REHYDRATING THE EARTH: NEW PARADIGM FOR WATER

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"The wars of the 21st century will be wars fought over water" - these are the now famous words of former UN Secretary General Boutros Boutros-Ghali, words that a growing number of authors are repeating today. But what if, instead of providing the catalyst for war, water could instead be the catalyst for deep, holistic and sustainable human participation in Earth systems?

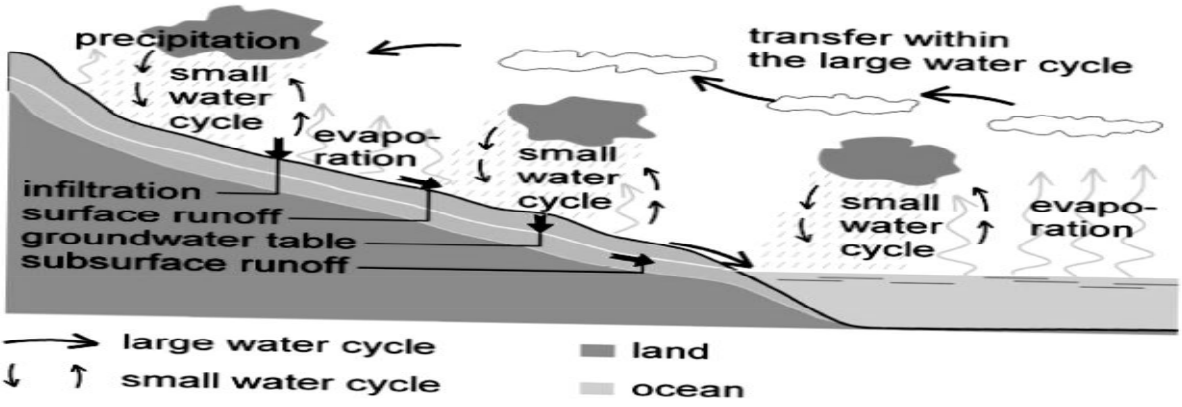
As someone drawn to holistic science and to the need for change towards big picture thinking, I struggle to think of a single area more ripe for holistic engagement than water management. I say this because, whilst my intention here is to articulate a complete paradigm shift in the way in which we think about and approach water management in our basins and catchments, none of the arguments I will be using to support this position are particularly controversial. What is unique here is approaching the subject in a holistic manner.

The development and adoption of a new holistic water management paradigm, a paradigm that acknowledges, seeks to understand, and in some instances to reverse, humanity's impact on the 'small water cycle', could be one of the most important challenges we face. The good news is that at its most fundamental level, the change in approach can be summarised in one short sentence: a shift from the current paradigm, where evaporation is viewed as a loss to the system to be avoided at all costs, to a new paradigm, where evaporation is understood and respected as the *source* of all precipitation and managed accordingly.

To understand the importance of this statement, we must first understand that there are two major parts to the water cycle - the 'large water cycle' and the 'small water cycle'.

As can be seen in *Figure 1 (below),* the small water cycle can be described as the closed circulation of water in which water evaporated on land (or water) falls in the form of precipitation over this same environment. There is nothing controversial about the small water cycle. It is simply a term that does not get used in current paradigm water management discussions.

Although it is called the *small* water cycle, don't be misled by its name. The small water cycle is actually more important to local precipitation patterns than the large water cycle. In fact, it is estimated that mean global precipitation overland is 720 mm, of which only 310 mm is from the large water cycle (i.e. Oceans) and 410 mm comes from the repeated evaporation-precipitation process of the small water cycle (Kravčík et al., 2007, p.17).



That is to say, up to two thirds of precipitation on land actually comes from the small water cycle. Acknowledgement of this simple reality alone should be enough to completely transform our approach to global water management. Furthermore, it is the small water cycle that is interrupted by human activity, and it is therefore the small water cycle that we can seek to act upon by becoming conscious of our influence upon it.
However, before I get into a lot more detail about the small water cycle and how we might influence it, I want to explore the current paradigm approach to water management, via the example of a globally relevant Australian water management planning process that I was closely involved with, the Murray Darling Basin Plan.
The Murray Darling Basin is one of the largest and also driest river systems in the world. Running from central Queensland, through New South Wales and Victoria, and eventually, down into South Australia where it meets the sea near Adelaide, the Murray Darling Basin covers an area of 1,059,000 square kilometers, around 14% of the Australian continent (MDBA, 2014a).

Entire books have been written on the political complexity of the Murray Darling Basin, but to get an idea of its significance it is important to understand that the basin contains approximately 40% of Australian farms and around 70% of Australia's irrigated land (MDBA, 2014b). In addition to this, the Murray Darling Basin is also the primary water source for a number of significant towns and cities.

Essentially, the Murray Darling Basin Plan was a multi billion dollar Federal Government initiative designed to redistribute a perceived over-allocation of water resources, in the hope of revitalising the basin environment. This process was initiated following a decade of the worst drought on record, and in the light of scientific predictions of increasing climate variability resulting from climate change.
The Murray Darling Basin planning process involved four separate state Governments and countless stakeholders all seeking individual outcomes. At the broadest level the Basin Plan operated on the premise that allocating more water to environmental sites was the best we could do to 'fix' the perceived environmental problems in the Basin.
However, whilst certainly effective in reallocating water to the environment, the Basin plan never got to the deeper level questions of water management, such as: is human activity playing a role in increasing climate variability? And if so, what can we do to begin reversing these trends? In other words, in over four years of being involved with the Murray Darling Basin Planning process, I heard almost no discussion about the water cycle and how human activity might be influencing it! *This* is where I believe our approach to water management needs to change.
Luckily, in Australia we do not have to look very far for examples of pioneering water management practitioners who have adopted a far more holistic approach. P.A. Yeomans, for example, released his first book '*The Keyline Plan'* in 1954. The Keyline approach seeks to re-mould the landscape using specialised methods of planning and design based on water control and land management. The primary aim of this approach is to increase the depth, stability and fertility of soils (*Yeomans, 1954*). Over the past three to four decades, Keyline practices have become a significant addition to the Australian rural landscape, forming, among other things, a key platform upon which the permaculture design process is based.
More recently, another Australian farming pioneer, Peter Andrews, has come up with his own philosophy on landscape rehydration and ecosystem restoration, 'Natural Sequence Farming'. Like Yeomans, Andrews places his major focus on the restoration of degraded soils. Based on the knowledge that soils have the capacity to hold twice as much carbon as the atmosphere, Natural Sequence Farming is designed to restore ecosystem functions by "re-coupling the carbon and water cycles" (Norris & Andrews, 2010). This approach is unique in its attempts to create managed systems designed to mimic natures own

design, and has achieved significant success in its short history in Australia.
Being Australian and having worked in Australian water policy I am more in touch with Australian examples, but that is not to say that there are not also interesting global case studies as well. India's Rajendra Singh and Zimbabwe's Allan Savory are two leaders that come instantly to mind.

Often referred to as the 'Waterman of India', in 1984 Rajendra was working to set up health clinics in the state of Rajasthan when he was told that they needed neither medicines nor food, but water. This simple statement led Rajendra on a journey of learning and action that resulted in him being named as one of the 50 people who could save the planet (*Guardian, 2008*). Rajendra's work is particularly interesting not only for its focus on traditional methods of water conservation and unique approaches to community engagement, but also for its irrefutable and broad scale success. By working with the local community to build over 10,000 strategically placed small dams or johads, Rajendra has been able to help bring water back to over 1,200 villages and restore the water flow of seven rivers in arid areas of Rajasthan in India.

Allan Savory is a Zimbabwean born biologist and farmer behind the concept of Holistic Resource Management. Savory's area of focus lies in what he terms "brittle environments" (up to a third of the worlds lands), which he defines as "areas where there are prolonged periods of the year in which conditions for plant growth are adverse" (Savory, 1983). Over the past few decades, Holistic Resource Management has achieved significant success by using livestock to mimic the herds of native wildlife that once roamed the world's grasslands. This method is particularly interesting for its unique approach to addressing desertification in a significant proportion of the world's lands.
This list is by no means exhaustive, these are simply four prominent examples of pioneering individuals who have taken a more holistic view of the role of water in our environments. And, importantly, they have been achieving remarkable results over varying periods of time. The sort of results that prove that we can reverse trends of global desertification and begin to rehydrate our landscapes. Results that, in my view, provide significant hope for the future of humanity.

Interestingly, the more I look at these, and similar approaches, the more I feel they are all intrinsically connected. Essentially, whilst they may use different techniques and means, they are all rooted in a holistic understanding of the key role of water in our ecosystems and environments. What appears to be missing is a language to bring these pioneering approaches together. A language that can explain why these approaches have achieved real, demonstrable results, whilst not requiring us to align ourselves completely with any one specific philosophy or individual. Enter Slovakian hydrologist Dr Michal Kravčík and his colleagues, and their call for a 'new paradigm in water management'.

I first came across Dr Kravčík via a book he co-wrote in 2007 called - 'Water for the Recovery of Climate - A New Water Paradigm'. At this time I had been working in the water policy space for four years, and this was, remarkably, *the first time I had ever heard anyone mention the small water cycle*.
Kravčík himself was the recipient of the 1999 Goldman Environmental Prize for his work in galvanizing support to halt a proposed mega-dam project that had been planned during the communist era. He achieved this by proposing a series of effective, democratic and cost effective alternatives, including smaller dams, decentralized water management, and restored farmlands (*GEP, 2000*). Possibly just as importantly, in articulating what I will refer to as the 'new water paradigm', Kravčík and his colleagues have provided something that may have much broader impacts on water management - *a new language to unite holistic water management practices from around the world.*
As I've already alluded to, a fascinating aspect of the new water paradigm is that, as Kravčík and his colleagues describe it, "...it is not founded on new, revolutionary knowledge; its

newness arises more from thinking through existing knowledge to its logical consequences" (*Kravčík et al., 2007 pg. 7*). The most important concept to understand about the new water paradigm is that its proponents believe that the leaching of fresh water from land into the oceans is one of the most significant factors not only in global desertification, but also in climate change. Essentially, the new water paradigm explains how human activities, such as deforestation, agriculture and urbanisation, have gradually reduced soil moisture, ground water, and vegetation, which in turn have reduced on-land evaporation, *completely interrupting the small water cycle*.

If there is anything revolutionary about the new water paradigm, it lies in its focus on the small water cycle. The new water paradigm is, essentially, a "plan for saturating the small water cycle through the conservation of rainwater on land" (*Kravčík et al., 2007 pg. 7*). In fact, if you have problems talking about a new water paradigm, drop it altogether and just start thinking and talking about the small water cycle.

The new water paradigm, rather than focusing on dams and rivers, focuses instead on slowing down the progress of water through the system, holding it in soils, vegetation and groundwater systems, based on the knowledge that the small water cycle will ensure that water is continually cycled through the landscape before eventually returning to the ocean. In simple terms, the new paradigm for water focuses on getting the most possible value from water on land via the small water cycle.

As I explained earlier, it is the small water cycle that is interrupted by human activity, therefore its absence from policy discussions highlights the disconnect inherent within current paradigm approaches to water management. The best example I can think of to highlight this point involves a debate often referred to in Australia as the "war of the willows". This debate revolves around a premise that willows are particularly thirsty trees, and, as they are an introduced 'weed' species, removing willows could save up to 5.5 megalitres of water per year, per hectare of canopy area (*Doody & Benyon, 2011*).

This is an argument being put forward by the peak science body in Australia, the CSIRO, and is therefore highly representative of the current paradigm approach to water management. The problem is that the argument in favour of removing willows completely ignores the water once it has been 'used' by the willows: it completely ignores the small water cycle. This is the point; almost all policy relating to water management ignores the small water cycle.

Once water has evaporated it is gone as far as our current paradigm thinking is concerned. The current water paradigm views water primarily in rivers and dams, and less so in ground water, as 'real' water. Almost all water policy is geared around the regulation of these forms of water, which is understandable given that water has become a highly valuable commodity. The problem is that this approach to water management has led us to forget about the other areas that water is held in our environments, such as soil, vegetation and the atmosphere; or worse still, as in the example of the willows, to actively discriminate against water in these states.

When we think in terms of the new water paradigm, we understand that trees (and all vegetation), instead of being 'users' of water, are instead key regulators of water in the environment. Indeed, we begin to think in terms of the role that plants are playing in the circulation of water and in the transformation of solar energy, as temperature regulators.

At this point we are in danger of entering into a level of complexity that is beyond the scope of this piece to articulate. Nevertheless, it is impossible to think holistically about water and ignore the role it plays in the broader environment.

One of the key premises of the authors of the 'new water paradigm' is the roles that water and vegetation play in concepts such as 'the greenhouse effect' and 'global climate change' have thus far been greatly neglected (*Kravčík et al., 2007 pg. 23*). The primary reasons provided for this neglect relate to the fact that the circulation of water is extremely dynamic

and complex, often involving innumerable mutually connected processes. Instead of being treated as an important greenhouse gas, water is instead treated as somewhat of a climatic constant and therefore not included in many climate models. However, this approach dramatically underestimates the importance of water in the climate (*Kravčík et al., 2007 pg. 29*).

Whilst the role of water in our climate may be under-researched, what is certain is that a key condition for the alleviation of climate change is the renewal of basic ecological functions that are closely associated with increases in water and vegetation on land. These functions primarily include the "soft dissipation of solar energy through the cycling of water" and the increased absorption of carbon dioxide and conservation of nutrients on land associated with increased vegetation (*Kravčík et al., 2007 pg. 29*).

By beginning to become conscious of how human activities have contributed to the leaching of water from land and into the oceans, we can begin to employ policies and practices that seek to reverse these trends. By acting to increase the amount of fresh water on land, we would, by default, increase the diversity and resilience of our ecosystems. In turn we will begin increasing the organic content of our soils and landscapes, pulling in large volumes of carbon from the atmosphere.

The details of the 'new water paradigm' are far more complex than I have been able to convey here. However, what stands in our favour is that there are numerous global examples, such as the four I have listed here, of tried and tested new paradigm aligned philosophies and practitioners. Our work now involves drawing these examples together and looking at them through the lens of this new water paradigm, to develop a common language for articulating how these results are being achieved and why.

The choice is simple, we can continue to ignore the role of humanity in the dehydration of small water cycles across the globe, and attempt to apply increasingly large band-aid solutions, as I experienced in the Murray Darling Basin Planning Process. Or, we can pick up the initiative that has been offered to us by these many pioneering water practitioners, and make genuine attempts to create a sustainable future through this new paradigm for water.

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