

Study on the water availability in Iran, using the international water indicators

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WATER RESOURCES OF IRAN

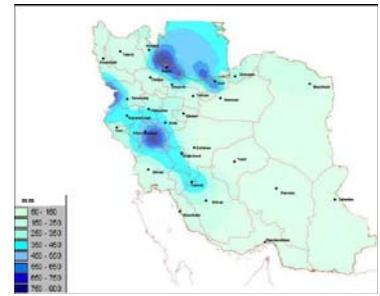
The state of water resources in Iran is summarized as follows. The main source of water is precipitation, which normally amounts to 251 mm or 413 billion cubic meters (bcm) annually. This precipitation depth is less than one-third of worldwide average precipitation (831mm) and about one-third of the average

precipitation in Asia (732mm). About 30 percent of the precipitation is in the form of snow, and the rest is rain and other forms of precipitation. While 1 percent of the world population lives in Iran, our share of renewable freshwater is only 0.36 percent. Of the 413 bcm of annual precipitation, 296 bcm are lost as evapotranspiration, 92 bcm runs as surface flows, and 25 bcm infiltrates into groundwater resources. Annually, about 13 bcm of water flows into Iran from neighboring countries. So, total renewable water resources are 130 bcm annually. From these sources, about 88.5 bcm is withdrawn, of which 82.5 bcm (93.2 percent) goes to agriculture, 4.5 bcm (5.1 percent) is for drinking, and 1.5 bcm (1.7 percent) is allocated for industry, mines, and miscellaneous uses. While the world uses 45 percent of its freshwater resources, Iran uses about 66 percent.

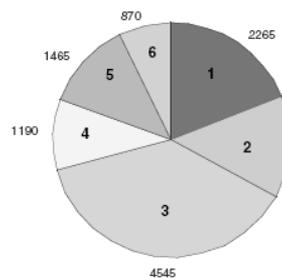
Precipitation in Iran does not have spatial and temporal uniformity. Part of the country receives less than 50 mm, while the northern part receives more than 850 mm of rain annually (Figure 1). More than 50 percent of the rain falls in winter, and less than 18 percent falls in summer. From the middle of the spring, river and stream discharges start to decrease, and groundwater is the only water source for summer and fall seasons. Statistics show that in 1996 and 2000 about 59.41 and 61.2 bcm, respectively, were withdrawn from the aquifers. Non-uniform temporal distribution of precipitation causes droughts in the years when most annual rainfall occurs in a short time and runs off quickly.



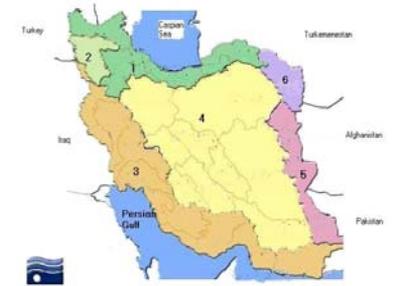
water scarcity in 2030 based on the Falkenmark indicator. (Source, Wallace 2000).



Precipitation Map of Iran (1999)



Per capita water resources in six main basins of Iran (m³/year) in 1994.



Basin No.	Basin name	Total area (km ²)	As % of total area	Rainfall (mm/year)	Precipitation volume (mm ³ /year)	NPV ^a (mm ³ /year)
1	Caspian	173730	10.5	484	84190	22937
2	Lake Orumie	51866	3.1	430	22300	6730
3	Persian Gulf and Gulf of Oman	419802	25.5	386	153820	57197
4	Central Plateau	851126	51.6	150	127510	26492
5	Lake Hamoun	107369	6.5	125	13480	1546
6	Sarakhs	44170	2.7	268	11860	2130
Sum		1 648 000	100	251	413860	117000
Across Borders						13000
Total						130000

Annual per capita water in Iran

Population growth in Iran is high. The highest recorded rate of 3.9 percent occurred in 1986. But a remarkable achievement of Iran in applying family planning programs during the years of 1986-1996 contributed to a lower rate of population growth of 1.45 percent in that decade (Ghazi, 2002). The latest census figures showed the population of Iran to be 60 million in 1996. Today, it is estimated that the population of the country may be more than 65 million. It is also expected that the population may double by 2021 (Plan and Budget Organization, 1999). Rapid population growth in the last two decades has changed the relative composition of the rural and urban populations. While the ratio of rural to urban population was 40/60 before the revolution, it is now reversed. By 2010 some 80 percent of the total population may live in urban areas and especially in big cities like Tehran, Mashhad, and Isfahan. Most of the water resources that sometime ago were used for agriculture are now used to supply drinking water to these cities. Altogether, population growth, urban and industrial growth, and agricultural development in Iran have created a condition of water stress. This situation is beyond a water shortage or crisis and aggregates the serious scientific, technical, ecological, economic, and social issues surrounding water for now and the years to come (Ghazi, 2002).

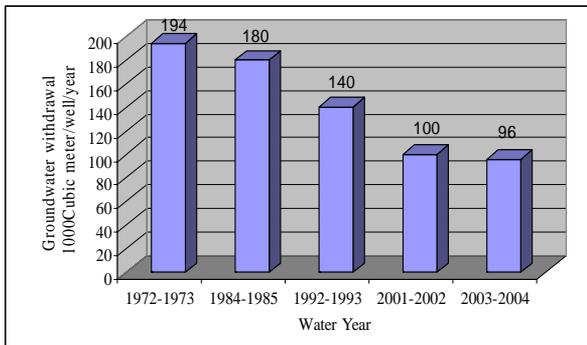
The increasing water demand has caused an alarming decrease in per capita renewable water available. The annual per capita water as a general index of the water resources status used to be about 7,000 m³ in 1956 when the population was only 19 million. At present, with a population that has grown to about 65 million, the index is estimated to be about 2,000 m³. With the increasing trend in population growth, it is predicted to sink further, to below 1,000 m³ in the year 2025. These figures clearly show that our future generations are to face a serious water shortage during the coming decades. Pollution of water resources due to human activities makes this situation even worse.

The main characteristics of annual precipitation and its conversion to water resources

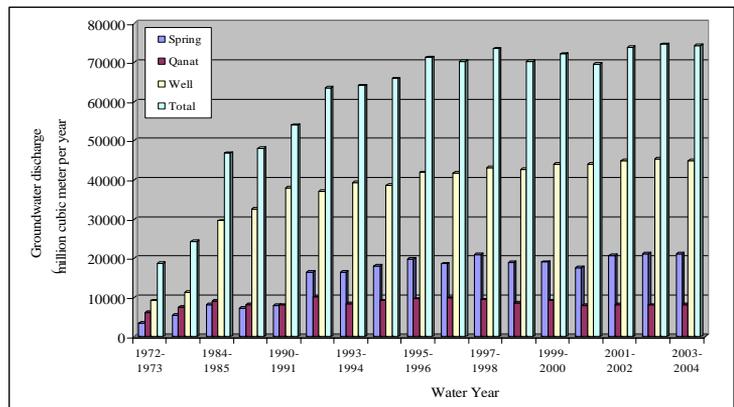
- Average annual precipitation 417 bcm
- Average annual evaporation & transpiration 299 bcm
- Surface currents 92 bcm
- Direct seepage to alluvial aquifers 25 bcm

The Water Poverty Index and Sub-Indices Compared with the Falkenmark and the Human Development Index in Iran

Country	Resources	Access	Capacity	Use	Environment	Water Poverty	HDI	Falkenmark
Iran	6	8	13.9	15.5	19	0.71		1850



Decreasing trend of underground surface water table and consequently the wells output during the years 1972 to 2005 in Iran



Increasing trend of groundwater discharge during years 1972 to 2004 in Iran

Challenges of water resources management

Renewable water resources of the country are estimated to be about 130 bcm. Because of rapid population growth, per capita water resources have steadily decreased and will continue to decrease in the future. Geographic distribution of water resources of the country has not been consistent with geographic distribution of population, especially in the last two decades. The transition from an agricultural economy and renewal of agricultural structure is not yet complete. Land ownership and agricultural activities are still going through transition, and agricultural development still happens mainly through expansion of irrigated lands.

In spite of previous endeavors, it is necessary to strengthen the following aspects of water resources management:

- Policy formulation,
- Laws, regulations, criteria, and standards,
- Organizational improvement (coordination, cooperation, different specialization, and decision making processes),
- Water allocation system,
- Personnel planning and management,
- Financial and economic management,
- Information systems and data banks, and
- Technological research and development.