



**Thematic Week:** Water Economics and Financing

**Thematic Axis:** Water Markets

**Title:** Water Scarcity and Competition: Challenges for Institutions To Promote Cooperation, Conflict Prevention and Resolution

**Authors:** Munther J Haddadin

Courtesy Professor at Oregon State University, University of Oklahoma, University of Central Florida, Former Minister of Water and Irrigation, Jordan

**Abstract:**

**Keywords:**

## 1. Introduction

Water needs in countries of the world are not uniform. Such need is a function of the economic category to which the subject country belongs. The author has done research to determine the water needs of countries belonging to the four economic categories as classified by the World Bank, and found that the water needs to satisfy municipal, industrial and agricultural needs are as follows in cubic meters per capita per year measured at the water source<sup>1</sup> (includes losses incurred in transport and distribution):

High Income Economy	1300
Upper Middle Income	1500
Lower Middle Income	1700
Low Income category	1900

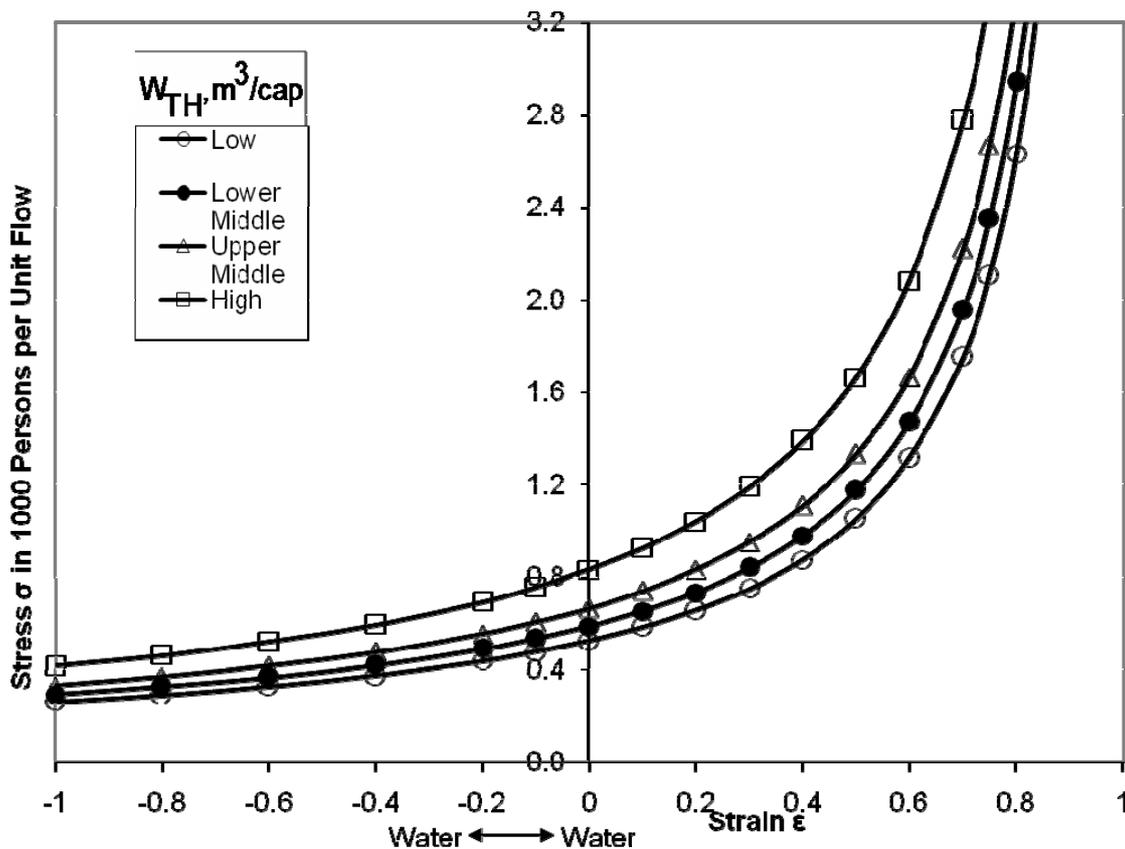
The inverse relationship between water needs and income level is explained by the fact that the higher the income the more able the country is to achieve high efficiencies in water conveyance, distribution and application. While it is true that high income countries need more water at the farm level to produce the diet of higher calories, it is argued that lower income countries whose populations consume less calories in their diets need more water at the source to account for lesser efficiencies of conveyance, distribution and application.

The above figures then express a balanced water resources- population equation. If the water resources measured at the source of a given country produce less water per capita per year then the country is water short. It is to be noted that there are other water needs that have not been accounted for in that research such as the water needs of the environment, power generation, transportation, etc..

Water demand produces stress on the water resources, and under conditions of scarcity, that demand generates strain in the society. The author has introduced the definitions of the water stress, water strain and water modulus, all expressing the water situation in the subject country. The following diagrams illustrate the standardized curves of water stress, strain and water modulus:

---

<sup>1</sup> Munther J Haddadin, "Quantification and Significance of Shadow Water in Semi Arid Countries," *Water Policy*, paper No. WP 06 017, September 2007.



## 2. Degree of Water Scarcity

The water resources of a country consist of:

- Blue water, which is the liquid freshwater resources of surface and groundwater occurrence,
- Green water, which is the soil moisture retained in the soil after rainfall, and this water supports rain-fed agriculture, pastures, forests, wild plants, etc..
- Grey water, which is the treated municipal wastewater for reuse,
- Silver water, which is the desalinated water produced from salty water sources, and,
- Shadow water, which is the indigenous water saved by importing needed commodities from the world market.

An important component of water resources, especially in arid and semi arid countries, is the green water. This component has not received the attention it deserves in the management of water resources, nor has it been counted among the water resources of countries. Perhaps the first serious attempt to have it calculated and included was made by the author<sup>2</sup>. Its blue water equivalent should be added to the other water resources to yield the total water resources. The water stress, which is the number of persons per unit flow of water resources, along with the economic category of the country, determines the location of that country on the stress-strain diagram whose tangent at that point determines the water modulus and the degree of water scarcity.

<sup>2</sup> Munther J Haddadin, author and editor, "Water Resources in Jordan: Emerging Policies for Development, the Environment and Conflict Resolution," Resources For the Future, Washington D.C, 2006.

Depending on where the country lies on the water stress-strain curve, i.e., what its water modulus is in comparison with the modulus at zero strain, the water scarcity is determined. Obviously, scarcity drives competition and shadow water, indigenous water saved by commodity imports, plays a substantial role in alleviating the intensity of that competition.

### **3. Strategic Importance of Water**

The strategic importance of water has to be visited to understand the driver of competition over water:

- The stress-strain curve displays the extent to which the society will be strained in case of water shortage.
- The strain is a result of social, economic and environmental factors.
- Socially, water is needed to sustain life, to keep hygienic conditions at home and in the urban settings thus protecting public health and impacts the quality of life. Water is needed to create jobs and to generate income which has a string of downstream social impacts.
- Economically, water is needed for production of commodities, goods and services. The amount of water needed for such activities is termed the industrial water; it is a function of the economic category of the country. Jobs are created accordingly.
- There is a natural synergy of water and energy; from waterfalls man is able to generate electricity, and from energy inputs freshwater is produced from the salty seas.
- Environmentally, water enhances the local, urban and rural environments.
- Water is indispensable in the process of producing food for man, animal and wild life. Life itself is not possible without water.

Finally, it should be noted that water needed to produce commodities, including food commodities for man and animal, can be off-set by imports of those commodities from countries more blessed with water resources than the arid and semi arid countries.

The above provides us with an analytical tool, for the first time, to assess water scarcity and understand the drivers of competition and conflict.

### **4. Water Conflicts and Management**

The above presentation clarifies the critical importance of water to persons, households, communities and societies. Its critical status emanates from its role in sustaining life, protection of public health, creating jobs, generating incomes and impacting the quality of life and the environment. Its role in food production and in creating jobs therein along with the income generation capacity is more important to countries the lower their economic status is. That is because the capital investment needed to generate one job is less in agriculture than it is in industry. The comparison in Jordan shows that, in 1987, the ratio was about 1 to 10 respectively.

An important factor to consider is that the stoppage of water service to man, animal or plants will cause immense impacts that threaten the life of these users. If water service to plants is stopped for periods between a week and two weeks in a hot summer, the life of vegetables and trees respectively is at stake, and their produce is definitely compromised.

Conflicts over water, therefore, are not like conflicts over other matters. Its availability is so critical that extreme shortages will trigger migration. In addition to the criticality of the resource availability per se, the infrastructure needed to deliver the water to the places of use is equally critical. Therefore, the conflicts have to be managed wisely in such a manner as to avoid the risk of resource diminishing or infrastructure demolition.

### **5. The Cries of Water Wars**

Cries of water wars emerged after a series of two seminars on Middle East waters were organized by the Center for Strategic and International Studies in 1986, then affiliated with Georgetown University. Despite advice to the otherwise, the Chairperson of the seminars insisted that, “water, not oil will be the cause of the next war in the Middle East.” She published extensively on the subject in famous U.S newspapers. Events proved her wrong: the war following her announcement was the Iraqi invasion of Kuwait in 1990, and that was not because of water. The war that followed was Desert Storm in 1991 to liberate Kuwait from Iraqi occupation, and that too was not because of water. The next war was the Palestinian Israeli war (1999 – present), and that was definitely not triggered by a water conflict. The war that followed was in 2003, the occupation of Iraq, and that was not because the U.S wanted to take the waters of the Tigris nor the Euphrates. The following war was in 2006 between Israel and Hizbullah, and that was not because of water.

In fact water, by its very nature is used to extinguish fires; it never ignites them. But oil fires are natural.

What is strange is that the cry of water wars limits their eruption only in the Middle East. We never heard of a war over the Rio Grande between the United States and Mexico, nor of a war over the Great Lakes between the United States and Canada. We have witnessed three wars between India and Pakistan last century but never the water structures were targeted.

### **6. Challenges to Institutions**

Perhaps the biggest challenge to institutions, as different from governments per se, is the sharing of data and information. Next on the challenges list is the imperative to comply with the provisions of what can be termed as International Law concerning water resources. If complying with the entirety of the U.N Convention on the Non-Navigational Uses of International Watercourses of 1998 is not possible then abiding by some important principles will ease tensions caused by water conflicts. Among the most important of these principles is not to cause appreciable harm to your co-riparian party. This requires the prior notification of the co-riparian parties of the intention to carry out projects that will amend the flow pattern or impact the water quality, or in any way impacting on-going navigation and river transport.

The duty of water institutions is to pacify the fears of the co-riparian parties by showing concern for the conditions of the other. An important strategy that helped the negotiations between former enemies, Jordan and Israel, succeed in 1994 was the preparedness of each party to put himself in the shoes of the other, and the innovative thinking that can produce a positive sum conclusion by which all parties can benefit. There is certainly a lot to gain from cooperation than there is through confrontation.

A different form of conflict over water is emerging, this time not over renewable resources as we have witnessed in many parts of the world, but over non-renewable water resources. Such resources extend under the territories of many countries of the Middle East and North Africa, and some of these countries are so water strained that no further renewable resources are available to cope with the increasing demand for municipal water. Jordan is an example. It has been planning to use the Disi freshwater aquifer that is non-renewable, and that aquifer extends inside Saudi Arabia that has been extensively using its water for agricultural production for over three decades now. Other examples exist between Egypt, Sudan and Chad.

From our experience in the management of the water conflict with Israel between 1979 and 1994, it was clear to us that acquiring the water shares of your neighbour cannot last forever. The acquisition of water or territory by force will never last forever. War can not be perpetual forever and peace has to come some day. Peace cannot be reached or, if reached, it cannot be stabilized unless the rights of the warring parties are restored. Water acquired by war has to be relinquished and given back to its rightful owner, and so will the territory. If the warring parties, which are neighbours most of the time, are in their countries to stay forever, then war cannot last forever, and peace has to prevail. Lessons of history tell us that, especially in Europe.

### **7.Forms of Cooperation**

Cooperation in the field of water can range between sharing data to implementing joint development plans in a single river basin. Following are examples:

- a) Establishing a joint data bank to which other regional parties can subscribe.
- b) Improving the efficiency of water use including conveyance, distribution and application.
- c) Jointly producing devices that minimize the waste of water, especially domestic devices.
- d) Cooperation in irrigation technology and agricultural production technology.
- e) Jointly work for the augmentation of water resources through treatment and reuse of wastewater, desalination, and inter-basin regional transfers of water.
- f) Preparing plans for managing the effects of global warming, a phenomenon that does not recognize political boundaries.
- g) Cross boundary infrastructure connectivity that serves to transfer water from one neighbour to the other.
- h) Training of human resources and exchanging standards and specifications

### **8.Conflict Prevention and Resolution**

Measures to avoid conflicts were stated in the above, but a political will must exist to peacefully manage any water conflict that may surface and to quickly treat it.

Perhaps a substantial step in preventing conflicts and resolving them is the establishment of Regional Center for Conflict Prevention and Resolution as a forum of dialogue with encouragement from people of experience and good standing. The forum can look into grievances, mediate, arbitrate and propose to mitigate the impacts of water conflicts.