

METHODS OF FACING WITH DROUGHT IN FARS PROVINCE – IRAN

MIR HASSAN SEYED SERAJI¹, ALI TORABI HAGHIGHI², POUYAN KESHTKARAN³

¹Power & Water University of Technology (PWUT), Tehran, Iran, h_seraji@yahoo.com

²Fars Regional Water Authority, Shiraz, Fars, Iran, atorabi_ha@yahoo.com

³Islamic Azad University of Estahban, Estahban, Fars, Iran, email: pouyan_keshtkaran@yahoo.com

ABSTRACT

Fars province with 123000 km² area is one of the largest provinces in Iran. This province has variety of climate so the warm and dry in southern and eastern parts and cold in northern part. The temperature range from -10 °C to 45 °C and annual rainfall from 100mm to 800mm are specific characters of this province. Considering the huge amount of exploitation of underground water resources, the level of underground water tables in most planes of province has negative balance. The drought in recent years has limited the conditions of using the underground water resources. Considering the region climate conditions, process of climate changes and recent droughts, in this research the activities has been done to reduce the effects of droughts have been evaluated. Some programs as accomplishing artificial recharge projects, changing the cultivation methods, changing the irrigation systems, limiting exploitation of underground water resources, using surface water resources instead of underground water resources as well as executing water crisis symposiums in some parts of province to acquaint the people and learn water consumers to manage exploitation of water resources during the drought. Evaluating these activities, accomplishing artificial recharge projects were adverted as the best method and the operation of 69 executed artificial recharge projects, expectation of 23 under construction projects and 59 under study projects were considered.

INTRODUCTION

Statistical surveys show that 11% of natural disasters are related to drought. The loss caused by drought in 1993 has been 1895000 people around the world_ this figure was 51% of the other disasters mortality. The whole hurt people in drought since 1966 until 1988 has been over 1,579,000,000. Some of the severest droughts in the world were the droughts of the years 1996, 1973, and 1982 in which 100, 200, and 200 million people -in order- were injured. In 1948, the mortality figure in Ivory Coast and Ethiopia was 20000. In 1973, drought in Ethiopia injured more than 300000 people, and another one in Brazil in 1983 injured 20 million ones. Iran, located in south-western part of Asia and Middle East (figure 1) is considered as one of little-amount-precipitation countries around the world. Continually, within the years, 1956, 1960, 1964, 1970, 1973, and 1982, and the years from 1988 to 2006, as the statistical surveys show, more than 60% of the whole country has been experiencing drought. Average precipitation in Iran is a third of world's average number; and this little amount's expansion is so vast, considering time and the site of showers. The evidence is the gap of 1500 millimetres between the maximum precipitation in north of Iran (Gilan province) and the minimum in South-east of Iran (Sistan-va-Balouchestan province). The mentioned cause along the others, such as fluctuation in precipitation amount, and high evaporation has made this country a dry one.

Considered as one of the largest agricultural centres, Fars province is located in the south of central part of Iran and it has been influenced by drought, like the other parts of Iran. In this paper after a brief discussion about Iran's disasters, we will talk about water resources, droughts, and the ways to face with it (Barshan, M. (2007).



Figure (1): Iran's position in Middle East and Asia

IRAN AND NATURAL DISASTERS

A phenomenon created by nature, causing humane, natural, or environmental loss, which cannot be prevented by society is called natural disaster. Iran is one of the 10 foremost sensitive countries to unexpected phenomena and natural disasters that experiences economical, humane, and environmental losses, annually. Annually, natural disasters like earthquake, flood, drought, and thunders happen in different parts of the world. Beyond economical and humane loss the ruins in these places cause environmental pollution and in some situations it stops living in these places and the places around. Iran is located on two big quake belts. Occasionally, severe quakes which cause deaths, injuries, living hindrances, and site pollution occur. Earthquake and the consequent diseases, along with old buildings destruction, lead into destroying fundamentals. In history of Iran great quakes are registered which have imposed great losses on this country, for

instance, quake in Tabriz in 1041 killed 50000 people and again in the same year another one killed 40000 people, and in 1527 it killed 40000 people, in 1720, 250000 ones, in 1779, 100000 people, and in 1780 with 100000 sacrificed people. One of the most disastrous recent quakes occurred on 5th, Day 2003 in an old city, Bam. Its magnitude was 6.7 Richter which was created by fault movement. More disastrous was the quake happened on 31, Khordad 1990 in Guilan and Zanzan provinces which destroyed about 1100 km² with 27 cities and 1871 villages in it just in a few seconds. 70% of 49 years' floods have occurred during 1981-1996 Some factors Which have created the increment of losses for these floods are the destroyed plant cover, building structures crossing rivers, illogical activities in river banks and ignoring notifications, warnings and predictions of floods. Of the recent great floods Golestan province flood in 2001 can be referred. Another flood in 2002 killed 45 people with the economical loss of \$2.5 million. Flood loss during 1951-1960 was 6000 victims, and within 1961-1970 was 1000 and during 1971-1980 was 1000 and within 1981-1990 was 3000 and in 1991-2000 they were 500 ones. Iran is located on dry line on earth, so it has dry climate and little water. A large part of Iran is influenced by causes of weather dryness and water shortage. Drought is a phenomenon which can be occurred in any kind of climate sort; and, in recent years, particularly from 1988 until 2000 the mild and dry regions have experienced drought. The most earthquake-prone provinces after Khoraasaan are Sistan-va-Balouchestan, Yazd, Fars, West-Azarbayejan, Zanzan, Ardebil, Khuzestan, Hamedan, Golestan, and Kerman. Based on researches, occurrence percentage of droughts, and their intensity are very high that the most occurrence with the figure 50% belongs to Bandar-Abbas and after that Zabol 46%, Zahedan 42%, Yazd 42%, Iranshahr 40%, and Kerman 27% have the most occurrence; and all of them are located in dry zone. Generally the calculated drought accumulation in central and southern geographical zone of Iran is more than the margins of the country. Iran as one of the countries located on dry belt of earth is faced with water shortage. Population growth rate, agricultural and animal productions need, and water and soil limitations to produce crop have caused the decrease in refundable sources. As we can see, water per capita has changed from 4000-5000 m³ in 30 decade into 2000 in current situation and with the current rate of use it will be less than 1000 in 1400 (solar calendar). After droughts in years 1988 to 2001 the most rivers have got dry or water has got so little. In mean, water level of most rivers has decreased about 53% in these years (Arshan, M. 2007):.

WATER RESOURCES IN FARS

Fars province is one of the southern ones.. The area is 123000 km² and it includes almost 7% of Iran's. It's the 3rd largest province in Iran. The climate in north of this province is cold, in central part it has mild and rainy winters and dry summers, and in south and south-east winters are mild and summers are hot. Based on last governmental divisions Fars has 16 cities, 48 towns, and 60 subdivisions of cities (bakhsh), and 185 villages. Fars region is one of the oldest centers of civilization (figure.2).48000km² of Fars makes 182 productive plains. This has made Fars the greatest producer of wheat, barn, corn and the 3rd producer of rice and the 5th producer of cotton in Iran. Average precipitation in this province is 330mm along with not a good time and site distribution. Annual precipitation is 41000 MCM that 27,000 MCM is evaporated and 8000 MCM becomes ground water and the rest flow as surface water.



Figure (2): Iran’s map and provinces

Water consumption in Fars is about 10.1 billion cubic meters that 2.6 billion cubic meters of it is provided by surface reservoirs and 7.5 billion cubic meters is provided by the underground sources (Figure 3). 95% of this consumed water is used in agriculture, and 1% in industries and the rest is used for drinking and hygiene. Ground water resources consist of 69203 wells, 2910 springs, and 1402 qanats. Fars has 5 dams under operation (Doroudzan 1973, Izadkhist 1998, Mollasadra 2006, Ghiir 2007, and Sivand 2007) with the reservoir volume of 2800 million cubic meters, And 17 dams are under study construction. As it shows, there’s a great dependency on water and especially the ground water (Rezaeean, KH. 2006).

DROUGHT IN FARS

Drought, naturally, is a repeatable phenomenon that its time and intensity are unpredictable. Drought can occur in any place with precipitation. Dry and semi-dry places, or places with little or no precipitation where are really dry are not considered as places with permanent drought. Drought occurs when the needed water for a site is basically less than a specific amount in advance. In recent years, more than 15 droughts with different intensities have occurred in different places of Fars. To illustrate the situation, here are some occasions: In Figure 4 you can see the variations of precipitation relative to the average amount in Abadeh city in the north of Fars. The average precipitation number in this city is about 137mm. As it can be seen, in 20 of 30 years, precipitation is less than average and in 4 years it is less than half of the average. In

Figure 5 the variations of the entrance water into Doroudzan Dam relative to its average is shown. These variations can show regional fluctuations in dam's district. Within years 1981-1986 and 1999-2003, this dam couldn't provide the needs and in 1984 Bakhtegan Lake dried, which was for the first time in history. This lake is the endpoint of Kor River which Doroudzan dam is placed on.

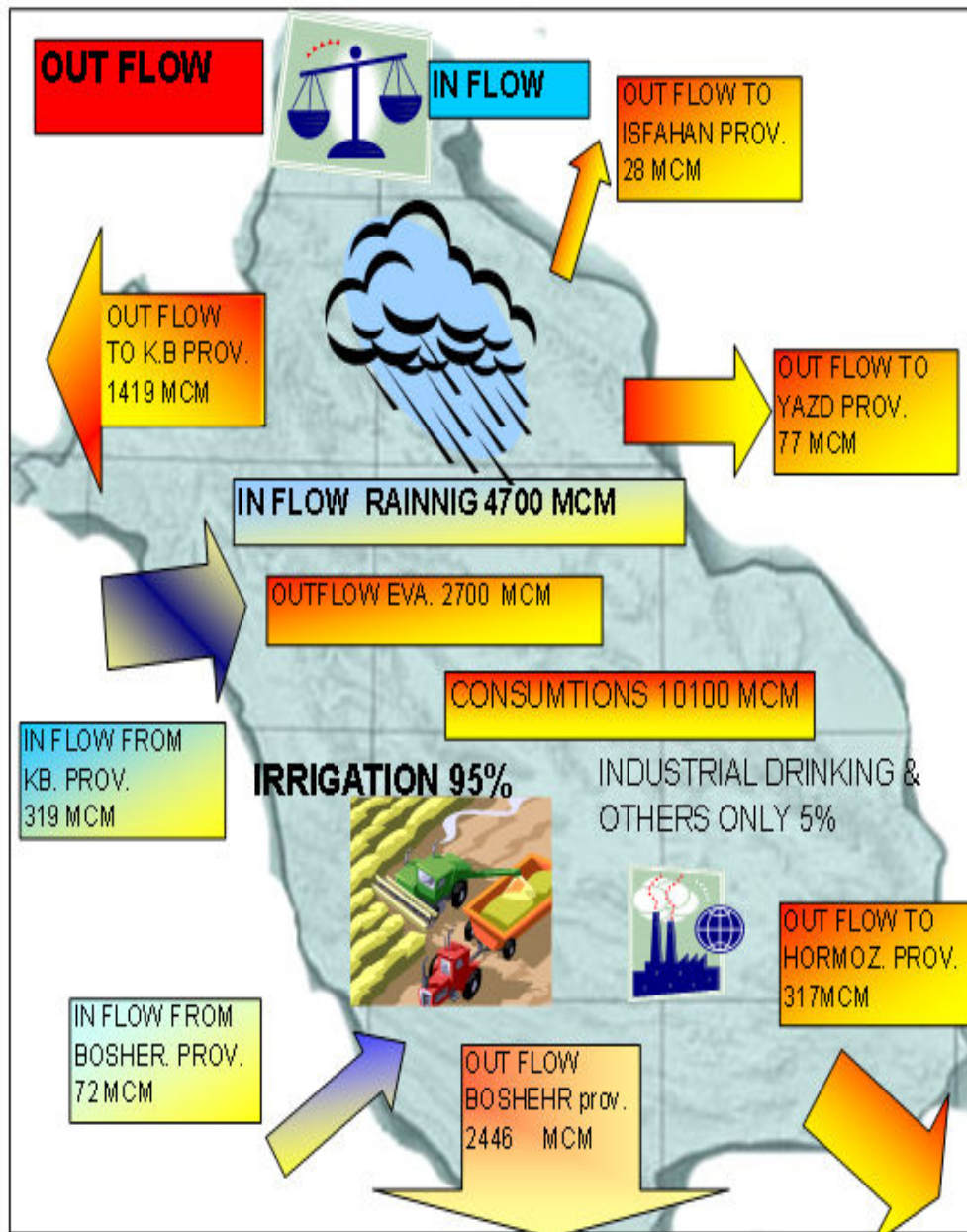


Figure (3): Fars province and water resources

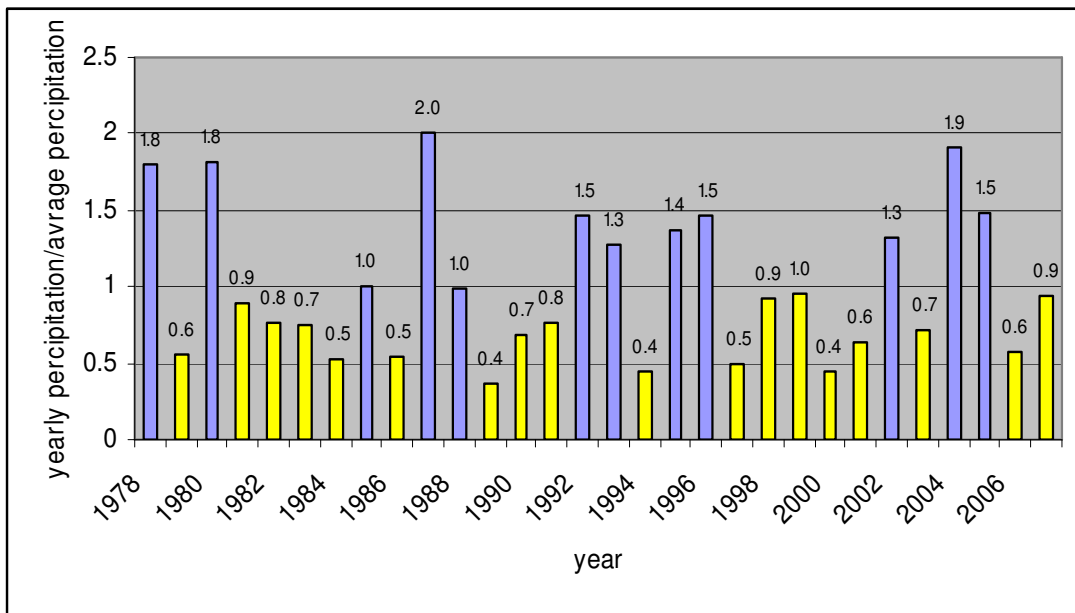


Figure (4): Variations of precipitation relative to its average in Abadeh city

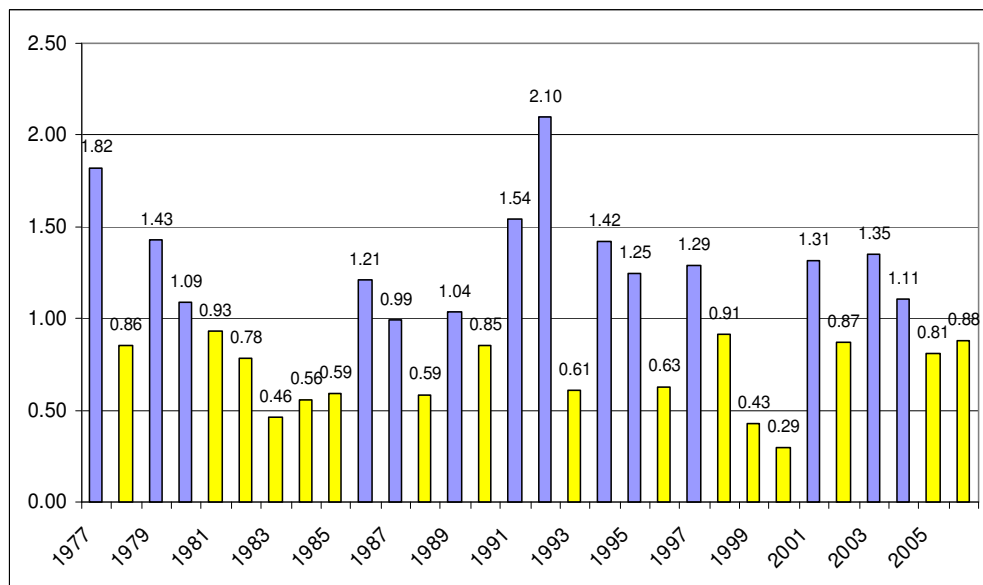


Figure (5): Yearly inflow to Doroudzan Dam's variations relative to its annual average

As a result of drought and high amount of consumption, the water level in 104 plains of Fars has gone about 5 to 21 meters down. Figures 6 to 8 show the variations of ground water level in some plains of Fars province. Based on the analysis done on comograph of 54 plains of the province that have quality-evaluation system, ground water quality is getting worse (Behroozifar, H. 2006).

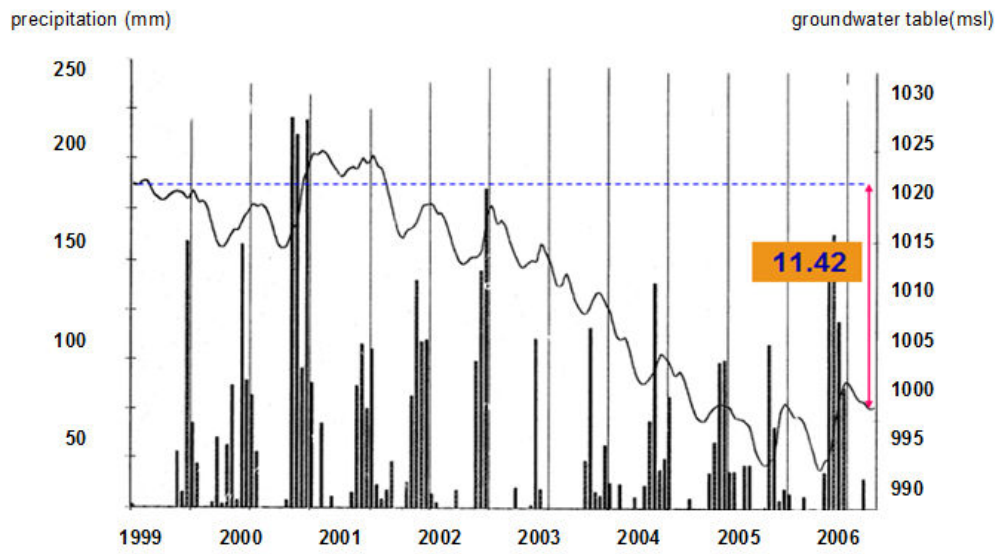


Figure (6): The variations of ground water level in DARAB plain

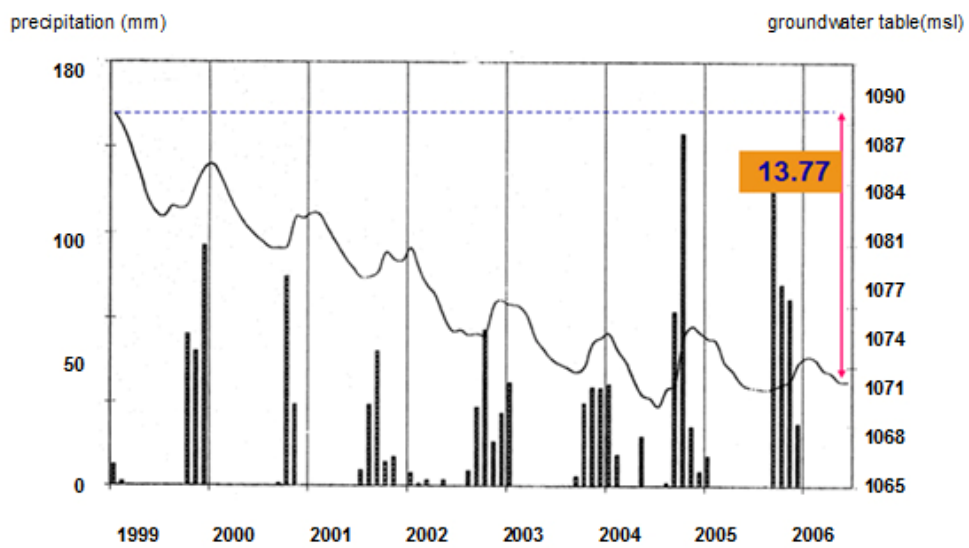


Figure (7): The variations of ground water level in JAHROM plain

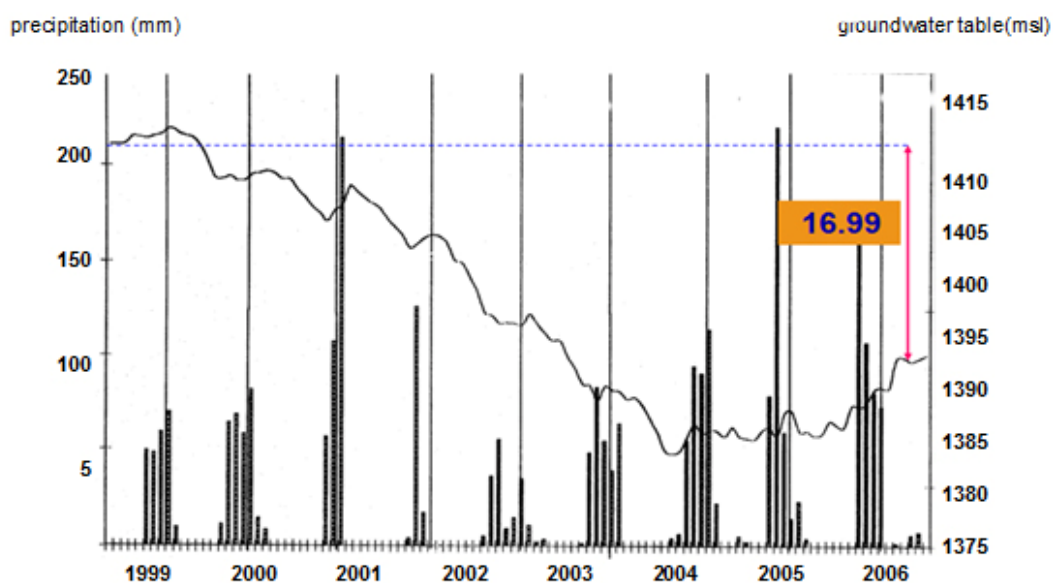


Figure (8): The variations of ground water level in Ieej plain

The worst situation is for Khasouyeh plain that within 8 years it has become 1518 micromouse/cm saltier. Ground water has been affected by droughts. As it can be seen in figures 9 to 11 the results are cracks in ground surface, springs to get dry, abandoned villages, and ground subsidence (Keshavarz, A. 2005) .



Figure (9): The appearing cracks and ground subsidence and in DARAB plain



Figure(10): Drying springs in DARAB plain



Figure (11): Abandoned villages in DARAB plain

METHODS OF FACING WITH DROUGHTS IN FARS

There are different methods to face with drought in Fars. Drought, as one of the natural disasters, cannot be prevented and it doesn't follow any specific rule and has lots of consequences such as mortality, diseases, water level getting down, ground settlement, and etc. As we said, Fars's economy mainly depends on agriculture and ground water; and ground water's share is 2.5 times as much as surface waters; hence, drought directly influences agriculture and underground water sources. Eventually, the best methods to decrease disadvantages of droughts are methods to improve or keep underground water sources. In Figure 12 the ways to face with drought are shown.

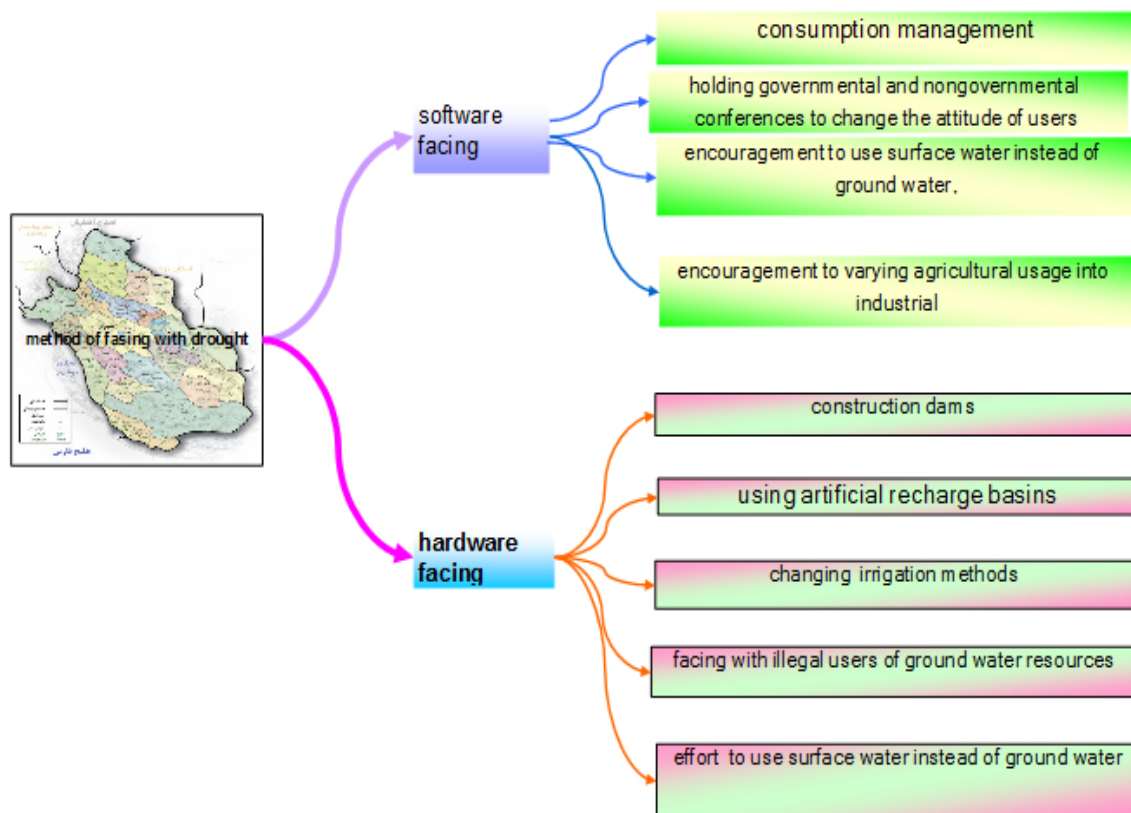


Figure (12): The ways to face with drought in Fars

Hardware Performances (Facing)

The first reservoir dam of the province, Doroudzan, was built on Kor River in 1972. After that other dams Izadkhast, Mollasadra, Sivand, and Ghiir- were built during 1998-2007 and in future other 17 dams will be built which will develop the current 2800 MCM surface water resources potential access to 4200 MCM. Attending distributed rains in the province, using artificial recharge basins is another fulfillment in the province which is done to decrease drought effects. By 69 artificial recharge projects 350 million cubic meters has been injected, and by 23 projects being under-construction 200 million cubic meters will be injected. Finally in the near future By the 59 under-study projects 300 million cubic meters will be charged the ground water resources. Of course, the success of these projects is on condition that precipitation is suitable Moreover, in southern parts of Fars where are the centers of garden products such as pistachio, citrus, olive, and etc. the piping irrigation systems(such as drip, micro, trickle and sprinkler) are used and surface irrigation(such as basin, border and furrow) is not applicable. Beside these performances, there are more than 70 groups, as inspectors, facing with illegal users of underground resources and they will stop these users. In this way, in recent years, more than 300 wells have been stopped.

Software Performances (Facing)

Beside the mentioned hardware performances, there are software ones to reduce the effect of drought, such as, encouragement to use surface water instead of ground water, holding governmental and nongovernmental conferences to change the attitude of users, changing agriculture and irrigation methods, consumption management, varying agricultural usage into industrial, and etc. In recent years, such seminars have been held in centers of water shortage, such as Jahrom, Neyriz, Daram, Arsenjan, and Fasa with reasonable results (with water crisis and droughts subjects).

CONCLUSION

Drought like the other natural disasters cannot be prevented. Human being needs to know how to face with them. Fars province is one of the biggest agricultural centers in Iran and its economy mainly depends on agriculture and water resources. This province has had lots of performances to escape from drought. Available potential amount of water will be 4200 million cubic meters if under-study dams get completed. This figure will be 850 million cubic meters for artificial injection basins. Introductory acts have been done to change agricultural methods and varying consumption from agriculture into industry and most of the province gardens have been equipped with piping irrigation systems. To create suitable attitudes in consumers, seminars are held in centers of crisis and droughts, regulary. And, with the help of inspector groups, facing with criminals is achieved.

REFERENCES

- Arshan, M. (2007): 100 methods to reduce drought effects, Mehrab journal of water and waste watervol 10. Tehran.
- Barshan, M. (2007): drought view in knowledge and wisdom, Mehrab journal of water and waste water vol.9, Tehran.
- Behroozifar, H. (2006): A Review in Fars droughts, Fars water authority. Shiraz
- Keshavarz, A. (2005): Water crisis in Fars provinces, Fars water authority. Shiraz.
- Rezaeean, KH. (2006): Fars Water's View, Fars water authority. Shiraz.