

## **Drought conditions and management strategies in Iran**

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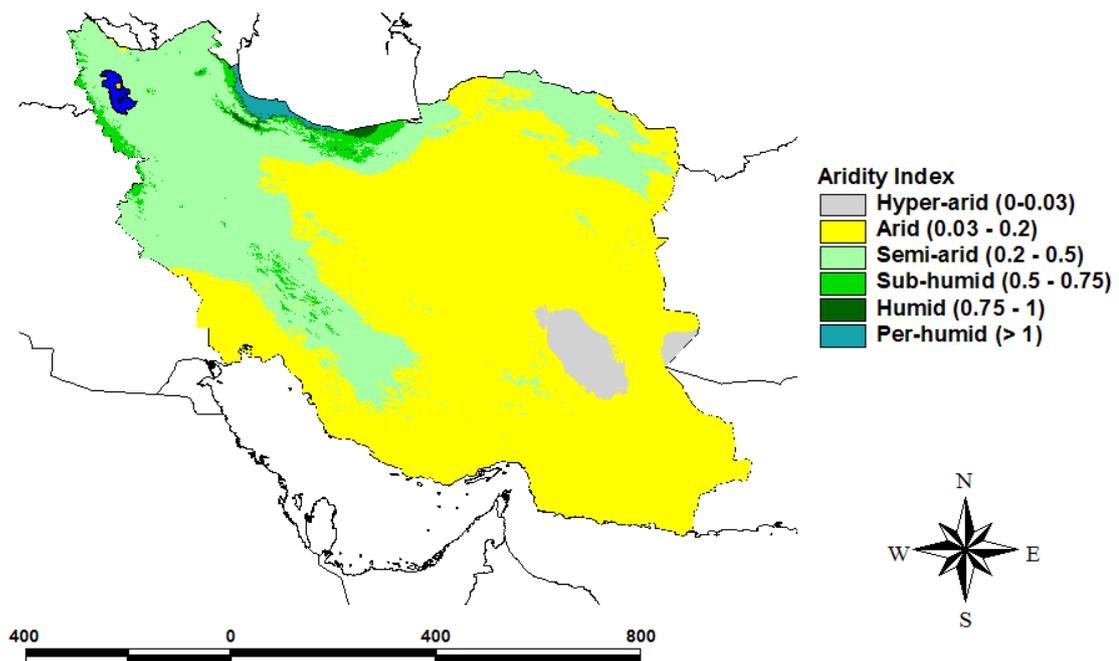
### **Background:**

Iran, with an area of 1648195 square kilometers is located in arid and semi-arid sphere in the world. Approximately, 73 percent of the country has arid and semi-arid climate. Map No. 1 represents aridity classification in Iran. Temporal and spatial rainfall distribution is variable and non-uniform; while merely 10 percent of rainfalls occur during hot and dry seasons in central, southern and eastern spheres of the country. Nearly 52 percent of annual rain and snow fall only in 25 percent of the country, which exposes some areas to drought and they are expected to face serious crisis in the near future.

Annual rainfall distribution indicates that 74% of the country (122.5 million hectares) benefits less than 200 mm rainfall. According to the data on average water balance of the country (30 years), rainfall volume all over the country is 413 billion square meters, evaporation is 283 billion square meters, renewable water resources are 130 billion, accessible surface waters 92 billion square meters and aquifers' feeding is 38 billion square meters. Considering that almost 70 percent of precipitation evaporates, any measure concerning natural resources in watersheds, which might mitigate evaporation and increase penetration of such precipitations into underground water resources or stabilize base flow of rivers, is effective.

Now, out of 609 plains in the country, 353 are in crisis situation due to uncontrolled exploitation of underground water resources. Average reduction of water table is approximately 60 centimeters per annum in the plains, which results in average 30 centimeters subsidence of land in the country.

Positive aspects of the policies adopted by the government include consideration of infrastructural concepts to combat drought and preventive measures and special attention to development of insurance schemes to cover products and provision of potable water for rural and urban areas where through efforts of Ministry of Energy in its current or completed programs, optimal use and exploitation of water is promoted.



**Map no1 : Aridity classes in Iran**

### **Drought monitoring and early warning systems:**

In light of control, monitoring and combating adverse impacts of drought, governmental bodies including Islamic Republic of Iran Meteorological Organization (IRIMO) is missioned to record and report reduced level of risk and vulnerability of different social sectors against climate changes and drought, reduced impacts and create adaptation during droughts, generalization and exploitation of the knowledge and technical competence to operate monitoring systems, early warning and drought notification all over the country, early and accurate warning and timely awareness raising regarding drought and coordination and action to alleviate adverse impacts and create adaptation, capacity building and transfer of knowledge and required technology of the country through support, cooperation and undertaking development and applicable surveys and studies through establishment of National Drought Warning and Monitoring Center (NDWMC). Ministry of Agricultural Jihad (MoJA) is in charge of provision of a comprehensive data bank to supervise and field confirmation of crop and existing livestock. The ministries established National Committee of Agricultural Drought (NCAD) in 2001. Addressing remote sensing is the authority of Iranian Space Agency (ISA), a subsidiary of Ministry of Communication and Information Technology (MOCIT), and is tasked to undertake research, design and execution of programs in the field of space technology, remote sensing and communication networks. Ministry of Energy (MOE) collects massive information on hydrologic indicators concerning river water level, stream acceleration, river discharge, water quality, snow masses and transferred sediment rate. Department of Environment (DOE) is in charge of preserving the environment and effective use of natural resources to ensure sustainable

development of the environment, prevent destruction and contamination of the environment and preserve biodiversity all over the country.

In order to review the incident and monitor drought, considering dominant climate of the country, standard and proper index such as (Standard Precipitation Index (SPI) shall be applied along with satellite images with high spatial and temporal resolution, which is experimented in over 40 countries.

### **Vulnerability assessment:**

Economic effects of drought are massive and multifaceted and in subsectors such as change of land use, rain fed, livestock, and range and forest management and at primary and developing levels it surpasses processing and complementary industries. Lack of occupational opportunities and income, sales of land and livestock, high production costs, low food supply and tax income and high governmental costs are examples of drought effects. In drought incident in 1999, Management and Planning Organization estimated the costs of such impacts to be (\$1.25 Billion) of which more than 80 percent constituted damages of crop, ranges and livestock. According to the latest estimate, total damages to national economy resulting from drought during 1998-2001 were over (\$7.5 billion). The impact of drought on food security, population growth rate and statistics indicators show that, best case scenario, the population of Iran will be over 90 million in 2021. Subsequent to drought, in order to pursue economic activities by various ministries including Ministry of Agricultural Jihad during 1999-2010, a credit of IRR62366150 million has been allocated to implement preventive projects and compensation and development of product insurance funds in the form of costs and capital acquisition and affordable bank facilities. Water is being supplied from both surface and underground water resources seriously affected by consecutive drought cycles during current years. Loss of underground water resources is almost over its standard (additional exploitation of 5 cubic kilometers) and its rapid reduction in many areas is alarming. Existing data indicate extraction of underground water resources connected to other critical areas in water supply for central areas and other plains and valleys.

Fifty years ago, with a population of 19 million, water per capita was 7000 cubic meters per annum while today with 70 million, it is less than 1900. Considering population growth rate, water per capita till 2025 will be approximately 1400 cubic meters per year. It is estimated that in 2020 water consumption shall increase to 116 cubic kilometers of which 106 or 91 percent (compared to current 93%) shall be exploited in agriculture.

Due to restrictions, especially lack of water resources, only 18.5 million hectares of total 37 million are cultivated; approximately 8.5 million hectares (46%) is irrigated and 10 million (54%) is rain fed. Despite arid climate and lack of water, agriculture is a vital sector in economic activities of the country. It provides 18 percent of gross domestic production, 25 percent occupation, 85 percent food supply, 25 percent non-oil products and 90 percent raw material used in agricultural industries.

### **Emergency relief and drought response:**

Economic effects of drought are massive and multifaceted and in subsectors such as change of land use, rain fed, livestock, and range and forest management and at primary and developing levels it surpasses processing and complementary industries. Lack of occupational opportunities and income, sales of land and livestock, high production

costs, low food supply and tax income and high governmental costs are examples of the effects of drought on economy.

One of the most important measures is to establish effective communication among public and non-governmental organizations with the aim of timely response during emergencies. Establishment of technical crisis committees in the fields of emergency food and water supply and damage control is essential.

Exploiting mass media including IRIB and national and local publications for awareness raising and warning are effective measures in combating emergency situations.

Indigenous competence is an important element towards alleviating damages of drought and optimizing efficiency in normal and drought situations.

Effective selection and land use change, modified cultivation frequency system, reasonable selection of plant species or change of technology, land reclamation through cultivation of trees, forestation, green spaces, loosening soil, soil reform, control of underground water resources, irrigation, coordinated supply of nutrients might be effective in mitigating damages of drought in a specific area. In this field, breeding and cultivation of plants with higher resilience are of critical importance.

Control of land and soil erosion, strategies and measures in watershed management, development of resilient seeds and promotion of water resources' effectiveness are other positive measures in the country.

Planning and management of water in water distribution, quality, use, quotas, rationing are other methods to combat drought.

An important issue regarding drought risk management is Agricultural Product Insurance Fund.

In order to support vulnerable groups, especially farmers, extended loan reimbursement deadline is considered by the banks.

The map of areas at risk of drought, assessment of environmental resources (biodiversity) in areas coping with mid and long term drought (periods of 10 to 30 years) and provision of ecosystem sensitivity maps are drought preparedness strategies in emergency situations.

Supporting non-governmental organizations to promote public awareness is essential to combat drought during emergencies.

### **Practices to alleviate drought impacts:**

Due to repeated drought, the government implemented aid and rescue program in 2003. The program included leadership and guidance, public training against natural disasters, duties of various institutions during crisis, provision of mass media map; in addition, financial resources and statutory support during natural disasters were also considered.

National Water Program was prepared in 1999. The focus in Iran is on drought prevention and alleviation; emergency interventions were conducted and aid measures include provision of agricultural inputs, small and medium funds, price, food subsidy and forage.

Aid and Rescue Program in 2003 was approved as part of the third five year development plan. Natural Disaster Task Force was established in 1996 by Ministry of Interior and range of assistance covered all types of disasters. The program constitutes 5 sections which cover insurance strategy, financial/logistic support for management of natural disasters. The program includes terms and guidelines of crisis management

through rescue and aid interventions, provision of training and public preparedness for special measures against disasters, definition of participatory approaches for various institutions, provision of IRIB map and other Medias and operational measures, financial resources and logistic support.

. The government provided in-water pumps and water purification and supplied food and forage. Water Police was appointed to supervise water consumption and prevent loss of rare resources. Also, the parliament instructed national banks to extend the deadline of loan reimbursement for another 2 years. The most important issue in drought risk management is Agricultural Product Insurance Fund. Product insurance started in 2005.

### **The need for knowledge and skills on drought management:**

For effective operation management, drought combat activities the knowledge regarding comprehensive watershed management shall develop and there should be coordination at national and provincial levels among relevant organizations in different levels. Proper drought management methods in agriculture shall reinforce empowerment of farmers and ranchers so that they can adopt proper technology to follow sustainable agriculture principles. Success or failure of strategies and plans towards promotion of water and land use systems such as water distribution, flood water management and constructions of artificial feeding pools and methods of mitigating evaporation and sustainable agriculture in farmlands of each province or area is stressed. There is need for proper technologies, management measures and technical expertise within national strategy framework of drought preparedness.

Agricultural Research and Training Organization has 24 research centers and capable of active involvement in implementation of long term research programs for drought management. Applied Research Centers in Ministry of Energy have fostered the opportunity of organization of a significant number of training workshops with regards to water use and drought management efficiency in the country. Applying local competence to support sustainable farmland use systems shall be promoted by involvement of the government in drought preparedness strategies.

Also, qanat water network system is a proper method to access underground water resources for irrigation and supply of potable water.

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