Spatiotemporal Dynamics of Oases in Turpan Gaochang District from 1989 to 2016 and Their Driving Factors: Postprint

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Abstract

This study employs remote sensing images of Gaochang District, Turpan from 1989, 1997, 2002, 2009, and 2016 as data sources to extract the oasis distribution in Gaochang over the past 27 years. Utilizing GIS, Fragstats, and related statistical methods, an analysis of temporal and spatial distribution changes of the Gaochang oasis and their driving factors was conducted. The results demonstrate that over the 27-year period, the Gaochang oasis exhibited an overall expansion trend, with significant conversion between oasis and non-oasis areas. The oasis area increased from 413.47 km² in 1989 to 800.48 km² in 2016, with the most rapid expansion occurring between 1997 and 2002. Oasis expansion and reduction primarily occurred on the eastern and western sides, while stable oasis areas were mainly concentrated in the central region, and fluctuating changes were predominantly located in the marginal areas of the oasis in scattered distributions. The fragmentation degree of the oasis landscape pattern first decreased and then gradually increased, with landscape shapes tending toward greater complexity; however, the overall landscape structure remained relatively simple and susceptible to human activities. Over the past 27 years, oasis changes in Gaochang District have been influenced by both natural and human-social factors, though human factors played a decisive role. Among these, the development and utilization of water resources constituted a prerequisite for oasis expansion, while agricultural population, economic development, agricultural modernization, and policy served as the primary driving factors.

Full Text

Spatiotemporal Change and Driving Factors Analysis of Oasis in Gaochang, Turpan from 1989-2016

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Abstract

In this study, we utilized remote sensing imagery of the Gaochang area from 1989, 1997, 2002, 2009, and 2016 as the data source to extract the oasis distribution in Gaochang. Using GIS, FRAGSTATS, and related statistical methods, we analyzed the spatiotemporal changes in the Gaochang oasis and identified the driving factors. The results showed that during the study period, the Gaochang oasis exhibited an expansion trend, with obvious conversion between oasis and non-oasis areas. The area increased from 413.47 km^2 in 1989 to 800.48 km^2 in 2016, with the fastest expansion occurring between 1997 and 2002. The expansion and reduction of the oasis mainly occurred on both the eastern and western sides. The stable area of the oasis was primarily concentrated in the central part, while fluctuations were mainly concentrated in the edge areas with scattered distribution. The fragmentation of the oasis landscape pattern first decreased and then gradually increased, and the landscape shape tended to become more complex, but the overall landscape structure remained relatively simple and was easily affected by human activities. Over the past 27 years, oasis change was influenced by natural, social, and cultural factors in Gaochang. Human factors played a decisive role in the development and utilization of water resources, which is the premise of oasis expansion. Population (particularly agricultural population), economic development, and agricultural modernization were key factors, with policy being the main driving force.

Keywords: Gaochang oasis; spatiotemporal pattern change; driving factor; human activities

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