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Drought Management and Recommended Solutions on How to Deal with Drought

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Abstract: Drought has frequently happened as a natural disaster and unavoidable phenomena in wide areas of the world. The rural poor in dry areas will suffer the most from this phenomenon and will require a range of coping strategies to help them adapt to changing climates. Iran is experiencing her drought seasons for 17 times in last 50 years. The worst one was in year 1999 with the average of annual rainfall lower than 138.3mm that has caused irrecoverable losses to the agricultural sector. Iranian officials fear that water shortages could lead to mass migration of rural populations into Iran's overcrowded cities, where water is already in short supply. Drought monitoring is one of essential component of drought management and it has become a recurrent phenomenon in Iran in the last few decades. This study is trying to examine the drought crisis in Iran and recommend the proper drought management methods in which to decrease the level of economic, social and environmental effects of drought. A descriptive technique was applied to access the study objectives. The required data was collected from private and public sources (e.g. Central Bank of Iran, Ministry of Agriculture and Farmers Cooperatives). The results indicated that due to drought a significant percent of rural people have immigrated to urban areas in recent years. In addition, it seems that factors such as; lack of efficient drought management strategies, weather forecasting techniques and low saving capacity of farmers, are the main reasons of increasing the drought's damages. It is suggested that in order to reduce the negative impact of drought on rural areas some steps should be taken by the government. Steps will include reducing the dependency of rural society on agricultural income, use of advance weather forecasting tools, water saving technology and efficient water pricing policy, switching from cereal-based to cereal–legumes systems, diversifying production systems into higher value crops and efficient water consumption. The latter include judicious use of water using supplementary irrigation systems, more efficient irrigation practices and the adaptation of existing and new water harvesting technologies.

Key words: Drought management · Agriculture · Economic damage · Iran

INTRODUCTION

The world's dry lands will face not only increasing temperatures with climate change but more importantly also disruptions to their hydrological cycles resulting in less and more erratic rainfall that will exacerbate the already critical state of water scarcity and conflicts over water allocation [1,2]. The rural poor in dry areas will suffer the most from these changes and will require a range of coping strategies to help them adapt to changing climates [3, 4]. Climate change and drought is likely to add to the existing threats to food production and security from a number of converging trends such as high population growth rates, water scarcity and land degradation. There is therefore an urgent need to increase the resilience of the production systems and improve drought management strategies to these pressures via technical, institutional and policy options [5].

There are many definitions for drought; for example, from the meteorological point of view drought means the rainfall is lower than the annual average and uneven distribution of rainfall in the region. And from the agricultural and ecological point of view it means insufficient humidity for the growth of produce. Drought causes economic losses and damage to agricultural production systems in developed countries, while it is a threat to health and life condition to many people in developing and less developed countries [6].

Some studies have shown the important of drought crises and the attentions that should be taken to overcome its damages [7-10, 11]. Kordavani [6] studied

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Table 1: The Effects of Recent Droughts in Selected Countries

Country	Drought Year	Damages
China	1994	Agricultural productions of 85000 villages were lost in the West South of China.
Cuba	1998	Severe lack of drink water and half of agricultural productions were lost.
Thailand	1998	46084 hectares of the forest area were burnt by fire.
Russia	1998	About 100 hectares of farms were destroyed due to lack of rainfall and sufficient water.
Spain	1999	Sugar Beet farms and domestic animals were lost.

Source: United Nation Annual Reports 1994-1999.

economic, social and environmental effects of drought in Southern region of Iran. The results of his study indicate that drought effects are similar to the foresaid effects. Kanti [12] studied the mechanisms of dealing with drought. He examined the conditions of people who suffered from drought in Bangal area in the North of Bangladesh. The results of his study show that drought occurs frequently and is a periodic phenomenon in Bangladesh and causes a significant reduction in food production.

Drought monitoring is one of essential component of drought management and it has become a recurrent phenomenon in Iran in the last few decades. Significant drought conditions were observed during 1998 to 2001.The country's agricultural sector and water resources have been under severed constrains from the recurrent droughts.

In this study an attempt was made to describe the effects of drought and its possible impacts in Iran and some other countries. The required data and information have been obtained from reliable public and private sources.

Recent Droughts in Selected Countries: World drought influenced on the life of 100 million people. Based on UN reports 60 million citizens in Central and South Africa have lost their livestock and farms as a result of drought [13]. Countries such as China, Cuba, Thailand, Russia and Spain also suffered from drought. According to reports and studies serious droughts happened in a majority of Asian countries during 1998-1999. Based on UN shortage of water caused a significant reduction in agricultural production, the lost of livestock and as a result decrease in rural income (Table 1).

Drought Effects in Iran: Iran has experienced several drought years due to reduction in the amount of rainfall. During the drought years the amount of rainfall even was lower than 50 percent of the annual average rainfall in the country. Zabol droughts are the examples of regional droughts in Iran. In an about thirty years period, four drought years have been occurred in Zabol region (i.e. 1939, 1949, 1958 and 1970), almost once every ten years. Also, a severe drought took place in Zabol region in Year 2000. Other droughts in this region are hydraulic types. In other words, the decreasing of water flow in Hirmand River and cutting of it in Afghanistan caused aridity (lack of water) and a grate damages to many farmers or livestock keepers [7].

The drought that happened in 1998-1999, was the most severe drought in 30 years and influenced all over the country. In 1998-1999, the rainfall was about 26% lower than the average rainfall in 30 years. In comparison with last precipitation in year 1997-1998, there was a 40.9% reduction in precipitation. There was a decrease of precipitation equivalent to 47.5, 44.8, 43.6 and 43% in the Orumieh Lake, Persian Gulf, Hamoon and Caspian Sea, respectively (Fig. 1). Due to drought in year

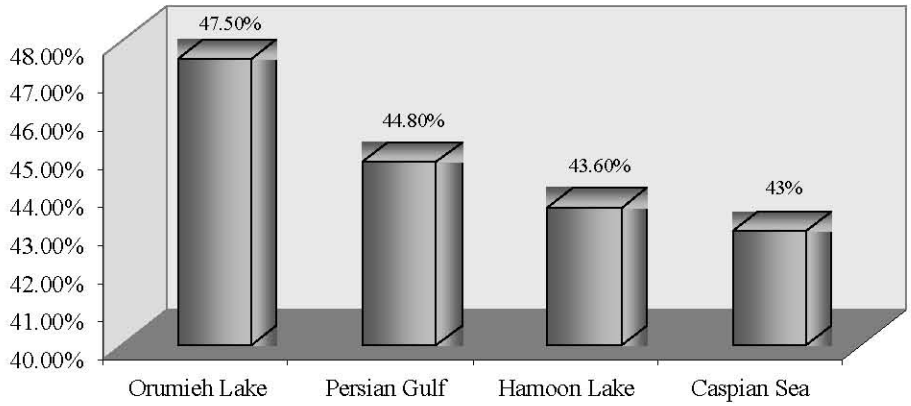

Fig. 1: Level of Precipitation Reduction in Some Area of Iran during 1998-99
Source: Study Findings

1998-1999, almost 70% of un-irrigated farm products and 10 percent of irrigated produces were lost. For example the levels of wheat and rice production were decreased about 2.4 million and 400 thousand, respectively.

The droughts in Iran have been affected in factors such as supply of water, agriculture, forests and pastures, soil fertility, livestock and deserts. Droughts also affected in industries, society, national and governmental budget. In following sections these effects will be described.

Drought Effects on Water Resources: Reports imply that the water volume of Iranian dams decreased 900 million cubic meters in 1999 in comparison with 1998. In Iran, water stored in dam reservoirs was 5300 million cubic meters by the end of December in 1999 which decreased about 50 percent in comparison with the volume in 1998; also water volume reduced by almost 50% in some reservoirs in December of 1999 [14].

Drought Effects on Agriculture: Reduction in quantity and quality of farm products, agricultural output and farmer's living standard are the main impact of droughts in Iran. Shortage of water and rainfall caused a large reduction in cultivated area and food production. Broadly, drought in 1998 destroyed almost 200000 hectares of horticultural products [14, 15].

Drought Effects on People, National Income and Environment: The most important effects of drought are related to the national income on the nation. Decreasing agricultural outputs and income from tourist industry, increasing poverty, unemployment, imports, risks of financial institutions and loans are the results drought. For example, the volume of wheat imports increased from 3 million tons to 6.6 million tons and the volume of rice imports increased from 800 thousand tons to 1150 thousand tons during 1999-2000. The level of national income also declined about 25% and more than 15% of rural population lost their jobs.

Evaluation of the Effects of Drought in Selected Provinces in Iran: Some of drought effects in selected provinces of Iran are reported in Table 2.

According to figures in above table, damages to rain-fed and irrigated farms caused a significant reduction in people's income and as a result poverty and immigration were extended. On the other hand, the main portion of damages has to be compensated by the government which means lower government income and consequently influences on government budgets plans.

Table 2: The Effects of Drought in Selected Provinces in Iran (1998-2000)

Province	Effects of Drought
Isfahan	-Disasters and damages were more than 1380 milliard Rials. -Water stock of Zayandehrood dam decreased from 1195000000 to 342000000 m^3 in 1999-2000.
Khouzestan	-The height of Karoon river become about 20 centimeters.
Khorasan	-95 percent of rain fed area of wheat and barley were damaged.
Kermanshah	-The agriculture sector was damages about 500 milliard Rials.
Lorestan	-145597 hectares of irrigated lands, 442650 hectares of Horticulture area were destroyed.
Sistan and Balouchestan	-The agriculture sector damaged about 1280 milliard Rials.
Hormozgan	-20 to 30% of agricultural production decreased. Source: Study findings

The Ways of Decreasing Drought Effects and Recommended Drought Management Strategies: According to reports provided by the "Extension and People Participation Office of Forests, Pastures and Watershed proper drought management system should involve designing strategic policies for forecasting drought, creating alarm systems, increasing the flexibility farming system, introducing plants resistant to aridity, desalting water, developing agricultural products and insurance[16].

Drought Management During drought: During a drought season, unemployment and immigration will rise. So some policies should be taken to compensate this rise in unemployment. It seems developing a handicraft industry should be considered. The purpose of propagating handicrafts industries is to create short-term employment [17-20]. Droughts occur gradually, so policy makers and planners have enough time to make appropriate plans to handle the drought. There are a number of certain issues which could help Policy makers to prepare a complete plan:

- Identifying the capability of dealing with drought.
- Analysis of incomes, investments, financial facilities and loans.
- Consulting with experts and those involve in farm management activities.
- Comprehensive programs of drought control that more successful.
- Preparing short-term employment plans
- Preparing plans for shortage of water and food

Drought Management After Drought: The existent evidence show that Iran does not have a suitable situation for providing water because of its geographical and natural conditions. Therefore it could be expected that there is always a possibility of droughts in the future. So, some efforts need to be done by the people and government of Iran.

Following a drought season, natural resources restoration should be considered as a main strategy by policy makers. Reconstruction of the animal husbandry and agricultural system are the most important issues of this strategy. The traditional irrigation system needs to be replaced with a modern irrigation system. Some measures such a effective price policy should be taken in account to optimize the use of water resources. The responsibility of the government is not merely compensation of the producers losses. Investment on water storage facilities and water saving technologies should be taken by the government.

CONCLUSIONS AND RECOMMENDATIONS

Drought has frequently happened as a natural disaster and unavoidable phenomena in wide areas of Iran. Significant drought conditions were observed during 1998 to 2001.The country's agricultural sector and water resources have been under severed constrains from the recurrent droughts.

The results of study indicate that due to drought a significant percent of rural people have immigrated to urban areas in recent years. In addition, it seems that factors such as; lack of efficient drought management strategies, weather forecasting techniques and low saving capacity of farmers, are the main reasons of increasing the drought's damages. It is suggested that in order to reduce the negative impact of drought on rural areas some steps should be taken by the government. Steps will include reducing the dependency of rural society on agricultural income, effective insurance plans, use of advance weather forecasting tools, efficient water pricing and diversifying production systems into higher value. The responsibility of the government is not merely compensation of the producers losses. Investment on water storage facilities and water saving technologies should be taken by the government. Training programs should be conducted to make people aware of drought impacts. In order to control and manage the effects of drought, credit facilities and loans should be provided for those who have suffered from drought. Finally, an effective drought insurance policy is required to reduce the risks of drought seasons.

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