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The Security of Water Resources

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ABSTRACT

In considering the security of water resources two concerns arise. Firstly, how water is envisaged seems to strongly influence water management decisions. Water being framed chiefly as inputs into economic production and urban water supply drives the dominance of dams and pipes. This perspective deflects from water having value and functionality beyond utility as an economic and social input. Water is multi-functional within interconnected socio-environ-ecological spheres. Therefore, the second concern relates to how water is managed so as to develop the conditions for water security. In this context, recognising the multi-functionality of water requires protecting to stimulate conditions of water security. Protecting water, it is argued, requires reflection on current processes and a re-defining of water management criteria. This is the challenge for policy makers. This paper reviews the water governance literature to evaluate emerging 'new water paradigm' approaches, such as the water soft path, in the context of developing water security.

Keywords: Water Security, New Water Paradigm, Water Governance

1. Introduction

In this paper, water security refers to the protection of water resources as an entire entity. This position requires some explanation. Firstly, water resources as an entire entity refers to all water; as surface and groundwater flows and stores, biological and atmospheric flows and stores.

Furthermore, as water circulates within and throughout these spheres it has biophysical, social, cultural and economic utilitarian relationships with the environment and society: for example, as rainfall and soil moisture for vegetation, as input into socio-economic cycles, and as support for recreational activities such as fishing and sailing (Budds *et al.*, 2014; Linton and Budds, 2014). Secondly, water security involves the protection of these waters from impacts which may produce threats to the quality and/or availability of water resources for use by the environment and society. Such threats may develop from climate change and drought, human related environmental degradation leading to increased turbidity and salinity, decreased river flows from dam constructions, disproportionate abstractions from rivers and aquifers, and urban and non-urban source pollution of water cycles (Cook and Bakker, 2012; de Fraiture *et al.*, 2010; Gleick, 2000; Nilsson and Renöfält, 2008; Rijsberman, 2006; Ryder *et al.*, 2014; Ward and Pulido-Velazquez, 2008).

In an attempt to understand issues relating to water security and potential opportunities to protect water resources, this paper reviews two related concepts: how water is envisaged and the connection to water security; and, the emerging 'new water paradigm' as an alternative approach to the security of water resources. The new water paradigm refers to a change in water management perspectives from a solely infrastructure and engineering based supply management approach of dams and pipes to a more environmentally friendly approach (Pahl-Wostl *et al.*, 2011), as well as broader demand management approaches for developing water efficiencies through innovative technologies such as dual flush toilets, and water use such as water recycling (White and Fane, 2001; Brooks and Brandes, 2011; Schoeman *et al.*, 2014).

In the first instance this paper briefly refers to the importance of water visions such as economic and environmental as well as socialised water; referred to as hydrosocial (Linton and Budds, 2014). The paper proceeds to consider water security in terms of protecting water resources as an entire entity, in all its configurations, by reviewing the proposed 'new water paradigm' as a shift from water management to water governance via the water soft path, in terms of shifting from the 'supply' of water to managing the demands for water through water use efficiencies, technological innovation and public-private collaborations (Brooks and Brandes, 2011; Gleick,

2002; Linton and Budds, 2014; Wolff and Gleick, 2002) as providing opportunities to structure pathways through the management of social change (Goldstein *et al.,* 2012) toward the protection of water resources. This paper ends with concluding comments and a suggestion for further research.

2. Water Visions

Rubenstein *et al.,* (2009) suggest how water resources are envisaged and initially framed influences how water is managed. From an economic development perspective, for example, the utility of water is viewed as an input into socio-economic production and growth, and higher standards of living supported through supplies of water (Ripl, 2003; Schmidt, 2014). This in turn reinforces the traditional perspective for water infrastructure such as dams and pipes to satisfy development and urbanisation (Wolff and Gleick, 2002). The issue with this view is that water is no more than a physical attribute external to society (Linton, 2011).

The values attributed to water can extend beyond the economic through to social, cultural, spiritual and recreational (Agnew, 2011; Bark, *et al.,* 2011; Linton and Budds, 2014; Strang, 2010; Wallace *et al.,* 2003; Wilson, 2014). An emerging vision of water with the potential to encompass multiple waters and significantly influence the direction of water security is the hydrosocial concept. This perspective provides a broader view of the utility of water as an entire entity. That is, water cycles occur within complex interconnected social-cultural-economic-political processes. As such the concept refers to the view of water and society mutually affecting change whereby water influences and shapes social processes which in turn shape the conceptualisation of water (Budds *et al.,* 2014; Linton and Budds, 2014). In this sense, hydrosocial waters are social constructions influenced by the diverse values and meanings bestowed upon water as an entity. So with water security in mind, the hydrosocial cycle provides a broader appreciation of multiple waters along with the biophysical hydrological cycle (Budds *et al.,* 2014; Linton and Budds, 2014; Wolff and Gleick, 2002; Linton, 2011).

Human activities and environmental systems and processes rely on access to water resources in all spatial and temporal regimes (Bark, *et al.,* 2011; Brooks and Brandes, 2011; de Fraiture *et al.,*

2010; Pretty, 2008; Ryder *et al.*, 2014). It is so important to life that it has been referred to as the 'bloodstream of the biosphere' (Ripl, 2003). As such, water as a 'bloodstream' supports the health, well-being and sustainability of environmental processes, ecosystems and biodiversity providing ecological services through processes such as rainfall and soil moisture, as well as the functions and stability of society through the supply of potable water (de Fraiture *et al.*, 2010; Pereira *et al.*, 2002; Perry, 2007; Ripl, 2003; Ward and Pulido-Velazquez, 2008).

Water visions may not always have a positive influence. A negative water vision affecting the security of water resources is identified by Falkenmark (2003, 2038) in that available water is 'taken for granted'. This relates to freshwater sources being envisaged as abundant and renewable. Merging these notions together may lead to the conclusion that water, as a physical entity, will always be available for the user to exploit at will. From a water management perspective this position may provide a false setting in which historical references to plentiful sources of water are applied to water management decisions. That is, the historical record of regular river flows and secure water supply creates a vision of an unchanging, albeit fluctuating, availability of water which determines the predictions for future water availability in order to satisfy demands for economic growth and increasing populations (Milly *et al.*, 2008). Continuance of such a vision of water being abundant and freely available for exploitation may diminish the opportunities for water security, as illustrated by the expressions of concern over the scarcity of available water resources (Cook and Bakker, 2012; Falkenmark *et al.*, 2007).

With the protection of water in mind, therefore, a clear understanding of what waters are being protected is necessary (Cullen, 2004). Water can no longer be viewed from one perspective: it has histories and is utilised in multiple ways (Schmidt, 2014). Recognising diverse water visions such as spiritual waters of indigenous people (Wilson, 2014), and broad hydrosocial and cultural waters (Linton and Budds, 2014) allows acknowledgement and appreciation of the many waters within interconnected socio-environment relationships (Molden *et al.*, 2010). In this sense, engaging with multiple water values in terms of how people relate to and experience water may stimulate and promote considerate and effective water security (Budds *et al.*, 2014; Linton and Budds, 2014; Schmidt, 2014).

3. New Water Paradigm

The concept of water security has evolved over time and will continue to evolve as new appreciations and understandings of multiple waters as well as the management of water develops (Cook and Bakker, 2012; Hall and Borgomeo, 2013). In this regard, the management of water as an object of the hydrological cycle and/or as an 'input' through the development of physical infrastructure to control and manipulate water resources for socio-economic growth and development is being questioned as the sole means of securing water resources for current and future use. This represents a transformative shift from water management, in terms of the control and manipulation of water for socio-economic processes, to water governance in terms of engaging with diverse water users and corresponding values (Bakker, 2012; Schoeman *et al.*, 2014). Recognising the diversity and complexity of water visions necessitates consideration of creative and non-traditional water governance processes. Such a shift in perspectives reflects the impetus in a call for a proposed new water paradigm reflecting a more non-structural approach to governing the complexities of multiple waters (Agnew, 2011; Bogardi *et al.*, 2012; Gleick, 2000; Linton and Budds, 2014; Pahl-Wostl *et al.*, 2011; Schoeman *et al.*, 2014; Wallace *et al.*, 2003).

Moving to a water governance perspective is not without its own challenges. For example, there is no consensus of what governance means (Adhikari and Tarkowski, 2013; Araral and Wang, 2013), although Rhodes (1996) indicates governance is not government, per se, but rather a practical process for collective actions 'steering' society (Tropp, 2007, 21). From this, good governance can be considered, broadly, to incorporate an interconnected whole-of-community perspective stimulating the development of supportive social infrastructure. In this context, good water governance may function as a deliberative democracy incorporating partnerships between local and state stakeholders and featuring notions of equity, accountability and transparency (Akamani and Wilson, 2011; Beer, 2014; Rubenstein *et al.*, 2009). In this, a holistic understanding of the values and meanings attributed to water may develop and, thereby an acknowledgement of 'water histories' (Schmidt, 2014, 230). Such a governance relationship may provide pathways for a more collaborative discussion between local and state stakeholders and acceptance of water governance and water security objectives (Pahl-Wostl *et al.*, 2011).

However, in managing all of the water visions and user dynamics and increasing water demands two further challenges need to be confronted. The first challenge concerns balancing the provision of water for continued socio-economic growth and human quality of life, on one hand, and for healthy ecosystems which provide ecological services for society, on the other hand: given that accessible freshwater resources are currently pushed to their 'supply limits' (Bakker, 2012; Gleick and Palaniappan, 2010). And in doing so the second challenge which arises is that due care will be required to ensure 'working rivers' are not 'worked to death' (Falkenmark, 2003). In this context, equity is argued to be important within a water governance 'mix' to reduce injustices for current and future users, including the environment. This implies greater engagement of, and with, water users and recognition of the multiple water visions for negotiated and agreed solutions to emerge within a broader water governance approach that incorporates equity and co-governance of interconnected processes (Bakker, 2012; Schoeman *et al.,* 2014; Wallace *et al.,* 2003).

Schoeman *et al.,* (2014) suggest that the emergence of the new water paradigm incorporating a greater focus on water governance rather than traditional water management is in some way a response to the acknowledgement of the 'Anthropocene' era. The Anthropocene reflects the dominance and influence of humanity upon the earth's resources and environment to overcome increasing urbanisation and escalation of industrial and agricultural production (Gleick, 2000; Pahl-Wostl *et al.,* 2011). As a response to humanity's impact, an ecosystem-based perspective focused on the conservation of water resources exists within the new water paradigm. The goal is thus to integrate water and land resources and society together as an interconnected socio-ecological unit (Gleick, 2000; Schoeman *et al.,* 2014). One approach considered within the new water paradigm which may provide a broad water governance perspective is the 'water soft path' (Brooks and Brandes, 2011; Gleick, 2002; Wolff and Gleick, 2002).

3.1 *Water Soft Path*

In moving from water management to water governance, the emerging 'water soft path' may illustrate good water governance in terms of transformative water security outcomes. That is, traditional water management can be viewed as a 'water hard path' in that the supply of water is

moulded or ‘engineered’ to ‘fit’ society’s utilitarian or instrumental conceptualisation of the value of water. Thus the traditional water management is a supply management dominated ‘hard path’ of dams and pipes to capture and transport water. In contrast, the ‘water soft path’ viewpoint emphasises a demand management approach by adapting society’s development to ‘fit’ the water resources regime (Brooks and Brandes, 2011; Falkenmark, 2003; Gleick, 2000; Gleick, 2002; Wallace *et al.,* 2003; Wolff and Gleick, 2002).

Demand management of water resources can stimulate innovations in processes and technological efficiencies by addressing how water is experienced and engaging with the values attributed to various waters such as with the hydrosocial cycle (Budds *et al.,* 2014; Linton and Budds, 2014). In this sense, water may be more efficiently used leading to increased conservation and water savings. Several water efficiency approaches are evident in Australia, for example, adopting leakage control measures for urban water infrastructure, water saving appliances, and domestic rainwater harvesting and recycling (White, 2001; White and Fane, 2001). The effects of the Millennium Drought seemed to have heightened attention towards water use efficiencies (Head, 2012; Grant *et al.,* 2013). For example, in the Lower Hunter region of NSW, adoption of ‘Water Wise Rules’ (State of New South Wales, 2014, 37) is a demand management strategy aimed at greater water use efficiencies and the conservation of water, as well as a proactive strategy against future drought conditions. The rules are promoted as ‘common sense actions’ such as using trigger nozzles on hoses and restricting watering of gardens and lawns to early morning and late afternoon.

Furthermore, the demands for water can be managed more effectively to create greater efficiency such as adopting a ‘fit for purpose’ perspective for matching water, in terms of quality, to specific uses. For example, irrigation of parks and golf courses can be completed with water of lower quality and recycled water rather than potable water. Thus, freshwater sources and potable water quantities can be protected to some extent thereby relieving some of the pressure to find ‘new’ water sources. As such, investments in bigger dams and deeper bores to access deep aquifers in the search for new water supplies can be reduced. And with less dams: less environmental costs (Brooks and Brandes, 2011; Gleick, 2000; Wolff and Gleick, 2002).

It should be noted, however, that the water soft path is not a radical change to the water management 'hard path' reliance on physical infrastructure. Rather it is based on small incremental steps to less environmentally intrusive means of managing water resources. Therefore, the water soft path perspective involves a process. As such, a plurality of soft paths, for example water recycling, water conservation and water saving, may formulate a broader water governance perspective recognising and incorporating social and cultural water values and multiple uses of water. As well, soft paths promote a move away from environmentally and ecologically damaging construction of dams and assorted physical infrastructure as the principle water management strategy. In this sense, the soft path advocates a shift from the supply of water to managing the demands for water through water use efficiencies such as economic incentives and technological innovation, and public-private collaborations to facilitate transitions to environmentally friendly non-structural water management strategies as guiding principles (Brooks and Brandes, 2011; Gleick, 2002; Wolff and Gleick, 2002).

A challenge for the soft path is to stimulate conditions for sustainable water resource use and environmental, ecological and community well-being while addressing the increasing demands for water resources due to population growth and increasing economic development (Cullen, 2004). The Netherlands approach of 'accommodating water' whereby water is socialised within water and spatial planning processes (Wiering and Immink, 2006, 423) rather than trying to mould it to imposed configurations may provide some direction. In this context, the soft path views water as a service, a means to achieve particular tasks within environmental and socio-economic processes, not an end product (Brooks and Brandes, 2011).

Water soft path planning can be considered as a long-term demand management strategy for efficient water use allowing for greater water conservation and savings transitioning into greater security of water resources (Cook and Bakker, 2012; de Fraiture *et al.,* 2010; Hall and Borgomeo, 2013; Rijsberman, 2006; Ripl, 2003). Thus, water security is more than merely secure water storage and water supply: it is also about the security of water resources as an entire entity encompassing all of its functions, configurations and values. Adopting a water soft path by

modifying human water demand regimes to fit catchment water resource regimes may provide conditions for greater water security (Rijsberman, 2006; Wolff and Gleick, 2002). In this context the challenge for the water soft path may not be great as first imagined as water users become directly responsible for achieving water use efficiencies and savings. Such an undertaking will have direct impacts on policy decisions and strategies (Brooks and Brandes, 2011; Cook and Bakker, 2012; de Fraiture *et al.*, 2010; Hall and Borgomeo, 2013; Rijsberman, 2006; Gleick, 2002; Wolff and Gleick, 2002).

4. Conclusion

Water flows in many directions within the hydrological and hydrosocial cycles. It carries many values ranging from economic, ecological, indigenous, cultural and social. As such the myriad of values and visions attributed to water reflect its flow as a bloodstream in the interconnected social, environmental and ecological spheres. For water security to be realised, the complexities of water visions and multi-functionality need to be understood before water resources can be protected.

No longer can the environment or society endue a singular perspective managing water resources and expect water security to emerge. Water management's focus on supply rather than demand has dominated approaches to water resources and driven the construction of dams and pipes. Although traditional water management focusing on infrastructure has provided security of water supply in the past to urban areas and economic processes, over allocation of water resources and extensive environmental degradation have been by-products and pose a threat to the security of water resources.

The management and protection of water resources needs re-evaluation. A water soft path governance approach to water resources may provide some promise in moving from an infrastructural-centred supply management regime to a broader demand management perspective. Water soft paths may provide the direction to envisage water differently by recognising the multiple values of water within and throughout diverse social, economic, and environmental spaces. In doing so, the soft path advocates a more environmentally friendly

approach to water governance by focusing on the management of water demands leading to improved water saving and conservation outcomes thereby reducing the need for the construction of additional physical infrastructure and, in turn, increasing opportunities for water security. It is suggested that the promises of the new water paradigm and the soft path provide fertile ground for further research.

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