

Water Sustainability: Anthropological Approaches and Prospects

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Abstract

Water has become an urgent theme in anthropology as the worldwide need to provide adequate supplies of clean water to all people becomes more challenging. Anthropologists contribute by seeing water not only as a resource, but also as a substance that connects many realms of social life. They trace the different forms of valuing water, examine the often unequal distribution of water, explore the rules and institutions that govern water use and shape water politics, and study the multiple, often conflicting knowledge systems through which actors understand water. They offer ethnographic insights into key water sites—watersheds, water regimes, and waterscapes—found in all settings, though with widely varying characteristics. Anthropologists provide a critical examination of a concept called integrated water resource management (IWRM), which has become hegemonic in the global discourse of sustainable development.

INTRODUCTION

Total social fact:

Marcel Mauss's idea to talk about social phenomena that cut across virtually all domains of society

Connectivity:

the articulation of the multiple social domains in which water is used

We propose to study water as a “total social fact” (Mauss 1990). Although Mauss had prestations or “service exchanges” principally in mind when he spoke of the total social fact, he did not limit this kind of fact to them. It suffices that

in these ‘total’ social phenomena, as we propose calling them, all kinds of institutions are given expression at one and the same time—religious, juridical, and moral, which relate to both politics and the family; likewise economic ones, which suppose special forms of production and consumption, or rather, of performing total services and distribution. This is not to take into account the aesthetic phenomena to which these facts lead, and the contours of the phenomena that these institutions manifest. (p. 3)

In the conclusion of the essay, Mauss explains that in his approach “[one] has the advantage of . . . seeing the social ‘things’ themselves, in concrete form and as they are” (p. 80).

Although we have the tendency to reduce water to a biological fact when thinking about its nature, it is integral, even essential, to many if not most domains or institutions of society—economic, political, religious, leisure, etc., as Strang (2004, p. 5) recognizes in her discussion of the “essentiality” of water. In this way, water is social and total in precisely the encompassing sense that Mauss had in mind. At the same time, water as a social fact takes concrete forms, even though physically and in the abstract we conceive of it as a continuous and homogeneous substance. When washing our bodies, we think of personal hygiene, and yet it matters to us whether water is delivered by a spigot into a bath or by a shower head into a stall whether the spray is strong or weak, sharp or gentle; and let us not even approach the cultural nuances of water temperature and softness. In these concrete forms, water is totalistically connected to the domain of public health and to popular notions of water as an invigorating as well as a

sensually pleasurable substance, as a morning social ritual, and as a political-economic aesthetic (as seen in accessories of showerheads, metal fixtures, shower stalls, bathroom tiles, mirrors, etc.). The choices and meanings are no less complex for a Ugandan farmer, who squats or sits on a low bench, first transferring water (usually, but not always, heated over an open wood fire) from a jerrycan or pot into a plastic basin, and then dipping out the tepid or warm or hot water (using either a plastic cup with a handle or the two hands pressed together to form a kind of scoop) and splashing it over the back and the rest of the body. The farmer may or may not use soap or washing powder; the spilled water may be absorbed by an earthen floor or mopped off a concrete floor.

Mauss was interested in the form or structure that prestations take (the acts of giving, receiving, and counter-giving), which the concreteness of water does not usually have, but it might be said to have a system, although again perhaps not quite as Lévi-Strauss had envisioned in his logico-mathematical model of kinship (Lévi-Strauss 1949). Water connects domains of life such that the water used in one will affect the water used in others, and if the notion of system suggests more integration of these domains than is warranted, perhaps “connectivity” might be a better term for what we seek to define. That is, water connects different domains of social life to each other in ways that are not haphazard or accidental because they depend on each other. Water’s connectivity is mediated by levels of social organizational complexity (Hannerz 1992). Getting water from something as apparently simple as a spigot is, in fact, no simple matter because it depends on a physical infrastructure that is both extensive and complex, not to mention a bureaucracy ranging from the most local unit (a water-user association or a village water works utility, for example) to national authorities and international governance structures such as the World Bank. Water’s management and control also entail legal systems, oversight agencies, and courts of law to regulate water use and adjudicate violations or conflicts.

Less apparent in Mauss's definition, but which we insist is critical to understanding water as a "a total social fact," is what we call the materiality of water. Its molecular properties give it many distinctive characteristics (transparency; incompressibility; chemical neutrality; odorlessness and tastelessness; an ability to exist as a gas, a liquid, and a solid at the temperatures and pressures found on the surface of our planet; an ability to dissolve many substances and to be absorbed by many substances). These properties combine into two key material attributes. Because a given volume of water is fixed by incompressibility but threatened with losses through evaporation, leakage, and absorption by soil, the quantity of water is a crucial matter. And because water can receive so many chemical and biological contaminants, only some of which are readily evident to the human senses of sight, smell, and taste, the quality of water is also a crucial matter. This article, concerned as it is with sustainability, addresses these two aspects, which might seem to be simple universal attributes but which, as we suggest, reflect the highly specific materiality of water in its interactions with human bodies and human-made structures (Hamlin 1990, Orlove 1998, Orlove & Caton 2009). To be sure, quantity and quality are always experienced as social constructions—a recent study (Wilk 2006) traces historical shifts in meanings of potable water in several countries, and another shows the changing concerns over pollution (Beamish 2000)—but they are not only that. Thus, Americans feel the need for a minimum amount of water to sustain their general sense of well-being. These needs are couched in a naturalizing discourse of bodily or societal needs; however, as water becomes scarce in California's Central Valley or in the aquifers under the High Plains, material pressures are put on these constructions, forcing people to begin questioning them and in time perhaps to adopt new water-use practices. The point, however, is not to determine where social constructions end and materialities begin, but to see how complexly they are intertwined. The point may be even more subtle in the case of water

quality, as illustrated in an ethnographic case study by Alley (2002); the water of the Ganges is known to be polluted, but Hindus perform their ablutions in it because of their belief in the restorative powers of Mother Ganga. Sometimes cultural beliefs trump material realities in stunning ways. And as Alley also shows, the point is not to dispel supposedly misguided cultural beliefs in favor of scientific truth (which is contested in any case) but to see that these are always complexly interconnected, thereby affecting how water policy can be implemented.

A widespread tendency exists among anthropologists to locate water's primary locus in the domain of agriculture and to extrapolate widely from this foundation. After all, one of the most influential works in Marxist social science is Wittfogel's (1957) hydrological theory of the rise of the state. Indeed, a focus on the provisioning of water in the agricultural sphere marks some of the most interesting work done in archaeology (Scarborough 2003) as well as in social anthropology (Fleuret 1985; Geertz 1972; Gelles 2000; Glick 1970; Guillet 1998; Ilahiane 1996, 2001; Lansing 1991; Rodríguez 2006; Varisco 1983; Wilkonson 1977). Surely one of the most brilliant ethnographic studies of water provisioning in the agricultural sphere is the analysis of the complex intertwining of Balinese religious ritual and irrigation practices by J. Stephen Lansing (1991). Yet, it is a fact of water's totality that it is extracted from and used in many other spheres besides agriculture, and for many more purposes than irrigation. It circulates through practically all domains of social life, rural as well as urban (Swyngedow 2004, Swyngedow et al. 2002), is handled differently by men and women (Bennet 1995, Bennet et al. 2005, Cleaver & Elson 1995, Elmendorf 1981, Harris 2005, Tortajada 2003), and is important in economic sectors other than agriculture, such as industry, fishing, tourism, and sports.

To name the totality of connections that water may have in any given society, we adopt Hastrup's term "waterworld" (2009a). (We also share Hastrup's sense that many waterworlds, pressed by climate change, growing demand, and social inequality, are in crisis.) This

Materiality (also elementality and essentiality): the physical attributes of water that affect its relation to the human body and environment and that shape its use

Social construction: the meanings and values people give to things so that they can be discussed and incorporated into action

Waterworld: the totality of connections (see connectivity) that water may have in a given society

connectivity means that water can mark the boundaries of groups and communities, defined by shared involvement with water (Orlove 1993). Raffles (2002) offers a particularly rich ethnography of a waterworld, showing how a major waterway has changed over time and has also been imagined as a politically fraught space. A counterexample is Mitchell's widely read book (2002) on colonialism, modernity, and power in Egypt; despite its attention to forms of control of persons, property, and knowledge, this book pays scant attention to the Nile and to the role of water management and regulation in the shifts in political order.

FIVE CENTRAL THEMES IN WATERWORLDS

To sum up the discussion so far, we have remarked on two of the central features of water, its connectivity and its materiality, that ought to be of paramount concern to anthropologists. The totality of connections in any specific case comprises what we call a waterworld. We now suggest that any anthropological analysis of a waterworld ought to be concerned with five principal themes: value, equity, governance, politics, and knowledge.

Value: Natural Resources and Human Rights

How do nature (or environment) and culture (or society) intersect in waterworlds? One way to answer that question is to say that water is valued on the one hand as a resource for human well-being and productive activity, and hence is part of economic systems, and on the other hand as a right that has meaning from its connections to our place as conscious social beings who live in a natural and cultural world, and hence is part of political systems. Moreover, the value of water can be negative as well as positive because of hazards such as flood and erosion, the risks of waterborne diseases, and lesser threats such as rot. And the rights to water are associated with obligations to use water prudently and to support water systems.

Anthropologists are particularly well-suited to consider the ways that water, a substance with specific properties, is understood and used differently in a variety of social settings (Bachelard 1942, Hamlin 1990). The connectivity of water associates it with survival, sanitation, production, pleasure, and other aspects of social life. In Levi-Strauss's term, it is "good to think" (Renne 1991, Shapiro 1995, Sheridan 2002). And water can be also termed "good to experience" (Anderson & Tabb 2002, Orlove 1997). Water is a substance that richly engages the senses (touch, sight, hearing, and taste) as mediated through social products and practices that have specific cultural value, as Limbert (2001) has shown in her beautifully rendered ethnography of the "senses of water" in an Omani town.

Equity: Access and Distribution

How is this valued substance to be shared among the members of a society or the inhabitants of the world? This matter is tied to two other linked issues: of justice, on the one hand, and of political economy, on the other. A crucial concern is the equity of access to safe drinking water for people of all classes, of all ethnic and racial groups, of all ages, and of both genders. The competition among uses and economic sectors is also crucial (Donahue & Johnston 1997). Political scientists have studied the complex factors and strategic interests that shape water distribution within and between nations (Fischer 2006), as well as the consequences of treating water as a commodity and allowing the market to allocate it in the name of efficiency (Whiteley et al. 2008). Peters (1994) offers a telling account of the factors that have led to a grossly unequal distribution of water in colonial and postcolonial Botswana.

Governance: Organization and Rules

How far do institutional economics and economic sociology lead us in understanding the organizations that manage and distribute water? This question is particularly complex for the case of water, with its multiple scales

that link storage facilities with dispersed users. The uneven availability of water worldwide promotes the development of large-scale water-distribution systems. Considerable capital and labor must be invested to build and maintain water facilities. Indeed, recent discussions of common-property resources draw heavily from examples of irrigation works, which have been a locus both of participatory governance (Ostrom 1990) and of state parasitism (Wittfogel 1957). This study of water organization is a particularly promising site for the integration of economic, sociological, and anthropological perspectives on water, as Geertz (1972) noted in his contrast of irrigation in Indonesia and Morocco and as Mosse (1997) describes in his account of the patterning of irrigation institutions in semiarid zones in India. These questions of governance can be particularly important at times of crisis and scarcity, and the uncertainty surrounding the resilience of water supply may be as much a question of governance as it is a question of the physical availability of water (Johnston 2003, Roth et al. 2005, Wagner 2009).

Politics: Discourse and Conflict

How do the three previous questions lead us to understand the struggles to control water in civil society and the public sphere? As Ernst (2003) shows in his study of political conflicts over regulation of Chesapeake Bay, three categories or concepts seem to dominate the analytical talk about water sustainability: conservation, justice, and governance. The term governance is useful, but its association with the notion of management may presume the agreement of all parties on the goals that they share and on the values that they place on water: The debates and conflicts over these goals and values lead us to the sphere of politics. With its propensity to flow, and with its ready partibility, water is almost without exception shared among people and among localities and is therefore linked to collectivities. The organizations that manage water operate within a broader political and regulatory context. These

public contexts draw on a variety of forms of discourse, including property laws and human rights (Boelens & Doornbos 2001, Derman & Ferguson 2003). As Guillet (1998) indicates, water law is often a crucial site of contestation between earlier regional customary law and nationalist reform. The political contestations over the construction of dams and distribution of water show these interacting forces with particular clarity because they lead water to shift between different individuals and groups (McCully 2001, Scudder 2006, McCormick 2007). In a discussion of dam-building in colonial and neo-colonial Rhodesia and post-colonial Zimbabwe, Hughes (2006) shows that the striking visual transformation of the landscape by water projects can become a subject of contestation as important as the actual distribution of water for drinking and agriculture. Many anthropologists look to see how different groups insert themselves in the larger debates over water sustainability. This question leads researchers to examine the strategies of water sustainability discourse and to compare the framings that consider practical challenges with solutions and the framings that address broader relations among states, societies, and environments. The power of such representations can lead to massive mobilizations, whether in Bolivia, where municipalities privatized water supplies (McNeish 2006), or in Peru, where mines altered traditional systems for irrigation and potable water in rural areas (Li 2009b). To be sure, the question of discourse as it relates to the problem of water sustainability is not only one of politics. When faced with such scarcities in the past, Muslim societies have responded with rain prayers, an ethnographic example of which can be found in the analysis by Caton (2006) of a recent drought in Yemen that occasioned elaborate and quite intense mosque supplications for rain.

Knowledges: Local/Indigenous and Scientific Systems

Water management, whether ancient or modern, depends on various kinds of knowledge.

Watershed: an area of land through which water drains downhill to a lowest point; a possible management unit

Anthropology and other researchers have long studied the great diversity of irrigation practices and the knowledge they entail. Needham (1971) documented the debates between Confucian and Taoist approaches to irrigation in Imperial China, and Carney (2001) showed how the rice plantations in coastal areas of the antebellum South depended not only on the labor of African slaves and their descendants but also on Africans' specific knowledge of water management in humid lowland environments. Researchers in the Andes trace the complex conceptual systems that underlie water management in terraced agriculture in steep canyons (Gelles 2000, Trawick 2003). Water use in the household requires a kind of knowledge (often undervalued) that is different from what is required in the agricultural field, a matter of gender difference.

In contrast, anthropologists have conducted fewer studies of water scientists and their knowledge, although we can glimpse what such studies might look like when we read the ethnographies of Walley (2004) on conservation experts in the development of a Tanzanian marine park, of Mehta (2001, 2005) on the construction of scarcity in India by water experts who have little grasp of local understandings and management, and especially of Helmreich (2009) on scientific narratives about ocean life and its beginnings (see also, Alatout 2007a,b; Li 2009a; Molle 2008, 2009; Nichter 1985; Orlove et al. 2010; Paolisso & Maloney 2000). These works can be classified within the history of science as well as within science and technology studies (Haraway 1989; Jasanoff 1995; Latour 1987, 2004; Latour & Woolgar 1986; Rabinow 1999; Shapin & Schaffer 1985). An example of anthropological research that links the study of science, the state, transnational institutions, and capital in Yemen appears in a later section of this review.

THREE SITES IN WATERWORLDS

Having reviewed general attributes of water and central themes in the study of water

sustainability, we now suggest that anthropological analyses of waterworlds could productively explore three specific sites: watersheds, water regimes, and waterscapes.

Watersheds

The term watershed (or water catchment) is widely used in scientific and policy contexts. The notion is simple and powerful: Because water flows downhill, each spot in the world can be assigned to a specific topographical basin. The water in each connected basin forms a watershed, and each watershed can be managed and governed as a unit. The boundaries of a watershed define a set of participants in this management, which includes natural scientists, government officials, members of local organizations, and ordinary citizens. In the past few decades, many watershed councils have been formed that are generally nonprofit participatory organizations that seek environmental quality and sustainable development. Other groups also promote more effective, equitable, and sustainable water management in a participatory way; the semiarid region of northeastern Brazil contains a number of examples (Broad et al. 2007, Lemos & Fariós de Oliveira 2004, 2005). At a much larger scale, some watersheds, such as the Rhine River basin (Cioc 2002), extend across national boundaries and are managed by organizations whose members span nations.

Although we recognize that these councils and other groups have done much work that addresses basic human needs and rights and that is broadly sustainable, we include a few words of caution about the term watershed. The conceptual boundaries that humans use reflect cultural systems as well as the natural world, so it gives us as anthropologists pause to hear that an administrative unit has an a priori material or natural existence. Other environmental and ecological categories, such as "forest" and "wetland," include both natural and social elements, given the complex nature of their characteristics and boundaries.

Watersheds may be simpler, more straightforward units than forests and wetlands, but

they are not entirely and unproblematically present in nature, as Strang shows in her account (2004) of the River Stour in England. First, watersheds vary enormously in scale, with a single watershed sometimes containing smaller subwatersheds, thus making the selection of a particular scale in part a social choice. [The Colorado River Compact of 1922, which divided the Colorado River watershed into upper and lower basins, is a particularly clear example of such a choice (Reisner 1986).] Second, water moves in many ways. Groundwater, a crucial resource in many regions, is located in basins whose boundaries do not always correspond with watersheds so that residents of a given watershed may dig wells that directly affect the residents of another watershed. Deforestation in one watershed may reduce the amount of water vapor that is carried to another watershed downwind of it, creating water scarcity in this second watershed. And the long human history of digging canals, leveling hills, and constructing dikes has also led water to move from one watershed to another. In this way, watersheds are not always the well-bounded management units that water managers and others often assume them to be.

Moreover, the notion of watershed tends to go hand-in-hand with the notion of stakeholder, understood as the residents, property holders, and public bodies within the boundaries of the watershed, all of whom, presumably, seek to assure sustainable water use because of their commitments to the watershed. The participatory democratic practices of watershed councils and other groups rest on this notion of the responsible stakeholder. But such a focus on watersheds can rest on a naïve and simplistic view of ecological citizenship. Stakeholders may engage in exclusionary practices while caring deeply about areas far from the ones in which they live [the idea of stakeholder can be linked to the archaic and widely rejected principle of allowing only property owners to vote (Holston 2008)], and even among the stakeholders who gain seats at the discussion table, there are some who are more powerful than others (Broad et al. 2007, Roncoli et al. 2009).

Water Regimes

A second term, water regime, had a specific meaning within the field of hydrology referring to the pattern of water flow in a freshwater ecosystem, but it is increasingly used in political science and other fields. The term regime comes from the field of international relations, in which it is defined as “sets of implicit or explicit principles, norms, rules, and decision-making procedures around which actors’ expectations converge in a given area” (Krasner 1983, p. 2); it has helped explain how nations might cooperate. It can be similarly employed to examine cooperation and coordination among water users, who, like nations, could seem to be autonomous and to have conflicting interests. For example, the political scientist Stefan Lindemann (2008) traces the multiple factors that have led to successful management of water quality in the Rhine and Elbe watersheds. But the term can also apply to specific national systems for regulating and managing water. Buller (1996) compares the French and British rules and institutions in the period of increasing integration into European frameworks. Galaz (2004) contrasts the water regimes in periods of public and corporate provision of water in Chile. He offers useful insights into the ways that the more recent water regime, consistent with other politics of privatization and market regulation of resources, weakens the rights of several groups of water users and reduces their ability to voice their concerns.

Anthropologists and other researchers have made important contributions to the study of water regime changes. Researchers have shown regime changes to be slow because physical infrastructure, reflecting earlier rules and institutions, remains in place, because water regulations overlap with other often entrenched legal institutions, and because social understandings do not shift overnight. Bakker (2001) discusses opposition of the shift from a state- to a market-centered regime in Britain, where people, accustomed to being treated as citizens with rights to water, do not readily accept becoming consumers purchasing water

Water regime: the aggregate of institutional rules and practices for managing water resources in a specific setting or watershed

Waterscape: the culturally meaningful, sensorially active places in which humans interact with water and with each other

Integrated water resource management

(IWRM): a paradigm for the management of water resources that holistically treats the use of water in different sectors of society

as a commodity. Similarly, research on the indigenous fishing villages of Lake Titicaca in Peru examines conflicts between local and state regimes that govern water, manage economically important aquatic plants, and grant rights to fish and to travel on the lake (Orlove 2002). Moreover, the notion of water regime can be associated with resilience because the rules and institutions that form part of specific water regimes shape response to external pressures such as climate change (Hastrup 2009b).

Waterscapes

A third term, waterscape, has been used since the mid-nineteenth century, by analogy with the word landscape, to describe works of art that depict scenery with bodies of water. In recent years, natural scientists have spoken of waterscape ecology as an aquatic specialization within landscape ecology, the discipline that studies the interactions of contiguous ecosystems. This term gained attention after its appearance in an influential 1999 article by the geographer Erik Swyngedouw, in which he considers Spain in the period from 1890 to 1930. He draws on political economy approaches within geography to examine the production of waterscapes, emphasizing the ideological dimensions of place in the construction of dams and canals and the creation of new administrative units based on watersheds. Other works examine the visual, experiential, and cultural aspects of waterscapes more extensively (Baviska 2007). Historian David Blackbourn's (2006) account of the reshaping of rivers, marshes, lakes, and coasts in nineteenth- and twentieth-century Germany is a good example, paralleling similar efforts, although on a smaller scale, in Iceland (Pálsson & Huijbens 2009). These and other studies show that water is not merely an economically valuable resource that flows through spaces, but is also a culturally and experientially meaningful substance present in places. Although humans are never fully aquatic, they are often, perhaps always, hydrophilic, and the human sense of place often engages with water

as well as with land, as Strang shows in her analysis of two very different Australian waterscapes (2009, p. 30) and Orlove documents in his accounts of the cultural importance of glaciers (2009a,b). A number of examples can be found in the anthropological literature; of particular importance are the accounts of irrigated rice landscapes in East Asia and Southeast Asia by Conklin (1980), Bray (1986), Lansing (1991), and others.

A number of studies consider all three sites: watersheds, water regimes, and waterscapes. Rodríguez's (2006) ethnography of community-managed irrigation in northern New Mexico examines watersheds, showing that the social boundaries of parishes and the hydrological boundaries of basins are close but not always overlapping because local residents redirect water between drainages. The study considers water regimes by tracing conflicts between customary practices and new state regulations. It also depicts the sensory and ritual aspects of waterscapes and shows how the annual cleaning of canals and other ritual practices by local residents inscribe them in the landscape and in the multilayered ethnic history of their region.

INTEGRATED WATER RESOURCE MANAGEMENT

Integrated water resource management (IWRM) has become the new and, many would claim, the hegemonic paradigm for discussing, legitimizing, and implementing policies regarding the management of the world's water resources, subsuming within it the notion of sustainability of 1970s and 1980s development discourses. This notion was enshrined in the World Water Council's *World Water Vision* (of the 2000 World Water Forum), which states that "to ensure the sustainability of water, we must view it holistically, balancing competing demands on it—domestic, agricultural, industrial (including energy), and environmental. Sustainable management of water resources requires systemic, integrated decision-making"

(Cosgrove & Rijsberman 2000, p. 1). However, there is no fixed or universally agreed-upon definition of IWRM, nor does it lead to uniform policies in the international organizations that advocate it or the states that are, voluntarily or not, attempting to implement it in their water resources management, although certain basic themes or principles are evident even if their formulation remains necessarily abstract.

First, IWRM argues that solutions to water problems cannot be found in only one sector of society, such as agriculture, because water is used across society as a whole (a view that we share in our notion of water as a total social fact); therefore a broad, multisectoral approach must be taken, one that attempts to integrate what is happening with water in each sector into a holistic view of the overall situation, delimited in IWRM usually by country or national boundary, if the water resource, as is often the case for rivers, is shared. Second, although it has a healthy respect for normal and universal scientific knowledge in being able to help solve problems, as one might expect of a paradigm that has emerged primarily from expert scientific networks, IWRM at the same time evinces skepticism toward narrow technological solutions for overcoming the world's water problems (a reaction, in part, to large-dam construction that came under heavy fire in the past two decades) by suggesting that these methods must be integrated with other approaches—bureaucratic, legislative, economic, political, cultural, etc.—depending on the water problems in question.

A third theme is the stress on the management of water resources, implying that it is unlikely that significant new sources will be found (through desalination, the discovery of underground aquifers, massive transfers from watersheds with low human populations, and other such methods) to alleviate water scarcity or contamination and that instead a finite and rapidly diminishing resource must be managed. The idea of management that is invoked is bureaucratic, though at varying levels of complexity and integration. The basic or fundamental level

is usually seen to be the watershed (for reasons given above in our discussion of watersheds), but it is understood by water managers that this notion is not enough because the regulation of watersheds must be integrated to meet the total demands on water by the various sectors and groups in society. To accomplish this integration, one should enlist the help of regional and national levels of bureaucracy such as governorates or provinces as well as the nation-state.

In some versions of IWRM, a fourth theme is evident: educating water users in a society about its water problems and the steps to alleviate them, starting with the ordinary citizen whose water-conservation practices are constructed as a civic duty to the nation as well as a gift of water (to invoke Mauss once again) to future generations. In other versions of IWRM, a fifth theme, akin to what we have referred to as value, also becomes important. For example, in the World Bank's (2003) "Water Resources Sector Strategy," water is explicitly valued as an economic good or commodity, leading to market solutions to managing the allocation of the world's water; the resulting patterns of distribution are not necessarily optimal for the world's poor. But there is another valuation of water: as a basic human right to be equitably distributed among all peoples of the world according to need, which is not consonant with water's market value (although in theory the two values are not necessarily incommensurable). This is the view taken, for example, in the 1997 *Comprehensive Assessment of the Freshwater Resources of the World* by the United Nations Commission on Sustainable Development. Still other views argue that three values—economic efficiency, social equity, and environmental sustainability—must be coordinated (Glob. Water Partnersh. 2000). The fact that all these valuations of water can be put forward in versions of IWRM demonstrates how contradictory the concept can be.

IWRM emerged as a discursive construct over the previous two decades, mainly in the work of international cadres of water experts (a broad array that includes, for example, scientists

such as engineers or experts on water pollution, members of nongovernmental organizations concerned with equitable water distribution, international aid and development experts involved in water conservation and water-delivery projects, economists who study water as a commodity, and members of international agencies such as the Food and Agriculture Organization or the World Water Council concerned with water distribution) and as such is not the brainchild of any one organization. [For a history of the concept, see White (1998), and for a critical analysis, see Conca (2006).] IWRM is discussed in academic conferences and scientific journals and ratified in world treaty agreements. It is, in short, an example of the impact of expert knowledge on water policies in the world today, which we refer to above as a crucial component to an anthropological understanding of water.

IWRM has a vision of the waterworld with many parallels to our own, namely of water as a total social fact. It also includes all the themes (value, equity, governance, politics, and knowledge) that we hold to be essential to address the problems of water scarcity and degradation. For example, with its emphasis on management, IWRM is a regime—a global regime—for governing the world's water resources (just as with forests or the atmosphere, water is seen as a global and not just a national resource). Thus it falls under what we have termed the politics of water, although we hasten to add that IWRM's explicit or stated political engagements do not go beyond two concerns: the supposed democratic participation in decision making regarding local-level water management, and equitable and affordable access to safe drinking water, especially for the world's poor.

What IWRM does not venture into is the complex political question of how its principles will be struggled over and fought out in concrete settings, a prime subject for anthropological inquiry. It is the politics that lies between conceptualization and practice that is crucial for understanding results, a politics of local actors supposedly nearest to the source of water in the ground, a politics of national bureaucra-

cies established to manage water resources, and a politics of international donor agencies that are supposed to assist them (Mehta 2005, Oré 2005, Strang 2009). Moreover, IWRM's narrative of normal science overlooks the disagreements among scientists over precise measurements and ignores the pressures to arrive at a broad consensus to conceal these rifts or disagreements. In contrast, Budds (2009) provides an ethnographic analysis of hydrological assessment in Chile that documents the intense political struggles about the construction of measures and interpretation of statistics, showing that such struggles frustrate planning and lead to skepticism over the authority of science.

As for the valuation of water, what is meant by a basic right or a commodity is hardly questioned, as if these matters were settled long ago in philosophical and scientific discourses and need not be revisited in settings where these concepts are highly contested or do not hold sway. Anthropology has an important role to play in keeping these questions open rather than to consign the discipline to the study of how the "natives" value and use water locally. That said, the meanings and values placed on water by its users and the contestations over these among those same users (along class, gender, and ethnic lines, as well as urban versus rural divides) will fundamentally affect how water can be managed at the watershed in the first place, and here anthropology has an obvious and perhaps singular contribution to make to the understanding of water's valuation. This incomplete treatment of the valuation of water reflects the tendency of IWRM to overlook waterscapes because it assumes that water is a resource that is used for specific ends, rather than a meaningful substance that is present in specific settings.

Let us illustrate an anthropological study of IWRM and these themes by examining the way it has been put into practice in a concrete situation: the Republic of Yemen. For a partial example of how anthropology might do an ethnography of IWRM, the reader should consider the article by Caton (2007), which is concerned with water sustainability in Yemen.

Four sites were studied, all of which are closely connected to IWRM as a concept and as a practice: a 2005 scientific conference in Yemen on integrated watershed management, in which experts affirmed the primacy of IWRM practices; the Yemen Center for Water and the Environment, which teaches IWRM to Yemeni water engineers with the assistance of Dutch IWRM experts, an example of the transnational circulation of expert knowledge; an assessment of Yemen's water-management policies and practices conducted by international donors (Dutch, German, and British) invested in Yemen's five-year water plan, an example of the global governance of water resources; and finally, but not least, an examination of how expert knowledge gets transmuted into local knowledge at the watershed level by international development experts working in a water basin north of Yemen's capital, San'a. Political contestations among experts were clearly visible in every site as were conflicts between national and international management agencies with their own legitimacies at stake. IWRM experts welcomed anthropological knowledge as helpful for understanding local stakeholders at the watershed level but were unsurprisingly ambivalent about the prospect of them becoming subjects of anthropological research as well.

HOW ANTHROPOLOGY CAN ENGAGE WITH WATER ISSUES

What have we learned about the world's water problems? There is no one solution, whether technological, economic, bureaucratic, or political, that works globally. A combination of approaches must be applied in each case, depending on the particular materialities and connectivities in specific contexts.

However, waterworlds must be studied ethnographically, in all their components, including the often-neglected waterscapes as well as the more commonly examined watersheds and water regimes. The wide range of people, agencies, and processes involved in addressing concrete water problems all require sustained scrutiny. Too often in the past, water consumers have been the sole concern, along with their national governments; this mindset is no longer sufficient when one realizes the profound presence and involvement of the transnational community of water experts. It is likely, therefore, that an anthropology of water can fruitfully link up with science and technology studies, even while continuing to connect with other specific, longer-established approaches, such as political ecology and material culture studies, and with the broad integrative styles of analysis that characterize the discipline.

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