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Water security: A review of place-based research

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ABSTRACT

Water security has emerged as a major framing template in environmental governance and resource management. The term and underlying concepts have attracted the attention of governmental and nongovernmental organizations, private industry, and the academy in policy and practice. Notwithstanding the palpable rise in its use, a comprehensive understanding of how water security is conceptualized and employed in different contexts around the world is limited. We aim to address this gap, by assessing how water security is considered, articulated, and operationalized in place-based studies. We employ a two-part methodological approach that includes (1) a systematic analysis of 124 articles, books, and book chapters published between 2010-2015 using a standardized coding framework to examine trends and patterns in place-based water security research, and (2) an analysis of the treatment of governance as a subset of this body of research to reveal how water governance is framed and understood in place-based water security scholarship. We find broad diffusion of water security across geographic regions and scales, expansive framing of water security, and evolving approaches to indicator formulation. The narratives around future pathways for governance practices include the promotion of participatory processes, solutions that engage both quantitative and qualitative methods, and a mix of both hard- and soft-path approaches to achieve water security. The persistent diversity in perspectives and applications of water security suggests that scholars adapt the concept to the contexts of the cases they are studying. The variation in how water security is utilized in different regions and spatial scales underscores the importance of incorporating *community context* in how we understand and employ water security. By empirically assessing the diversity and utility of water-security analyses, highlighting regional differences, and tracing evolving conceptions over time, our research can inform future project design, policy-making, and management from the international to the local levels.

1. Introduction

Since the 1990s, the concept of water security has served to articulate concern about issues such as reliability, quality, quantity, safe and equitable access, and environmental provisioning of water supplies. The notion has been increasingly employed in policy circles, from the World Wildlife Fund and the World Economic Forum to the United Nations (UN) (WWF, 2009; UNEP, 2009; WEF, 2011; UN-Water, 2013; UNESCO, 2013). Alongside the surge in policy usage, researchers have increasingly adopted water security as a framing device and worked to further define and apply the concept in peer-reviewed research (e.g., Cook and Bakker 2012, 2016; Gerlak and Mukhtarov, 2015; Zeitoun et al., 2016). Despite recognition of the growing use of water security as conceptual scaffolding in case-study research, understanding of the scope and extent of these examinations is limited. This review provides needed insight to understand the utility of place-based water security research for communities and other stakeholders.

A systematic review and comparative approach can complement earlier research and reveal new lessons about the application of water security around the world. To appreciate these trends across geographic space, we devise and employ methods to understand how water security is considered, articulated, and operationalized in peer-reviewed research. We seek to determine how different authors employ the term "water security" *in situ*, and how their analyses and interpretations vary according to the geographic regions they are studying and the aims of their research. Our data analysis, drawing on previous research, is guided by the proposition that water security definitions have been found to vary by geographic region, with particular definitions arising

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in contexts with acute water security concerns (Cook and Bakker, 2012). Here we further expand to consider geographic and scalar variability in the metrics of water security.

We analyze place-based case studies that use an explicit water-security frame — and that acknowledge this in the title, abstract, introduction, or other direct exposition—within the architecture and design of their studies. In geographical literature, "place" is important to how people experience and understand both society and nature (e.g., Agnew, 1989; Jessop et al., 2008). Place and context are also recognized as key to understanding the practice and politics of water governance (e.g., Ingram, 2011; De Boer et al., 2013).

We systematically analyze an ensemble of peer-reviewed studies from 2010 to 2015 (N = 124) to assess patterns and trends in place-based water security research. Employing a standardized coding framework, we interrogate the geographical context, and associated themes and scales of the studies. We ask: How is water security defined? At what geographical and spatial scales? Water security for humans or ecosystems? What sources of water? How is water security measured? How is water governance understood?

To answer these questions, in the Methods section below, we detail our analytical criteria and methodology. In Sections 3 and 4 we present our findings. Based on recommendations of social-science scholars, we expect authors assessing place-based water security case studies to pay attention to defining concepts (Gerring, 2012). Earlier research has highlighted water security as a contested concept (Pahl-Wostl et al., 2016), open to multiple interpretations (Zeitoun et al., 2013) and meanings across disciplines and methodological approaches (Cook and Bakker, 2012). Following, we anticipate contestation in how water security is interpreted, conceptualized, and operationalized across place-based studies and how water governance is framed and understood in this body of research. In Section 5, we discuss how place-based water security research is contextualized and in Section 6, we offer conclusions on the operationalization of water security and connect to broader water governance and water security debates. The persistent diversity in perspectives and applications of water security that we uncover suggests that scholars adapt the concept to the contexts of the cases they are studying. This variation in how water security is utilized in different regions and spatial scales underscores the importance of incorporating *community context* in how we understand and employ water security.

2. Methods

We conduct a systematic review of case-study literature, adopting an explicit search protocol, to investigate patterns and trends in place-based water security case research (Cox, 2015). After reporting the findings from our large-N study (N = 124), we conduct an additional analysis of the treatment of governance as a subset of this body of research (N = 31) to reveal how water governance is framed and understood in place-based water security scholarship.

2.1. Data source and case selection criteria

To review the use and application of water security in peer-reviewed research, we searched for empirically based water-security studies using Scopus, the search engine database. We used Scopus because a) it offers significantly wider coverage of journals than Web of Science and b) it identifies peer-reviewed studies, which are the focus of our analysis. We recognize that Google Scholar − often prioritized by social sciences (Mongeon and Paul-Hus, 2016) − may cast a wider net (Cox, 2015), but the focus of our study is on the scholarly literature. We also recognize that our sample may be limited by the fact that we searched for publications in English only.

We queried the database with the keyword phrase "water security" for articles, books, and book chapters published between 2010 and 2015. The search returned 520 articles and 63 books or chapters containing "water security." From the larger sample, we selected empirically-based studies, and then filtered these results using three selection criteria: (1) Is water security a fundamental frame for the case study?; (2) Is there an application of water security in a specific place?; and (3) Do empirical data exist? Articles, books, and book chapters that did not meet all three criteria were excluded. The final sample selected for the systematic analysis included 124 place-based water security cases, or 21% of total texts found in the search (Appendix A presents further details on our methodology and Appendix B provides a complete listing of the studies included in this analysis).

2.2. Coding of cases and data analysis

To analyze the cases and assess the application of water security around the world, we developed a codebook and coding instructions (Appendix C describes our intercoder reliability process). In the quantitative analysis, we calculate descriptive statistics (count [N], frequency, and percent). Contingency tables provide information about emerging scholarship trends over time and identify significant relationships between variables, such as the presence of definitions and indicators to measure water security, and geographic location and spatial scale (Appendix D summarizes statistics of coded items).

3. The expanding landscape of place-based research on water security

Next, we present our findings of place-based research on water security. How water security is framed and operationalized through specific definitions, metrics, and scales, serves to influence how the concept is pragmatically applied on-the-ground making some futures actionable, while precluding others. The scale at which water security is operationalized, the indicators used to measure it, and its object (i.e. humans/environment) also influence who is invited to the table as decision-makers and stakeholders, whose interests are considered legitimate and whose are excluded or ignored. Surveying the diverse mobilization and conceptualization of water security (i.e. the definitions, metrics) across distinct geographies makes important contributions to wider debates around water security.

3.1. How is water security defined?

By design, water security is central to all 124 studies examined. But while the concept may be central, the understanding of what water security means or how it is used as a framing mechanism is not universally shared or even articulated. We reviewed the literature to identify the most prominent definitions (Table 1). We recognize that these characterizations have been developed primarily by scholars and development organizations—rather than by on-the-ground practitioners. These formal definitions tend to accrete attributes over time, suggesting a progression of thinking. In reality, what is happening is that as the topic becomes more central to water management and policy, discourse over its nature is expanding and becoming more diverse. The evolution of the definitions themselves may not necessarily capture the core meaning or influence of the discourse itself. Still, insofar as there exists a suite of such definitions, we considered it important to look closely at the ideas they encapsulate (Table 2) and to determine which of those are cited in the studies in our sample.

We learned that nearly half (56 or 45%) of the studies fail to offer an actual definition of how the concept is understood or employed. The remaining 55% (68 studies) employ a variety of definitions that generally share core attributes, but add specific ones according to relevance. Of the studies articulating a definition, about 60% (41 studies) present ones by that study's author(s) thereby, ignoring established and previously-cited definitions. The remaining 40% (27 studies) use definitions formulated by other authors in earlier research. In the papers reviewed, Grey and Sadoff's (2007) definition of water security is the