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International Journal of Hydrology

Opinion

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Did water science fail to predict the water crisis in Brazil?

Opinion

Volume 2 Issue 3 - 2018

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Received: January 20, 2018 | **Published:** May 22 2018

It is undeniable that there has been a huge accumulation of knowledge in environmental sciences focused on the study of water resources in the recent years. Every day it seems we are told about the launch of a new scientific journal or on-line newletter. There has been a noteable increase in the level of infrastructure investment by governments as well as in the numbers of students entering water related disciplines in universities worldwide. International scientific associations of hydrology, geology, marine sciences, ecohydrology, ground water among many other related engineering disciplines sponsor national, regional and major international events with the presence of thousands of academics and practitioners. Despite all the advances in scientific knowledge and the growing exchange among water researchers, planners and managers, it is also indisputable that we are facing an evermore complex suite of inter-rerlated water problems globally, incluidng wildfires, landslides, drought and crop failure, food security, transboundary conflicts, etc.

Human populations of every size and composition are facing these crises with increasing frequency and intensity in every corner of the world: California (USA), substantial sub-regions of Latin America, Small Island developing states, large areas in north and South Africa, the Middle East and Asia. The case of Brazil however is emblematic of what the term "water crisis" implies: large cities such as São Paulo, Rio de Janeiro and Belo Horizonte may not have sufficient and safe drinking water, even at present demand levels, by the end of this decade. Rural areas, dependent on irrigation (surface and ground water) for agricultural production, some having to deepen wells annually and exascerbated by the 2013-2016 drought, are especially at risk. The very future of the country is dependent on the continued development of the hydroelectric sector. Politicians who have never contemplated having to restrict access to water in such a "water rich" nation are now contemplating the impacts of such "natural mandates." And even regional security and stability is also at risk as Brazil shares several macro-basins with neighboring countries, all demanding greater access to freshwater resources, particularly those countries sharing downstream water or shared aquifers.

Many researchers, investors and international scientists have warned that the crisis of water in Brazil could easy spin out of control. Social movements can and do emerge from seemingly "nowhere" and the outcomes of these reactions (peaceful protests or worse) can not always be predicted. It is obvious that the water crisis in Brazil will cause serious social and economic consequences that can impact the whole of South America. And it is our contention that policies based on sound science are more sustainable than those put in place as the result of a political weight-lifting contest or short-term political gain. The current water crisis in Brazil is not only linked to a noticeable drop in atmospheric precipitation in 2013-2016, but also to a lack of mid and long-range planning and the adoption of an economic model and land use policies that do not always take into account the real carrying capacity of aquatic ecosystems. However, it's a "simple" reaction to say that politics failed us yet again. When comparing the advances in science and the severity of the water crisis in countries like Brazil, we can easily conclude that there was something wrong with or lacking in the underlying science. That's also a "simple" response and one that politicians often times use, particularly when it's politically expedient. We all believe that science is able to help anticipate and even solve problems; that scientific activity brings tangible progress and social well-being. So what went wrong with the sciences and scientists who take care of the freshwater?

One of the causes of the failures of science to predict, mitigate and improve the "water crisis" may be related to the profound inability of environmental sciences to put into practice and into understanable language knowledge that has been accumulated. This principle is well-grounded in hundreds of scientific articles. We know the general physical and biological impacts of different human actions on the availability and quality of fresh water on the planet. Again and again, the scientific community warned that a water crisis was readching a tipping point. However, giving alerts and warnings to restricted audiences in major scientific meetings; publishing or editing scientific articles or books showing that we would have serious problems in relation to fresh water on the planet, has been ineffective in terms of follow-up at the community level, political responses and true social change. What was missing then? The four points below are indicators of mistakes taken by decision makers in water governance around the world that contributed to the present situation:

a. More than 70% of all the water utilized by human populations goes to irrigated food production. In many regions, the use of freshwater resources for agriculture surpassed the carrying capacity and the recharge capacity of aquifers.

b. In many countries, there has been an explosive increase of urban populations. Many mega-cities around the world (i.e. São Paulo, Mexico, Bangkok) are facing serious problems related to drinking water availability. Besides, these cities produce enormous amounts of untreated wastewater further compounding access to quality potable water.

c. Many countries exaggerated the demand for freshwater as a justification to construct large reservoirs for hydroelectricity without the necessary understanding to the context for such investments. Many of these projects face problems in their operation: deforestation, increasing social tensions, methane emission, siltation, eutrophication, an increase of multiple uses, etc.

d. The models of economic development adopted by many emerging countries prioritized the so called "brown economy" over the new "green economy". Thus, very high investments in off shore oil production, mining, steel, pulp production and various tropical agriculture monocultures led to an early exhaustion of important water surface and importantly groundwater reserves.

We propose that freshwater science seek new ways to apply all the knowledge and skills available to create investment conditions that tangibly contribute to society's welfare.

In our opinion, the changes that could affect the practice of environmental science should follow four basic lines of actions:

a. Enhance and improve education at all levels and particularly what UNESCO calls "popular education" for water. This is a non-formal education model that can in a short time, effect noticeable changes in the behavior of large populations.

b. Find ways to influence and improve the governance of water at all levels of public administration.

c. Provide the information necessary for the productive sector to improve hardware, methods and practices, particularly in food security and production. Develop new models of economic development suited to the regional carrying capacities of freshwater ecosystems.

d. Improve and enhance relations and the sharing of scientific information between the North and the South. "Open access" of scientific data is vital to all aspects of water planning and manaagment. This concept has been endorsed by systems such as the UNESCO-IHP category 2 centers and should be more widely adopted to assist in the management of the world most precious natural resource - water.

Acknowledgement

None.

Conflict of interest

The authors declare there is no conflict of interest.

Citation: Pinto-Coelho RM, Havens K, Meganck RA. Did water science fail to predict the water crisis in Brazil? *Int J Hydro.* 2018;2(3):319–320. DOI: 10.15406/ijh.2018.02.00089