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

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Introduction

- Nomadic pastoralism had flourished in Uzbekistan until the 1930th where it was replaced by soviet socialistic farming units.
- In 1969, heavy rainfall initiated large water inflow into the Chardara Reservoir, causing a release of huge amounts of water which formed the Lake Aydarkul (Fig. 1) , a reversive scenario of the Aral Sea disaster.
- The subsequent changes of land cover and their effects on pastoral livelihoods have been poorly studied.

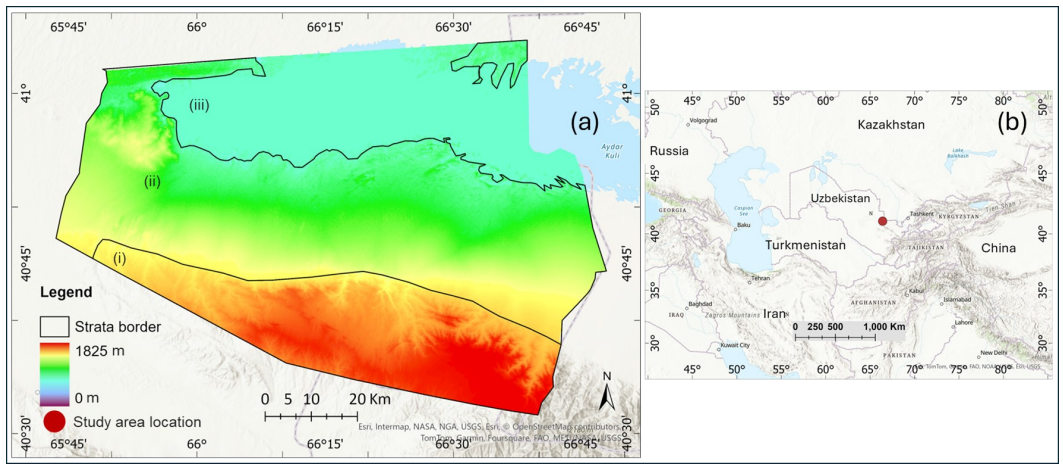

Fig. 1 Study area in Nurota, Uzbekistan: (a) Elevation; (b) Location; (i) Highland, (ii) Lowland and (iii) Lake strata.

- This study aims at filling this knowledge gap by examining the processes of land use and land cover (LULC) change triggered by cropping and livestock grazing using GIS-based remote sensing.

Methodology

- 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 (Fig. 2).
- Corona image classification after Haralick texture analysis was implemented using an unsupervised ISO classifier[1].
- Supervised classification with Support Vector Machine algorithm was employed to classify Landsat images.

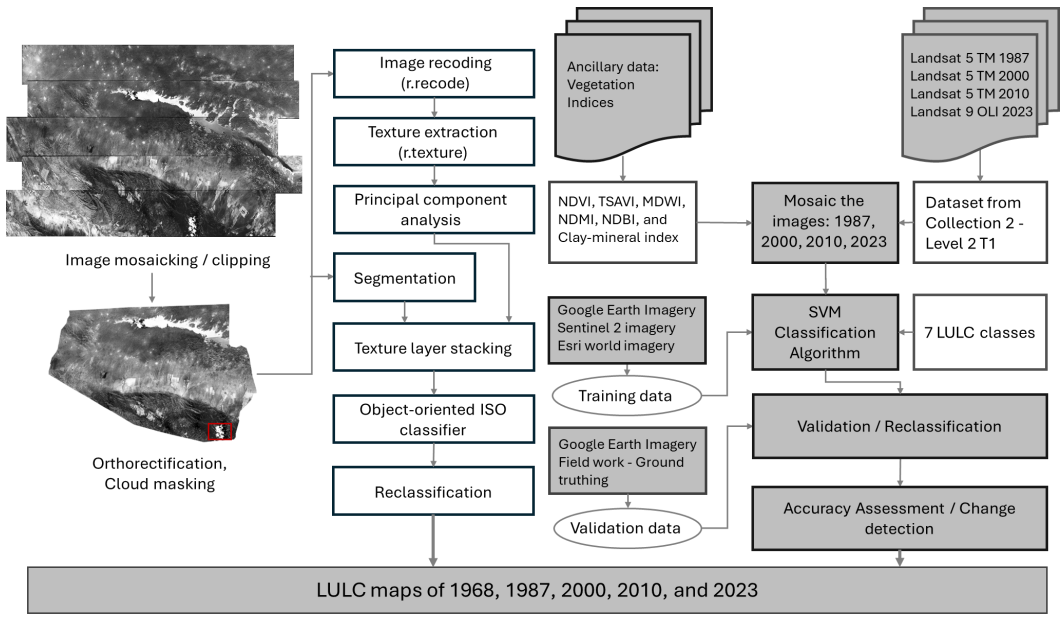

Fig. 2 The workflow of pre-processing and classification of the Corona and Landsat images.

Results

- The abandoned/bareland, built-up area, cultivated area, lowland pasture, highland pasture, trees/shrubs, and water classes were correctly identified.
- An increase of the lake's water volume from 158 in 1968 to 641 km^2 in 1987 has altered herding locations followed by a decrease of lowland pastoral areas (Fig. 3 and 4).

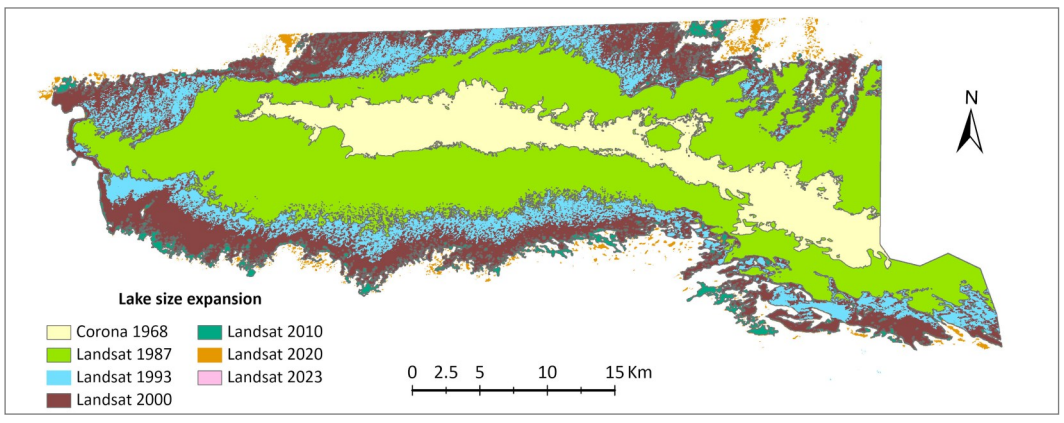

Fig. 3 Expansion of the Lake Aydarkul in Uzbekistan (Source: Corona and Landsat images).

- Rainfed wheat (*Triticum aestivum* L.) cultivation has expanded by 182% from 5300 ha in 1968 to 9600 ha in 2000, however, decreased to 33 ha (-99% cut off) in 2023 (Fig 4).

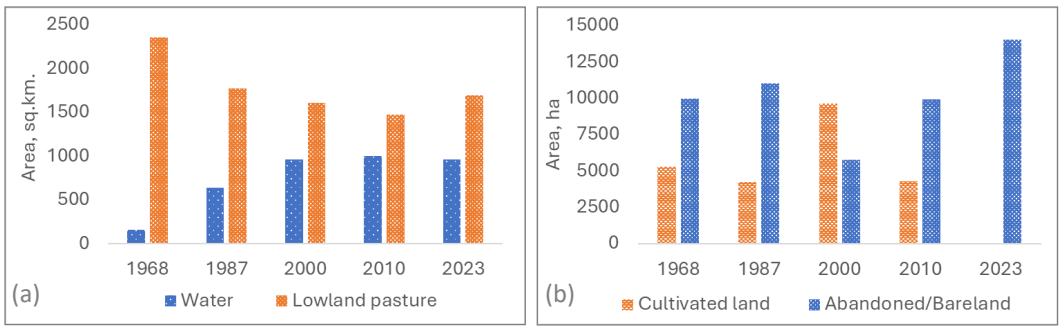

Fig. 4 Land cover and area change: (a) water><lowland pasture; (b) abandoned/bareland><cultivated land in Uzbekistan.

Discussion

- Land cover change initiated by lake expansion reduced the area of lowland pastures. Unintentional relocation of livestock herding condensed the grazing radius around stationary camps.
- Rain-fed cereal production gained importance following the post-Soviet farm restructuring aiming at achieving independence in wheat supplies, and converting lowland pastures with fertile soil into cropland. This was eventually stopped due to unsustainable management and climate change effects.
- Low quality pastures with bare soil and least palatable species are unable to sustain the livestock and hence local people continue to rely on the limited high-quality pasture areas.

Further Research

- Ongoing studies investigate land cover changes also in highland areas, and assess the pasture quality using extensive fieldwork and laboratory analysis.

* [1]*Rizayeva et al. (2023): Large-area, 1964 land cover classifications of Corona spy satellite imagery for the Caucasus Mountains. In Remote Sensing of Environment 284, p. 113343. DOI: 10.1016/j.rse.2022.113343.*

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