The vegetation growth in Hexi Corridor is greatly affected by precipitation.

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