EGU22-12041
https://doi.org/10.5194/egusphere-egu22-12041
EGU General Assembly 2022

Newly-Born Sand Dunes of Lake Urmia: Assessing Migration Rate and Morphodynamic Changes Using Remote Sensing Techniques and Field Studies

Hesam Ahmady-Birgani[1], Parisa Ravan[1], Zhengyi Yao[2], and Gabriela Mihaela Afrasinei[3]
[1]Urmia University, Natural Resources, Range and Watershed Management, Urmia, Iran, Islamic Republic of (h.ahmadybirgani@urmia.ac.ir)
[2]Northwest Institute of Eco-Environment and Resources, Chinese Academy of Sciences, Lanzhou 730000, China (yaozy@lzb.ac.cn)
[3]College of Engineering and Built Environment, School of Surveying and Construction Management, Technological University Dublin TU Dublin, Ireland (gabrielamihaela.afrasinei@tudublin.ie)

To enhance the understanding of aeolian landforms and their processes, the assessment of origin, migration and evolution of newly-born sand dunes is vital. In this regard, Lake Urmia, in NW Iran, was considered as a representative case study, given that it has lost approximately two-thirds of its water volume in the past two decades and, consequently, the newly-born sand ridges and sand dunes on its western shores were formed. The emerging sand dunes are located close to the villages, adjacent to the agricultural and farmlands, international transit road, and industrial zone, encompassing the whole area. The present study aims to assess the sand dunes' origin and their migration both in speed and direction in the past decade.

To understand the questions above, remote sensing techniques and in-field studies were coupled. Therefore, wind data from the closest meteorological station were employed to calculate the wind rose, drift potential (DP), the resultant drift potential (RDP), and the resultant drift direction (RDD) across the region. Change detection techniques using high-resolution satellite images were chosen to detect the migration rate and morpho-dynamic changes of Lake Urmia sand dunes. To classify the geomorphological features and land uses in the region, a hybrid supervised classification approach including a customised decision tree classifier was used to distinguish sand dune units from other signatures. Using the minimum bounding geometry method, feature classes were created. These feature classes represent the length, width, and orientation of sand dunes, retrieved after the image classification process. Also, fieldwork surveying was carried out on the sixteen sand dunes in different periods to measure the morphological and evolutionary changes.

As the wind results show, the trend of DP parameters between the years 2006-2009 and the years 2015-2020, the percentage of wind speeds above the threshold velocity (V>Vt%) to DP has significant gaps, suggestive of weaker winds in those periods. However, between the years 2009-2015, the V>Vt% and DP values are corresponding and coequal. This indicates that the most erosive and shifting winds are between 2009-2015, with the weakest wind power in tails. Moreover, the annual variability of DPt is well correlated with Lake Urmia water level changes; but

there is no correlation between the DPt and precipitation amount. The evaluation of image processing results depicted that after 2003, the area of sand dunes had dramatically increased. On average, the smallest area belongs to 2010 (287.3 m2), and the largest area is for years 2019 (775.96 m2), 2018 (739.08 m2), and 2017 (739.74 m2). In addition, between the years 2010 and 2014, a significant increase in area of the sand dunes from 287.25 to 662.8 m2 was observed. The migration rate is the highest between 2010 and 2015, with the lowest values before 2010 and after 2015.

The results of this study have broad implications in the context of sustainable development and climate-related challenges, ecosystem management and policy-making for regions with sand dune challenges, hence crucial insights can be gained by coupling remote sensing techniques and in-situ studies.