[1,*]Shijun Lu
[2]Guoqing Yu
[3]Lixiao Wang
[4]JianHu Wang
[5]Zengjin Liu
[6]Kaixu Wang

# Spatial-temporal Evolution and Driving Factors of Desertification Based on Computer Interpretation in Tarim River Basin

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***Abstract: -*** The Tarim River Basin is an important life hinge in Xinjiang, which plays a vital role in maintaining ecological stability. In recent years, it is faced with challenges such as the expansion of sandy land, the decrease of precipitation and sand-dust storm, which lead to the aggravation of desertification and the contradiction between man and land. This study used remote sensing images from 2000 to 2020 to analyze desertification trends through automatic interpretation by computer, combined with NDVI(Normalized Difference Vegetation Index) and FVC(Fractional Vegetation Cover) indicators. The results showed that the total area of desertification land decreased, but the area of serious desertification land increased. Precipitation, Sunshine, wind speed, air temperature, cultivated land area change, urbanization and other factors affect desertification, of which cultivated land area change, temperature change and precipitation change are the most important factors. Policies focused on preventing wind erosion have been inadequate as the economy has developed and conflicts between people and land have intensified.

***Keywords:*** Tarim River Basin, Desertification, Spatiotemporal Evolution, Driving Force, Linear Regression Models.

## I. INTRODUCTION

Desertification is a natural (non natural) phenomenon caused by factors such as drought, lack of rainfall, vegetation destruction, overgrazing, strong wind erosion, flowing water erosion, and soil salinization, resulting in a decrease or loss of productivity in large areas of soil. The Tarim River Basin is located in a geographically remote area, far away from the influence of the ocean. As a result of its geographical location, the basin experiences typical characteristics of an arid climate.In addition, excessive exploitation and utilization of natural resources and damage to the natural environment are the main factors leading to desertification.

Qualitative and quantitative evaluations have been extensively conducted by both domestic and foreign scholars to delve into the issue of desertification. The vegetation index is divided into five levels and dominates[1]. Betty and Ford initially proposed a desertification grading system that is divided into four levels according to the previous desertification grading system. However, environmental factors are the main reference factors, while human factors are not the main factors[2], and there is no specific threshold given. FAO and UNDP have developed the "Desertification Assessment and Mapping Plan" based on previous experience, which has initially laid the theoretical foundation for quantitative evaluation of desertification, it provided the foundation for the construction of the subsequent desertification evaluation index system and promoted the emergence of various new and more practical rating systems[3]. In recent research on desertification rating, the most representative one is the desertification risk assessment index system proposed by Rubio et al.[4]. In the project led by Liang Wenqiong and others, a more efficient rating system was established using remote sensing technology, which overcame the errors caused by traditional visual interpretation and improved the universality of the desertification evaluation system application[5]. Regarding the research on the driving factors of desertification, Bayram and Ozturk proposed that natural factors have always been the main triggers in the changes leading to desertification. However, human factors only exacerbate this trend to a certain extent[6]. In Ignacio's research, it is believed that

[1] College of Civil Engineering and Architecture, Xinjiang University, 830046, Urumqi, China; Xinjiang Key Lab of Building Structure and Earthquake Resistance, Xinjiang University, Urumqi, Xinjiang, China
[2] College of Civil Engineering and Architecture, Xinjiang University, 830046, Urumqi, China
[3] College of Civil Engineering and Architecture, Xinjiang University, 830046, Urumqi, China; Xinjiang Key Lab of Building Structure and Earthquake Resistance, Xinjiang University, Urumqi, Xinjiang, China
[4] College of Civil Engineering and Architecture, Xinjiang University, 830046, Urumqi, China
[5] College of Civil Engineering and Architecture, Xinjiang University, 830046, Urumqi, China
[6] College of Civil Engineering and Architecture, Xinjiang University, 830046, Urumqi, China
*Corresponding author: Shijun Lu

the causes of desertification are not limited to the study of natural geography, global economic activities, as well as various global activities, can all have an impact on land desertification[7]. In recent years, the mainstream research trend believes that natural and human factors cannot fully summarize the main causes of desertification[8-9]. At present, there is a lack of a standardized assessment system to evaluate the extent of desertification in the Tarim River Basin. As a result, the establishment of a more precise evaluation system has emerged as a significant aspect in the field of desertification research.

The occurrence and formation of desertification are not the result of a single formation of various factors within a limited timeframe, but rather the interaction of various factors that lead to desertification over a long period of time, forming observable landscapes of various desertification[10-12]. The various surface objects that originally needed to be detected tend to be single, so there are certain patterns in the process of desertification. For tributaries such as the Tarim River Basin, which are rich in ecology, diverse in population, and the world's second largest mobile desert, Taklamakan[13], they collectively constitute the complex land types of Tarim River Basin. At present, the research methods on land desertification mainly rely on vegetation index and desertification index, such as NDVI, MSAVI, EVI, DDI, etc[14-15]. There is a lack of specific classification thresholds and research based on long time series. In order to accurately consider the desertification factors of multiple land types, it is urgent to carry out research on the degree changes and driving forces of land desertification under long time series.

At present, most research on desertification focuses on monitoring and comparing the degree of desertification during different periods, lacking analysis of spatiotemporal evolution and driving factors under long-term time series. Land desertification itself is a dynamic evolution process, and the use of static indicators for research is not effective. The current research results are mostly based on vegetation coverage and vegetation index as indicators, dividing the degree of desertification into five levels: mild, moderate, severe, extremely severe, and native desert. This classification is used as the basis for this study[16-17]. In view of this, this study is based on satellite remote sensing image from 2000 to 2020. In view of this, this study is based on satellite remote sensing image from 2000 to 2020. The NDVI and FVC were extracted by computer automatically to evaluate the status of soil desertification and analyze the spatio-temporal characteristics of soil desertification, use meteorological data and land use data to analyze the driving factors of the spatiotemporal change characteristics of soil desertification, and reveal the evolution laws and causes of desertification in the Tarim River Basin, provide suggestions for desertification prevention and control in the Tarim River Basin.

## II. RESEARCH DATA AND METHODS

### *A. Overview of the Study Area*

The Tarim River Basin spans an expansive area of 1.02 million square kilometers, extending from 39°95′N to 45°00′N and from 99°27′E to 71°65′E. The Tarim River stretches across the basin for an impressive 2486 kilometers, establishing its position as China's longest inland river. This remarkable feat not only showcases the vastness of the river but also highlights its significance within the region. The Tuota River Basin is composed of five Xinjiang prefectures: Bayin Guoleng, Kokzilsu, Aksu, Hirowada and kashgar[18-19]. To ensure a more accurate representation of desertification in the Tarim River Basin and its future development trends, thorough research must be conducted. The Tarim River and its extensive network of tributaries flow through a region with complex geographical features. In order to understand this region better, it is important to consider the relationship between human activities and the land in each area. To define the study area, data from the national basic geographic information center was used. The study area includes Bayin Guoleng, Kokzilsu, Aksu, Hirowada, and Kashgar, as depicted in the figure1 and figure 2.

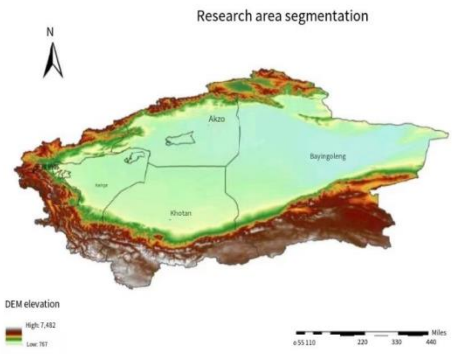



Figure 1: Study Area Subdivision Diagram

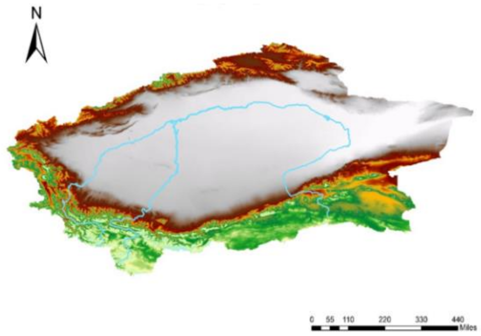



Figure 2: Tarim River Basin Display

*B. Data and Processing*

In order to accurately understand the driving factors of desertification in basic image remote sensing data, it is essential to classify the different land use types. The research image is Landsat data, and the selected time interval is the image from 2000 to 2020 (a total of five periods). Through the statistics of various numerical values of multivariate data, land use data, DEM data, vegetation coverage data and climate factor data obtained by software-based spatial analysis method experiments. Table 1 presents the data sources utilized in this study.

Table 1: Data Source Display Form

| Data | Data sources |
|---|---|
| LUCC Data | Resource and Environment Science and Data Center |
| DEM Data | Resource and Environment Science and Data Center |
| Boundary Data | Resource and Environment Science and Data Center |
| Meteorological Data | CAS National Earth System Science Data Center |

*C. Methods*

*1)NDVI extraction in Tarim River Basin*: The normalized vegetation index is the data obtained by further processing based on the images obtained by remote sensing satellites. It mainly reflects the growth of surface vegetation and is often used as the main judgment basis for desertification research[20]. The software commonly used to extract NDVI values is ENVI. We will use the band calculation tool in the software to calculate the image information (band information mainly refers to NIR near-infrared light and R infrared). The formula is as follows:

$$NDVI = \frac{(\mathrm{Float(b4)\text{-}Float(b3)})}{(\mathrm{Float(b4)+Float(b3)})} \quad (1)$$

*b3* red band (R), *b4* near infrared band (NIR).

*2) Vegetation coverage index FVC extraction*: The vegetation coverage index is often related to the degree of vegetation coverage on the surface. Shade index, in the context of plant research, commonly pertains to the proportion of shadow cast by surface plants (encompassing leaves, stems, and branches) that covers the experimental area. The shade index essentially measures the extent to which the area is occupied by the shadows generated from the vegetation[14-15]. It mainly reflects the luxuriance of vegetation in this area. The acquisition of vegetation coverage index is mainly based on the normalized vegetation index. The formula is as follows:

$$\mathrm{FVC}=\frac{\mathrm{NDVI\text{-}NDVI}_{soil}}{\mathrm{NDVI}_{veg}\text{-}\mathrm{NDVI}_{soil}} \quad (2)$$

$NDVI_{soil}$ represents the NDVI measurement within the image of the study area where bare surface occupies, while $NDVI_{veg}$ corresponds to the NDVI value in areas that are entirely covered by vegetation. In addition to the NDVI value, the band in the original remote sensing image can be directly used to calculate according to the NDVI formula. The $NDVI_{soil}$ and $NDVI_{veg}$ values need to be based on the NDVI value of the remote sensing image, according to the following formula：

$$\mathrm{NDVI_{soil}}=\frac{\mathrm{FVC_{max}\times NDVI_{min}\text{-}FVC_{min}\times NDVI_{max}}}{\mathrm{FVC_{max}\text{-}FVC_{min}}} \quad (3)$$

$$NDVI_{veg}=\frac{((1-FVC_{min})\times NDVI_{max})-(1-FVC_{max})\times NDVI_{min})}{FVC_{max}-FVC_{min}} \quad (4)$$

After the calculation of the above two values, we can theoretically obtain the FVC value in the study area.

*3) Land desertification dynamic transformation rate and transfer matrix calculation*

In order to more accurately grasp the dynamic changes of land desertification, a single land type dynamic degree is introduced to reflect the changes of desertification land in more detail[21]. To calculate the dynamic change of a single land type, we need to use the following formula to calculate the dynamic transformation rate:

$$ACL_j=U_{j,b}-U_{j,a} \quad (5)$$

$$AVR_j=\frac{ACL_j}{U_{j,a}}\times\frac{1}{T}\times 100\% \quad (6)$$

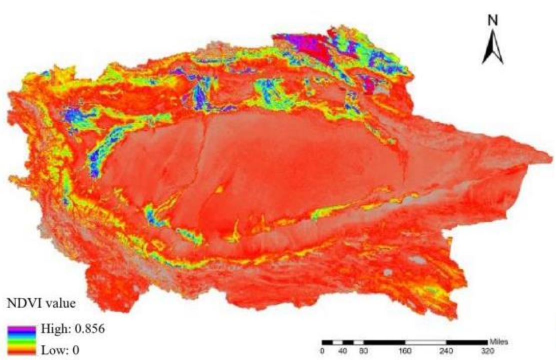
$ACL_j$ is $j$ type area change (ten thousand km$^2$), $AVR_j$ is $j$ type desertification area change rate ; $U_{j,a}$ is the desert area of type $j$ (ten thousand km$^2$) at the beginning of the study ; $U_{j,b}$ is the area of type $j$ desert (ten thousand km$^2$) ; $T$ represents the duration of the study, measured in years, from its commencement to its completion.

In order to realize the conversion trend of desertification land types between different degrees. By utilizing spatial calculation techniques, we have successfully computed the transfer matrix that depicts the transition between various degrees of desertification land within the Tarim River Basin. This calculation was performed using FVC (vegetation coverage) values spanning from 2000 to 2020. The resulting matrix visually portrays the dynamic changes occurring among the different levels of desertification over this time period.

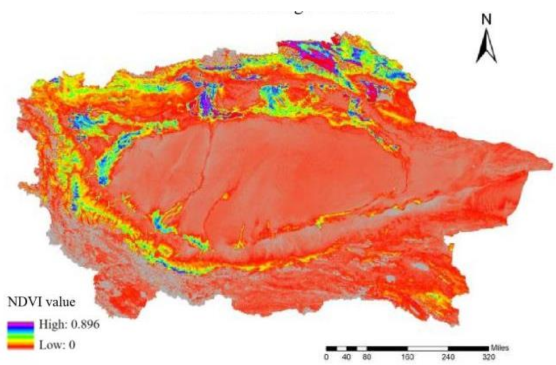
## III. RESULTS AND ANALYSIS

### *A. Tarim River Basin's NDVI Extraction Results*

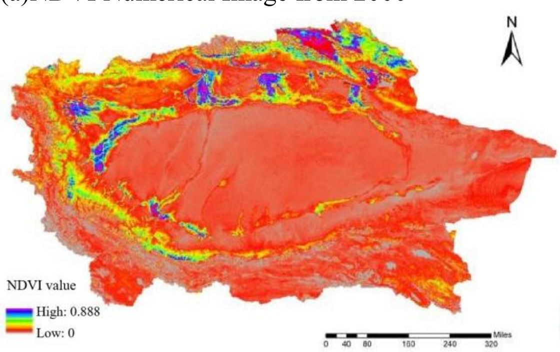
The following are the numerical images of NDVI calculated from Landsat images in 2000, 2005, 2010, 2015 and 2020 (Figure 3). The vegetation growth and coverage tend to improve as the value increases. There is a large area of oasis distribution between the edge of the Tarim Basin and the basin. Limited by water and heat conditions, the vegetation coverage in the northern part of the basin is higher than that in the south, and the west is better than the east and northeast.



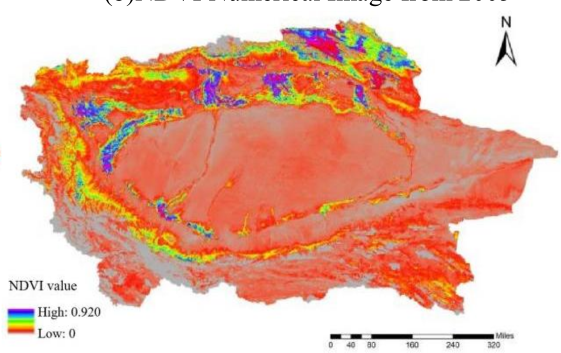

(a)NDVI Numerical Image from 2000



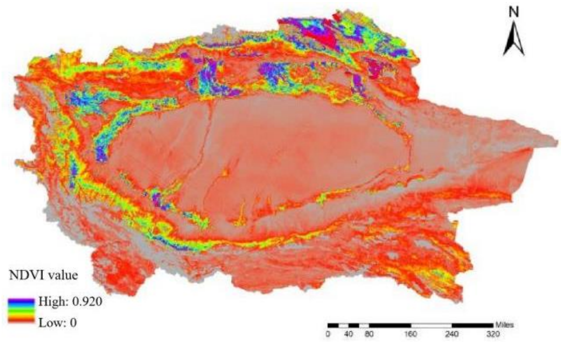

(b)NDVI Numerical Image from 2005




(c)NDVI Numerical Image from 2010




(d)NDVI Numerical Image from 2015




(e)NDVI Numerical Image from 2020

Figure 3: NDVI images from 2000 to 2020

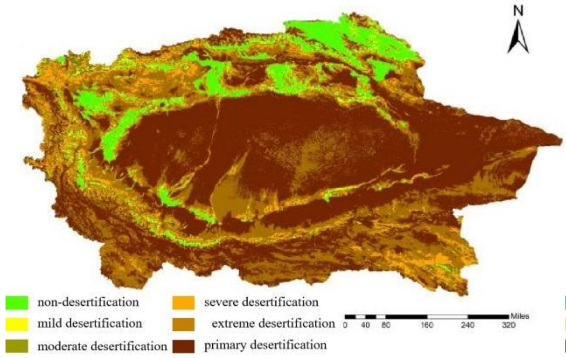
*B. Spatio-temporal Distribution Pattern of Desertification Based on FVC*

Combined with the previous experience of desertification stratification and grading, and according to the needs of this experiment, the desertification grade was classified into six categories. According to the previous experience of desertification classification and grading, NDVI (annual normalized difference vegetation index and) is generally used as an important index to determine the degree of desertification. However, there are large-scale deserts in the middle of the Tarim River Basin, and deserts and deserts are often integrated with areas with less desertification, which will lead to the confusion of NDVI values in a certain area. Table 2 presents the classification of desertification in different regions of the study area, using vegetation coverage data (FVC) as the primary indicator. This classification system aims to provide a more comprehensive and intuitive understanding of the level of desertification in the study area.

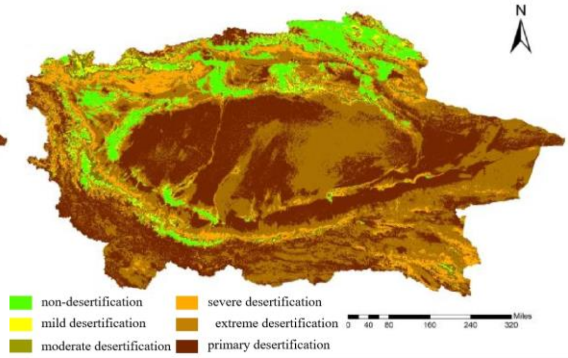
Table 2: Desertification FVC Hierarchical Grading Table

| Area | Non | Mild | Moderate | Severe | Extreme | Primary |
|---|---|---|---|---|---|---|
| Kokzilsu | 0.83 | 0.64 | 0.48 | 0.34 | 0.24 | 0.13 |
| Kashgar | 0.88 | 0.70 | 0.51 | 0.34 | 0.25 | 0.09 |
| Hirowada | 0.82 | 0.60 | 0.40 | 0.24 | 0.13 | 0.06 |
| Baoyin Guoleng | 0.87 | 0.65 | 0.44 | 0.28 | 0.17 | 0.09 |
| Aksu | 0.90 | 0.72 | 0.54 | 0.37 | 0.23 | 0.12 |
| Whole | 0.87 | 0.67 | 0.49 | 0.32 | 0.19 | 0.10 |

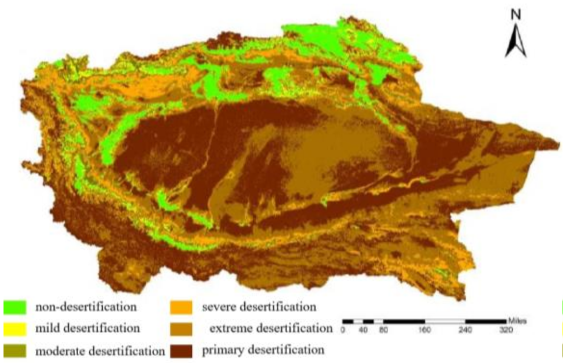
The following are the desertification classification images based on NDVI images extracted from 2000, 2005, 2010, 2015 and 2020 with vegetation coverage as the index (Figure 4).



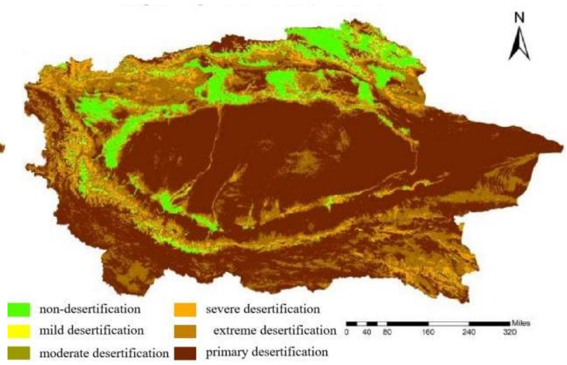

(a)Map of Vegetation Cover Index in 2000



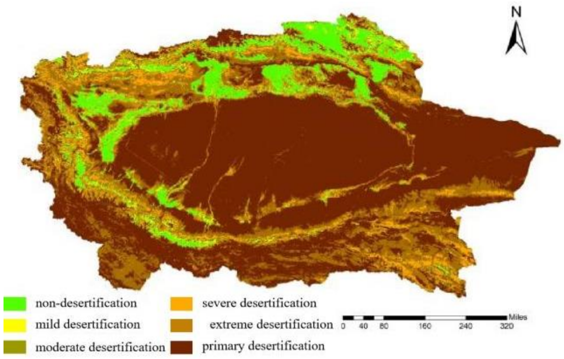

(b)Map of Vegetation Cover Index in 2005




(c)Map of Vegetation Cover Index in 2010




(d)Map of Vegetation Cover Index in 2015




(e)Map of Vegetation Cover Index in 2020

Figure 4: Vegetation Coverage Images from 2000 to 2020

Based on the data presented in Table 3, there has been a decrease in the total area of land affected by desertification from 96.73 million km$^2$ in 2000 to 96.07 million km$^2$ in 2020. Additionally, the overall extent of desertification has decreased from 93.61% to 92.98% in 2020. Notably, there has been substantial progress in combating extreme desertification within the Tuota River Basin, as the affected area has decreased from 301,400 km$^2$ in 2000 to 207,100 km$^2$ in 2020, corresponding to a reduction in land proportion from 29.17% to 20.04%.

Between 2000 and 2010, aside from addressing severe and extreme desertification, the areas affected by other grades of desertification have remained relatively stable. In 2000, the areas affected by mild, moderate, and severe desertification were 28,200 km$^2$, 46,400 km$^2$, and 92,500 km$^2$, respectively, representing 2.73%, 4.50%, and 8.95% of the region. By 2010, these figures changed to 30400 km$^2$, 55,300 km$^2$, and 101,100 km$^2$, with respective proportions of 2.95%, 5.35%, and 9.78%. In 2020, the areas affected by mild, moderate, and severe desertification expanded to 35,400 km$^2$, 46,400 km$^2$, and 89,400 km$^2$, accounting for 3.43%, 4.49%, and 8.65%, respectively. When comparing these three years, it becomes evident that greater progress has been made in addressing mild and severe desertification.

Table 3: The Area and Proportion of Land Desertification in the Study Area

| | Area（10000 km$^2$） | | | Proportion of land area（%） | | |
|---|---|---|---|---|---|---|
| Type | | | | | | |
| | 2000 | 2010 | 2020 | 2000 | 2010 | 2020 |
| Mild | 2.82 | 3.04 | 3.54 | 2.73% | 2.95% | 3.43% |
| Moderate | 4.64 | 5.53 | 4.64 | 4.50% | 5.35% | 4.49% |
| Severe | 9.25 | 10.11 | 20.00 | 8.95% | 9.78% | 8.65% |
| Extremely | 30.14 | 27.76 | 20.71 | 29.17% | 26.86% | 20.04% |
| Primary | 49.87 | 50.22 | 58.24 | 48.27% | 48.60% | 56.36% |
| Total | 96.73 | 96.66 | 96.07 | 93.61% | 93.54% | 92.98% |

*C. Evolution Trend of Land Desertification*

According to Table 4, the overall desertification experienced an upward trend between 2000 and 2010, with a 2.91% increase in the desertification area. The period from 2010 to 2020 witnessed a continuous deterioration in the desertification situation, accompanied by a significant rise in the total area of desertification land, reaching an expansion of 104.8 thousand km$^2$. Specifically, severe desertification and primary desertification exhibited the most severe deterioration during this period. Severe desertification expanded by 98,900 km$^2$, while primary desertification increased by 80,200 km$^2$. However, extreme desertification witnessed a decline of 70,500 km$^2$

between 2010 and 2020, leading to an overall desertification conversion rate of 8.88%. Overall, from 2000 to 2020, the desertification situation became increasingly serious, as the desertification land area expanded by 104,100 $km^2$, indicating a change rate of 2.15%. In comparison to 2000, the area of extremely desertified land in 2020 decreased by 94,300 $km^2$, implying a change rate of -2.28%. Apart from severe desertification and primary desertification, which experienced notable increases (severe desertification by 10.75 $km^2$, primary desertification by 8.37 $km^2$), the other types of desertification land remained relatively stable.

Table 4: Dynamic Transformation Rate of Land Desertification in the Study Area

| | 2000-2010 year | | 2010-2020 year | | 2000-2020 year | |
|---|---|---|---|---|---|---|
| Type | ACL | AVR | ACL | AVR | ACL | AVR |
| | （10000$km^2$） | (%) | （10000$km^2$） | (%) | （10000$km^2$） | (%) |
| Mild | 0.23 | 0.80 | 0.50 | 1.64 | 0.72 | 1.02 |
| Moderate | 0.88 | 1.90 | -0.88 | -1.60 | 0.00 | 0.00 |
| Severe | 0.86 | 0.92 | 9.89 | 9.97 | 10.75 | 2.69 |
| Extremely | -2.38 | -0.79 | -7.05 | -2.54 | -9.43 | -2.28 |
| Primary | 0.35 | 0.07 | 8.02 | 1.60 | 8.37 | 0.72 |
| Total | -0.07 | 2.91 | 10.48 | 8.88 | 10.41 | 2.15 |

According to the data provided in Table 5, there were significant changes in the extent of desertification from 2000 to 2020. The total area of land transitioning from less desertification to more serious desertification during this period was 184,500 $km^2$. Additionally, there was a noteworthy area of land, measuring 99,000 $km^2$, that experienced a reversal of desertification. In terms of specific conversions, there was a conversion area of 107,300 $km^2$ where extremely severe desertification land transformed back into its original state of desertification. Furthermore, 35,500 $km^2$ of extremely severe desertification land underwent conversion to other degrees of desertification. The conversion from primary desertification to extreme desertification accounted for an area of 31,900 $km^2$. Surprisingly, the total area that converted from primary desertification to other degrees of desertification was only 35,000 $km^2$, indicating that primary desertification had a relatively limited impact on the overall desertification process. Interestingly, the conversions between moderate desertification land and mild desertification land constituted 35% and 27% respectively of the total area converted to other degrees of desertification. On the other hand, the conversions between extremely severe desertification land and severe desertification land accounted for 20% and 47% respectively of the total area converted to other degrees of desertification. Furthermore, there was an area of 19,000 $km^2$ that transitioned from desertification to non-desertification land, suggesting successful efforts in combating desertification in certain regions. However, it is concerning that the transfer area from non-desertification land to desertification land amounted to 137,000 $km^2$, indicating a substantial expansion of desertified areas. Notably, the largest conversion rate was observed in mild desertification land, constituting 54% of the total area undergoing conversion to other degrees of desertification. This highlights the pressing need for effective measures in combating mild desertification to prevent further degradation and expansion of desertified areas.

Table 5: Desertified Land Transfer Matrix in the Study Area from 2000 to 2020

| | | | | 2020year | | ten thousand $km^2$ | |
|---|---|---|---|---|---|---|---|
| 2000year | | | | | | | |
| | contains | extremely | mild | primary | moderate | severe | total |
| contains | 5.38 | 0.01 | 1.00 | 0.00 | 0.31 | 0.05 | 6.76 |
| extremely | 0.13 | 14.58 | 0.12 | 10.73 | 0.43 | 2.87 | 28.86 |
| mild | 1.02 | 0.03 | 1.04 | 0.01 | 0.74 | 0.27 | 3.11 |
| primary | 0.04 | 3.19 | 0.03 | 46.38 | 0.06 | 0.22 | 49.92 |
| moderate | 0.48 | 0.30 | 0.95 | 0.39 | 1.65 | 1.32 | 5.10 |
| severe | 0.23 | 2.60 | 0.41 | 0.78 | 1.45 | 4.21 | 9.69 |
| total | 7.28 | 20.72 | 3.54 | 58.30 | 4.64 | 8.94 | 103.43 |

Desertification land conversion map of Tarim River Basin(Figure 5):

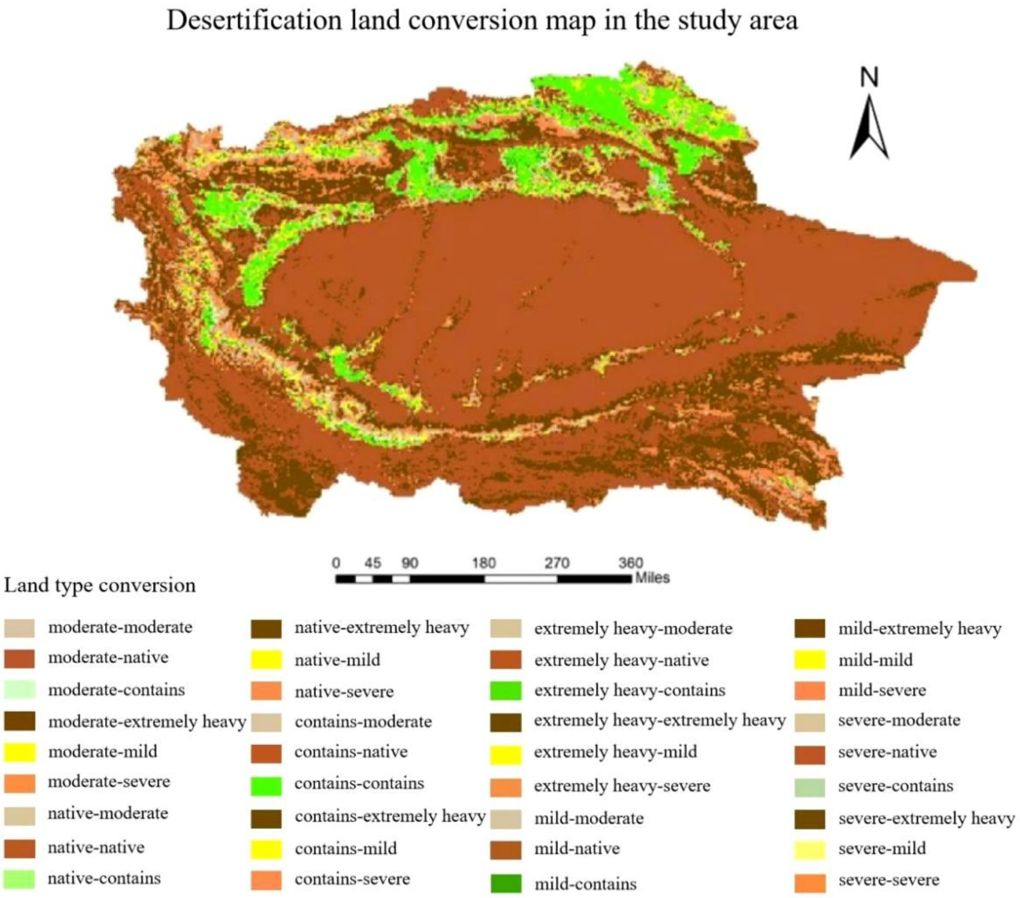



Figure 5: Desertification Land Conversion Map in the Study Area

Desertification land development in the Tarim River Basin (from lighter to more serious in Figure 6):

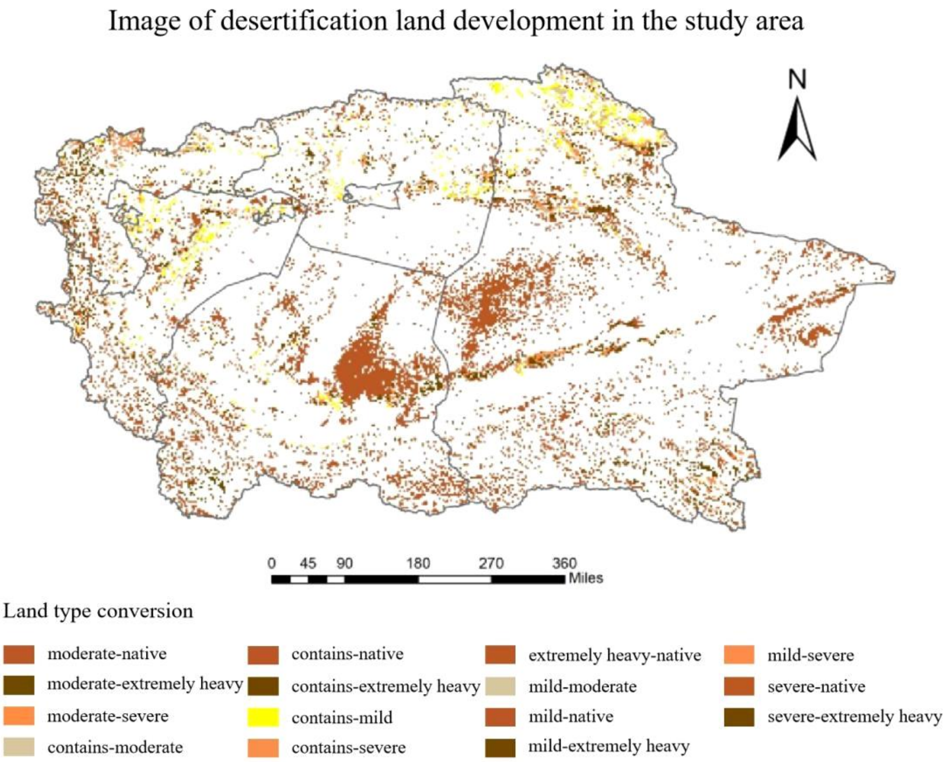



Figure 6: Images of Desertification Land Development in the Study Area

The reversal of desertification land in the Tarim River Basin (from more serious land to lighter land in Figure 7):

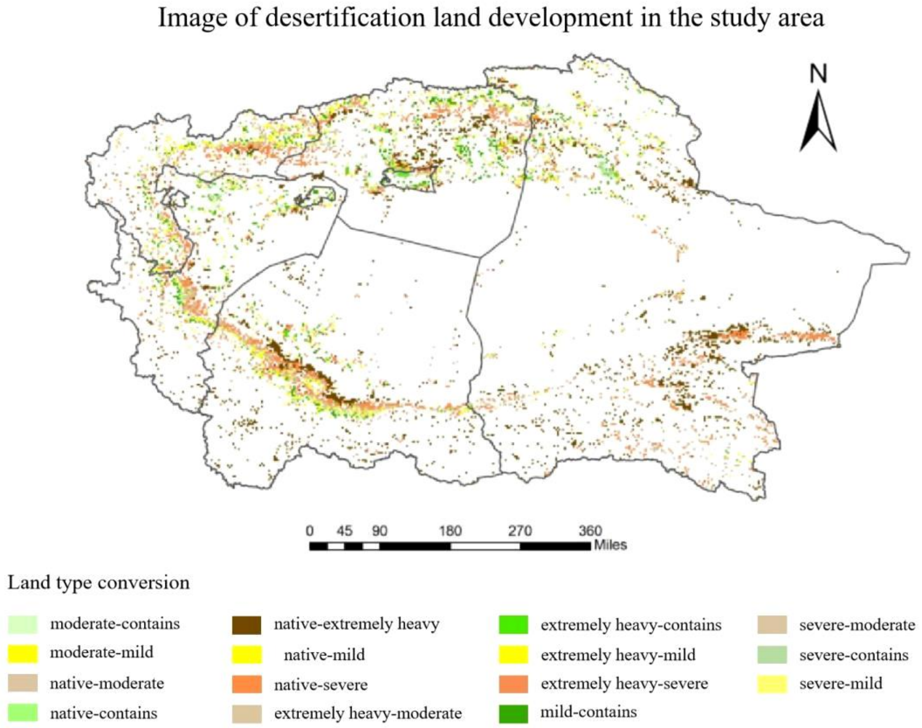
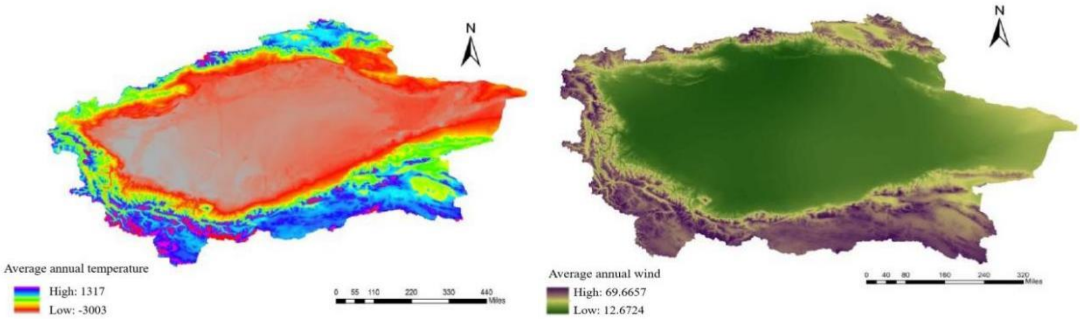


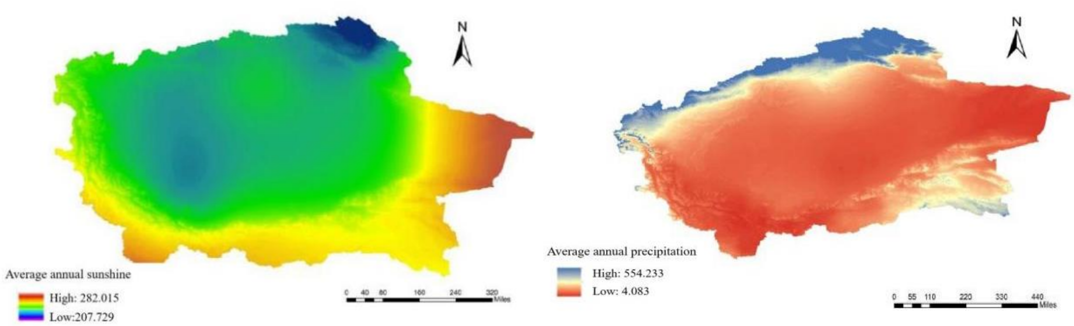

Figure 7: Desertification Land Reversal Image in the Study Area

*D. Analysis of Driving Factors of Desertification*

Xinjiang belongs to the ecological environment characteristics of arid areas [18]. Desertification is influenced by various natural factors and human activities, which exhibit both spatial and temporal variations. In the process of land desertification, it is difficult for us to accurately lock in a specific factor and determine what kind of sample it must have played in the process of desertification. At this time, we generally based on the experience summarized by the predecessors and the summary of the experiment to select the factors that cause desertification. The annual average rainfall, annual average temperature, sunshine hours, and average wind speed are selected as the objects of natural driving force factor analysis. The driving force factors are comprehensively displayed as Figure 8.




(a)Average Annual Temperature (b)Average Annual Wind Speed




(c)Average Annual Sunshine (d)Average Annual Precipitation

Figure 8: Average Annual Temperature, Wind Speed, Sunshine, Precipitation Image

In addition to natural factors, human factors also play a role. The area of urban related land and cultivated land, which are closely related to human activities, are selected as human factors to drive desertification changes. The following is a display of the results of the selected factors (Figure 9 and Figure 10)

*1)The change of urban area*

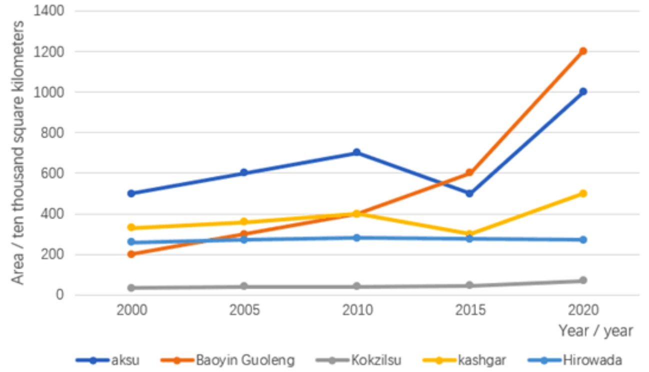



Figure 9: The Change of Urban Area from 2000 to 2020

*2)Cultivated land area transformation*

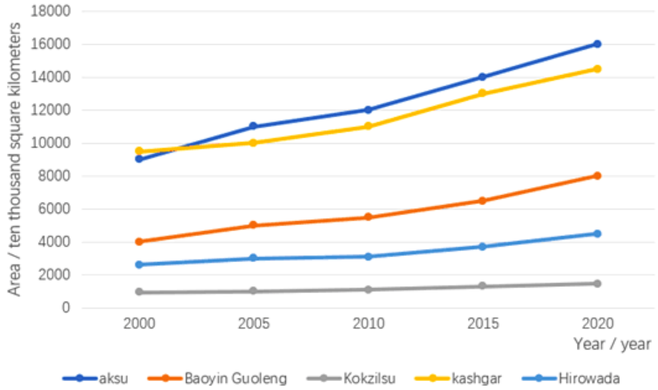



Figure 10: The Change of Cultivated Land Area from 2000 to 2020

Based on the findings from Figure 9 and Figure 10, it can be observed that the change in cultivated land area follows a similar pattern to that of urban area. This suggests that the expansion of urban areas is consistently accompanied by the transformation of cultivated land. As urban areas continue to grow, the corresponding increase in cultivated land plays a crucial role in supporting the production and daily needs of cities and towns.

Moreover, by conducting a comprehensive multiple linear regression analysis on the Tarim River Basin, the significance of the driving factors of desertification in the study area was investigated. The results of this analysis are depicted in Figure 11.

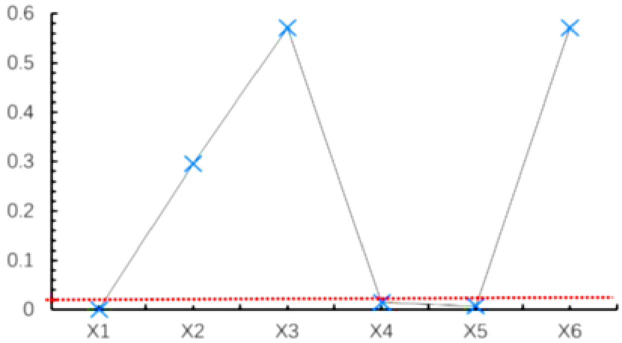



Figure 11: The Significance Diagram of Driving Force Factors in the Study Area

Figure 11 illustrates the impacts of annual average rainfall, sunshine, temperature, wind speed, urban-rural related area, and cultivated land area on the development and reversal of the study area. The factors that possess a significance value lower than 0.05 in the aforementioned figure are considered as the driving forces behind desertification land change in the study area. Additionally, the desertification change in each area generally aligns with the overall trend.

## IV. CONCLUSION

This article examines the temporal and spatial patterns of desertification in the Tarim River Basin between 2000 and 2020. It assesses both the extent and changes in desertification within the basin, while also investigating the potential drivers of these spatiotemporal variations by incorporating meteorological and socio-economic data. The key findings can be summarized as follows:

(1)The total area of desertification land in the Tarim River Basin has decreased from 967300 square kilometers to 960700 square kilometers, and the total area of desertification land is showing a decreasing trend year by year.

(2)An analysis of the study area revealed that the degree of desertification is categorized into six levels. Interestingly, the total area of desertification land exhibited a decline from 2000 to 2020, but the most severe degree of desertification in native desertification land increased from 498,700 $km^2$ to 582,400 $km^2$. Severe desertification has increased from 925,00 $km^2$ to 200,000 $km^2$. In addition, according to the desertification land transfer matrix, it can be seen that the land area of desertification development is greater than that of desertification reversal. Among the existing desertification land, many milder desertification land is developing towards more severe desertification land on a large scale.

(3) Selecting precipitation, temperature, wind speed, and sunshine hours as natural driving factors, selecting cultivated land area transformation and urban area transformation as human driving factors, using multiple linear regression analysis to verify the role of the six factors in the process of desertification transformation, and calculating the significance values of each factor, it is found that cultivated land area, temperature, and precipitation are the most significant factors that have a significant impact on desertification transformation among all factors, The activity changes influenced by solar energy in natural factors follow a consistent transformation trend; Human factors are also influenced by human activities and follow the same trend in transformation due to unity.

Although the desert of the Tarim River Basin is analyzed as a whole, the five regions of the Tarim River Basin are different in topography. Therefore, in the future research, local analysis can be carried out from various regions. Finally, the factors of each region are integrated to analyze the Tarim River Basin as a whole, which can improve the accuracy of the research. In addition, in the selection of driving force factors of desertification, more factors can be selected to analyze the driving force factors of desertification, so as to find more reasons for the transformation of desertification. With the discovery of more desertification driving factors, more detailed and sufficient data support can be provided for desertification control, so as to achieve more reasonable and efficient desertification control.

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