



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

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## Abstract

The climate of Iran is one of great extremes due to its geographic location and varied topography. The summer is extremely hot with temperatures in the interior rising possibly higher than anywhere else in the world; certainly over 55°C has been recorded. Annual rainfall ranges from less than 50 mm in the deserts to more than 1600 mm on the Caspian Plain. The average annual rainfall is 251 mm and approximately 90% of the country is arid or semiarid. Overall, about two-thirds of the country receives less than 250 mm of rainfall per year. In the last century (since, 1900) the population of Iran has increased about six-fold. The population growth rate, which was less than 0.6 percent in the beginning of this period, reached the rate of 3.19 percent in the decade from 1976 – 1986. Fortunately; it has considerably decreased once again in the last decade. The major changes in population growth rate, resulting from reduction of mortality and increase of natural growth rate, occurred in the 1960s and afterward. In the period from 1961-2000, the urban population increased by about 31.7 million and the rural population increased by 11 million. In 1956, there were only three cities with a population over 250,000 in Iran, while in 2000 the number of cities with a population of over one million reached seven. The direct impact of population growth on the water resources management of the country was an increased need for potable water in population centers. Indirect impacts were increased demand for agricultural products, development of irrigated lands, and the need for job opportunities and more income, especially in the agricultural sector.

This paper reviews and assesses water scarcity based on the international indicators in Iran. The most widely used indicator, the Falkenmark indicator, is popular because it is easy to apply and understand but it does not help to explain the true nature of water scarcity. The International Water Management Institute model (IWMI model), The Water Resources Vulnerability Index and the Water Poverty Index (WPI) are the other international indicators that are evaluated for the water resources situation and availability of water in Iran.

**Key words:** water deficit indicators, Falkenmark, water poverty index, water availability, Iran.

## INTRODUCTION

Water scarcity (Rijsberman, 2006) is among the main problems to be faced by many societies and the World in the XXI century. Water scarcity is commonly defined as a situation where water availability in a country or in a region is below 1000 m<sup>3</sup> per person per year. However, many regions in the World experience much more severe scarcity, living with less than 500 m<sup>3</sup> per person per year, which could be considered severe water scarcity. The threshold of 2000 m<sup>3</sup> per person per year is considered to indicate that a region is water stressed since under these conditions populations face very large problems when a drought occurs or when man-made shortages are created. Figure 1 presents the delimitation of arid and semi-arid regions of the world as defined by the Map of the World Distribution of Arid Zones (UNESCO, 1979). This delineation is primarily based on a bio-climatic aridity index, the P/ETP ratio (where P is the mean value of annual precipitation, and ETP is the mean annual potential evapotranspiration). The three zones are the “hyper-arid” zone ( $P/ETP < 0.03$ ), the “arid” zone ( $0.03 < P/ETP < 0.20$ ) and the “semi-arid” zone ( $0.20 < P/ETP < 0.50$ ). In addition to these criteria, temperature is taken into account based on the mean temperature of the coldest and the hottest month of the year. Consideration is also given to the rainfall regimes (dry summers, dry winters) and to the position of the rainfall period in relation to seasonal temperatures (Pereira, 2002).

## WATER RESOURCES OF IRAN

The state of water resources in Iran is summarized as follows. The main source of water is precipitation, which