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Investigating the Trend of Changes in Water Area of Shadegan Wetland and its Relation to Drought Occurrence Hydrology and Sugarcane Drainage Water (Jarahi watershed)

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Abstract

Wetlands in arid and semi-arid regions play a vital role in the region's ecosystem. Drying of wetlands can be caused by natural factors; Decreased rainfall, increased temperature, increased evaporation, drought and human factors; Reduce discharge in order to exploit water in agricultural networks and maintain it in upstream. In order to investigate the relationship between hydrological drought and its role on changes in water area of Shadegan wetland, stream drought index (SDI) was used for the surgical catchment with 10 stations with a statistical period of 30 years. Hydrological drought characteristics including frequency, continuity and magnitude were calculated and analyzed for decades for the wetland catchment area. Landsat TM, ETM + and OLI sensors from 1998 to 2017 were used to monitor the water level of Shadegan Wetland. Three stages of pre-processing, processing and post-processing were performed on the images and the images were classified into three categories of water, vegetation and without cover or soil using supervised classification by support vector machine (SVM) method. Classification accuracy for images was calculated using two indicators, overall accuracy and kappa. Changes in discharge of Shadegan hydrometric station as the last entrance station of Jarahi River to wetland and other sources of water entering the wetland whose flow rate was measurable and available information, such as sugarcane drains, were calculated and their values with changes in wetland water area compared. The results showed that although the frequency, continuity and magnitude of drought in the wetland catchment area has increased in the last decade compared to other decades, but the water area of the wetland has increased. The water area of the wetland in the last decade was not consistent with the outflow of the last Shadegan hydrometric station, but was related to the inflow of sugarcane and Shadegan discharge. Therefore, sugarcane drainage, regardless of its quality, due to the severity, continuity and magnitude of drought in the last decade has played an important role in the rehabilitation of Shadegan wetland as a living ecosystem.

Keywords: Wetland ecosystem, Hydrological drought, Sugarcane drainage, Jarahi River.

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Extended Abstract

Introduction

Shadegan International Wetland is one of the largest wetlands in the country, which was included in the list of international wetlands of the Ramsar Convention in August 1975. This wetland is very important with its great biodiversity and various functions such as flood control, air conditioning, soil erosion control and livelihood of a part of human communities. Wetlands ecosystems play an important role in the ecosystem in arid and semiarid regions. Drying these ecosystems can be caused by human and natural factors; Meteorological droughts are caused by natural factors such as precipitation and temperature rise and evaporation, but in the event of hydrological drought, despite the above factors, human factors in water management play a key role. Climate change and ongoing droughts with rising temperatures and evaporation and declining humidity and runoff in catchments and by human intervention through the construction of dams and large irrigation networks, the entry of agricultural wastewater, industrial and urban pollution and the oil ecosystem have made it difficult for wetlands.

The trend of climate change and the occurrence of continuous droughts with increasing temperature and evaporation and decreasing humidity and runoff in catchments, especially in the catchment area of wetlands located in arid and semi-arid regions, like Shadegan, and due to human intervention, ecosystems have caused wetlands problems and caused them irreparable damage. The purpose of this article is to monitor the wetland surface area of the wetland over a period of 30 years. The relationship between the occurrence of hydrological drought and the water area of the wetland and the calculation of the drainage water entering the wetland and its relationship with the water area of the wetland are the objectives of this article. The results of this paper will help water resource management decision makers to provide both wetland water supply from the Jarahi River freshwater source and integrated sugarcane drainage potential with respect to its treatment as an opportunity to save the wetland as an ecosystem. Live help with multiple functions.

Materials and Methods

In order to investigate the relationship between hydrological drought and its role on Shadegan wetland changes, Streamflow Drought Index (SDI) was used. For Jarahi basin with 10 stations, has a 30-year period. Hydrological drought characteristics including the frequency of continuity and magnitude were calculated and analyzed for decades for the catchment area of the wetland. To calculate the duration of the drought, the year of occurrence was calculated as the first year and its continuation until the conditions became positive. Drought magnitude is obtained from the positive sum of droughts in each decade

Landsat TM and ETM + and OLI satellite images were used in the years 1988 to 2017 in June. Three stages of preprocessing, processing, and post-processing on images are carried out and to categorization use of Supervised Vector Machine (SVM). The images were classified into three classes of water, vegetation, and no cover or soil. In order to evaluate the classification accuracy of classified images, two indicators, total accuracy and kappa were calculated. Changes in Discharge The Shadegan hydrometric station were calculated as the last entry point of the Surgical river to the wetland and other water sources entering to Shadegan wetland, whose discharge was measurable and available, such as sugar cane drainage water. Their values were compared with changes in wetland area water. Data's related to discharge from other sources of water entering to wetland, which was caused by sugarcane drains, was received in millions of cubic meters and converted to cubic meters per second, so that with the data's of discharge, the last entry point to Shadegan wetland from Jarahi River and be consistent. The water area of the wetland was compared and analyzed with hydrological drought. Then, its relationship with the inflow to the wetland was identified and analyzed, and the role of the inflow of sugarcane in increasing the water area of the wetland was revealed.

Results and Discussion

Naturally, the most important source of water for wetlands is seasonal and permanent rivers and runoff from the watersheds leading to them. The frequency of occurrence, persistence and magnitude of drought in the watershed area of the wetland leads to a decrease in freshwater inflow to the wetland. Meteorological drought, especially in the last decade, and the development of irrigation networks and the construction of dams have been the main reasons for the occurrence of hydrological drought in the watershed, resulting changes in the water level of Shadegan wetland. The frequency of hydrological droughts of the decade in the watershed of Shadegan wetland has been increasing and in the last decade the drought storm has reached 8 to 9 event. The persistence of hydrological droughts in the basin has an increasing trend, although there is no continuity in the first decade, but in the second decade in most stations the continuity is three years and in the third period the drought is 8 years. At Shadegan station, which is the last water entry station to the lagoon, the continuity has reached 9 years. The study of the large size of the hydrological drought of the decade in the watershed of Shadegan in the first and second decades was low, but in the third decade the magnitude of the drought reached more than 8, which indicates the persistence and pervasiveness of the drought in the third decade.

The trend of 30-year changes in the water area of Shadegan wetland is increasing. Prior to the arrival of the drainage system due to sugarcane projects, the highest water area of the wetland was 22.4%, which was due to the conditions of the watershed related to the wetland facing severe wet conditions. In 2005, the wetland's water area reached its maximum value during the 30-year period under surveillance; in the previous year, 240 million m^3 of Drainage water entered the wetland from sugarcane projects, and this year 266 million m^3 of Drainage water entered the wetland. In addition, mild wetland conditions have prevailed in the watershed this year. Therefore, the water area of the wetland in the early years was subject to precipitation conditions in the wetland watershed and since the year that sugarcane drainage entered the water of the wetland, it has been subject to precipitation conditions and the volume of incoming drainage water from sugarcane projects.

Conclusions

Naturally, the most important source of water supply for wetlands is seasonal and permanent rivers and runoff leading to them. Frequency of occurrence, persistence and magnitude of drought in the catchment area of the wetland lead to a decrease in fresh water entering the wetland. Meteorological drought, especially in the last decade and the development of irrigation networks and construction of dams and earth dams have been the most important reasons for hydrological drought in the catchment area and as a result of changes in water level of Shadegan wetland (Dargahian et al., 1397). Drought is an integral part of the nature of Iran, especially the arid and semi-arid region, including the study area. The whole basin has been facing the longest drought cycle. The results showed that although the frequency of drought persistence and magnitude increased in recent decades compared with other decades, the area of wetland water has increased trend. The area of the wetland in the last decade has not been consistent with the discharge exit from the last hydro meteorological station of Shadegan, but has been associated with the total amount of water entering the sugar cane and discharge Shadegan hydro meteorological station. Therefore, sugarcane Drainage water, regardless of its quality, has played a key role in the recovery of the Shadegan wetland as a living ecosystem in recent decades, due to the severity and severity of drought.