

Effect of Drought on Surface Water Reduction of Gavkhouni Wetland in Iran

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ABSTRACT

In this paper the effect of recent drought in Isfahan in Iran on reduction of surface water of Gavkhouni wetland was studied. In order to achieve this purpose, considered data, computer analyzing and statically methods were used. After determining and sorting of available data including of annual precipitation, monthly precipitation and seasonal precipitation, frequency of occurrence drought were studied. Spatial distributing of four kinds of drought was considered (very severe drought, severe drought, normal drought and slight drought) in Isfahan and process of changing mentioned data state was studied. Attention of changing rate of meteorological parameters and Gavkhouni wetland position and negative balance of its water, it will be true assumption that recent drought in Isfahan has affected on water surface reduction in Gavkhouni wetland.

KEYWORDS: drought, Gavkhouni wetland, surface water reduction

INTRODUCTION

There are more than 50 definitions for wetland as yet, nevertheless the first scientific definition of wetland, has provided in international Ramsar convention [7]. Gavkhouni wetland as one of international wetlands in Iran and one of Ramsar wetland list has significant role in preventing to progression of Iran central plateau desert. Also it's a haven for migratory and native birds and it can conserve life of many kinds of fishes and plants. Changing in wetland (as habitats for special animal species) such as water table depth, surface saturation and drought causes many problems [3]. Also there are many factors that influence wetland life, such as temperature, precipitation, water inflow, evaporation and sediment [1].

It's clear that zones in margin (in climatically view) are more critical. Countries in arid zones or desert (have dry weather) dry years are more than wet years. According to reports, Iran had drought 13 years in 23 years ago. In dry and drought field, some organizations (such as FAO and WMO) have presented useful studies. Interaction of wetland and upstream river of it in flood field is one of subject in previous studies [8]. Policies and management in land use has positive effect on climate change of wetland [9].

Iran is in the arid zone and it caused to periods of drought and the effects of it prevail in the wet periods. Although wet periods has caused flood, but social and economic losses caused by drought severity and range of accessories is more. From September 1998 to March 1999 precipitation in Iran has 40 percent reduction than previous year. It has about 180 milliard m³ volume of water and in according to the statistics published, 57 cities in Iran were in drought probability. Also precipitation in western and upstream of Zayandehroud River has reduced 35-45 percent in 2010 than previous year and Isfahan state has been in very arid situation in 2011 (fig.1). In general water shortage is estimated about 25 million m³ per year in Isfahan state. This is a fact that a large part of Iran's territory is placed within the triangle of desert; it will be cleared in figure 2.

The purpose of this study is evaluating of drought effects on surface water of Gavkhouni wetland in Isfahan state in Iran.

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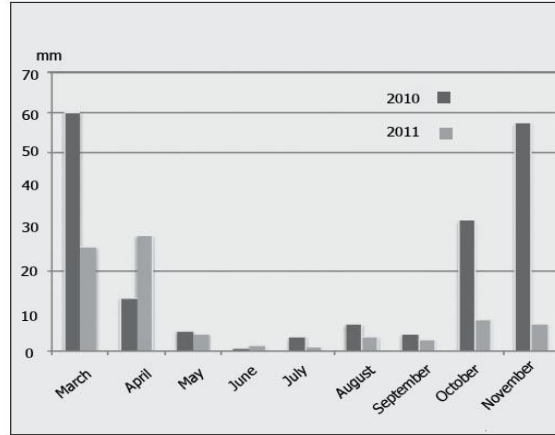


Figure 1; 9 months precipitation in Iran (2010 and 2011) [6]

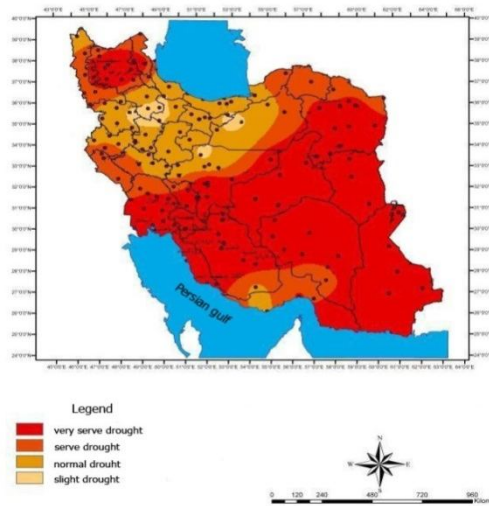


Figure 2; drought distributions in Iran in 2010

Evaluation of drought in Isfahan state

In refer to drought delineated data and its spatial distribution (based on Isfahan Agricultural Research and Natural Supplies reports, fig.3) it is found that Isfahan is located in very arid zone, although there is in other states of Iran severe drought, normal drought and slight drought [6].

The results of the last drought monitoring from September 2010 to January 2010 in Agricultural Drought Management of Isfahan state [6], shows there are large area of this state is in severe drought (4.66% of the area). Also all of this state is in drought, and a large part of Gavkhouni wetland is located in south of Isfahan state.

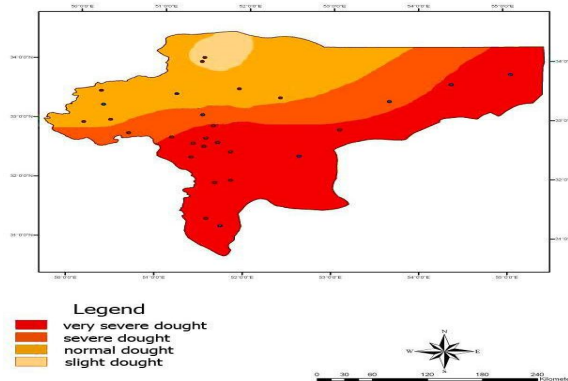


Figure 3 drought distributions in Isfahan state in 2010

Isfahan precipitation from September 2010 to January 2010

Mean of total Isfahan precipitation up to 2010 has been 3.32 mm, although the mean of long-term is 4.63 and the reduction of precipitation is 6.47 mm over long-term data. The most percentage of droughts in Iran is in Isfahan station (4.86% precipitation reduction over long-term). Four-month changes in precipitation show that Isfahan station s had no precipitation, from September 2010 to December 2010. Precipitation was 44% less than long-term of it in October 2010. At November 2010 there was not any significant precipitation. So the percentage of drought was the maximum for 4 month. In general autumn of 2010 was the most droughts in Isfahan in a few years ago (only 9.2 mm of precipitation). Also in winter amount of precipitation was less than it long-term, but drought was less than autumn. In general the central basin (Markazi Basin) of Iran shared only 6.48% of total precipitation on Iran basins in autumn 2010 (fig. 4) [2].

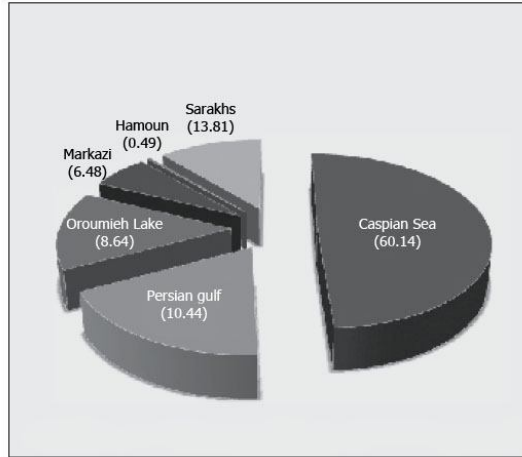


Figure 4 percentage of rainfall in Iran basins in autumn 2010

Geographical properties of the area

Upstream of Zayandehroud valley in Isfahan state is located in North-East section of Isfahan-Sirjan basin and its direction is from North-West to South-East and the length of this valley is about 300 km in mentioned basin and finally its downstream is in East part of Gavkhouni wetland. Gavkhouni basin is located in 140 km from South-East of Isfahan and 30 km from Varzaneh historical city. The heith of this basin is 1470 m-msl and has triangular shape. Maximum width is 50 km and maximum length is 25 km. The area of this basin is 98000 km². More than 50 km² of it is desert.

Weather properties of Gavkhouni wetland

Gavkhouni basin has warm weather and it’s a large part of deserts of Iran. In attention to Varzaneh data weather station where is the nearest station to basin, the daily mean temperature is between 1.83 °C to 28.9 °C in different months per year and minimum mean temperature is -6.6 °C and 37.4 °C as maximum temperature. Totally the temperature of 5 months is more than 20 °C and 5 months has less temperature (less than 10 °C). According to statically data in weather station mean of annual precipitation is 83 mm. However annual evaporation was estimated about 3000-3200 mm/year in Gavkhouni wetland [5].

Gavkhouni wetland hydrology

In base of quantities studies in Gavkhouni basin, the total annual precipitation is 15.4 milliard m³. 1/16 of the basin precipitation distributes in Zayandehroud River (960 million m³). The upstream of Zayandehroud River (as only water source of Gavkhouni basin) is in heith of Zardkuh in Chaharmahal Va Bakhtiari state. Also there are many reaches that in warm days in year are dry. There are some small seasonal rivers in Shahreza and Izadkhash regions that water of them flow in Gavkhouni wetland directly, but water received form these sources is little.

RESULTS

Mean annual precipitation in Isfahan state is 40.8 mm and precipitation in winter is more and in summer is the least amount. Mean annual temperature has been 15.6 °C that summer has been the hottest season and winter has

been the coldest. The important property of recent drought is increasing of temperature that has negative effects on water supply region [4].

They are: 1.Changing in kind and amount of regional precipitation that is little and has been in rainfall shape that it hasn't the benefit of snow melting and gradual penetration of water which causes water supply be in minimum [4].

2. High temperature causes increase evaporation of surface water and transpiration an area.

To consider drought data and its spatial distribution in Isfahan it can be categorized as table 1. Studies of mentioned parameters and analyzing results shows that it's a true assumption that recent drought in Isfahan had affected on surface water of Gavkhouni wetland and has caused decrease area of Gavkhouni wetland.

Table 1 kind, percentage and location of drought in Isfahan state

kind of drought	Percentage of drought	Location of drought
Very severe drought	1.45	East, center and south
Severe drought	3.21	center
Normal drought	30	Center to west
Slight drought	20	North

Conclusion

Drought is a phenomenon faced by most countries. This natural disaster has affected many parts of the country. Thus, this term represents the insufficient rainfall and a dry climate permanent feature in a region. In this paper Gavkhouni wetland as an important geographical place in Iran and the only wetland in Iran central plateau desert is studied and the recent continues drought has caused severe economic losses to natural resources, particularly surface water. Also it affects groundwater that causes decrease head of water in aquifers. In attention to precipitation regime, temperature and hydrology data of Gavkhouni (Varzaneh station) and droughts and economic, environmental and social data, the ways will be find to decrease potential dangers. In addition management in water resource in upstream of the area and analyzing of its results in downstream can reduce the effect of drought on Gavkhouni wetland.

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