



ORIGINAL ARTICLE

Studying and investigating Maroon basin drought via standard precipitation index SPI

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ABSTRACT

Starvation as a natural disaster and inevitable phenomena was happened frequently from long time ago in different wide nations especially those areas located in warm and dry climate, and had a many damage in economic, social, environment areas. Undoubtly, first step to overcome starvation and its outcome is actual identifying and understanding of this phenomena and its effect due to it in different dimension, that base on that we can plan effective strategy and approach and apply them. We can consider starvation via different indices and standardized precipitation index (SPI) is one of the most important of them, and its goal is assigning numerical value to most important climate factors (precipitation). This index is applied for determining lack of precipitation in different time scale. In this article, we consider starvation in several selected station in Maroon basin during 29 years statistical common period. (SPI) index is considered in annual time scale and then we draw a (SPI) index changes diagrams in different year's base on starvation severe. In all stations, we had an normal statue in most years and we had a starvation statue recently. Mushin station (Zard River) had a most severe starvation among these stations between 1386 and 1387.

Keywords: Maroon,starvation, standardized precipitation index, starvation severe

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INTRODUCTION

Drought is one of the main disasters related to meteorology. This natural disaster affected all aspects of our life .there is not any common definition about drought in international level which be acceptable to all. Generally, drought happen when there is a significant decreasing in water in a especial place and time .every drought is recognized by three characteristics: intensify, duration, and width .there are different kind of drought which create with regard to drought period and define as follow:

1. Meteorological drought: happen when precipitation is lesser than about 75 percent from normal quarter or even more than biannual (6 months).
2. Agricultural drought: in this stage, the moisture of soil is very low, especially where vegetations are dense and biomass in soil is decreased .another properties of this stage is decreasing water for cattle.
3. Hydrological drought: the significant signs of this stage of drought are decreasing river flow, water resources, and lakes and underground aquifer and social – economical drought: this stage is that last part of drought which affected on lack of water resources on human lives.

We should bear in mind those effects of precipitation reduction on soil moisture, water resources, and rivers surface flows and underground water level show in different scales .drought definitions are changing frequently with regard to its effect rate on social and natural environment. It is logical that we relate drought in wide level with event time, duration and location. However, to drought quantity analysis, it is necessary to have an especial index to determine dry and moisture duration accurately. Drought monitoring systems efficiency is affected by index accurate selection that provide a description from real and subjective condition in drought situation .in the recent years, several indexes was presented to investigate drought and necessity every indexes such as " Palmer " index are related to one of three kind of droughts ; index of "Dezman " and " Shafer" index surface water , " Moli" and " Balmeh" index , " john Wick et al " index and SPI index – was introduced by " Macke ki *et al* [1].

Applying SPI index is acceptable among quantity indexes to analyze drought due to computation simplicity, using available precipitation and acceptable data, calculation for different time periods and different places scales, several studies was done to evaluate drought by researchers in different areas and were considered indexes. We mention to some of these researches in follow. "Ensafi [2] evaluated climate

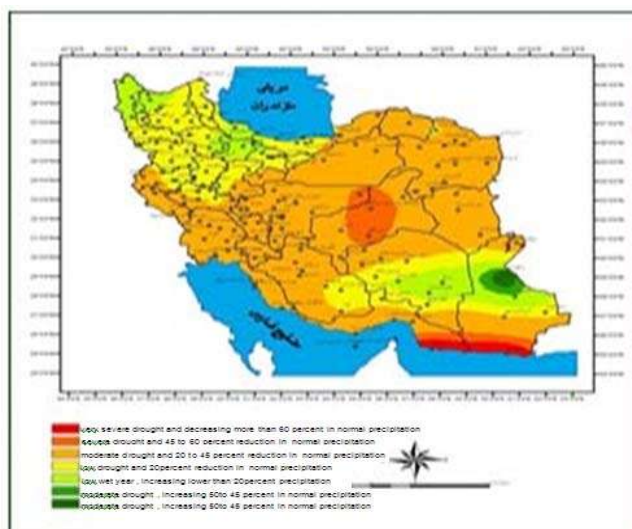
drought indexes and determining the best index in salt lake basin concluded that SPI index and deciles coincide to precipitation minimal occurrence year, is a severe drought event, and had a more effectiveness rather than other indexes in terms of showing most severe drought. Mosaedi et al [2007] applied SPI indexes to evaluate and analyze weather drought in "Golestan" province spatially and reached to different results including an important drought and wet year 11 years and being the most severe drought in Caspian coastal and border areas. "Badagh Jamali" and "Javanmard" were done drought monitoring and zoning in "Khorasan" province via SPI index, which finally drought zoning maps in "Khorasan" province was achieved by two models of kriging and distancing picture.

Drought in Iran

Iran is a country which has a prone to drought and dry, and a loss due to this natural damage is increasing. Uncontrolled exploitation from water resource cause to reduce per capita water .. In the last 50 years ago which country population was 19 million, amount of water per capita was 7000 cubic meters Per year, while today's this rate reach to 1900 cubic meters per year with a population around 70 million.

With regard to population growth, water per capita will reach to around 1400 cubic meters per year in 2025. Lack of water and drought are the most important challenges that country agriculture development in present and future will face to it. Estimating food needs shows that if there is not any measurement in increasing irrigation efficiency, decreasing lesions after harvesting, appropriate land management and, in addition, if there is not any appropriate strategy to water management and preparing to decrease drought effects in agricultural section, land and water resource potential in country can not meet the food needs. With regard to available estimation, a loss due to drought in agriculture section was about 2/5 milliard dollars in 2001 and about 1/7 milliard dollars in 1999. Main loss due to decrease agricultural actives and Gross Domestic Production (GDP) from agriculture was about 12 percent. also, occurring drought in Iran economic was due to decrease production in agriculture and it was created by lack of supplying staple for industries and lack of demand for industrial products. drought affected on rate of agricultural inputs demand such as fertilize, poison, machinery, credits and etc. Additionally, drought had a severe effect on water resources, jungles, grass land and other natural resources. Strategy for combining water management and drought management for agricultural section needs cooperation between different organizations. Strategy related to drought effects compensation relates to water strategic planning and management which include two measurements that both plan for long-term and short-term decreasing. Long-term measurements cause to decrease vulnerability in water supply systems in agricultural parts. Examples of long-term measurements are increasing water supply via appropriate technologies and refeeding of underground. Short-term measurements include executing unpredicted disasters plan. Planning to use water resource should be base on supply management principles, demand management, and reducing drought loss [4]. In agriculture section, in order to managing drought and minimizing its effects, preserving soil and water is an important strategy. Applying pressurized irrigation, planting products which do not need too much water, inhibiting weeds which compare to food products to achieve water and foods, costing water and re-using waste water cause to preserve water. Supplemental irrigation via underground water has an important role in increasing and stabilizing product performance in agriculture systems in dry lands. Preparing Correct method to confront drought, should be applied base on farmer's capabilities. We should pay attention to apply drought-resistant plants, on time planting, tillage and fertilizing, appropriate use from water, increasing product quality and performance, decreasing lesion after harvesting. Giving loan and insurance to farmers capable them to perform correct management in climate critical condition. In a sustainable agricultural system, it is possible to use water and land appropriately in national strategy framework of preparing confrontation to drought. Iran Islamic Republics located in one the driest area in the world. It has annual precipitation average 250 millimeters, which is one-third of world precipitation rate. Total area is 165 million ha which about 37 million ha is fertile lands, 90 million ha is grass land, 13 million ha is jungle and the rest are barren lands, deserts, mountains and lakes. due to several limitations, especially lack of water, at present just 18.5 million ha from whole 37 million ha are planting: about 8.5 million ha (46 percent) is irrigation farming and about 10 million ha (54 percent) is dry farming. irrigation farming uses 84 milliard cubic meters from total 93 milliard cubic meters of country water that is more than 93 percent of total available water resources. In spite of dry climate and lack of water, agriculture section is one of the most important economic actions in country. This section produces about 18 percent of gross domestic production, 25 percent employment, 85 percent food, 25 percent non-oil productions and 90 percent staple which uses in agriculture section. In addition to dryness, Iran is a country prone to drought and drought loss rate is increasing due to decrease available per capita water because of increasing population, changing climate and uncontrolled exploitation and decreasing equality of available water resources (salty and pollution) [5]. Average per capita water is decreased, as if

this amount is reached to 1900 cubic meters from ^{Kar et al} 7000 cubic meters in 50 years ago. With regard to population growth rate, it is predicted that this rate decrease more and more, so until 2025 reach to 1300 cubic meters.



Iran drought condition map in water year 2009-2010

METHODOLOGY

Area under study: Maroon river basin is located in southern and west southern part of middle Zagros Mountains in 48 degree and 35 minutes to 51 degree and 10 minutes eastern longitude and 30 degree and 31 minutes to 31 degree and 43 minutes in northern latitude. The area of this section is 24307 square kilometers which about 10331 square kilometers of it is mountains area and 13976 square kilometers are plains and foothills. Maroon basin weather is affected by low latitude, altitude changes in different area (zero to 3600 meters) and proximity to Persian Gulf in southern part.

For the first time, "Mache et al" in Kalarador state applied standard precipitation index and concluded that Gama distribution is appropriate for precipitation data process. determining wet year or drought properties in one area is one of the crucial needs to environmental , economic and especially water resources management planning .it is crucial that draw perspective of future precipitation condition and wet and dry period for region in many long- term planning , for this reason ,drought and its properties is very important in water resources management. "Mache et al" in 1993 used classification system to show standardized precipitation index. Standard precipitation index shows standard score Z (lower or higher standard deviation). They introduced a classification system to define drought from standard precipitation index results. Without any doubt, such events whether in the past or now, always have had unsuitable occurrences which the economic losing is the most important of them. Only in 2007 and 2008, the lost due to drought and coldness in Maroon was estimated about 1924710 Rails. The damages due to drought in different dimension create a crisis in development planning. It is possible to study and investigate drought for officials to compare available condition with last years in any time and decrease losses via predicting weather condition and applying fight methods to it and prevent from possible crisis due to it.

Amount SPI	Drought classification
2 and higher	Very severe wet year
1.50 to 1.99	Severe wet year
1.00 to 1.49	Moderate wet year
0.99 to -0.99	normal
-1.00 to -1.49	Moderate drought
-1.50 to -1.99	Severe drought
-2.00 and lower	Very severe drought

Table 1: drought classification base on standard precipitation index

In this research, several rain gauge stations of energy administration, which had a longer statistic, were selected. Stations include "Kheir Abad" , "Dehlama" , " Machine(Zard River) , " jokanek" , " idenak" and " Deh Sadat" .At first, precipitation data in all stations were investigated in terms of accuracy and homogeneity and after insurance of homogeneity, loss data in every station were re-built via adjacent stations data and regression method (correlation) .common statistical year 1980-2009 was selected as a basis. Then, standard precipitation index was achieved annually for ever station. Then, we draw diagram for every station to show these changes better. SPI index was computed base on precipitation amount in every month and precipitation average in determined time period of section to precipitation standard deviation in that time scale (time scale is 12months).

DISCUSSION AND CONCLUSION

In this part, SPI changes diagrams in different stations in Maroon basin were drawn, which you can see in the following.

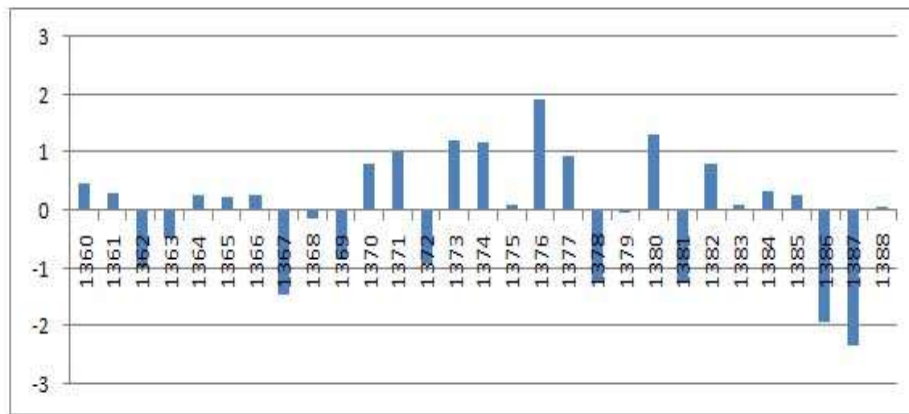


Diagram 1: annually standard precipitation index in Kheir Abad station

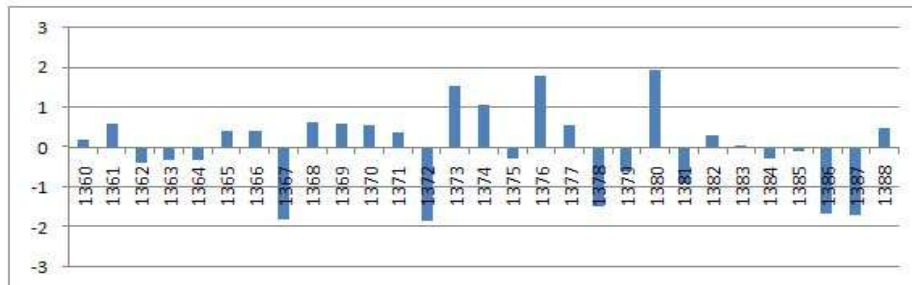


Diagram 2: annually standard precipitation index in Dehlama station

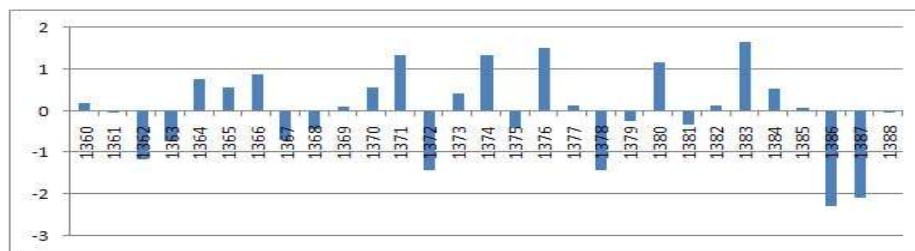


Diagram 3: annually standard precipitation index in Machine station

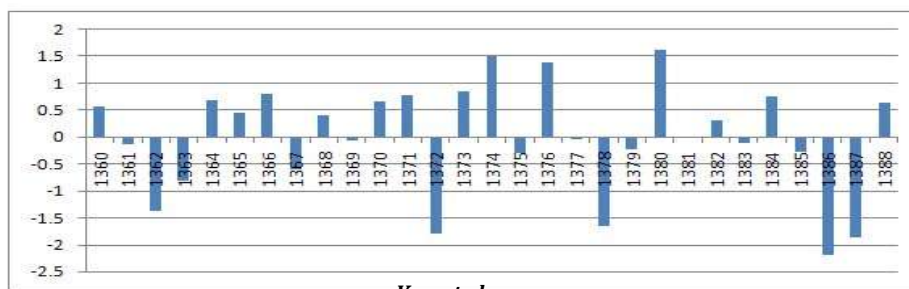


Diagram 4: annually standard precipitation index in Jokanak station

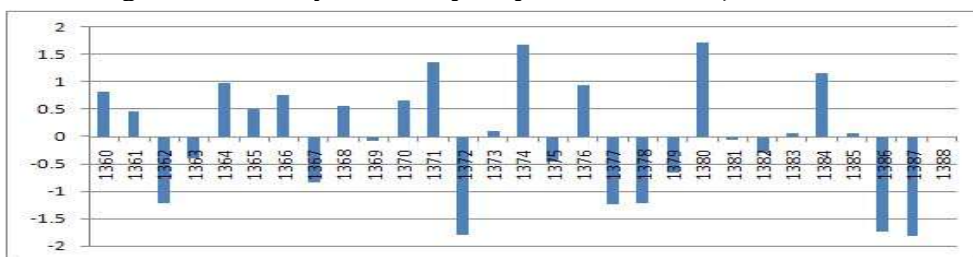


Diagram 5: annually standard precipitation index in Deh Sadat station

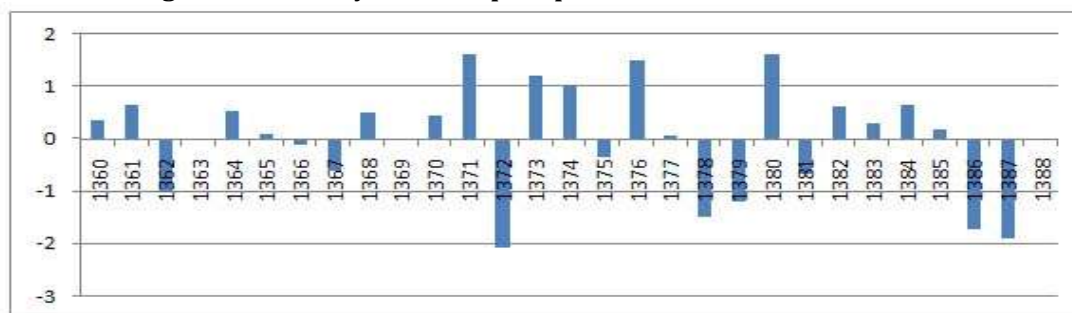


Diagram 6: annually standard precipitation index in Idenak station

As you can in diagram 1, there was a most severe drought in 2008 and most severe wet year in "Kheir Abad" station and the situation was normal in rest of years. In diagram 2, in "Dehlama" station, there was a most severe wet year in 2001 and most severe drought in 1988, 1993, 1999, 2007, 2008 and the situation was normal in rest of years. In diagram 3 and in "Machine (Zard River)", there was a most severe drought in 2007 and most severe wet year in 1383 and the situation was normal in rest of years. In diagram 4 and in "Jokanak" station, there was a most severe drought in 1386 and most severe wet year in 2001 during 29 years ago and the situation was normal in rest of years. In diagram 5, and in "Deh Sadat" station, there were most severe wet years in 1995 and 2001 and the most severe droughts in 1993 and 2008 and the situation was normal in rest of years. In diagram 6 and in "Idenak" station, there were most severe wet years in 1992 and 2010 and the most severe drought in 1993 and 2008 and the situation was normal in rest of years. With regard to above diagram, we can say that the most severe droughts during 29 years were happened in several decade ago and this matter warns the managers to take a basic measurements against drought, and drought continuity in annual scale is not tangible .

SUGGESTIONS

With regard to this matter that drought is one of damages which affect on all life aspects and environment, so identifying its effects on different environments and resources can be an important step to manage resources .country water industry managers should pay special attention to water issue and provide necessary situations to investigate this creepy phenomenon in all Hydrological basin in Iran for experts , and take basic measurements in wide nation via diagnosing this phenomenon better and better.

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