

14.西部地区生态地理与环境地理

Significant influences of extreme climate on autumn phenology in Central Asia grassland

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摘要： Over the past half-century, there has been a significant rise in the frequency and intensity of extreme climate events in dryland ecosystems. While vegetation phenology acts as an important indicator of how ecosystems respond to climate change, the impact of extreme climate events on autumn phenology in dryland ecosystems remains uncertain. In this study, we firstly assessed the temporal variations in the end of growing season (EOS) in Central Asia using the Normalized Difference Vegetation Index and enhanced vegetation index over 2001–2018. Then, we assessed the impacts of eight climate indices, which capture the average and extreme conditions of the local climate, on EOS across diverse vegetation types using linear mixed models. Finally, we conducted partial correlation analysis to explore how the primary influencing factors affect EOS along an elevational gradient. Our results suggested increased occurrences of drought and heat events in the pre-growing season (April–September) in Central Asia. Under the background, a general trend towards earlier EOS (ca. 1.01 days/decade) was observed for grassland. This trend was mostly attributed to the changes in extreme climate indices (CI_{extreme}), especially heavy rainfall and heat stress. The total explanatory power of CI_{extreme} was almost twice that of mean climate indices (CI_{mean}). However, the impact of CI_{extreme} was less pronounced in regions with elevations exceeding 1500 m. For forests and shrublands, the EOS exhibited delaying trend of 1.29 days/decade and advancing trend of 1.21 days/decade, respectively. Contrary to grasslands, the variations in EOS of forests and shrublands were largely influenced by the shift of CI_{mean}, especially mean minimum temperature and accumulated precipitation. The contribution of CI_{extreme} accounted for only 1/6 of the contribution of CI_{mean}, likely attributed to the adaptation of forests to cold conditions and shrublands to arid conditions. The results provide valuable insights into the phenological response to extreme climate events and serve as a reference for ecosystem management in arid regions.

关键词： Autumn phenology, Extreme climate, Climate change, Central Asia