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Identification and Extraction of Qaranqu Catchment Landforms and Landuse Using Object-Oriented Techniques

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1-Introduction

Landforms are essential elements of the earth's surface landscapes and the result of the action of internal and external forces. The sum or total of the earth's surface shapes is known as landforms, including a single mountain such as a volcanic cone, a dune, a sand dune, a single valley, and a dissolution pit. One of the standard methods in geomorphology is the classification of phenomena and features of the earth. There are several ways to express geomorphic units, all of which are mostly similar. The analysis of land systems is one of the first attempts to study and classify landforms in practice, which has been accepted as one of the working methods in geomorphological studies. This analysis is a scientific classification based on landform and hierarchical structure and emphasizes the relationship between landform, land capabilities, and constraints. Landforms have at least two basic characteristics; the first is that the results of geomorphological and geological processes, the second is that there are clear boundaries to determine the domain of the current geomorphological processes. One of these steps has been used in a change detection project. The process of classifying data is remote sensing. Classification can be considered as a decision-making process in which image data is assigned to specific classes.

2-Methodology

Qaranqu catchment area is between longitude 45 degrees 25 minutes east to longitude 47 degrees 50 minutes, and latitude 36 degrees 50 minutes north to latitude 37 degrees 50 minutes. Landsat satellite imagery of ETM + (1990) and OLI (2020) sensors were used to detect changes in landforms of the Qaranqu catchment. The images were first taken from the US Geological Survey. After preparing the images, the necessary pre-processing was applied to the images. This pre-processing includes radiometric and atmospheric correction performed in ENVI5.3 software to examine the geometric errors, radiometry such as interference, overlapping scan lines, duplicate pixels, and an atmospheric error

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such as the presence of cloud spots. The eCognition software was used to extract the landforms of the study area from the object-oriented classification (nearest neighbor algorithm and threshold). PCA and MNF algorithms were used to facilitate the classification process. Finally, the kappa index and overall accuracy index were used to evaluate the accuracy of the classifications.

3-Results and Discussion

According to the results obtained from the nearest neighbor method, the highest rate of change in the region is related to the irrigated landform, which has increased by 11.45% compared to 1990. Landfill for rainfed agriculture has also increased by 3.45% during the same period. The highest area reduction in the area is related to the dense pasture landform. Compared to 1990, it has increased by 2.15% due to increased rural migration, better health facilities in urban areas than in rural areas, having more amenities, and more income and construction around the city. Based on the results obtained from the thresholding method, the highest area in 1990 using the threshold classification method is related to the deformed cone landform and dense pasture with 19.01% and 17.02%, respectively. The lowest area is related to the dam and residential landforms, which each occupy 0.02% and 0.12% of the area, respectively. However, the classification results for 2020 show the trend of change in all landforms in the region. The highest reduction rate is related to dense rangeland landform, which is faced with a reduction of 12.49% in the area compared to 1990. The other landform that has the highest decrease in the study area is the medium rangeland landform, which has been reduced by 4% in area, which over time has become a barren landform and rainfed agriculture. Nevertheless, the most incremental change is related to irrigate landform, which has increased by 10.83%.

4-Conclusions

In the present study, Landsat 5 and 8 satellite images from 1990 and 2020 were used. After preparing the images, the required corrections were applied to the images. PCA and MNF algorithms were used to identify landforms better and perform the classification process. Then, the object-oriented technique, threshold algorithms, and nearest neighbor were used for classification. The overall accuracy index and kappa coefficient were used to perform the accuracy of the classified maps. By comparing these two methods, it can be said that the accuracy obtained from the nearest neighbor algorithm is higher than the threshold algorithm. The results obtained from the detection of landform changes in the study area showed that over the period of 1990 to 2020, the largest increase is related to irrigated landforms. This increase is due to the construction of Sahand Dam in this area during the time the land Rangelands have become irrigated agriculture. Rainfed agriculture has also faced an increase in area, as the use of agricultural machinery and

implements; however, an increase in population rates has increased the demand for food. Eventually, this has led to some cultivation of barren land. Residential areas have also increased during this period. On the one hand, the migration of villagers to urban areas has increased construction, and having welfare and health facilities and having an employment environment in urban areas has increased the population.

Keywords: Geomorphology, Object Classification, Landform, Qaranqu Watershed, North Western Iran.

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