# Study of changes in vegetation and water level in Zarivar Lake using Landsat satellite in the period 1984 to 2016

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**Abstract**

Lakes in the world have a very important ecological role in ecosystem balance. One of the methods of reviewing changes over time is the use of multi-time satellite imagery, which is useful way in terms of economic. Considering the importance of Zarivar lake as the largest freshwater lake in the west of the country, temporal and spatial changes of vegetation and its water level were studied using the satellite imagery of TM (Thematic Mapper) and OLI (Operational Land Imager) Landsat from 1984 to 2012 and 2013 to 2016, respectively. Dense and light vegetation changes using NDVI (Normalized Difference Vegetation Index) index and water level changes using NDWI (Normalized Difference Water Index) index were assessed. Using these indicators, it was determined that the water level of the lake decreased during the study period 8168 $km^2$, and the size of dense and light vegetation was from 2,401 and 0.961 $km^2$ in 1984 to 13.576 and 3.122 $km^2$ in 2016. With a field visit to the lake, the changes in this vegetation were confirmed. By examining the parameters of annual precipitation, evaporation and annual mean temperature at the synoptic station of Marivan (1 km from the lake), it was found that the decrease of lake water surface and the increase of dense and light vegetation levels is due to human intervention through the entry of agricultural, urban and industrial effluents into Zarivar Lake. This action could be considered by field visits and observing the entry of effluents from residential areas into the lake. On the other hand, by examining the amount of rainfall in the province, it is clear that the rainfall factor has a lesser role in reducing the lake water level.

**Keywords:** Landsat Satellite, Water level changes, NDVI, NDWI, Zarivar Lake, Kurdistan.