

Submitted Abstract

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Abstract

Grasslands support billions of people and important biodiversity, but their ability to function as natural support systems is hindered by both climate change and human activities. Grassland degradation is especially problematic in Afghanistan, where political instability, overgrazing, and drought threaten grassland ecosystems, upon which most people critically depend. We applied spectral unmixing analysis and temporal segmentation to high-resolution satellite imagery to reveal detailed spatiotemporal patterns of three distinct grassland degradation processes over 20 years in Afghanistan's vital northeastern grasslands. Both green and dry vegetation loss occurred mainly in highly populated areas, while desiccation occurred widely from valley bottoms to high mountains. Model results were validated using data from field surveys of green vegetation cover in two opposing regions of the landscape. Annual trends in green vegetation were associated with reductions in precipitation and snow cover as measured by reanalysis and MODIS satellite data, respectively, but models also revealed vast areas of degradation unexplained by these factors adjacent to and likely driven by people and livestock. Protecting high integrity grasslands, restoring degraded grasslands, and establishing alternative livelihoods are essential to bolster adaptation potential and reduce pressure and reliance on grasslands.