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Using remotely sensed vegetation indices to model ecological pasture conditions in Kara-Unkur watershed, Kyrgyzstan

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Kyrgyzstan has a long history of nomadic lifestyle in which pastures play an important role. However, currently the pastures are subject to severe grazing-induced degradation. Deteriorating levels of biomass, palatability and biodiversity reduce the pastures' productivity. To counter this and introduce sustainable pasture management, up-to-date information regarding the ecological conditions of the pastures is essential. This research aimed to investigate the potential of a remote sensing-based methodology to detect changing ecological pasture conditions in the Kara-Unkur watershed, Kyrgyzstan. The relations between Vegetation Indices (VIs) from Landsat ETM+ images and biomass, palatability and species richness field data were investigated. Both simple and multiple linear regression (MLR) analyses, including terrain attributes, were applied. Subsequently, trends of these three pasture conditions were mapped using time series analysis. The results show that biomass is most accurately estimated by a model including the Modified Soil Adjusted Vegetation Index (MSAVI) and a slope factor (R^2 = 0.65, F = 0.0006). Regarding palatability, a model including the Enhanced Vegetation Index (EVI), Northness Index, Near Infrared (NIR) and Red band was most accurate (R^2 = 0.61, F = 0.0160). Species richness was most accurately estimated by a model including Topographic Wetness Index (TWI), Eastness Index and estimated biomass (R^2 = 0.81, F = 0.0028). Subsequent trend analyses of all three estimated ecological pasture conditions presented very similar trend patterns. Despite the need for a more robust validation, this study confirms the high potential of a remote sensing based methodology to detect changing ecological pasture conditions.