CONTROL ID: 1493169

TITLE: Satellite monitoring the rangeland degradation under the impacts of climatic and socio-economic changes over central Asia

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ABSTRACT BODY: Central Asia, encompassing the republics of Kazakhstan, Kyrgyz, Uzbekistan, Turkmenistan, Tajikistan and China's western Sinkiang, is a typical arid and semi-arid area. The climate in Central Asia is extreme arid, where summer is hot, cloudless and dry, and winter is moist and relatively warm in the south and cold and dry in the north. Rangeland, accounting for 46% of the entire area, is the main vegetation type in this area. Recent findings showed that climate change had caused unprecedented rangeland degradation in Central Asia over the past 30 years. Socio-economical change and environmental change due to the collapse of Soviet Union also accelerated rangeland degradation. Rangeland degradation adversely further deteriorated the environment. With the development of high resolution remote sensing images, an increasing attention has paid to study rangeland degradation in this area. However, previous investigations based on either Advanced Very High Resolution Radiometer (AVHRR) or Moderate Resolution Imaging Spectroradiometer (MODIS) data, has not integrate multi-resolution satellite data for investigating vegetation change and its response to climatic and socio-economic change .
In this paper, we employed 30 years' remote sensing data, including both AVHRR (1982-2006) and MODIS (2000-2011) satellite data, and in-situ meteorological and social data (e.g. population, economic, and land use change data), to investigate rangeland degradation in the central Asia. We 1) analyzed the spatial-temporal variations of vegetation changes during the past 30 years, and 2) evaluated the roles of climatic and socio-economic factors as potential causes of observed vegetation changes. The results showed extensive area had statistically significant degradation trends ($p<0.05$). Precipitation was the main driver of rangeland degradation, while there were relatively weaker relationships between temperature and NDVI, indicating that water deficit largely limited vegetation activity. With the collapse of the Soviet Union, rangeland degradation was accelerated due to increased population and economic changes, but this degraded trend slowed down since the political system became relatively stable in 1991. These results could help to better understand the interactions between rangeland degradation and climatic and socio-economic change in arid and semi-arid central Asia.

KEYWORDS: [1640] GLOBAL CHANGE / Remote sensing, [1630] GLOBAL CHANGE / Impacts of global change, [1637] GLOBAL CHANGE / Regional climate change.

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