THE TURNING OF A SCREW

Social resource scarcity as a bottle-neck in adaptation to water scarcity

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Leif Ohlsson, PhD. Dept. of Social Sciences, University of Örebro (SE-701 82 Örebro, Sweden) & Dept. of Peace and Development Research, University of Göteborg. E-mail: L.Ohlsson@padrigu.gu.se

Anthony R. Turton, SOAS Water Issues Study Group (University of London) & African Water Issues Research Unit (AWIRU) (Pretoria University Department of Political Sciences), Pretoria, 0002, Republic of South Africa. E-mail: Art@icon.co.za

The story of meeting the challenges of water scarcity is a social story. It is the story of societies employing different means of adaptation over time, at different stages of scarcity, and in response to different perceptions of what constitutes the challenge to be met. Like all good stories it can be told in many different ways. Here are some stories presently told. Let's see if there isn't also the beginning of an entirely new story here.

The "Rivers running dry" story is the familiar identification of the first symptom of the problem: There is not enough water – or, as some would prefer to say, there are too many people for the available amount of water in the ecosystems. The literature here is enormous; examples are Sandra Postel (1996), and Robert Engelman & Pamela LeRoy (1995). It is also the most wide-spread and popular perception of the problem.

It has given rise to what increasingly has been called "The numbers game", that is, indices of water stress or water scarcity, built on a per capita measure of available, renewable fresh water; or its inverse, the number of people that have to share a given amount of water, pioneered by Malin Falkenmark (1989).

"The triple squeeze" story, as told by Lundqvist (1996), is the story of how the need for management of the water resource has turned water from a free (natural) good, to a public (managed) good, and increasingly also to a public worry good. At its most serious, it becomes the story of "Hydrocide". Also told by Lundqvist (1998), this is the story of water scarcity as a result of social misuse of the water resource.

The changing social use of water is most clearly reflected in the story of "Virtual water", Tony Allan's (1998) tale of how water-starved countries, unable to mobilise enough water to grow the food they would be able to produce other-

wise, instead import water in the form of food.

The story of "Water wars" by Joyce Starr (1991) is the first alarmist recognition from the beginning of the 90s, of how scarcity of water could lead to widespread social disruption. Countered by Aaron Wolf (1998), it has gradually been replaced by the understanding that shared water resources tend to lead to cooperation rather than conflict between countries. On the other hand, conflicts over water, as we all know, do occur – but they are much more likely to take place between user groups within societies, than between countries. An excellent tool for understanding the mechanisms of such conflicts has been provided by Thomas Homer-Dixon (1994, 1995), in the form of "Environmental scarcity", "Resource capture", "Ecological marginalization", and "The ingenuity gap".

These are all true stories, and good stories, since they each teach us something important about the present predicament, and how we have arrived there. The ways we tell them reflect the *conceptual glasses* through which we understand the challenge. And the implicit *arguments* in our recounting of those challenges constitute *guidelines for action*. Therefore, it is important to identify what the stories we tell teach us to do, and to reflect upon whether it is really the best story to tell, in order to help us understand what the most urgent challenges are, and how to respond to them.

What we would like to do, is to pick up the thread by telling a new story of "Social resource scarcity".

The new story emerging

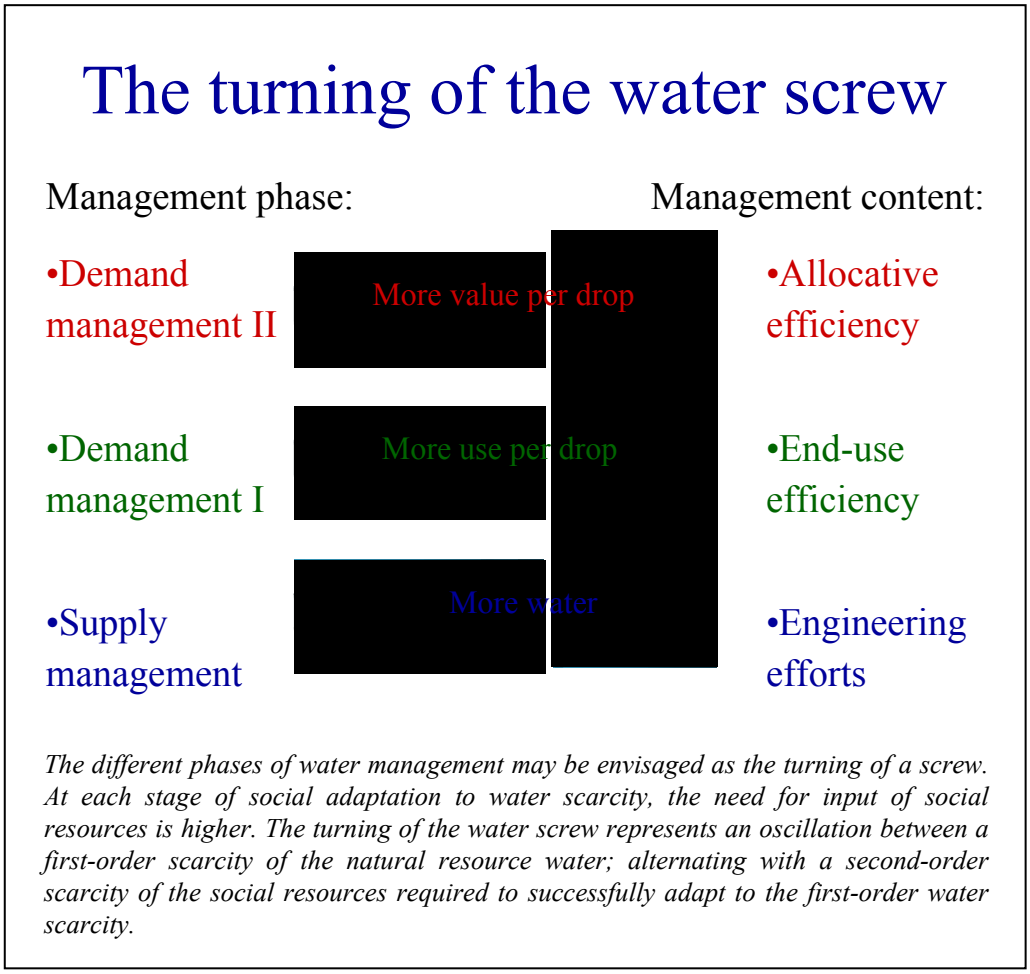
The new story emerging follows from the evolution of water management practices. The recounting of experiences collected in the scientific literature on water resources management form a progression. They are about i) identifying bottlenecks; ii) finding the appropriate social tools to meet the challenges posed; and iii) dealing with the conflicts created by the new ways of using water resources socially.

For simplicity, three steps are often identified:

1) Supply management, which involves often large-scale engineering efforts, sometimes even called "heroic engineering". It includes the building of dams, large water transfer projects, etc. The objective clearly is to "get more water".

2) Demand management, which in the first step involves end-use efficiency measures. The objective is to get more use out of the existing amount of accessible water: It is the "More use per drop" stage.

3) In the third step demand-management is taken further by what has been called *allocative efficiency* measures, which entails large-scale social restructuring. The objective here is to do better things with water; to get "more value per drop"; which means industries and cities instead of agriculture.



The different phases of water management may be envisaged as the turning of a screw. At each stage of social adaptation to water scarcity, the need for input of social resources is higher. The turning of the water screw represents an oscillation between a first-order scarcity of the natural resource water; alternating with a second-order scarcity of the social resources required to successfully adapt to the first-order water scarcity.

The image we use is faulty however. This development does not form a linear progression.

The turning of a screw

The story of changing social uses of water rather forms a spiral movement, oscillating between a perceived scarcity of the natural resource water, and a perceived scarcity of the social means required to overcome the original scarcity; all the while progressing towards ever increased amounts of social resources applied to overcome the natural resource scarcity.

A more appropriate simile, therefore, is *the turning of a screw*. The content is the same, but intuitively it becomes easier to see the interaction between the sphere of natural resource management and the social challenges encountered.

We would like to suggest that this turning of the screw represents an oscillation between a *first-order scarcity* of the natural resource water; alternating with a *second-order scarcity* of the social resources required to successfully adapt to the first-order water scarcity.

Similarly, the task of managing this process essentially is about learning how deal with: i) the *conflicts* encountered as a result of the natural resource scar-

city itself (both international and internal conflicts about the distribution of the resource); and ii) the *conflicts* encountered as a result of the social resources applied to overcome the natural resource scarcity (internal conflicts, often directed at the state, and therefore a dangerous impetus for external conflict).

The management task therefore constantly shifts between *managing first-order conflicts* over the scarce resource itself; and *managing second-order conflicts*, caused by the very means societies employ to overcome the first-order scarcity.

Any discussion aimed at finding appropriate strategies for managing water scarcity therefore seemingly would benefit from starting off with some reflections on where on the thread of the ever-turning screw a particular country is situated at a given moment. Let's have a closer look at the three large turnings of the screw identified here.

Natural or social resource scarcity?

At every turning on the screw, the crucial task is to identify the social bottlenecks, which stand in the way of new kinds of adaptive measures.

1) When large-scale supply-side engineering efforts no longer is the appropriate solution, a way must be found to overcome the vested interests of what by then will have become a powerful and entrenched economic and political sector.

2) When the new economic incentives entailed by the first stage of demand-management ("more use per drop") creates conflicts with previously subsidised water uses, ways must be found of compensating aggrieved parties.

3) When irrigated agriculture no longer can be the main source of livelihood for people, the influx to cities must be handled, and new jobs created at a rate that will satisfy justified demands for better lives from still increasing populations.

Each step, gigantic as the challenge is, means turning a natural resource scarcity into a social resource scarcity, in the sense that the ability to mobilise *a sufficient amount of social resources in order to change societal water use* emerges as the strategic bottleneck.

Bringing *the adaptive capacity* of a society into the equation thus means transcending the trap of absolute scarcity. A previous *absolute* scarcity of water (under prevalent forms of usage) is turned into a *relative* scarcity; in the sense that how societies will succeed to live with less water now depends on how well they handle the challenges of adapting to another social usage of water. (Ohlsson 1999)

Natural resource reconstruction

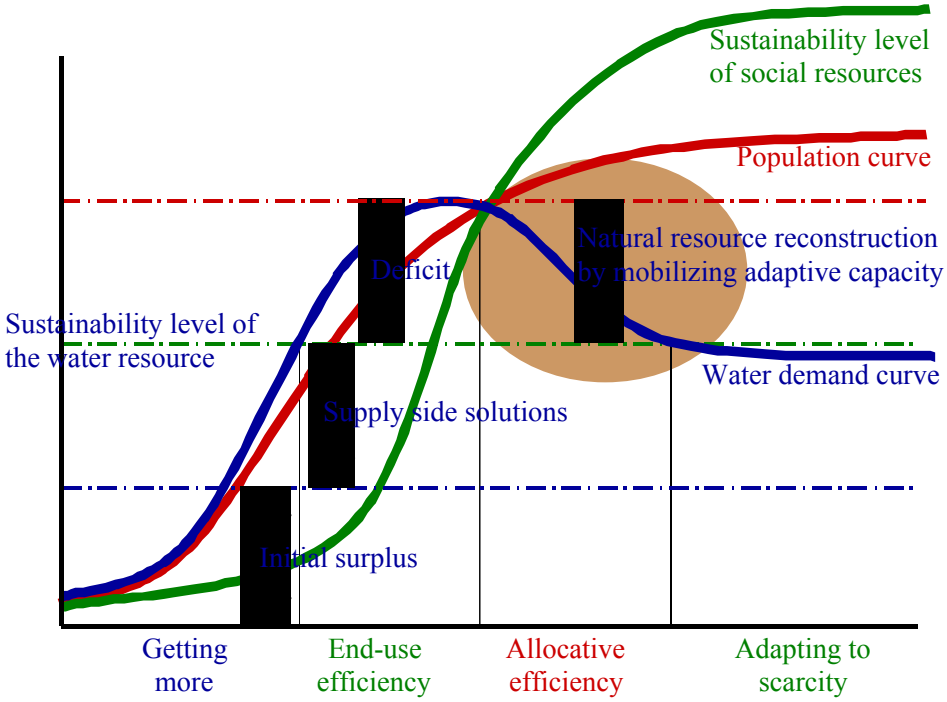
The goal of adaptation to water scarcity is to accomplish what Allan & Karshenas (1996) has termed "natural resource reconstruction", that is, a level

of resource withdrawal which is below the natural resource sustainability level. In the case of water this means that total water withdrawals must be less than the annually renewable amount of water.

The challenge for water management is to accomplish this with available social resources, in a way that does not endanger development expectations, thus risking social disruption. It is a huge task, but not an impossible one. The tools, however, are widely different from the era of ”heroic engineering”. Today the most effective tools are institutional change, economic incentives & disincentives, and the large-scale social structural change necessitated by the strategy of “virtual water”, that is producing goods with “higher return to water” for export, and importing the food for which there is not enough water to grow.

Anthony Turton (1999) has shown how this process is well under way in several countries. Israel is a case in point, where recycled wastewater is now being used to revitalise aquatic ecosystems. South Africa provides another example where the new Water Law has made the needs of aquatic ecosystems equal in status to that of basic human consumption, calling this the "reserve" and thus protecting it as a legal right. Other Southern African countries such as Botswana and Namibia are now following suite.

The point we both are anxious to bring across, is that this process is extremely demanding on the adaptive capacity of all countries, and not least developing countries. In fact, just as we are familiar with the concept of a sustainability level for water, we ought to attempt to grasp the content of a corresponding sustainability level for social resources. Unlike the natural resource sustainability level (which is a constant), the sustainability level of social resources would seem to increase with every turn of the water screw, since the amount of social resources needed to successfully implement adaptation becomes progressively higher at every step of adaptation.



The focus of this stylized diagramme is on natural resource reconstruction, that is, the process whereby a previously unsustainable water-use may be turned around to sustainable practices. The process puts greats demands on the adaptive capacity of societies, that is, their ability to mobilize a sufficient amount of social resources. Supply-side solutions, that is, engineering efforts may for a time may mobilize a surplus of water (blue curve) to meet rapidly rising demands of population (red curve) and welfare increases. Beyond the sustainability level of the water resource, however, demand-side solutions become necessary, first by end-use efficiency measures, then by allocative efficiency. Whereas the sustainability level of the natural resource water is a constant, the sustainability level of social resources (green curve), that is, the amount of social resources needed to successfully implement adaptation becomes progressively higher at every stage of adaptation. (Adapted from Turton & Ohlsson 1999.)

First- and second-order conflicts

Ultimately, the reason for turning the water screw ever harder is the necessity to avoid social conflict and widespread disruption. Concurrently, however, new types of conflicts are encountered; both first-order conflicts about the water resource itself, and second-order conflicts caused by the very means societies employ in order to adapt to water scarcity.

1) *First-order conflicts* at the first stage (supply side management) are tensions, possibly open conflicts, between countries. This is the upstream-downstream game. *Second-order conflicts* may arise within countries as a result of the large number of people displaced by dam-building projects.

2) At the second stage (end-use efficiency) *first order-conflicts* take place be-

tween user groups within countries. This is the resource capture mechanism of what Homer-Dixon has called environmental scarcity. It is always followed by marginalization of weaker segments, and thus increased inequalities. *Second-order conflicts* follow from the implementation of new institutional frameworks, which may infringe on the privileges of previous users, for example subsidised irrigated agriculture.

3) The *first-order conflicts* at the third step (allocative efficiency) takes place between *sectors*, most notably agriculture and cities. They may be comparatively easy to resolve in the development process. The *second-order conflicts* at this stage, however, are much more difficult. They result from the frustrations of people who no longer can get at livelihood from agriculture, and not yet are able to secure a livelihood in cities.

Note particularly here, that conflicts *between* countries (the risk of water wars) follows only from the first turning of the screw. In the further progression of water management we are facing conflicts *within* countries. (Ohlsson 1999)

What is the most important scarcity to measure?

We measure what we think is important. The learning lesson of studying the development of different generations of water scarcity indices is that they mirror the progression in the perception of what constitutes the real scarcity in water affairs at different stages of the turning of the water screw.

The first generation of simple per-capita availability water scarcity indices were appropriate for identifying a problem in the prevalent supply-side management efforts, and to sound the alarm. As a by-product, they spurned the fears of international conflict over water.

As the perception of the character of the challenge of adapting to this first-order water scarcity grew, refined indices evolved, some of them concentrating on fine-tuning the perception of the challenge at hand from an ecological point of departure, while other focused on the challenge of mustering a sufficient amount of social resources necessary to both manage adaptation, and handle the second-order conflicts ensuing from the very means societies were likely to employ in order to adapt to scarcity.

All of the indices highlight important aspects of water scarcity. None of them should be used to the exclusion of others; rather they complement each other. The interesting part is the way they mirror a growing and changing perception of the complexities involved in water management.

But how do you measure an entity like social adaptive capacity in regard to water scarcity?

A Social Water Stress Index

If you think that the capability of a society to respond to difficult challenges depend on factors such as, for example, distributional equity, political partici-

pation, access to education (all of them very likely important to foster commitment, and political loyalty of the population) – then there already exists a very appropriate and widely accepted indicator, namely the UNDP Human Development Index.

The human development index measures the average achievements in a country in three basic dimensions of human development – longevity, knowledge and a decent standard of living. A composite index, the HDI thus contains three variables: life expectancy, educational attainment (adult literacy and combined primary, secondary and tertiary enrolment) and real GDP per capita (in PPP$).

If you construct a water scarcity index by taking the equally widely used first-generation water scarcity index of per capita availability of renewable fresh water (or its inverse, the number of people per flow unit), and *dividing* it with the HDI (and some arbitrary but common correction factor) you will get a *Social Water Scarcity Index* (SWSI) which not only would serve to high-light the importance of a society's social adaptive capacity facing the challenges of water scarcity, but also gets rid of some annoying anomalies in that first-generation index.

As an example, the SWSI index will no longer classify countries such as South Korea, Mauritius, Poland, Iran, Cyprus, United Kingdom, Belgium, and Peru as water-stressed. Due to their higher social adaptive capacity (as measured by a higher HDI) they will now be classified as relatively sufficient (at present). Countries such as the United Arab Emirates and Oman will move from water-scarce to "merely" water-stressed. On the other hand countries such as Niger, Afghanistan, Burkina Faso, Eritrea, and Nigeria will move from "relative sufficiency" to "water stress"; and a country such as Ethiopia will move from "water stress" to "water scarcity", in all cases due to their low adaptive capacity as measured by the HDI.

The SWSI also seems to be able to shed some light on the anomaly of Israel being able to maintain a high level of modern society, in spite of both of them being classified as "beyond the barrier" according to the first-generation water-scarcity index. According to the SWSI Israel is "merely" water-scarce, due to its high level of social adaptive capacity. A similar change of category goes for Tunisia, while Egypt is moved from "water scarcity" to "water stress", if you take social adaptive capacity into account. (Ohlsson 1998)

Testing the value of the concept

The Social Water Stress/Scarcity Index is just an illustration, not a proof, of the viability of a concept like social water scarcity. In order to prove its value, it has to be tested. Anthony Turton has drawn up the lines of an intriguing collaborative research project in the SADC area, southern Africa (Turton & Ohlsson 1999).

The basis for the project is to describe the two pillars of adaptive capacity (or the stock of social resources available in the society under study). One pillar is

what Turton terms the *social component* of adaptive capacity. It is largely endogenous, existing in the ”hearts and mind” of the governed and cannot be artificially created. The other pillar, the *structural component* of adaptive capacity, however, is partially exogenous and can be assisted by foreign technical and financial support in the form of ”capacity building”.

We chose to study Water demand management practices as the empirically testable manifestation of the adaptive capacity of a society striving to accomplish both natural resource reconstruction *and* fulfil the development expectations of its population. We hope to show some light on the conditions under which “structurally-induced water abundance” could be accomplished, in spite of a chronic first-order resource scarcity.

We look very much forward to testing these ideas shortly in the southern African context, and would much like to get into contact with colleagues who may find something of value in them for their own purposes, in that region or elsewhere, for mutual benefit.

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