



Investigating the Effect of Hydrological Drought and Traditional Utilization (Distribution and Transmission) of Water Resources (Flood Streams) on Land Degradation and Desertification in Drylands: A Case Study of Sistan Plain

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Extended Abstract

Introduction: Water is crucial for survival and development. Long-term access to water resources provides the ground for scientific and technological developments. Geographically, Iran is located in an arid part of the world. Water scarcity and mismanagement could create a water crisis in the world, and that droughts may exacerbate different environmental and socio-economic aspects of life. As revealed in a report issued by the United Nations' Environment Programme, 80 percent of the world's population currently live in places with no water security, and that 1.5 billion people throughout the world are facing anhydrous risk.

As Iran has, in recent years, been affected by drought, access to water for agricultural, industrial, and drinking purposes is now of great concern for inhabitants of the country's drylands. According to the reports issued by the World Bank, mismanagement and inefficiency of irrigation systems are the main reasons for water insecurity in the world. In recent years, mismanagement of available water resources in the arid region has followed by the destruction of natural ecosystems that are dependent on water resources. As a result, changes in land use over a long period and the expansion of desert areas have led to environmental degradation. Sistan is located in an arid region in Iran where difficulty to access surface water resources due to drought in recent years has brought about environmental degradation in the region. Low precipitation (50mm), high temperature (48o), high transpiration (5000mm), and 120-day winds are among the specific climatic conditions that characterize the region. Sistan is also hit by floods for a limited period when the Hirmand river flows as a

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result of torrential rainfall in Afghanistan, providing the required water for its 120,000 ha agricultural land.

Materials and methods: This study sought to investigate the environmental impacts of hydrological drought and traditional utilization of floods streams on Land Degradation and Desertification in Sistan. Located at the southeastern border of Iran and Afghanistan, Sistan forms part of the Dasht-e-Lut desert land, possessing an extreme arid climatic regime. The region is a roughly flat and featureless arid plain with an average height of 475–500m ASL in its eastern parts. To realize the purpose of the research, the hydrological drought status of the Hirmand river was investigated. Using the Streamflow Drought Index (SDI), the hydrological drought was then calculated for 22 years. The distribution and utilization of flood streams in the Sistan area were examined via Infield operation. On the other hand, the Irrigation system of the area was examined through library studies and the factors affecting the circulation of surface water resources were identified. Weighting these variables via Analytic Hierarchy Process (AHP) and integration of data layers, access priority map of sectors to the water resource was estimated. The land-use map of the years when the hydrological drought occurred and didn't occur were extracted through the Landsat satellite images of the years 2002 and 2018. The identification of changes in the region was then carried out by assessing the accuracy of the images and their classification, using the comparison approach. Moreover, the land-use change maps were overlapped with the access priority map of sectors to the water resource to investigate the effect of the utilization method on desertification and land degradation.

Result: The findings of this study showed that the severity of drought in Sistan has increased over the past 18 years. On the other hand, the findings for the areas with years of hydrological drought indicated that barren land had increased by 41 percent, and that agricultural, residential, and water zone areas had decreased by 61, 31, and 84 percent respectively. It was also found that the distribution and transmission of incoming floods to the Sistan area lead to limited access to these surface waters in areas such as Hirmand (Gregory sector), Nimroz (post ab sector), and Zabul (Central sector) because of their seasonality and uncertain continuity. The most land-use changes were found to be the conversion of water zone, (equivalent to 12581 hectares) agricultural lands (equivalent to 3073/22 ha), and poor rangelands (equivalent to 4495/8 hectares) into barren lands where access to floodwaters is limited.

Discussion and Conclusion: This study proved the clear environmental effects of hydrological drought and traditional utilization of water resources on the Sistan region. Reduction of streamflow in the Hirmand river due to the recent occurrence of hydrological droughts and limited access to water resources because of the irrigation system and the traditional methods of utilizing water resources led to the land-use change as a result of the destruction of water-dependent ecosystems, increasing the desert areas and critical points in the Sistan area accordingly. Having said that, breaking the drought, improving environmental conditions, and using efficient production methods require new approaches for proper utilization and management of water resources in the Sistan area.

Keywords: Hydrological drought, Irrigation system, Land destruction, Land use change, Sistan.