

Abstract

Analysis of Climate Change Impacts on Vegetation Growth in the Aral Sea Basin: a casa study in Uzbekistan

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In recent years, the Aral Sea region has been known for its uneven spatial distribution of water resources in the basin. At the same time, climate change has also had an extremely significant impact on surface vegetation cover. Changes in land cover characteristics will have a corresponding feedback effect on the climate of the Aral Sea region and the climate system. The Aral Sea region is facing serious environmental and water resource problems, therefore, it is considered necessary to study the local climate change and its impact on the regional hydrological system. This study selected Uzbekistan within the Aral Sea region as the main study area. By analyzing the numerical changes of Normalized Difference Vegetation Index (NDVI) between non-artificially irrigated land and irrigated land in Uzbekistan over the past few decades, the relationship between vegetation and climate factors was found out.

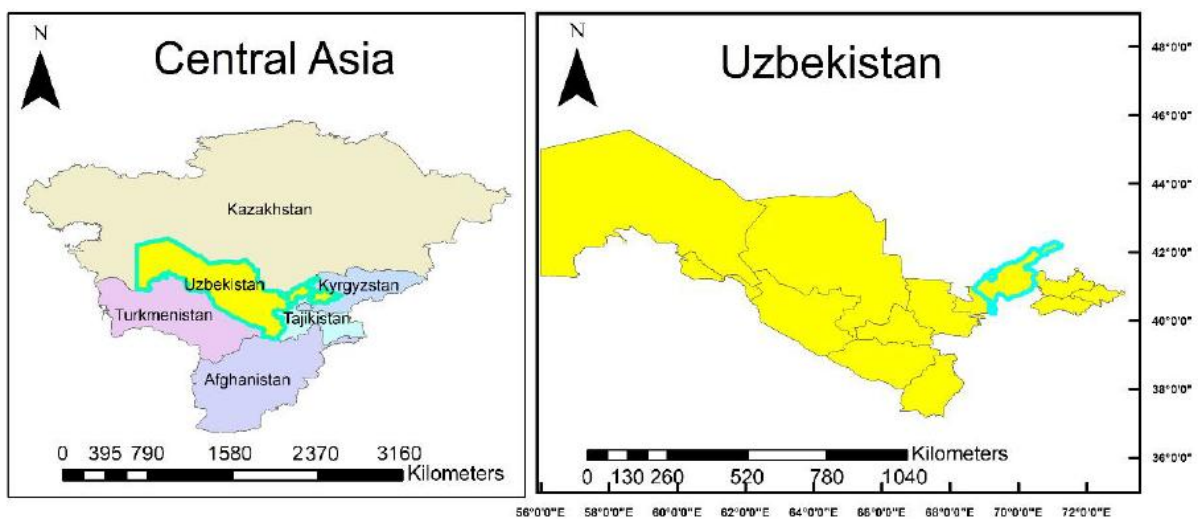


Figure 1. Location of the study area (Elbek et al., 2022)

The spatial distribution of water resources in the Aral Sea Basin is uneven, and 80% of the runoff is formed in Tajikistan, Kyrgyzstan and Afghanistan in the upper reaches of the river. In the Aral Sea Basin, the downstream countries Uzbekistan, Turkmenistan and Kazakhstan have the largest demand for water, accounting for more than 80% of the water consumption in the basin. Uzbekistan is a landlocked country located in Central Asia. Uzbekistan is bordered by Turkmenistan to the southwest, Afghanistan to the south, Tajikistan and Kyrgyzstan to the east, and Kazakhstan to the north and west. Agriculture is an important source of Uzbekistan's economic income. The country is now the world's sixth largest cotton producer and second largest cotton exporter. The agricultural population accounts for 28% of the country's labor force and contributes 24% of GDP.

Vegetation not only plays an important role in regulating the global carbon balance and slowing down the increase in the concentration of greenhouse gases such as CO₂ in the atmosphere, but also plays a pivotal role in the global material and energy cycle and maintaining global climate stability. It is a sensitive

indicator of the impact of climate on the environment. Vegetation is the most vivid reflection and symbol of ecological environment change because of its obvious interannual and seasonal variation characteristics, which can represent the change of land cover to a certain extent. Therefore, the dynamic change of vegetation can reflect the trend of climate change to a certain extent. Remote sensing dynamic monitoring of vegetation status and the interaction process between surface vegetation and the atmosphere are also the research focus in the field of earth science in recent years.

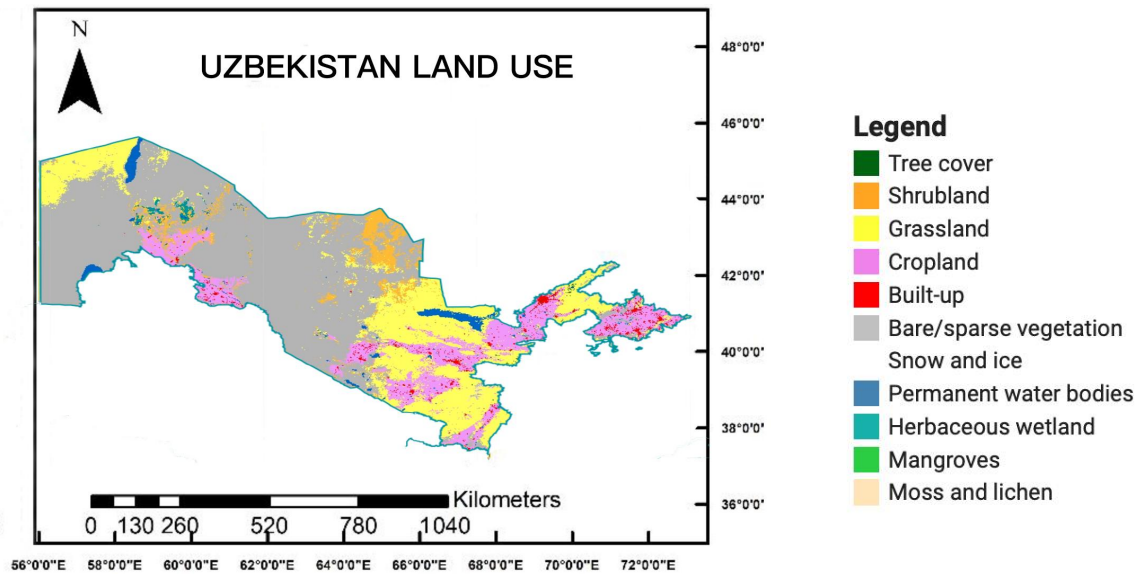


Figure 2. Uzbekistan land use map

As shown in Figure 2, most of the land use types in Uzbekistan are bare/sparse vegetation. In its northwest and east, there are large areas of grassland and cropland, in addition, there are small areas of scrubland and tree cover. In order to reduce the impact of artificial irrigation on the plant growth cycle and soil moisture, this study focused on natural plant growth areas that were not artificially irrigated. Vegetation index is an important parameter to reflect the state of surface vegetation coverage, and the analysis of the relationship between climate factors and vegetation index is helpful to reveal the impact of climate change on vegetation. Therefore, this study uses remote sensing data to study the dynamic changes of grassland vegetation in the study area based on the vegetation index, and finds out the relationship between vegetation and climate factors. The effects of climatic factors on vegetation growth were compared. The results showed that the NDVI of vegetation in the growing season was positively correlated with the temperature and precipitation in the same period.

Reference

Erdanaev E, Kappas M, Wyss D. Irrigated Crop Types Mapping in Tashkent Province of Uzbekistan with Remote Sensing-Based Classification Methods. *Sensors*. 2022; 22(15):5683. <https://doi.org/10.3390/s22155683>