# SOME CONSIDERATIONS UPON WATER STRESS: ITS TRIGGERS AND CONSEQUENCES

**Ciprian – Beniamin Benea**[191]
**Adrian Negrea**[192]
**Adina Secară-Oniţa**[193]

**DOI: https://doi.org/10.31410/limen.2018.619**

**Abstract***: We live in a water-stressed world. This paper intends to signal some of the main peculiarities of this situation, which are their causes and the possible effects. Rising population number coupled with urbanization, industrialization, food and modern agriculture practices, energy production and use, are all demanding access to an already stressed and polluted resource. Furthermore, dams, as expression of last hundred years' concrete revolution, could complicate even more the political relations among riparian states sharing a river, promoting a new type of water-nationalism with very complex consequences. And we must be aware that an unsustainable management and use of water could strongly hurt us back, with negative consequences for all.*

**Keywords***: Dams, energy, food, mass migration, water, water stress*

## OVERVIEW

Quiet at it is, water has some unique qualities: it is – together with the air – the most important resource on Earth. Even it doesn't make headlines water directly influences stability and security, human and animal health, economic development, and the environment sustainability. The water stress is less visible as we hardly note the depletion of aquifers (both deep/fossil and shallow), but it is more visible when looking at rivers, which have registered decreased flows, to the limit of their full dryness, doubled with lakes' disappearance. *Since over-pumping of aquifers and rivers is a common fate in all populous countries, hitting the bottom line of those aquifers – with the food shortages connected to it – could come roughly at the same time.* And food scarcity there creates hard time not only for governments of those countries, but for the whole world.

There is a high probability to encounter hard times in real life brought by such a crisis-scenario because of water-stress in not a too distant future; numbers speak for themselves: the available average per capita of freshwater resources at global level was 9000 tons (1988), it was 6079 tons (2012), while the projections for 2015 pointed to only 5000 tons [1]. It is crucial to mention that in case freshwater availability is under the 2000 cubic meters (c.m.)/person/year, a serious disincentive upon economic activity's rapid development is the direct consequence, hurting the environmental sustainability, too; furthermore, when water availability is under 1000 c.m./year/capita – the international recognized water poverty verge [2] – the constraints on economic and social activities are extreme.

[191] University of Oradea, Faculty of Economics, Oradea, str. Universitatii, no. 1, Romania
[192] University of Oradea, Faculty of Economics, Oradea, str. Universitatii, no. 1, Romania
[193] University of Oradea, Faculty of Economics, Oradea, str. Universitatii, no. 1, Romania

Being both a regional, and a global problem, growing water shortages across much of the world brings challenges in security and socioeconomic areas. Water stress, hit when yearly water availability per person is lower than 1700 c.m., [3] poses great menaces to a well-functioning economy, stretching it to the limits.

Reduced water availability is due both to economic-social factors such as growing population, industrialization, urbanization, modernizing agriculture, moving up the food chain for a large number of people, but it has to do with poor water management practices regarding water distribution, use, and recycling.

A strong proof there is a pending water crisis, given by the focus of reputed research centers on the subject; "What is now a global water challenge will soon become a global water crisis," recalled CSIS; while other informed research centers from US (CFR), London (IISS and RIIA), Paris (IFRI), or Moscow (IMEMO), are all overseeing this water problem and its security implications.

## TRIGGERS OF POTENTIAL WATER CONFLICTS

### *Agriculture and food*

The main consumer of freshwater resources is agriculture: at global level, 70% of water goes to irrigations and animal husbandry [4], creating enormous harm to environment. One lower profile and hard to note consequence of Green Revolution has to do with water: since 1950s, this revolution – thought to bring relief for the hungry particularly in developing nations such as China and India – has removed drought-resistant *local crop sorts*, replacing them with water-guzzling crops, thought to produce higher yield. But the ecological and social costs were largely ignored [5]. Until Green Revolution local water resources were used in a protective way, resorting to indigenous traditional irrigation technologies, but this revolution has triggered oil engines and electric pumps' use, which extracted water in a completely unsustainable manner, coupled with large dams' construction, which have hindered normal flow of great rivers.

Adding more to this unwise water use, the high-yield crops need chemical fertilizers and herbicides, harming the organic character of soil through erosion. Soil is the biggest water reservoir humankind has, and reducing organic matter in soil determines a reduced capacity to hold moisture. The volume of water retained in soils is connected to soil organic matter, 0,5% organic matter soil retains 80 c.m. of water/hectare, while 4% organic matter means 640000 liters/hectare. Chemical fertilizers, destroying living process in the soil, make it more vulnerable to droughts and this is coupled with the production of nitrogen oxygen, a greenhouse gas which is more potent than carbon dioxide. And biodiversity and soils are the most potent carbon dioxide sinks.

Food industry centered on animal protein is another water guzzler. In every society where income has risen, the demand for meat followed suit; today some 3 billion people are moving up the food chain. World meat consumption went from close to 50 million tons (1950) to 280 million tons (2010), while the yearly per capita consumption climbed from 17 kg to 40 kg [6]. As there is needed a quantity of 2400 liters of water to produce just *one* standard hamburger patty [7] – because of all water required to grow cereals for the animals – moving up to food chain as new developed countries emerge puts more and more pressure on water resources; contrary, there are needed some 1000-1500 liters of water to produce one kilogram of cereals, some 10 times less than water needed for the equivalent quantity of beef [8]. A diet with more

vegetarian component – beyond creating conditions for a better health – could bring some relief related to the pressure put on scarce water resources.

Another trigger of future water stress and competition is related to a scenario where cities are pitted against villages. Striking examples of competition between cities and farms can be found in the US; the depletion of aquifers in leading irrigation states such as California – the irrigation leader – as well as the diversion of water to megalopolises have reduced irrigated area from close to 3,7 million hectares (1997) to 3,2 million hectares (2007), while in Texas the irrigated area decreased from 2,84 million hectares (1978) to 2 million in 2007, as the thin southern end of Ogallala aquifer was depleted [9].

As states' policies and especially corporations, favor industry and city development over village and traditional way of living, the pressure to "redirect" water from village and orient it to the cities is so great that the village has little to do, but to comply. Economic output rising based on development of industrial and tertiary sectors determines water to head to the higher bidder, which of course is the city, in a world where each year are added some 70 million more people [10]. Domestic water conflicts are in the focus of domestic politics, farmers being on the losing side in most cases; political leaders are preoccupied with an expanding economy, using industry and services concentrated in cities, and unemployment rate's lowering, and because there are needed over 1000 c.m. of water to produce a ton of grain, while it takes some 15 c.m. of water to produce 1 ton of steel, for example, it can be easy observed that the village is on the losing side.

But who can honestly argue which is more important in case of a water shock and food crises, the city with its high concentrated and intense economic activity or the farm which could feed farmers, cities, and even other societies in the importing countries? This is yet another face of water as a conflict trigger, pitting against each other peculiar interests at local, regional, state levels, as well as at the international level.

***Agriculture and transport***

Ethanol and biodiesel are quite new ingredients of propulsion in transportation and they strongly compete with the food production for land and water resources. Starting with the 70s, in some European countries, in the USA and Brazil took roots the idea of cultivating crops to produce fuel [11]. The pressure put by industries connected to bio-fuels on the limited agricultural land area and on the fast reducing water resources face-to-face with food production is so great, that food prices have steady raised in last decade. Of course global population's rising coupled with higher incomes in developing countries is a determinant for such a trend, but the competition between "feeding" the car of the wealthy and allocating food for those with lower chances marks its weight on global food price. Furthermore to produce 1 liter of biodiesel there is needed 16.45 linters of water [12]; bio-fuel is 3 to 5 times more water intensive than traditional fuels [13].

Furthermore, moving one calorie of food needs four calories, consumed in transport [14].

***Energy sector***

It competes for water resources too. Resources such as coal, oil, natural gas, or uranium cannot be geared for energy production without using great amounts of water. The energy sector is the largest water consumer in Europe and the US [15]. Petrol refineries consume usually larger quantity of water related to the quantity of gasoline or diesel they output. Furthermore, the extraction of hydrocarbons from tight stones underground means losing huge amounts of water

due to "stimulation". Pointing directly to electricity generation, it takes about 87 liters of water to produce 1kW/h electricity to provide the conditions for running an energy-efficient refrigerator for one day. The cooling and steam-cycle processes at thermoelectric power plants that receive heat from sources as coal, gas, oil, nuclear, biomass, concentrated solar energy, geothermal energy takes their share in water guzzling.

***Dams and imagined geography***

When there is taken a decision to build a dam we are working with imagined geography; it is hard to grasp all consequences of dam's construction, with all their ramifications. Costs involved, needed time, river flowing regime, how forced-removed communities will adapt, how river fragmentation due to impoundment creates spill-over effects in aquatic life, environment and evaporation regime, are few elements which can differ a lot between the moment of project imagination and its behavior in real environment, after its completion.

Furthermore, dams can be employed as political weapons due to their capacity to store or release water to other lower co-riparian states; this could trigger intensified tensions, especially when there is a period marked by severe drought in the river's basin area.

As one public presented reason behind the decision to build a dam could be flood prevention, imagined geography could have nothing to do with that reality; there were cases when during heavy rains a decision to relinquish water from a dam was taken, in order to prevent its burst. When they are needed most, dams aimed at promoting flood prevention, could end up creating floods. Dams becomes more contentious matters when he, who controls the headwater through these concrete structures releases water, destroying fields and food, settlements, infrastructure, and as a consequence the economy and society of lower riparian states.

Water is very hard to be transported over long distances, and it could be locally or regionally "manipulated". As a consequence, relocation of people is a given in case their access to water could not anymore be secured. The reason behind regional upheavals connected to water stress is due to the fact that water cannot be imported, like other commodities. As a consequence, there are big incentives to create instruments to commandeer *internationally shared waters, especially when they are on national territory*. The result is the focus on massive scale hydro-engineering projects (irrigation schemes and especially *dams*) in upper-riparian states, without much care about downstream societies. These large infrastructures regulate the trans-boundary flow of a vital resource, fashioning *water* in an instrument with powerful diplomatic clout and strong political leverage.

There are 276 international river and lake basins in the world, yet only 18 are covered by a mutually binding water-sharing agreement [16]. And what is even more important, as in 2005, there was no one international river or lake basin covered by a powerful regime comprising all nations with interests in that resource [17]!

Hydro-hegemony is a policy pursued quietly, but actively by two international actors with regional, respectively global influence: Turkey and China. Using *dams* and *water transfer schemes* China can influence and even control in some way, the fate for nearly half of world population [18], and on a continent already torn by low water availability. As China is home of some half of world's great dams, and because Beijing has no visible intention to stop its course regarding water control [19], this can bring tensions and even open rivalries with other riparian countries.

The other strong player on hydro-hegemony arena is Turkey; it claims *absolute* rights over water coming from its territory, without taking seriously into account Syria's and Iraq's rights over Tigris and Euphrates' waters, and to put it in practice, it had launched an ambitious project aiming at building dams and irrigations schemes in its Eastern and South-Eastern regions.

We can note that power relation among co-riparian influences such an outcome. Both are examples fitting this power equation; this could create the potential for a latent revenge from those disadvantaged, with hard to imagine results.

We need just to look carefully around us and all that was here shortly presented becomes visible, but that would not be enough. There is needed a greater awareness from the part of those who have the noble mission to educate others. The changing attitude regarding our very precious "blue gold" should be one of the main focal points for all of us on short term, while *reconciling* mankind with its environment should become the central ethics of future leaders.

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