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Water worlds: Introduction to the special issue of *Social Studies of Science*

Jessica Barnes
Yale School of Forestry & Environmental Studies, Yale Climate & Energy Institute, New Haven, CT, USA

Samer Alatout
Department of Community and Environmental Sociology, University of Wisconsin, Madison, WI, USA

Abstract
The use and management of the world's freshwater has become a critical focus of scholarly engagement. In the introduction to this special issue on water worlds, we highlight two contributions that science and technology studies offers to recent conceptualizations of water relations. The first emphasizes the multiple ontologies of water, resulting from its varied enactments in different sociotechnical assemblages. The second underscores water as a substance that does not merely mediate relations between existing social groups, but constitutes a necessary material for the organization of life in late modernity.

Keywords
hydropolitics, society–environment relations, water, water ontologies

Water flows through our lives. It quenches thirst, sustains crops, generates power, cools industry, carries ships, disposes waste, and maintains ecosystems. Where the flow of water is reliable, clean, and plentiful, it fosters growth; where the flow is too much, too little, or too dirty, it wreaks havoc. The use and management of the world's freshwater has therefore become a key contemporary issue: a topic of intense political debate and popular concern, and a focus of considerable scholarship within the social sciences.

This literature has yielded rich insights into how we understand water. We now recognize water to be much more than something that falls from the sky as rain, runs through

Corresponding author:
Jessica Barnes, Yale School of Forestry & Environmental Studies, 195 Prospect Street, New Haven, CT 06511, USA
Email: jessica.barnes@yale.edu

rivers, spurts from taps, and laps at shores. Anthropologists have highlighted how deeply embedded water is within social, cultural, spiritual, and political domains (Alley, 2002; Anand, 2011; Kaplan, 2011; Lansing, 1991; Limbert, 2001; Orlove, 2002; Rademacher, 2011). Environmental historians have demonstrated how aquatic features such as rivers are not givens but, rather, are shaped through the intertwining of human and nonhuman natures (Cioc, 2002; White, 1996; Worster, 1992). Geographers have theorized these linkages between water's material and symbolic dimensions in terms of hybridity (Swyngedouw, 2004) and the 'hydrosocial cycle' (Budds, 2008; Linton, 2008), and have emphasized the politics generated by uneven patterns of access to water (Bakker, 2004; O'Reilly et al., 2009; Sneddon and Fox, 2006).

Scholars in the field of science and technology studies (STS) have also increasingly engaged with questions of water (see, for example, Alatout, 2009; Bijker, 2007; de Laet and Mol, 2000; Helmreich, 2011; Lee and Roth, 2001; Pritchard, 2011). This special issue continues these efforts, building on a series of panels that we organized at the 2009 Annual Meeting of the Society for the Social Studies of Science in Washington DC. In their commentaries for this special issue, Karen Bakker (2012) and Wiebe Bijker (2012) highlight several of the themes that run through the five papers and place this work in the context of the wider literature on water. In this brief introduction, we therefore choose not to duplicate those efforts but to underscore two points: the multiple ontologies of water and the necessity of water as an object for the study of the social. By focusing on these two interventions, we make a case for the valuable contribution that STS research can make to scholarship on water. This is not to define an exclusive realm for STS (indeed the contributors of this issue come from a variety of disciplinary backgrounds, including anthropology, environmental history, geography, and sociology). It is, however, to argue that the theoretical and methodological frameworks of STS, including those that the papers in this issue draw on, offer some promising avenues towards a closer understanding of water and water politics.

In a recent review article, Benjamin Orlove and Steven Caton (2010: 401) summarize anthropological approaches to water. 'Anthropologists contribute', they write, 'by seeing water not only as a resource, but also as a substance that connects many realms of social life.' STS scholars can add to this perspective, we propose, in two important ways: first, by looking at water, as Alatout (2010) suggests, as a singular object with multiple ontologies (see Mol (2002) for more on ontological politics); and second, by seeing social realms not as being separate from water, but rather, as being built, at least partially, in and through engagements with water. Water is, we argue, a necessary material for the organization of life in late modernity.

Multiple waters

The papers in this issue cross a number of time frames and geographical areas. What links them is a consideration of how water is multiple, not only in its meanings, but more importantly, in its very materiality. From this perspective, water is not a singular object of epistemology for which abstract knowledge can be produced and circulated in all times and places without interruption. Its properties are not fixed. Rather, water reveals its complex, multilayered biophysical identities for particular enactments (Mol, 2002),

depending on assemblages that are in place or still in the making (DaLenda, 2006; Delueze and Guattari, 1987). As a result of the assemblages in which it finds itself, water can be and become a border, a resource for regeneration, a foundation for empire, a means of nation building, and a material linkage between past and present. In the recent history of Israel and Palestine, for example, water has at different moments in time been a historical object, a territorial object, and a biopolitical object, with implications for diverse ontological politics (Alatout, 2010).

This multiplicity, and the tendency of different groups to highlight disparate dimensions of water's biophysical makeup, plays into the kinds of social and political relations that evolve around water. Drawing a linkage between water, the technologies used to capture, cleanse, and distribute it, and society raises familiar questions for STS research on the material effects of biophysical and technical objects. The danger for STS scholars has always been falling into the explanatory traps of environmental determinism (where water itself is seen as the sole or most important determinant of social organization) or technological determinism (where water technologies are seen as having their own internal developmental logics, which not only effect technological change, but also effect certain types of sociopolitical organization). A naive realism, which ignores four decades of research on social and discursive construction within technoscience, also has its pitfalls, as does the social constructionist thesis, in which the biophysical properties of matter (nature and technologies) are seen as indefinitely manipulable through social dynamics. To avoid these deterministic excesses, the authors of the articles in this issue adopt a number of different approaches to describe the many relationships between water, technology, environment, and society. These include actor-network theory, and systematic uses of the idioms of co-production and boundary objects. Through a set of case studies, the papers present water and the technologies, management paradigms, expertise, organizations, and governance regimes that attempt to organize and harness it, not as pre-existing or determinate factors, but as mutually produced assemblages.

Patrick Carroll's (2012) article explores how water became an object of governance in late 19th century and early 20th century California. The water in his study of the Sacramento River Valley is multiple in its ontological forms. It is a substance that must be removed from swampy or flooded land, a force that has the power to dislodge material and open up access to mineral deposits, a thoroughfare that can transport ships, and a resource that can be directed onto parched land. As the concerns raised by these different waters coalesced into a singular 'water problem', Carroll shows how they became something that could only be governed on the scale of the state. The paper therefore demonstrates quite explicitly how a socio-political formation – the state – may emerge in and through struggles over managing water.

Jessica Barnes's (2012) article takes the theme of reclamation and looks at its enactment on the borders of Egypt's cultivated zone. Here the water flows through canals and up through pumps in its pathway to the desert. The process of diverting Nile River water to reclaim desert land reworks patterns of water quantity and quality distribution, producing different kinds of water – a bountiful, clear flow in some places and a saline, depleted flow in others. This has profound social and political consequences for the relations within and between farming communities.

Ashley Carse's (2012) article examines the natural infrastructure created in the form of a regime of watershed forest management in an effort to secure a massive flow of water into the Panama Canal. In his discussion, we see how water in a river differs from water in a watershed, and how rainwater that runs over sloping land differs from water that is intended to supply a canal. Each signifies a different framework for dealing with the Panama Canal, and each implies a contrasting set of power relations between the various parties who have a stake in water management in this area.

Chris Sneddon's (2012) article examines the production of technical expertise around a proposed dam on the Mekong River. His paper presents two distinct kinds of water – water that flows down a river versus water that is stored in a reservoir. The potential power of water held behind a dam – or at least, the imagination of that potential – sets the tenor for United States relations with nations in Southeast Asia. Water can be both a geopolitical and a geohydrological object; a matter of political posturing and a matter of hydrology. This amalgam of knowledge about water produces particular relationships between states engaged in a Cold War standoff.

Sara Pritchard's (2012) article similarly focuses on the generation and circulation of expertise around water. Her discussion follows the flux of hydraulic knowledge and technical experts between France and French North Africa in the colonial and post-colonial periods. Water appears in this case in hydrologic surveys, as an object of technical practice, and as a mechanism for capital accumulation. It is not the water itself that moves from core to periphery and vice versa, but the knowledge about how to manage water in both regions. As this expertise flows, it generates new sets of political relationships across time and space.

Scholarship on water can therefore benefit from a close attention to water's multiple ontologies, which is exemplified by the contributions to this special issue. Any one of these liminal ontologies, on its own or in combination, may become convenient, necessary, reducible, and abstractable, at particular times and places and for certain practices or projects. The emergence of these ontologies, and the ways in which they are variously cemented, contested, and discarded is closely tied to the production of social worlds. Thus, just as Karen Bakker (2012: 617) writes in her commentary, water is not an inert 'backdrop to politics', but a substance that is both produced by and productive of political relations. Wiebe Bijker's intriguing proposition that we study societies as 'water cultures' highlights the significance of this substance that permeates all elements of society. With its focus on the ways in which resources are produced and mediated through technological apparatus and knowledge regimes, STS is well placed to contribute to the growing field of water research.

Notes

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Biographical notes

Jessica Barnes is a Postdoctoral Associate at the Yale Climate & Energy Institute and Yale School of Forestry & Environmental Studies. She is currently completing a book manuscript, entitled *Cultivating the Nile: The Everyday Politics of Water in Egypt*, and is developing a new project on climate change, water management, and agricultural policy in Egypt.

Samer Alatout is an Associate Professor at the University of Wisconsin, Madison. He is affiliated with the Holtz Center for Science and Technology Studies, the Department of Community and Environmental Sociology, the Nelson Institute for Environmental Studies, the Graduate Program of Sociology, and the Department of Geography. He has published extensively on water politics in the Middle East. At the moment he is preparing a book manuscript on the subject. He is also conducting research on border environmental politics focusing in particular on the US/Mexico and Israel/Palestine borders.