



United Nations
Educational, Scientific and
Cultural Organization



Regional Centre
on Urban Water Management
(under the auspices of UNESCO)

DROUGHT AS A CONSEQUENCE OF CLIMATE CHANGE/**VARIABILITY** IN IRAN; A CASE STUDY OF LAKE URMIA

ON THE OCCASION OF :

**REGIONAL WORKSHOP:
BUILDING RESILIENCE TO CLIMATE CHANGE RISK AND VULNERABILITY TO MEET
WATER SECURITY CHALLENGES
10 - 11 JULY 2017, MALAYSIA**

ALIREZA SALAMAT

UNESCO REGIONAL CENTRE ON URBAN WATER MANAGEMENT-TEHRAN



INTRODUCTION

- Droughts as consequences of climate change pose a serious threat to the resilience and security of communities
- Droughts regularly impact the lives of millions of people worldwide
- Extreme, widespread drought, challenges the security of the world's food supply
- The impacts of climate change increase the frequency, intensity, and duration of both floods and droughts in many regions



INTRODUCTION

- The far-reaching impacts of drought, impact human and environmental health
- Likewise human communities, lakes have always been subject to droughts
- Natural climate variations in the past have been one of the main reasons that lakes are ephemeral features of the landscape
- Most of today's lakes are the result of climate amelioration and the retreat of glaciers some 10000 years ago



The case of the disappearing Great Lake

Updated 8/14/2007 10:07 AM | Comments  60 | Recommend  34 | E-mail | Save | Print | Reprints & Permissions |  RSS



 [Enlarge](#) By Andy Nelson-Zaleski, Freelance

Ted Shalifor of the Ojibwa Recreation Area in Baraga, Mich., looks out over the campground marina that should be filled with docks and boats. Lake levels this year were so low the campground was unable to install the docks.

By Dennis Cauchon, USA TODAY

BARAGA, Mich. — "Where did the water go?" asks Ted Shalifor, manager of a marina and campground on Lake Superior's Chippewa Indian Reservation.

The water on Lake Superior is so low that he couldn't put his docks in the water this year. Where he used to see water, he now sees sandbars.

Lake Superior, the world's largest freshwater lake, has dropped to its lowest level in 81 years. The water is 20 inches below average and a foot lower than just a year ago.

PHOTOS: Lake Superior drops to record lows

 [Mix It](#)

Other ways to share:

 [Digg](#)

 [del.icio.us](#)

 [Newsvine](#)

 [Reddit](#)

 [Facebook](#)

[What's this?](#)



INTRODUCTION

- Some of the immediate impacts of climate change on lakes:
 - loss of perennial ice cover, increasing water temperatures, shifts in water balance: depth and areal extent
- This in some cases leads to complete drainage or dry up of the water bodies.
- Changes in air temperature and precipitation have direct effects on the physical, chemical, and biological characteristics of lakes

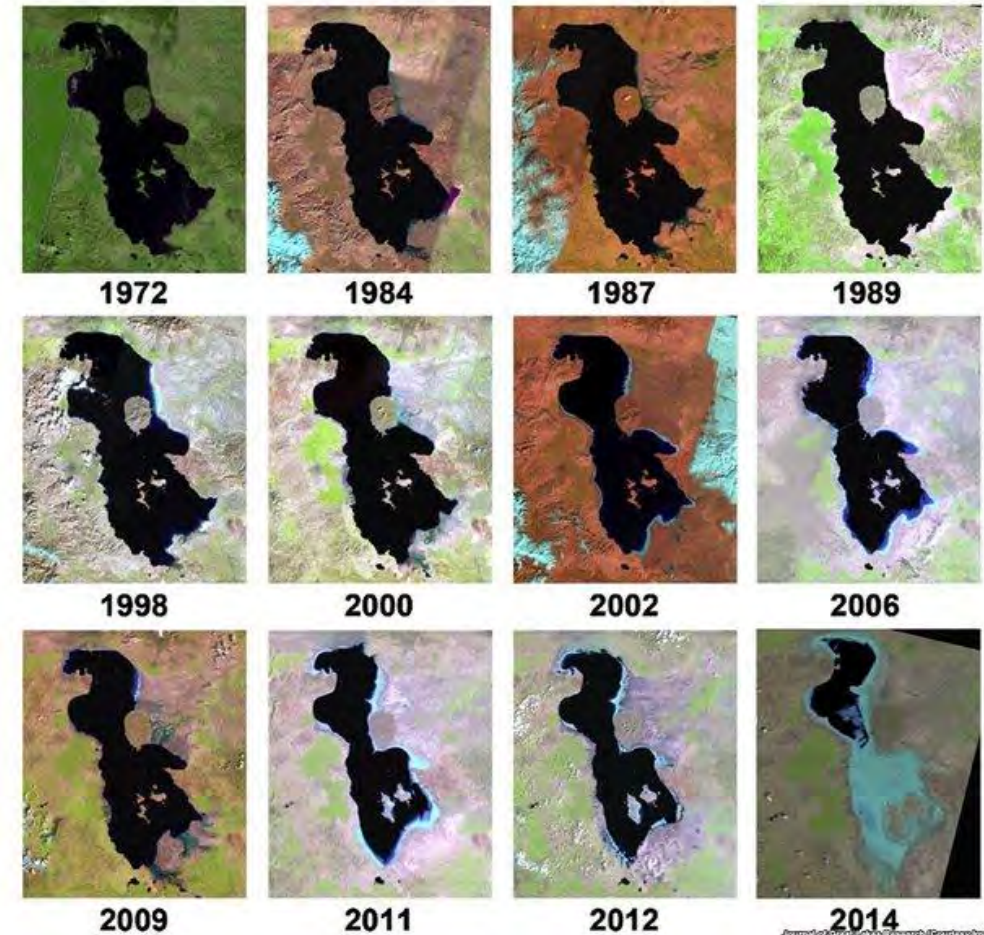
LAKE URMIA

- Lake Urmia, located in this basin, is considered as the largest lake in Iran
- Its the sixth largest saline lake in the world with a surface area of around 5200 km²
- According to the latest information, the rate of precipitation has decreased to a level of 18 % during the past 20 years due to climate change



LAKE URMIA

- This has led towards a serious decline in surface runoff in the basin which is a result in a considerable decrease in the lakes inflows
- The average surface water resources inflows to Lake Urmia has decreased from around 5000 MCM to 2400 MCM (~ 50 % decline) within the past 20 years
- This has also resulted in a considerable decrease in the Lake's water level



LAKE URMIA

- The surface area of the lake with an ecological water level of 1274.1 was 4348 km² with a volume of 14.5 BCM
- The lake's surface area has been estimated to have been as large as 5,585 km² in 1974 with a water level of 1277.1m from the sea level with a volume of around 29 BCM



LAKE URMIA

- Since then the area has dramatically declined to only 1100 km², approximately 20% of its original surface area with a water volume of around 3 BCM in 2016
- The Total dissolved Solids (TDS) in its ecological water level was 205 gr/lit. which is now higher than 500 gr/lit.
- This has caused a serious decrease of aquatics which have almost disappeared from the lake.



LAKE URMIA

- The agricultural sector consumes 89 % of the basin's water resources as the highest consumer
- The drying up process of Lake Urmia has caused severe socio-economic and environmental impacts in the region
- The basin area is an important agricultural zone with a population of around 6.4 million people
- Around 76 million people live within a radius of 500 km of the lake in five countries including: [Iran](#), [Turkey](#), [Iraq](#), [Armenia](#) and [Azerbaijan](#)



LAKE URMIA

- Those around the lake fear a situation similar to Aral Sea, which has dried up over the past decades.
- Disappearance of the Aral Sea has been an environmental disaster affecting people with windblown dust-storms
- The population surrounding Urmia Lake is much denser putting more people at risk of impact



LAKE URMIA

- It threatens agricultural land and pollution of nearby cities with salt storms spreading around
- This seriously threatens the health of inhabitants
- Today's miserable situation of Lake Urmia is result of long neglecting the lake conservation
- It is also the result of ignoring impacts of rapid development of agriculture, industrial and urban water use on the water flow towards the Lake



LAKE URMIA

- The dry up of the lake has been the result of climate change which has resulted in a considerable decrease in:
 - precipitation and surface runoff, human factors such as increasing the agricultural lands, changing the crop patterns, producing high water consuming products, low water productivity, etc.
- Establishment a Steering Committee to work out the challenges causing this situation



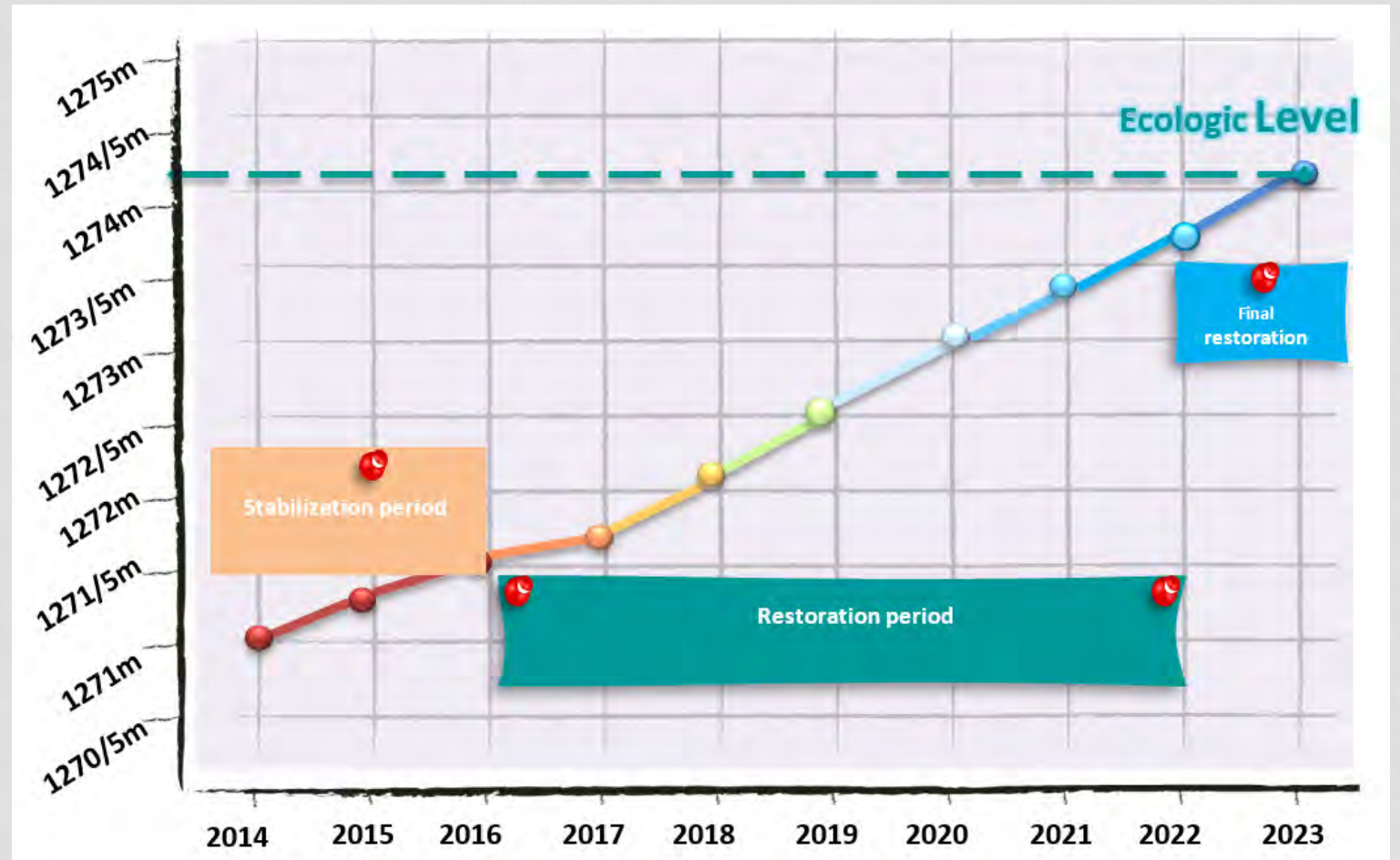
LAKE URMIA

- The time schedule for the ecologic water level restoration of the lake will take around 10 years as shown in the following table and figure.

Year	Level (m)	Area (km ²)	Volume (MCM)	Volume (%) to ecologic volume (%)	Area (%) to ecologic area (%)
2014	1270/6	2146	2584	22	50
2018	1272/05	3330	4685	44	75
2019	1272/53	3676	8290	56	85
2020	1272/9	3875	9960	67	89
2021	1273/37	3980	11593	78	93
2022	1273/69	4266	13205	89	98
2023	1274/1	4307	14721	100	100

LAKE URMIA

The estimated level of Lake Urmia restoration process during 2014-2023



RESULTS & DISCUSSION

- After precisely investigating the causes of current Lake Urmia crisis via data collection, processing, modeling and vast analysis carried out, the program came up with concrete findings:
- Controlling and saving water in the agricultural sector which could result in 40% surface-water saving and groundwater rights for a period of two years
- Preparation and implementation of programs to increase efficiency of 60% remainder of agricultural sector water use



RESULTS & DISCUSSION

- Suspension of all dam construction projects along with all downstream water supply and irrigation networks
- Implementing systematic monitoring and management of groundwater wells throughout Lake Urmia basin
- Conducting measures to facilitate and fast-track inventory of unlicensed groundwater wells' laws and regulations with responsible legal bodies

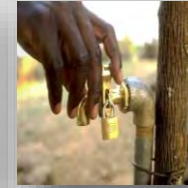
RESULTS & DISCUSSION

- Implementing new and alternative plans by responsible governmental organizations
 - such as transferring water from nearby wetlands, rivers and lakes, transferring treated wastewater from water treatment plants located in the basin
- Studying the health, social and environmental impacts of Lake Urmia crisis and implementation of preventive measures
- Compiling and implementing a comprehensive plan for public education, training, awareness and participation particularly for local residents

CONCLUSION & RECOMENDATION

According to the developed roadmap of activities, the time schedule for the ecologic water level restoration of the lake will take around 10 years

- The total required budget for the Urmia Lake restoration is estimated to be over five billion USD.
- Designing and implementing an Integrated Decision Support System (IDSS) as well as a Smart Water Management System (SWM) for comprehensive management of Lake Urmia Basin is essential.



ISLAMIC REPUBLIC OF
IRAN

INTERNATIONAL DROUGHT INITIATIVE (IDI)

PROCESS OF PROPOSED IDI PROGRAMME

- Iran submitted a resolution to the 35th session of the General Conference of UNESCO in 2009 proposing to establish the **International Drought Initiative**.
- It would support the execution of the seventh phase of the International Hydrological Programme.

PROCESS OF PROPOSED IDI PROGRAMME

- The concept paper on the **International Drought Initiative (IDI)** was developed.
- It was supported by the representatives of the IHP National Committees at the IHP National Committees meeting **held in Tehran in July 2009**.

DETAILED PROCESS OF PROPOSED IDI PROGRAMME

- Iran submitted to the 35th session of the General Conference, Draft Resolution 13 calling for the establishment of an International Drought Initiative (IDI).
- The Secretariat advised the Islamic Republic of Iran to submit the proposal to the governing bodies of the International Hydrological Programme.
- Director-General had welcomed the concept of a new international initiative on droughts as a new cross-cutting or specialized project.

PROCESS OF PROPOSED IDI PROGRAMME

- The proposal on the establishment of the **International Drought Initiative (IDI)** was reported to the 44th session of the IHP Bureau, Delft, 6-8 may 2010.
- The bureau recognized the importance of this proposal, while noting the increasing number of separate initiatives on water already in place, in particular the International Flood Initiative.
- The Bureau suggested looking into the option of establishing an Extreme Initiative, covering **both floods and droughts**, which can have significant impact, especially considering new challenges brought about by climate change (IHP/IC-XIX/11).



NECESSITY OF IDI ESTABLISHMENT

- A persistent multi-year drought in Central and Southwest Asia has affected close to 60 million people as of November 2001 as well as serious drought affected in 2008 in whole region.

DROUGHT CONDITION IN IRAN-

DROUGHT EFFECTS

- In Iran, a three-year drought has severely affected 10 of the country's 28 provinces, leaving an estimated 37 million (over half the country's population) vulnerable to food and water insecurity.
- In the agricultural sector, Iranian farmers have sold roughly 80% of their livestock, and an estimated 800,000 livestock were lost in 2000 as a result of the drought.
- An estimated 2.6 million hectares of irrigated lands and 4 million hectares of rain-fed agriculture have experienced the drought's impact in 2001.



DROUGHT CONDITION IN IRAN-

DROUGHT EFFECTS

- The United Nations estimates the damages to agriculture and livestock at \$2.5 billion in 2001, up from \$1.7 billion in 2000.
- The extreme drought conditions have led to widespread migration.
- Iran must also contend with the swelling number of Afghan refugees who are seeking to escape drought and political instability.



NECESSITY OF IDI ESTABLISHMENT

- The Programme discusses underlying climatic mechanisms that might explain the causes for the persistent drought, and presents seasonal climate forecasts and their implications for the region.
- Central and Southwest Asia represents the largest region of persistent drought over the past three years anywhere in the world.
- Significant shortfalls in precipitation have led to widespread social and economic impacts, particularly in Iran, Afghanistan, Western Pakistan, Tajikistan, Uzbekistan and Turkmenistan.

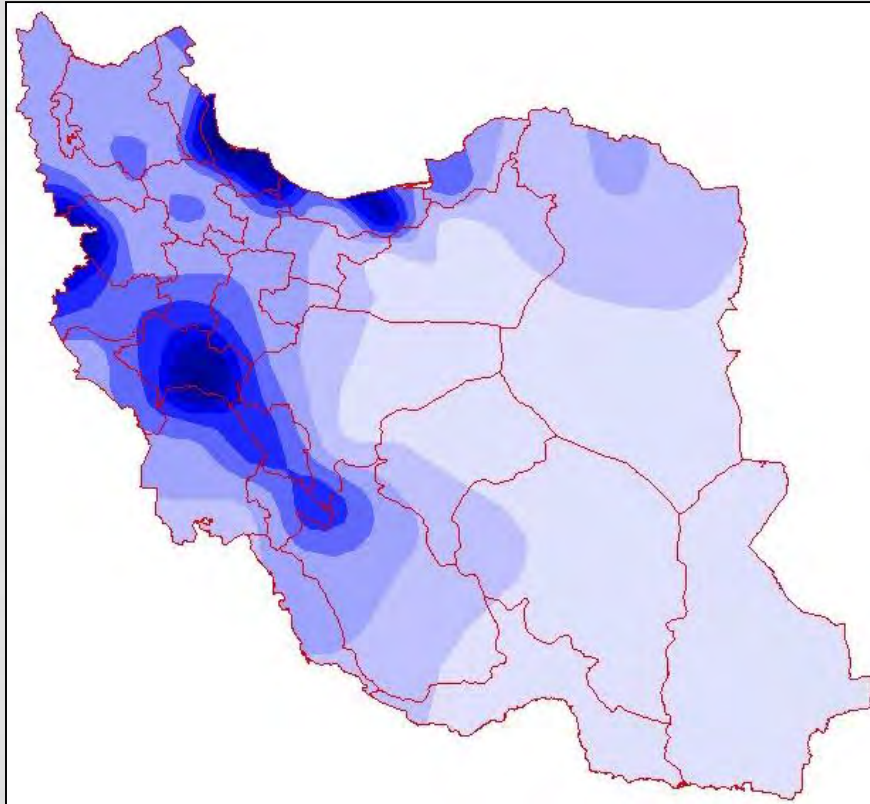


NECESSITY OF IDI ESTABLISHMENT

- Agriculture, animal husbandry, water resources, and public health have been particularly stressed throughout the region.
- Preliminary analysis suggests that drought is related to large-scale variations in the climate across the Indian and Pacific Oceans, including the recent “La Niña” in the eastern Pacific.

Drought Condition in IRAN- Climate Condition

Rainfall Distribution

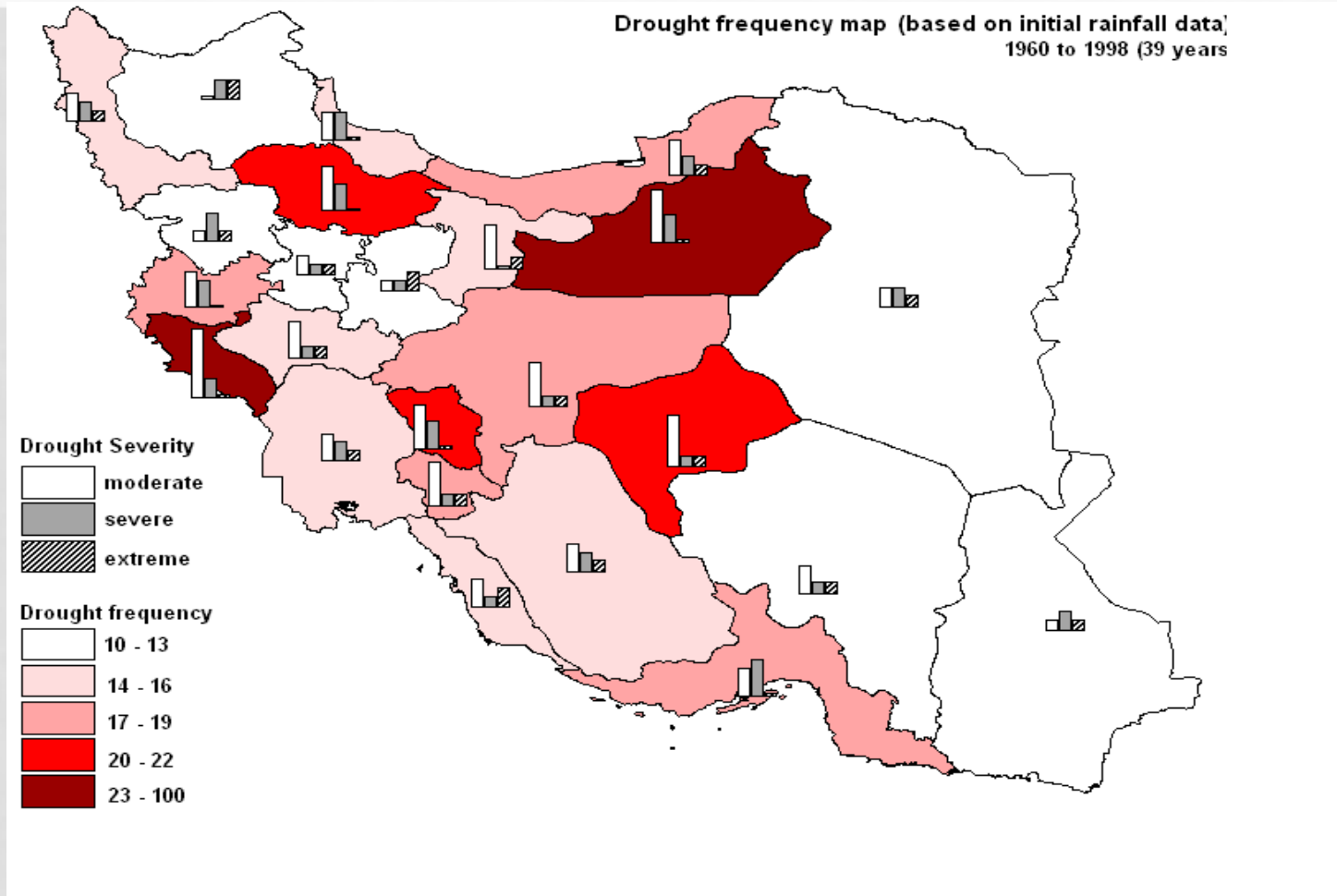


Precipitation	Area(%)
< 50	6
50 – 200	45
200 – 500	40
500 – 1000	8
> 1000	1

mean Annual Precipitation ~240 mm

Drought Condition in IRAN-Analyzing Drought

Analyzing Drought in IRAN



Drought Assessment Framework

Outputs of IDI Programme





DROUGHT MANAGEMENT ACTION PLAN

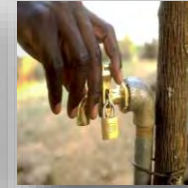
- The purpose is Drought prediction and drought mitigation especially in central and south-west Asia countries.
- Risk and crisis management and rehabilitation of drought losses.
- The Stakeholders are: Agriculture, Industry and mining, Environment, Commercial, Central bank, interior ministry and water participants of related countries.

THIS INITIATIVE HAS SO FAR LUNCHED TWO MAIN PROJECTS

- First Project:
- Development of a Grid-based Precipitation Dataset for West Asia to feed Climate Change Studies with the aim of providing an online and easy to use version of PERSIANN precipitation data produced for the West Asia.
- The products of this dataset can be used for different purposes such as predicting phenomena including floods, drought, extreme precipitation events, climate sensitivity, evaluation of climate models and further studies.

THIS INITIATIVE HAS SO FAR LUNCHED TWO MAIN PROJECTS

- **Second Project**
- Development of a National Water Security Atlas to Support Sustainable Water Governance in Iran with the purpose of bringing the concept of water security into practice to support sustainable water governance.
- Apparently, water security promotes sufficient, safe, affordable, and clean water to lead a healthy and productive life for all human beings, where communities are protected from floods, droughts, and water-borne diseases.
- It also endorses environmental protection and social justice by addressing the conflicts and disputes that arise over shared water resources by providing common platforms for different disciplines and interest groups.



ISLAMIC REPUBLIC OF IRAN - MINISTRY OF ENERGY

Thank You !