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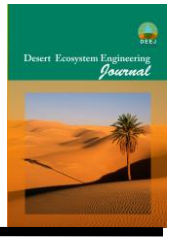

Assessing the Relationship between Alterations in Groundwater Level and Physical Changes in Water Bodies: A Case Study of Arjan Wetland, Fars Province

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Extended Abstract

Introduction: Considering the rapid changes occurring in natural phenomena of the earth and their considerable influence on human life throughout time, it is crucially important to thoroughly examine such changes so that one can better understand the natural and human processes involved in those changes. Monitoring and assessing the areas where the aforementioned changes occur are considered as important steps in national development and the management of natural resources. In this regard, remote sensing technology is uniquely applicable in collecting information concerning such phenomena, taking into account various advantages of multispectral satellite imagery, including their availability and interpretability. This study, therefore, sought to investigate the changes made in Arjan wetland using RS and GIS technology. To put it more precisely, the current study examined the changes that occurred in the wetland's banks, the decline of the area covered by the wetland's water, and the changes made in the earth's surface temperature and groundwater level. Throughout the past few decades, remote sensing technology has widely been used by scholars to detect such changes over time. On the other hand, coastal areas, especially inland lakes, have received special attention as ecological environments.

Materials and Methods: This study used two types of data: meteorological data including precipitation, temperature (average, maximum, minimum), humidity, evaporation, and transpiration data, and remote sensing data, including the information collected from Landsat and MODIS images to calculate water indices and surface temperature. It should be noted that MODIS satellite images used in this study possessed low spatial resolution and high temporal resolution. Moreover, the NDWI was calculated for the study period (1968-2018) using coding in the google engine system. On the other hand, grace satellite imagery was used to estimate the alterations made in the groundwater level within the study area. Moreover, the data regarding the observed wells within the study area were used to validate the results and zone the aquifer's water level. To determine the optimal position of the earth's surface and remove hydrological effects, the GRACE satellite (GLDAS model) was used.

Discussion and Results: Like other lakes, the Fars province's lakes are completely dependent on the status of water resources in the related watershed. Having been dried up since 2013, Arjan seasonal wetland, where the water height reaches one meter during high water periods, is currently in critical condition. In winter and spring, the surplus water is stored in the surrounding plain due to the increase in the plain's surface inflows and the limited irrigation capacity in its eastern part, turning the wetland into a lake.

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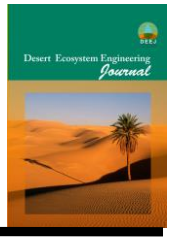

In this study, first, the area of Arjan wetland was examined in terms of climatic parameters. While Arjan Wetland experienced lots of fluctuations throughout the study period (1986-2018), it could be argued that its main crisis started in 2010 when the area of the lake was reduced to less than half, and finally became zero in 2013. According to the obtained results, the wetland had its largest area in 1989 (14.78 square kilometers) when, based on data recorded at the meteorological station, the precipitation rate was 488 mm, which is regarded as one of the maximum precipitation rates throughout the study period. On the other hand, the time series data collected from the GRACE satellite and validated via Piezometric well's data were used to examine the status of groundwater in the Arjan aquifer during the study period (1986-2018). The time period considered for the investigation of the changes that occurred in the aquifer was from 2003 to 2017. According to the data extracted from the GRACE satellite, the highest amount of groundwater decline occurred in 2018 by 20 cm. Also, the analysis of the general trend of changes shows that the decline rate is more than 8 cm per year.

Conclusion: The consequences of climate change may be exacerbated in different regions by human activities-induced changes in the climate and the drying up of inland continental lakes. As a climatic hazard, the drying up of lakes is a critical issue to be taken into account, the consequences of which, as shown in this study, will affect the climatic conditions of the region and even the surrounding areas.

Arjan wetland is an Iranian seasonal lake with fresh water whose area has been declining in recent years due to climate change and reduced precipitation rate, getting totally dried up recently. As found in this study, the wetland has completely been dried up as a result of a significant decline in its area from 1986 to 2018. It was also found that the Arjan aquifer's groundwater level has decreased by roughly 20 cm.

Keywords: Arjan Wetland, Level Change, Groundwater, Water Body, Remote Sensing.