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# The Recognition of Drought with Dri and Siap Method and its Effects on Rice Yield and Water Surface in Shaft,Gilan,south Western of Caspian Sea

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**Abstract:** Drought in Iran is a recognized phenomena, Trend and velocity of drought in recent years, especially in 1998 and 1999 in Gilan, South western of Caspian Sea, is very noticeable. The aim of this paper is recognition of drought years with DRI(Dependable rainfall Index) and SIAP Index (Standard Index of Annual Precipitation) in Shaft township, Gilan,South Western of Caspian Sea and comparison its effects has been on Rice yield and water surface. The result of this paper has shown that in years of 1998 to 2003 has observed of drought in Shaft township with around area, in Shaft,Rasht and Ghalehrudkhan with 6 years and Pasikhan and Chobar with 3 years has been seen. Its effects have direct relationship on water surface and rice production that submitted by comparison figures in full paper. The return period of drought in two models has been in 10 years (1976, 1986) and before of drought years has been normally years in two years ago. Drought years are harmonious with deficit of low discharge in water surfaces and yield production of rice in same years. The toward of SIAP and DRI models in area shows that its toward to drought .This phenomena is high important for environmental planning and executive managers.

**Key words:** Drought, DRI, Drought Rainfall Index, Agriculture Drought, Hydrological Drought, Shaft, Gilan

## INTRODUCTION

Drought is a normal and temporary of climate that it's observed with low and high tensity but it difficult with aridity.

Drought isn't permanent phenomena of area and is deficit of precipitation in area with known time that necessary is not arid (comp, 1999) for definition of drought, all researches hasn't a unity view but anomaly of precipitation and time difference with average line that shows of environmental damages and social(Ncaria,2003 Nazamzadeh, 2002).

This phenomena in South Africa causes of changes in environmental, rural and cultural landscapes(Vagal,2005).drought observed in wet climate or dry climate but it difference with aridity and low waters (Kardavani,2001).This phenomena causes, different of soil natural vegetation and animal life's (Moradi, 2006) and different of precipitation in equal of additional evaporation (Alyasin,2008).

Iran is a dry and semi dry country even in northern of Iran that has wet climate, this phenomena has observed and exists many damages in agricultural economics and environmental landscapes(Biekdaly, 2009) .Ramezani (2005) with normal present index has researched in central of Gilan and Anzaali wetland of Gilan shows that drought in this area occurred. Frajzadeh (2007) for recognition of wet and dry years in north western of Iran with Niche model has used of DRI model and SPI models, Zahedi and and Raheme (2007) with DRI model has worked for Ormaee lake basin in north western of Iran,Khalili (2003,1991,1998) has worked with 7 indexes of drought investigation and introduced that the SIAP model is best .

This research with aim of recognition of drought years with DRI and SIAP models in Shaft area of Gilan.

***Data and Methods:***

Data of precipitation collected for 6 stations in 20 years (Table 1, Fig 1).

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**Table 1:** Geographical situation of meteorological stations.

| Type | Elevation | latitude | Longitude | Station |
|---|---|---|---|---|
| synoptic | -6.9 | 37,15 | 49,36 | Rasht |
| climatology | 45 | 37 | 49,22 | Pasikhan |
| climatology | 40 | 37,10 | 48,51 | Chobar |
| climatology | 240 | 37,25 | 49,16 | Ghalehroudkhan |

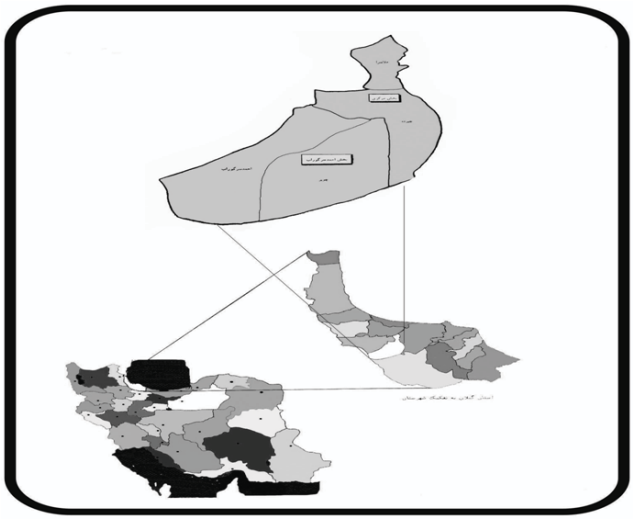

**Fig. 1:** Situation of Shaft area in Gilan and Iran

Research method uses of Dependable Rainfall Index (DRI) and to determine wet/dry-years, this index was used as follows:

$$DRI = (\sqrt[N]{P_1 \times P_2 \times P_3 \ldots P_N \times}) \; )*0/8$$

The presented scale for classifying the intensity of rainfall and also to determine the rainfall quality through the DRI is as follows:

$$NP = DR \leq P \leq GM$$

$$D = P \prec DR$$

$$W = P \succ GM$$

Where DRI, Drought index, p1.p2.p3, is precipitation of years and is the given year's precipitation observations (duration of the statistical period), N is number of the annual precipitation observed, GM, geometric mean of observation, 0.8 is the constant coefficient, NP is the normal precipitation range, D is the drought threshold hold and W is the number of the wet-year threshold. (Popov,2002).

DRI is one of the hydro climatic indices which is used for estimating the minimum water requirement of a region and water resources as well

And is excellent for calculate of dependable precipitation in agriculture water (Khoshraftar, 2009).

For comparison has used Standard Index Annual precipitation (SIAP) method (Khalili, 2003).

SIAP= (Pi -; -P)/PSD

Where Siap is drought index, Pi is annual precipitation, P is mean of precipitation in period, and PSD is standard deviation index of period.

The gauges of drought index in two models are shows in table 2.

**Table 2:** Gauge recognition of drought in two models.

| Draught limit | Normal | Wet limit | |
|---|---|---|---|
| +0.25-(-0.28) | +0.25-(-0.25) | > +0.25 | SIAP |
| P=DRI | DRI<P<GM | P>GM | DRI |

***Results:***

Result of statistics calculate precipitation is shows in table 3, Ghaleh roudkhan and Chubar is wetness station and standard deviation and coefficient variety of precipitation in Pasikhan and Chubar is lowest firmness or stable.

Rasht, Ghalehroudkhan is dependable station of precipitation view.

**Table 3:** Descriptive Statistic of Area.

| Station | Rasht | Pasikhan | Chobar | Ghalehroudkhan |
|---|---|---|---|---|
| Average | 1335.3 | 1049.1 | 1577 | 1693.2 |
| Geometric mean | 1323.5 | 998.8 | 1540 | 1672.3 |
| Rang precipitation | 708 | 1131.2 | 1278.2 | 1145 |
| Minimum | 989 | 415.3 | 1041.5 | 1307 |
| Maximum | 2452 | 2319.7 | 1546.5 | 1697 |
| ?Standard deviation | 187.5 | 289.3 | 336.5 | 276 |
| Coefficient of variety | 14 | 27.5 | 21.3 | 16.3 |

Dri index has calculated for each stations and recognition of limit index in normal dry,wetness (table 4).

**Table 4:** DRI,Drought,Normal and Wet limit for area.

| Parameter | Rasht | Pasikhan | Chober | Ghale roudkhan |
|---|---|---|---|---|
| DRI | 1058.8 | 799 | 1232.7 | 1337.9 |
| Normal | 1058.8-1323.5 | 799-998.8 | 1232.7-1540.9 | 1337.9-1672.3 |
| Drought | Less than 1058.8 | < 799 | <1232.7 | <1337.9 |
| wet | More than 1323.5 | >998.8 | >1540.9 | >1672.3 |

In period of research rasht has been with 12 years accompanying drought, two years wet and 6 years is normal, other stations has shows in table 5 and 6.

**Table 5:** Drought years with uses of DRI and SIAP models (R-Rasht,P-Pasikhan,C-Chobar,GH-Ghalehroudkhan,S-SIAP)

| Year | R-DRI | R-S | P-DRI | P-S | C-DRI | C-S | GH-DRI | G-S |
|---|---|---|---|---|---|---|---|---|
| 1989 | N | N | N | N | D | N | D | D |
| 1990 | D | D | N | W | N | W | D | D |
| 1991 | D | D | W | W | W | W | D | D |
| 1992 | N | W | D | D | D | D | W | W |
| 1993 | N | W | W | W | W | W | W | W |
| 1994 | N | W | W | W | W | W | N | W |
| 1995 | D | D | N | W | N | W | D | D |
| 1996 | D | D | D | D | D | D | N | N |
| 1997 | N | W | N | N | D | D | N | N |
| 1998 | D | D | N | N | N | N | D | N |
| 1999 | D | D | W | W | D | N | D | N |
| 2000 | D | D | W | W | D | D | D | D |
| 2001 | D | W | D | D | N | N | D | D |
| 2002 | D | D | D | D | D | N | D | D |
| 2003 | D | N | D | N | N | W | D | N |
| 2004 | N | N | N | W | N | N | N | N |
| 2005 | W | W | D | N | N | N | N | N |
| 2006 | D | D | D | D | D | D | D | D |
| 2007 | D | D | D | D | D | D | N | W |

**Table 6:** Frequency of drought years, Normal years and wet years.

| Station | Drought years -SIAP | Drought years - DRI | Normal years- SIAP | Normal years - DRI | Wet years-SIAP | Wet years-DRI | Limit DRI |
|---|---|---|---|---|---|---|---|
| Rasht | 10 | 12 | 3 | 6 | 7 | 2 | 1058.84 |
| Pasikhan | 6 | 8 | 4 | 7 | 9 | 5 | 799.04 |
| Chobar | 7 | 9 | 7 | 8 | 6 | 3 | 1232.73 |
| Ghaleroudkhan | 8 | 11 | 7 | 7 | 5 | 2 | 1337.9 |

The effects of drought on rice production yield and discharge of rivers in area has showed in fig 2,3.

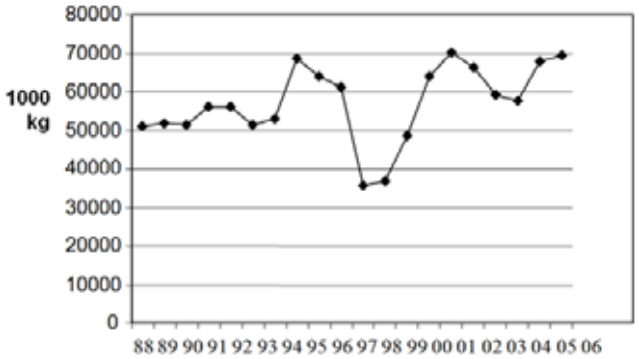


**Fig. 2:** Rice production in Rasht township.

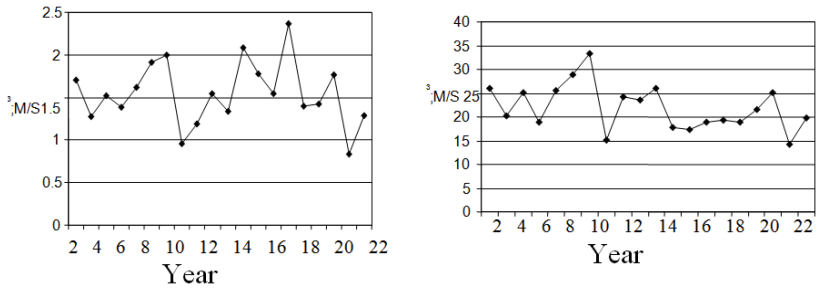


**Fig. 3:** Mean discharge (/s) in river of Chobar(right) and Pasikhan (left).

In years of 1995 and 1996 that area has seen with climatic drought, yield production has lowest in area and trend of Siap drought has shown that area going toward permanent climatic drought or aridity time. This phenomenon is important for environmental planning executive managers (fig 4).

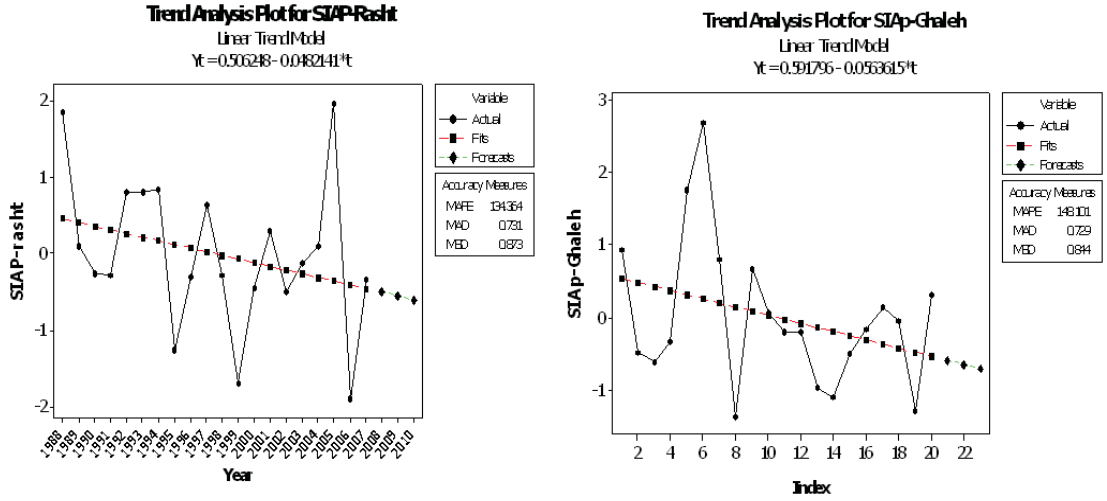


**Fig. 4:** Trend of Siap index in Rasht (plain) and Ghaleroudkhan (mountainous)

***Conclusion:***

Results of this research has shown that DRI index in pre notice of drought occurring and probably damages,this pre notice in area is in Rasht with 12 years, Ghalehroudkhan with 11 years has been drought, pasikhan with 5 years most of wet years . Lowest area of drought in Rasht and Ghalehroudkhan (1998-2003) has been with 6 years, from view of space wet years; Chobar is 6 years and more.

Rice yield production in area has decrease and water surface in area has decrease SIAP index also shows that in 10 years period return of drought, in two years before of drought occurred we have normal or wet years.

This phenomenon is an important for environmental and executive managers for prefect and fore case drought occur. Trend of SIAP index has shown that decrease index in area toward drought.

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