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Land cover changes associated with the rise of the Lake Aydarkul in Nurota, Uzbekistan

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Abstract

For many centuries Uzbekistan's arid to semiarid steppe biomes accommodate pastoral farming activities, while since the 1930s water- and input-intensive cropping systems have been introduced throughout the country's semi-arid lowland regions. Land use and land cover (LULC) change in these regions is accompanied by often negative effects on soil and pasture quality. In contrast to the well-documented and devastating consequences of desiccation and salinisation of the nearby Aral Sea region, a reverse scenario of LULC change has occurred in the central part of Uzbekistan. In 1969, heavy rainfall initiated large water inflow into the Chardara Reservoir, causing a release of enormous amounts of water, forming the Lake Aydarkul near the Nurota District. The subsequent changes of LULC, and their effects on local herders' livelihoods have been poorly investigated. This study aims at filling this gap by examining the processes of LULC changes triggered by cropping and livestock grazing using GIS-based remote sensing. Time series analysis of historical Corona image from 1968 and Landsat (TM and OLI/TIRS) data covering 1987, 2000, 2010, and -2023 were employed using machine learning algorithm. The following LULC classes were distinguished: abandoned/ bareland, built-ups, cultivated area, lowland pasture, highland pasture, trees/shrubs, and water bodies. First insights suggest that an increase in the lake level from 158 to 961 km² (1968 and 2023, resp.) has altered locations of livestock herding followed by a decrease of lowland areas. This has increased the pressure on existing lowland pastures. In addition, rainfed wheat (*Triticum aestivum* L.) cropping has extended by 182 % from about 5300 to 9600 ha (1968 and 2000), however, decreased to 33 ha (–99 % cut off) in 2023 due to an unsustainable land management which resulted in tremendous land abandonment. Local land abandonment has increased by 145 % from 9989 ha in 1968 to 14050 ha in 2023, leaving soil bare, being invaded by unpalatable species, thereby decreasing the quality of the lowland pastures. Low quality pastures are likely unable to sustain the uncontrolled growing number of livestock and therefore herders forcibly continue to rely on the limited high-quality pastoral areas to keep their livestock.

Keywords: GIS, livestock, LULC, overgrazing, remote sensing, semiarid pastures, Uzbekistan