

# Mapping trends in livestock grazing pressure in the mountains of Central Asia; combining satellite imagery and field data

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## Abstract

Grasslands are the largest biome on the earth and the most impacted ecosystems, mainly because of land use change. Traditionally, highly mobile livestock herding had been key land use in the vast areas in Central Asia, which is now replaced by collective and sedentary grazing systems. This change affects biodiversity and diminishes ecological role of the grasslands. The sudden socio-economic and institutional change in Central Asia, after the breakdown of the Soviet Union, resulted into the decline in livestock numbers. Yet, the rate and spatial patterns of livestock grazing pressure in the mountainous countries like Kyrgyzstan and Tajikistan is still unclear. To address this research gap, we combined the field data and Landsat TM/ETM+/OLI images to map and quantify the grazing pressure change from 1990 to 2020 in the mountainous study region of Kyrgyzstan and Tajikistan. We tested the feasibility of topographic correction on grazing pressure mapping based on an empirical rotation model in our study. We used various spectral-temporal metrics in a random forest regression to estimate the grazing pressure change and obtained a high accuracy for both study regions. In Kyrgyzstan, grazing pressure declined during the year 1995, while it was observed during 2000 in Tajikistan, which closely followed the events occurred after the independence. Later, both study areas showed the gradually increasing change in grazing pressure. We used Kendall's tau test to further identify the monotonic increasing and decreasing trend and found that the significant increasing grazing pressure trend in the vicinity to the settlements. Our findings uncovered the spatially located hot-spots of the livestock grazing as well as an underutilized area of the grasslands. Our study emphasizes that the use of Landsat archive in combination of field data can be used to map the grazing pressure reliably across large areas.

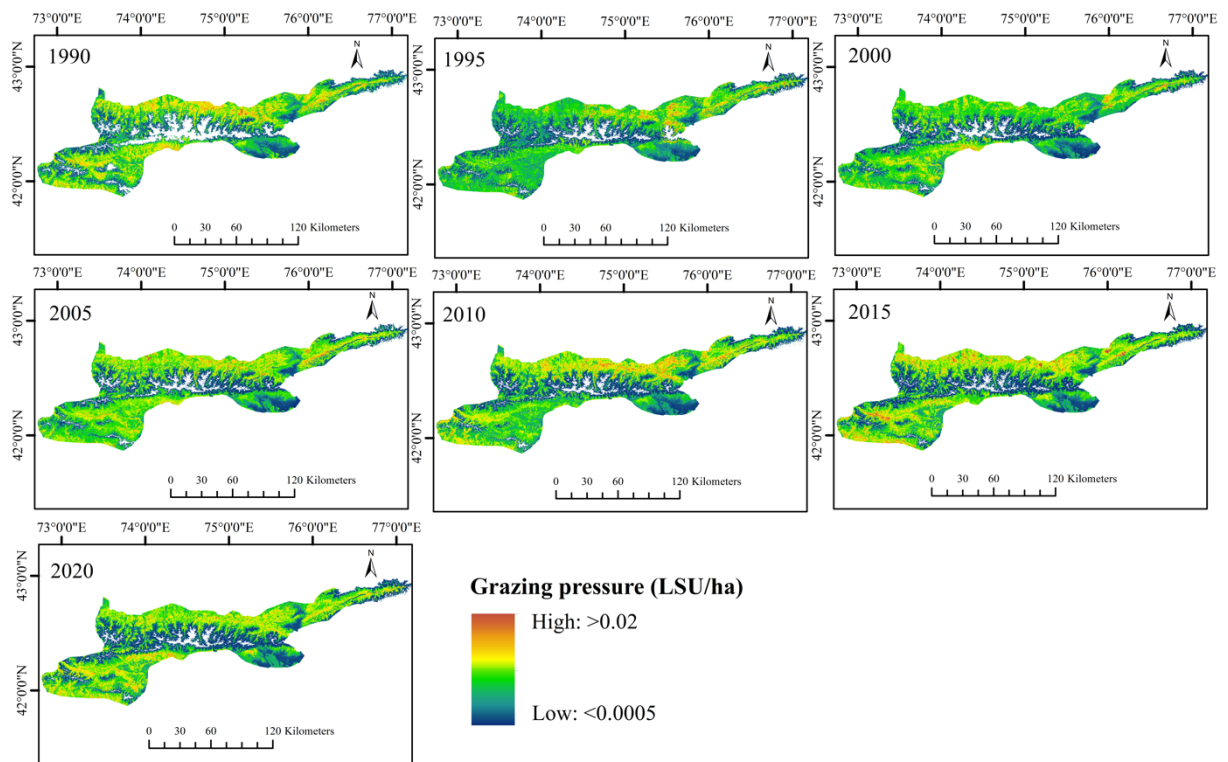


Figure 1 Spatial and temporal pattern of grazing pressure in Kyrgyzstan for 5-year intervals from 1990 to 2020.

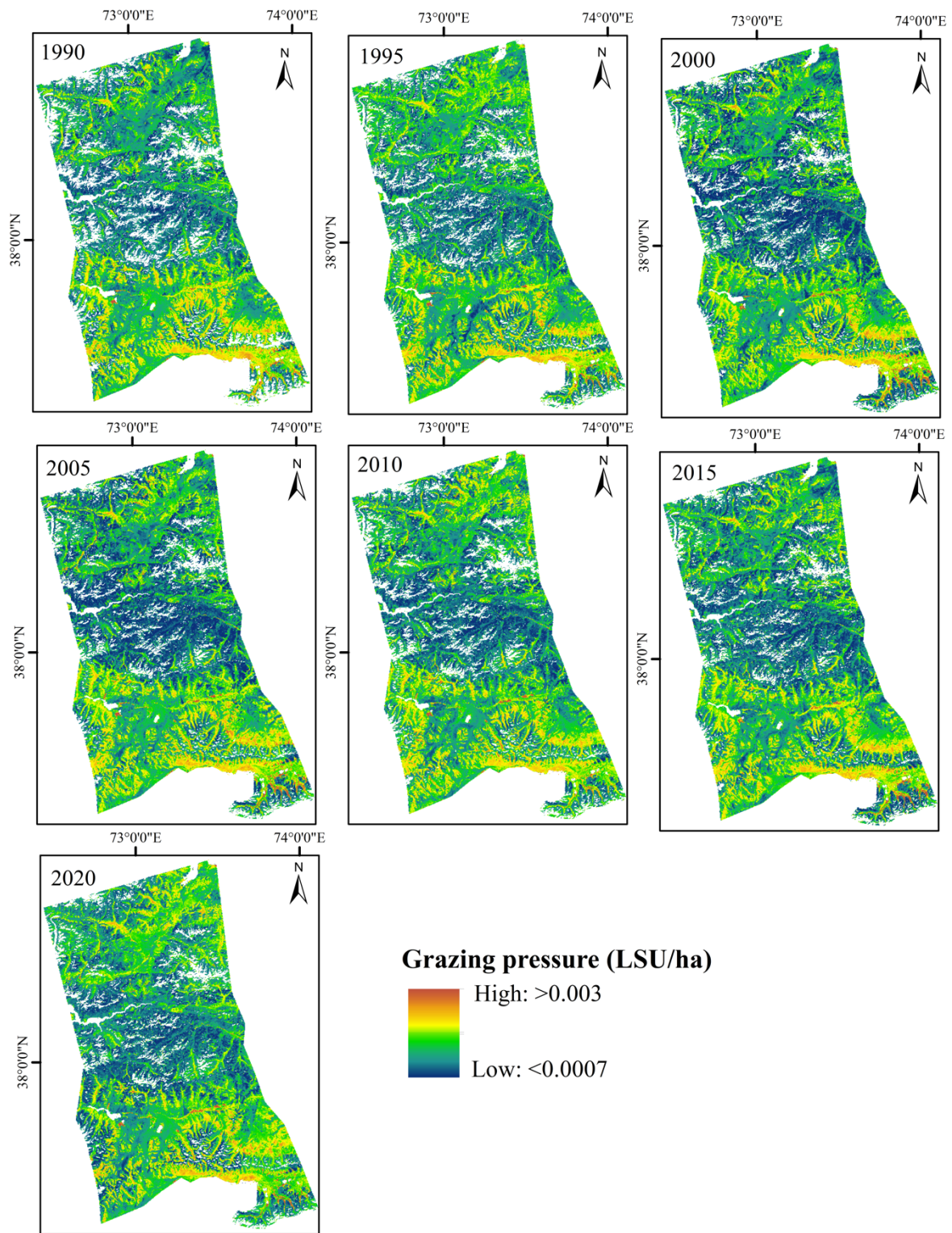


Figure 1 Spatial and temporal pattern of grazing pressure in Tajikistan for 5-year intervals from 1990 to 2020.