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## Strategies on Management of Water Resources In Drought Conditions

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### ABSTRACT

From the beginning of history, drought has been the part of climate changes in our environment. The lack of water from one side and indiscriminate and incorrect using are counted serious fulmination for environment and nature sources. Nowadays, water sources are particularly important in the country that is counted the one of Arid and semiarid regions of the world such as Iran. Precipitation condition and limited water sources and territory condition of this country shows this fact that we must have a plan for drought phenomena and deal with its effects and occurrences. Moreover, the need to enhance water use efficiency in agriculture, modification of usage pattern and irrigation management according to water efficiency must be considered. In this research has been notices the fundamentals of water resource management in Iran, management of provide solutions in the areas of demand management, Environmental management, economic and financial management of water, participation management and absorption private sector investment and communication, notification and education management to apply the strategies for management of water resources in drought conditions.

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## INTRODUCTION

Human thought about water, depends on water abundance, if it abounds imagined godsend optimized any time and for any reason. The variation of civilization had Spectrum of attitudes among of two bounds. The bitter fact that we will face that is the non- adequate godsend distribution in entirely world and because of this situation we are faced to drought phenomena in so many parts of the world. From beginning of history, drought has been the part of climate changes in our environment and Survival of Humanity is evidence on its tolerance capacity in such weather phenomenon (Yojuvich 1977).

The one of important and basic steps on drought study in any region that can be measured the rate and intensity of continuous drought of some region is to specify the indexes is followed. (Arefiyan and Ahmadiyan 2007) Specially, the management method of water sources systems is no constant method and it is changing. The sources management of impressive water is generated by different factors such as physically and society factors.

In according to differentiation of management society aims of water sources systems must have enough adaptability and the management is implemented with regard to social uncertainty. The water resources management is important under social uncertainty as a proceeding that is implemented for management of uncertainty for distributing of time and place of sources (Mousavi, 2000).

### *Agriculture drought:*

When soil moisture is less than real requirement of production and led to damage on production, the drought will be happened.

The effects of drought (anonymous 2001)

In zavareh (2001) opinion, the effects of drought are entirely divided into economic effects, environment effects and social effects.

### *The economic effects of drought:*

- 1 - Damage to agricultural production
- 2 - Damage to livestock production
- 3 - Damage to wood products

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- 4 - Damage to fisheries products
- 5 - Damage to tourism
- 6 - Damage to water resources
- 7 - Damage to the transportation industry
- 8 - Reducing food production and destruction of food sources

*The environment effects of drought:*

- 1 - Damage to animal species
- 2 - Hydrological Impacts (lower water levels in reservoirs, lakes and ponds to store water  
Reduced water flow in the summer - reduced river flows- Damage to wetlands - impacts on the estuary (changes in salinity levels) - Increasing ground water discharge, sat down, cut back water supply - effect on water quality (increased salt concentration, temperature, PH, dissolved oxygen and muddy water pollution))
- 3 - Damage to plant communities
- 4 - Increased frequency and severity of fires
- 5 - Increase water and wind erosion, loss of soil quality
- 6 - The effect on air quality (dust, pollutions)
- 7 - Quality of landscape and eyesight. (Davrapanah 2008)

*Social effects of drought:*

- 1-Health (Wellbeing)
- 2 - Increase the involvement
- 3 - Reduced quality of life, changing the lifestyle
- 4 - Disruption of cultural belief systems (religious and scientific consideration of natural hazards)
- 5 - Re-evaluation of social values (priority, the needs and rights),
- 6 - Public discontent over the government's decision about drought (Zavareh, 2001).

*The water crisis in Iran:*

With the increase in population, the country's per capita water regularly is decreasing (Table 1). Due to the fact that between 1000 and 1700 cubic meters of renewed water per capita water, Iran is country with water tension and with less than 1,000 cubic meters of water among of countries has low water sources, therefore, in the future water crisis is inevitable.

**Table 1:** Per capita water of country in different years

Year	Population (million people)	(Per capita cube meter)
1956	16	7000
1996	60	2160
2006	70	1800
2021	100	1300

In the current situation, about 90 billion cubic meters of renewable water is used and despite about 40 to 45 billion cubic meters of water are unavailable, however in the case of complete inhibition, the value of 90 billion will be achieved to 112 billion cubic meters of water.

According to the available statistics of Iran Water Resources Management Company, surface flow is obtained from about 412 cubic meters to 92 billion cubic meters of rainfall.

About 13 billion cubic meters of rainfall penetrates to underground water bed and the same rate, According to statistics of the previous years, the water is entered from abroad.

Thus, the volume of available surface water surface water is 92 billion cubic meters that is segment of six main areas of the country catchment are summarized in Table 2.

**Table 2:** the Volume of available surface water according to 38-year-old Statistics

Catchment area collection	Caspian	Persian golf	Oromie	Markazi	Hamon	Saraghs
93/77	18/085	50/80	5/66	14/57	1/742	2/324

*The foundation of water resources management:*

*1 - Management of demand (consumption):*

Rapid population growth and the growing need for resources and production, particularly irreversible resources such as water, has been considered by statesmen attention to the planning issue in Control of consumer demand. The acute level of per capita water resources in each country has doubled to pay attention to these trends of management. Demand management in the water sector has considered water consuming and its costs of providing by making Balance between self-interest, rather than more trying to find a source to estimate

water needs. As a matter of fact, demand management suggests the methods and available tools for enhancing the levels and patterns of water consumption. As well as demand management practices improves water resources management, increases also the benefits of a certain exploit and decreases the resources needed to gain a certain benefit (Lughran, Jonathan 2004).

#### *2 - Environment management:*

One of the aspects sustainable developments is "ecosystem-oriented". Supporters of this paradigm believe that the nature not only attend as a means to satisfy human needs.

The non-disturbances cycle of ecosystem and environmental protection and to respect the right to of future generations to exploit natural resources, including the issues that this topic will be investigated. Currently, an average of 29 billion cubic meters of waste water for agricultural, municipal and industrial enters water bodies of the country. According to this statistics, it is enough for water sector policymaker managers to face to serious challenge in this field. Thus, the optimization system status of ecology, conservation of ecosystems, the ecological integrity of rivers and lakes, groundwater and coastal areas and water purification Water wastewater Water purification of urban and agricultural and all and all, including actions that sector should be considered in the area of environmental management and purification activity in the water. Global approach to the issue of freshwater pollution prevention and environmental protection is a vital issue in recent century, and we must not forget it in Water Resources Management (Sullivan, 1991).

#### *3 - The economic and financial management of water:*

To clarify the various aspects of the financial aspects of water management is entailed study, research and reviews all aspects of it. Difference of supplement cost, transmission, purification and distribution of water (cost price) with a return on investment that forced the government began subsidizing in this field. Despite of this theme "cost containment" and "payment" as the aspects of considerable economic management and water resource management should be part of the policy agenda. Pricing policies of comprehensive, detailed studies of finance for water projects, estimating and analyzing financial credit of water projects, enterprising long-term investments in the water sector, the ceding of consumer participation, transferring of activities in the private sector, Collection Cycle of costumer's fees and matching effects economic issues and financial resources with other areas can be effects of management in this issue of water (David *et al.*, 1997).

#### *4 - Management of participation and private sector investment attraction:*

Participation, mental and emotional involvement of individuals is in group situations that provoke them to achieve group aims, and caused to help them participate on responsible and will be group helpers. Fortunately, the field of water sector management is contributed by supplying of selling of participation papers to attract investment for the considerable effort. Assignment of large water sector projects to the private sphere is a step has been implemented in this field by water sector management in recent years (kahrizi, sangdel 2003).

#### *5 - The management of communication, noticing and mass education:*

In this section in according to noticing issue and culture promotion of correct water using in different parts of home interior, industrial and agriculture is challenge that water sources of Iran is faced on it. We currently are confronted to either losing water about 70 percent in agriculture segments. In home interior and industrial segment sadly, we are faced on water consumption by 4 times more than world standard indexes.

Using of the social media extensive and other ways of noticing is the included tasks that must be considered by whole parts are associated with water industry. Promotion of public awareness will not be achieved without noticing and public education (Nazemi, 2005). Participation of people in the planning and water management issue is essential. Promoting of public awareness about the quantity and quality of water resources and conservation of water sources are the main issues for water resources management. Methods of public participation, are boosted the awareness of water importance between the legislators and the public and also the decision must be taken in planning and implementation of water sources based on the full of public consultation and with participation of consumers.

#### *Approaches on management of water resources in drought conditions:*

Type of plants and, management strategies and irrigation methods for a particular area is determined usually for climate zone based on the expected patterns.

Drought is a deviation from the expected pattern. It means that conventional irrigation methods frequently are inadequate to deal with water shortages.

Depending on the severity and duration of drought, farmers may be reacted in several forms instead of reduced water resources and rising demand.

One of the researchers described some general strategies for water consumption during drought periods. The First strategy is to strengthen water resources (anonymous, 2005).

- Using of the saline water in agriculture
- Non-structural solutions to the water crisis
- Using of the climatic –agriculture zoning models
- Fog-water harvesting as a source of water supply for agriculture
- Using of the furrow irrigation
- Using of the expert systems in drought management plan
- Using of the water- source
- Application of hydrophilic substances in agriculture

#### *Conclusion:*

While agricultural, urban and environmental sectors increasingly are competing for limited resources over the world; many parts of the world suffer from the rapid deterioration of water quality. It is expected that further development is severely restricted by water, unless will be taken steps to protect and enhance the efficiency of its consumption.

Agriculture is the largest consumer of water and because of its Lateral consequences such as pesticides, nitrates and other dangerous substances is counted the major pollution of soil and water resources. Effective and Efficient consumption of water in agriculture can be achieved on several goals, such as saving in fresh water, maintaining high standards of public safety and improve environmental quality. The agriculture management in farm and regional level require a decision about amount of gained subjects is in specified production, distribution of gained subjects among of competing products, investment for appropriate technologies and for production process, replacement among of perfect gained subject. The impact of these decisions on yield and concentration of contaminants in soil and water must be considered. The effects of long-term and short-term profitability and pollution should be analyzed.

Raining condition and water sources limit and country regional condition show this fact that have a program for drought phenomena and on event time is seriously collated by its effects and phenomena. In addition to increasing requisiteness of using water Efficiency in agriculture, Modified consumption patterns and irrigation management and in according to water productivity must be considered. Environmental management, economic management and water resources management, private sector participation and raise funds and managing communication, Informing and public education is endeavored by Careful investigating of water resources management pillars in the areas of demand management present according to using of strategies in the field of water resources management in drought conditions

#### *Suggestions:*

In order to handle and take appropriate measures to deal with drought phenomenon, it is worth, under the Suggested guidelines are followed below:

- Education of water consumption proportional to value of water needed by plants according to region conditions
- Selection of the desired planting, farming operations suitable for agriculture water-saving and how to exploit the integration of land, to implement crop rotation and changing on cropping pattern and composition, to limit under cultivation crops with high water requirements, evapotranspiration reduction with crops under the plastic, making greenhouses and windbreak surrounding fields
- Serious attention in the task of field's investment in the various water supply, transport and optimal use of water consumption in agriculture is contained according to this issue that water is the one of important subjects for agriculture production and optimal use of water involved saving of water consumption.
- Taking of the incentive policies in carrying out of all infrastructure operations in the farms and orchards and streams cover with priority of policy development of the pressurized irrigation and farm regenerating.
- Controlling and detailing of statics and underground water sources and installation of equipment and applying of Necessary introductions in order to control the consumption and receiving of water such as surface and underground water.
- Planning for control of surface flow (watershed) and the discharged groundwater capacities of aqueducts and fountains in the non-agricultural seasons through re-injection into underground aquifers and making surface reservoirs.
- The required management on behalf of provincial administration in order to be lawed for Criteria and how to deliver the volume of water to farmers depending on the cultivation type and determined crop value for town based on cropping patterns, administrative regulations optimal use of water and the water national document.
- Incentive adoption policies for saver water and reducing of power consumption costs on users of pressurized irrigation policy
- Establish mechanisms for Promoting and Protecting of research that led to the introduction of rigorous scientific methods in order to reducing of damages drought.

- The preparation, formulation and implementation of training programs for various levels of management and executive for persons who are involved on agriculture in crisis management field
- It is important to optimize water consumption according to large share of water use in agriculture and the low efficiency of water use in Iran, selection and implementation of appropriate strategies. so in water cultivation and non-irrigation agriculture are suggested by water deficits and supplemental irrigation strategies respectively.
- Reduce-irrigation is an efficient management, knowledgeable and dynamic method is affected on Collection irrigation system, cropping patterns and type of soil, climate, water quantity and quality aspects, human resources management and economic dimensions.

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