# Remote Sensing and GIS based Land Use Land Cover Change. A case study from the Bostanlik District, Uzbekistan

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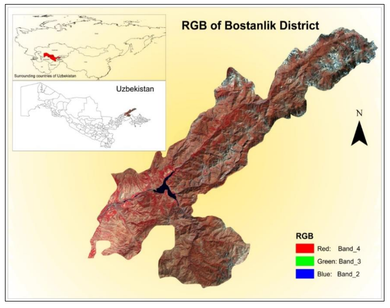
## 1. Introduction

- Bostanlik district is one of the landslide-prone areas of Uzbekistan and most of the landslides are triggered by snow melting and precipitation.
- The presence of a mountain reservoir increases the frequency of landslide occurrence, in particular for areas near the waterbody.
- Around 65% of total landslides in Uzbekistan located in Tashkent Province.
- The monitoring of existing landslides is necessary, and a landslide susceptibility zonation is highly recommended in order to mitigate hazards.
- LULC is a main parameter for the landslide susceptibility analysis.
- The main objective of the current study was the application of open source datasets for LULC change detection analysis

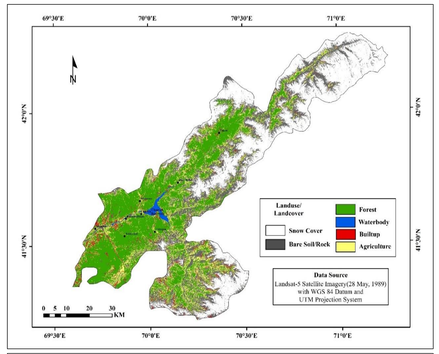
## 2. Study area + input data

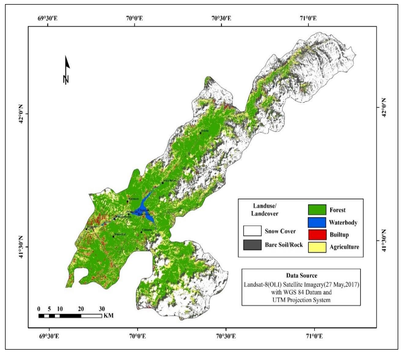
- The Bostanlik district is located in the north-east part of Uzbekistan and covers 4,982 km$^2$ and it is the largest district in the Tashkent region (Fig. 1).
- Almost the entire part of the study area is covered by high mountains and the altitude range of the district varies from 568 to 4,301 m asl.
- The district belongs to the seismically active zone and more than eight earthquakes occur on an annual average (Juliev et al.,2017).
- The climate of the territory belongs to the continental type and the average value of precipitation 800-1200 mm per year.
- The main river of the area is the Chirchik river. Within the district, the mountain reservoir operates with the area of coverage 40 km$^2$ and with 2 billion m$^3$ of storage volume.
- Landsat 5 TM data of 28 May 1989 and Landsat 8 OLI data of 27 May 2017 provided by the USGS database system were used for generating LULC maps.

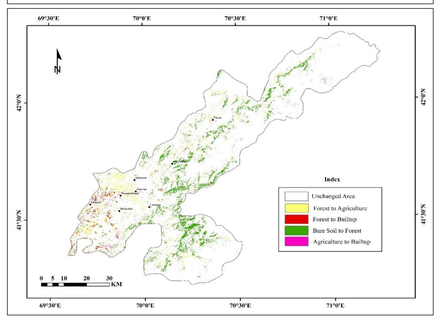



## 3. Results

- All the processing and post-classification steps were completed using the software packages ENVI 5.1 and ArcGIS 10.1.
- Six types of LULC classes were identified in the study area: snow cover, bare soil/rock, forest, waterbodies, built-up areas and areas used for agriculture.
- Supervised classification methods and maximum likelihood algorithm were used for preparation of LULC maps.




| Landuse/Landcover | 1989 | | 2017 | |
|---|---|---|---|---|
| | Area(Km$^2$) | Area (%) | Area(Km$^2$) | Area (%) |
| Forest | 1519.55 | 30.5008 | 1804.09 | 36.2122 |
| Snow Cover | 1511.26 | 30.3344 | 1504.93 | 30.2073 |
| Water body | 36.18 | 0.72621 | 38.94 | 0.78161 |
| Agriculture | 654.99 | 13.1471 | 656.85 | 13.1845 |
| Bare Soil | 1118.59 | 22.4526 | 863.26 | 17.3276 |
| Built-up | 86.43 | 1.73485 | 113.93 | 2.28683 |
| Total Area | 4982 | 100 | 4982 | 100 |

Land use and Land cover Change Trend (1989-2017)

| | | Initial State(1989) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Snow Cover | Water body | Forest | Bare Soil | Agriculture | Built-up | Class Total |
| Final State 2017 | Snow Cover | 1163.06 | 0.17 | 64.95 | 192.42 | 78.68 | 17.31 | 1504.93 |
| | Water body | 0.4 | 35.14 | 0.23 | 2.99 | 0.16 | 0.01 | 38.94 |
| | Forest | 5.6 | 0.05 | 1191.15 | 279.08 | 289.36 | 1.012 | 1804.09 |
| | Agriculture | 10.52 | 0.1 | 190.3 | 208.82 | 212.67 | 34.45 | 656.85 |
| | Built-up | 1.6 | 0 | 26.27 | 19.96 | 18.31 | 20.28 | 113.93 |
| | Bare Soil | 330.08 | 0.71 | 46.65 | 415.32 | 55.81 | 14.7 | 863.26 |
| | Class Total | 1511.26 | 36.18 | 1519.55 | 1118.59 | 654.99 | 86.42 | 4982 |
| | Change Class | -6.33 | 2.76 | 284.54 | -255.33 | 1.86 | 27.51 | |

Change Detection Matrix between Initial and Final State (1989-2017)

## 4. Conclusion

- Remote sensing methods with accurate input data and monitoring results can support to assess the further behavior of LULC processes. The achieved results show that within 28 years the LULC of the Bostanlik district changed significantly.
- We observed an increment for the forests, built-up areas, waterbodies and agriculture classes and we verified the obtained results with already existing results from fellow using other methods of assessment.
- Utilization of remote sensing and GIS techniques allowed us to calculate the development status of the Ugam-Chatkal national park.
- The study area exhibits different geomorphological phenomena, such as erosion, glacial lake outburst floods, debris flows, and landslides, all of which can turn into hazards once elements are at risk. The LULC maps resulting from this study will be further used for landslide susceptibility mapping of the district, which will support the governmental authorities and stakeholders to establish land-use planning for the Bostanlik district in order to prevent natural hazard losses.
- Moreover, the results obtained may help to achieve the sustainable development of the entire region by providing necessary input data.

## 5. Acknowledgements

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