



Reductionist and integrative research approaches to complex water security policy challenges



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ABSTRACT

This article reviews and contrasts two approaches that water security researchers employ to advance understanding of the complexity of water-society policy challenges. A prevailing reductionist approach seeks to represent uncertainty through calculable risk, links national GDP tightly to hydro-climatological causes, and underplays diversity and politics in society. When adopted uncritically, this approach limits policy-makers to interventions that may reproduce inequalities, and that are too rigid to deal with future changes in society and climate. A second, more integrative, approach is found to address a range of uncertainties, explicitly recognise diversity in society and the environment, incorporate water resources that are less-easily controlled, and consider adaptive approaches to move beyond conventional supply-side prescriptions. The resultant policy recommendations are diverse, inclusive, and more likely to reach the marginalised in society, though they often encounter policy-uptake obstacles. The article concludes by defining a route towards more effective water security research and policy, which stresses analysis that matches the state of knowledge possessed, an expanded research agenda, and explicitly addresses inequities.

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1. Complexity: the fault-line of water security research

A 2012 review of water security research categorised it as either narrow and discipline-specific, or broad and integrative (Cook and Bakker, 2012). The authors demonstrated how the narrow framings facilitated uptake into policy, and convincingly argued that they would be usefully complemented by the broader framings, in order to ensure that “robust governance processes

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[serve] to mediate the trade-offs between different stakeholders, scales, and uses of water” (Cook and Bakker 2012: 98).

Four years and many peer-reviewed water security articles later, there is very little evidence of such blended water security research or policy. What may be observed instead is a drifting apart and entrenching, as in the recent water security debate in *Science* that posits environmental solutions against infrastructure solutions (Muller et al., 2015; Palmer et al., 2015). Others have noted that the concept of water security is ‘popular but contested’ (Pahl-Wostl et al., 2016), called for its reframing (Tarlock and Wouters, 2010), or labelled the contentions as a ‘battleground of ideas’ (Zeitoun et al., 2013). The dissonance is evident from the contradicting and growing number of definitions of water security shown in Table 1.

The addition of the term ‘security’ to ‘water’ originally raised hopes as well as concerns amongst water research and policy communities. The hopes stemmed from the belief that the term might shake up staid thinking, which had not moved far from decades-old debates about the utility of the Dublin Principles, or the management paradigm of Integrated Water Resources Management (see e.g. Hepworth, 2009). The concerns were that the term would invite ‘securitization’ of water by national military-political apparatuses, which threatened to place water resource management decisions beyond the reach of normal politics (see Oswald Spring and Brauch, 2014)—though this has not developed in any meaningful way.

Even with securitization concerns allayed, however, the extent to which the term ‘water security’ has served to invigorate water research and policy communities is questionable. The term may still lead to broad, interdisciplinary and inclusive approaches, with security understood in the sense of reliability, adaptability, and freedom from fear. Alternatively, ‘water security’ could be understood in terms of predictability and control, and serve only to re-brand out-dated ideas. This article asserts that if the water security community is to take full benefit of the interest renewed by use of the term, it should debate the epistemological roots of the fault-line between the two outcomes. The fault-line is in the approach that different parts of the water security research

community approach and consider the complexity of water-society challenges.

For all practical research and policy purposes, that complexity is partially composed of the nonlinear functioning and coupling of the many political, technological and biophysical processes that weave water and society together (see Grafton et al., 2013). A second source of complexity of water-society challenges comes from the uncertainty of future water availability and demand, which are themselves driven by inter-woven and constantly changing geo-political, economic, demographic, and climatic processes (see Milly et al., 2008).

Limiting its review to literature that employs the term ‘water security’ with specific intent, this article categorises two major research streams on either side of the complexity fault-line. It finds that the clearest research messages and policy recommendations currently on offer come from a ‘security through certainty’ stream that seeks to reduce the complexity through quantified risk-analysis and simplifying assumptions about national economy, hydro-climatology, and society. Policy options ensuing from an uncritical uptake of recommendations derived from this first, ‘reductionist’, approach may exclude a number of tested or innovative solutions, be poorly-equipped to deal with non-stationary environmental conditions, and offer little to the most vulnerable communities. Indeed, the approach risks relegating the communities to collateral-damage status or, more perniciously, accord them the blame for their own water insecurity.

A second stream of research integrates several uncoordinated tributaries that follow a general ‘security through pluralism’ approach, which is more comprehensive in the methods employed to understand the water-society processes, and more socially-driven and adaptive in dealing with the broadened set of uncertainties that are considered. Research carried out under this ‘integrative’ approach to complexity introduces novel policy options and takes advantage of the myriad context-specific techniques and solutions already in place. This latter approach currently has less reach into global water policy fora, primarily because the context-specific solutions are not readily translatable. The article concludes by defining a route towards more effective water security research and policy, which stresses the use of

Table 1

Contrasting definitions of water security. For more comprehensive reviews see Cook and Bakker (2012) and van Beek and Lincklaen Arriens (2014).

Notes	Definition of water security	Source
The Hague Ministerial Declaration on Water Security in the 21st Century had social equity and the environment at its heart:	<i>ensuring that freshwater, coastal and related ecosystems are protected and improved; that sustainable development and political stability are promoted, that every person has access to enough safe water at an affordable cost to lead a healthy and productive life and that the vulnerable are protected from the risks of water-related hazards</i>	The Hague Ministerial Declaration (2000)
By far the most cited definition of water security seeks to be comprehensive from within an otherwise reductionist qualitative ‘acceptable risk’ framing:	<i>the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies</i>	Grey and Sadoff (2007: 569)
An equally all-encompassing working definition that will have widespread use in global institutions:	<i>the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability</i>	UN-Water (2012b: vi)
Within a framework designed to support the implementation of ‘pro-poor’ projects, water security is narrowed to:	<i>reliable access to water of sufficient quantity and quality for basic human needs, small-scale livelihoods and local ecosystem services, coupled with a well managed risk of water-related disasters</i>	WaterAid (2012: 6)
The working definition of water security for the Department for International Development maintains the component of equity:	<i>sustainable and equitable access to water of appropriate quantity and quality for all users (e.g. for drinking water & sanitation, agriculture, energy, industry and ecosystems) whilst reducing the impacts and costs of water shocks and stresses including floods, droughts and pollution to an acceptable level</i>	Penrose (2012)
The most succinct definition eschews comprehensiveness and equity for a reductionist ‘tolerable risk’ framing:	<i>a tolerable level of water-related risk to society</i>	Grey et al. (2013: 4).
Acknowledging contrasting objectives of groups with inequitable influence, “divergent water securities” has been suggested as:	<i>an intrinsically relational, political and multi-scale issue of both water access and control that takes shape in contexts of unequal power relations</i>	Boelens and Seemann (2014: 3)
Directly tackling complexity and uncertainty, an adaptive management perspective sees water security as:	<i>the sustainable availability of adequate quantities and qualities of water for resilient societies and ecosystems in the face of uncertain global change</i>	Scott et al. (2013)

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