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Water Resources Management in Arid Environments: Towards Sustainability

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Abstract: Water management over the last century has privileged immediate human needs over those of future generations, other living beings and ecosystems. Giving the fact that water is basic to life and water resources management is an issue of high necessity (specifically in hot arid environments), an ethical dimension persists in every decision related to water. By explicitly revealing the ethical ideas underlying water-related decisions, human society's relationship with water and with natural systems of which water is part, can be contested and shifted or be accepted with conscious intention by human society. In recent decades, improved understanding of water's importance for ecosystem functioning and ecological services for human survival is moving us beyond this growth-driven, supply-focused management paradigm. Environmental ethics challenge this paradigm by extending the ethical sphere to the environment and thus water or water resources management per se. An ethical approach is a legitimate, important and often ignored approach to effect change in environmental decision making. This qualitative research explores principles of water ethics and examines the underlying ethical precepts of selected water policy examples. The constructed water ethic principles act as a set of criteria against which a policy comparison can be established. This study shows that water resources management is a progressive issue by embracing full public participation and a new planning model and knowledge-generation initiatives. However, making ethical ideas explicit in assessment and formation of equitable and sustainable water policy is a matter of necessity not a privilege.

Key words: Water resources management • Sustainability • Environmental ethics

INTRODUCTION

Ethics are moral guidelines for human behaviour that function at societal and individual levels. However, conventional ethics embrace only human concerns. Environmental ethics challenges this moral isolation and attempts to include the environment within the ethical sphere. Water ethics is an example of applied environmental ethics. UNESCO's series on water ethics is a particularly informative exploration of ethics in water [1-3]. The Ministerial Declaration from Bonn posits equity and sustainability as the two primary goals for water management. Equity connotes a sense of fairness. Sustainability suggests the idea of maintaining the conditions for and of life into the future. The two concepts are central to realizing better water management.

In the UNESCO survey on water ethics, [4], proposes that principles "should reflect the concepts of sustainable development and environmental justice, which are underpinned by equity: equity between geographical entities, between the industrialized and developing world, between rural and urban populations, between generations and between the managed and the managers". The concept of equity, while an important element of sustainable development as social and intergenerational equity, may become lost among other nuances of sustainability. Distinguishing the idea of equity and sustainability, particularly in the case of water, serves to emphasise the importance of equity. Such separation allows a broader discussion of equity beyond social equity and intergenerational equity to include equity for ecosystems.

MATERIALS AND METHODS

This qualitative case study research explores principles of water resources management through examining the underlying ethical precepts of selected water management policy examples. A broad literature review provided the theoretical framework upon which this study is built. Then, a discourse analysis is taken as the method to analyze the different approaches to water

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policy and management. Upon completion of this deconstructive process, the water ethic principles act as a set of criteria against which a management policy comparison can be established.

Sustainability: In the UNESCO survey on water ethics, [4] proposes that principles "should reflect the concepts of sustainable development and environmental justice, which are underpinned by equity: equity between geographical entities, between the industrialized and developing world, between rural and urban populations, between generations and between the managed and the managers". The *Brundtland Report* [5] and Agenda 21 from the United Nations Conference on Environment and Development (UNCED Earth Summit), in Rio de Janeiro, 1992, popularized and lent international legitimacy to the concept of sustainable development. The *Brundtland Report* defined sustainable development as human development that "meets the needs of the present generation without compromising the ability of future generations to meet their own needs" [5]. Agenda 21 recognized humanity's dependence on the natural environment and thus the necessity to protect it for current and future generations [6]. Agenda 21, followed by various other international conventions and agreements, strengthened the commitment to sustainable development and recognised that water and other natural resources must be managed for the benefit of future generations. Intergenerational equity is important for the shift from short-term thinking to long-term planning. Sustainability extends moral consideration to the future. [7] suggest that sustainable development embodies the following aspects: meeting basic needs; maintaining ecological integrity and diversity; merging environment and economics in decision making; keeping options open for future generations; reducing injustice; and increasing self determination. Because traditional water management approaches have often been about controlling situations and concrete supply-side solutions [8, 9], growing uncertainty have made such approaches less desirable. Adaptive management has become a more appealing approach [4]. Although representing future generations is important but difficult. Youth representation and explicit recognition of needs of future generations as an ethical principle are two approaches to this challenge. The idea of stewardship may also contribute to "caring for" future generations. Stewardship "directs attention not only to the necessity to manage water to meet basic needs for a variety of interests, but also to ensure that water is protected and conserved and that its uses and values are sustained" [7], implicitly for future generations.

Equity: Equity is about just distribution of "goods and services, wealth and income, or opportunity and disadvantage" [10]. If the resource in distribution is in abundant supply, the question of equity is not an issue; if, however, supply is scarce, the question of distributive equity is most certainly an issue [11]. How equity is perceived determines how justice is formulated and implemented. According to [12], distributive justice is only one of three key elements of a justice framework; procedural justice and relational justice are also important. Distributive justice addresses such questions as "who gets what, who pays for what and according to what criteria" and focuses on the outcomes of decision making. Procedural justice addresses "the institutional processes of decision making", where the opportunity to have a voice in the process and the ability to inflence the decision are central dimensions [12]. Traditionally water policy and legislation have been formulated without regard for the environment, instead framing use of water as within a human system rather than human systems within a natural one. Nor have future generations been explicitly acknowledged in water law and policy. Inclusion of the nonhuman world and future generations in the net of recipients, in addition to humans here and now, expands the conception of equity. This expansion necessitates a more inclusive procedural justice and demands a shift in relational justice. Relevant law and policy likewise could shift. To address the possibility of such expansion to include the natural environment and future generations, three justice paradigms has to be considered: environmental justice, ecological justice and ecosystem justice. While environmental justice refers to fair distribution of environmental 'goods' and 'bads', or quality and risk, among humans, the concept relates humans to their environment [13, 14]. Ecological justice is justice of the relationship between the human world and the nonhuman world; this changes humans' relationship to the environment from an instrumental one (as in environmental justice) to a moral one [15, 16]. However, ecosystem justice has to be the framework that extends beyond justice towards nature to justice among all living things in the ecosystem. The concept expands our sense of justice and our sphere of moral consideration to the larger ecosystem and re-conceptualises interactions important in justice considerations. Taking a broader ecosystem perspective allows recognition of integration and cumulative impacts and it means taking account of all preferences within the ecosystem, not just the human preferences [17]. Thus, ecosystem justice provides the most comprehensive approach to building a water ethic (Table 1).

Table 1: Comparison of environmental, ecological and ecosystem justices.

Dimensions	Environmental justice	Ecological justice	Ecosystem justice
Recipients	All humans (esp. marginalised, from local to global scales)	Humans and nature	All living things
Process	Inclusive decision-making processes for all humans to influence process	Inclusive decision-making processes	Inclusive decision-making processes where values of all taken into account
Relationship	Equality among all humans; no humans, regardless of gender,race, class, should endure greater burden or receive greater benefit than any other	Moral relationship between the human and nonhuman worlds	All living and non-living things are interdependent & form an ecosystem & deserve equitable treatment; humans embedded within ecosystems

Table 2: Literature Sources.

Principle	Dublin Principles (1992)	Selborne (2000)	Bonn Keys (2001)	Priscoli *et al.* (2004)
Availability	X	X		X
Commonality		X		X
Security	X	X	X	X
Inclusion	X	X	X	X
Justice		X		X
Sustainability		X		X

Towards Sustainability: The following discussion presents and defines a number of principles to comprise a water ethic framework and explores what they may mean in practice. Key literature sources for the discussion were the *Dublin Statement* from the International Conference on Water, Dublin 1992. the Bonn Keys from the International Conference on Freshwater, Bonn 2001. [4] *The Ethics of Freshwater Use: A Survey*; and *Water and Ethics: Overview* by [3]. These sources contributed to the water ethic principles but each on its own was deemed insufficient to fit [18] framework. The *Dublin Statement* on Water and Sustainable Development [19] offers a set of four principles that emerged from discussion at the International Conference on Water and the Environment, Dublin 1992. This *Statement* was prepared for the participants of the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992. It and the complementary *Conference Report*, were intended to bring awareness of immediate and future concerns around water and the environment to world leaders and to guide their actions in this regard. The principles relate to water's basic role to sustain life and its limited, vulnerable nature; to the importance of participation of policy makers and the general public; to women's pivotal role in water management; and to water's nature as an economic good while recognizing a basic human right to water [19]. Although these principles are concise, based on Hurka's framework they are not comprehensive [3]. The contribution of the key sources of literature to the discussion of water ethical issues is illustrated in Table 2. Where indicated, the literature source contributes one or more characteristics to the ethical issue.

Availability: The *Dublin Statement* addresses the essential and finite nature of water as one of its four principles for water management: "Freshwater is a finite and vulnerable resource, essential to sustain life, development and the environment" [19]. According to this *Statement*, recognizing water as finite and vulnerable involves a holistic approach, linking social and economic with ecosystem protection and should be applied across a whole catchment area or groundwater aquifer. Quality of water also limits its availability [20]. If water is of poor enough quality, it is unusable. Thus measures to avoid water pollution should be taken in recognizing water's limits. The agriculture sector should avoid overuse of water and runoff pollution from fertilizers and pesticides [4]. Industry must consider the available local supply, socio-economic conditions, as well as local ecosystems and protect quality and quantity of water and include local participation in decision making [4]. Moreover, availability depends upon a local area's geography, biophysical characteristics, supply and demand conditions and culture. Historical use of water in an area changes over time and plays a role in shaping the current conditions of water and its use in a local area. Furthermore, water availability varies over time and space. Its fiow results from a confluence of factors both natural, such as seasonal climate patterns and anthropogenic, such as water consumption and diversion. Water withdrawals should take into account both seasonal

variation and ecological requirements for water, especially during low flow periods. Factors of population and economic growth affect this availability over time and are necessary to consider in planning for the future. Climate change has long-term implications and should be taken into consideration in any decision that has long-term consequences.

Commonality: Unlike land, water flows, resists political and ownership boundaries and, as such, is a common-pool resource. The United Nations World Water Development Report, *Water for People Water for Life*, distinguishes two types of sharing water: sharing water between users (e.g., administrative regions or countries) and sharing between different uses of water (e.g., energy, cities, food and environment) [21]. This principle addresses sharing between users as general sharing among users and sharing across boundaries. Water can be perceived as a common good which should be managed for the good of whole community and provide environmental flow allocations [12]. Fundamental in these notions is the sharing of water as a commons for the good of the human community or beyond. Governing common-pool resources involves restricting access and creating incentives. Water is a basic need for all life, thus the basic needs of humans and the environment must be first priority. Water moves, thus management by one person or group will affect others who hold rights upstream or downstream. Water is a local issue and can only be traded in a local net or market, such as naturally. Administrative boundaries rarely follow those of watersheds [21]. Helsinki Rules on the Uses of the Waters of International Rivers, 1966. provides some guidance to negotiating transboundary issues [22]. Equitable use and reasonable use are key principles for international parties, where "Each basin State is entitled, within its territory, to a reasonable and equitable share in the beneficial uses of the waters of an international drainage basin" (Article IV). Because water flows and is shared among users, all users of water are responsible for their use of the resource. This shared responsibility mean water must be commonly governed. The stewardship principle is one expression of accountability and responsibility towards the wider community of ecosystems as a whole.

Security: Water security is not a global phenomenon or equitable. The issue of security-be it physical, psychological, economic, or military security-" is one of the enduring sources of passion in policy controversies" and generally revolves around the question of need [10]. Thus water security is about meeting needs for water. Clean water for drinking and cooking (about100 litres per day per person [1] meets basic physical needs and nourishment requirements. Water for healthy sanitation systems meets the need for basic dignity, privacy, convenience and fends off disease through hygiene. Human dignity is an important principle in a water ethic [3]. Thus all humans have a positive right to access sufficient amounts of clean water for drinking, cooking and hygiene. Inequitable access particularly affects marginalised segments of society. Thus, one of the Bonn Keys' five principles is ensuring water security of the poor [23-24] describes some important aspects for comprehensive drinking water protection: drinking water source protection; safe distribution systems; testing; public notice and information; and sufficient financial resources for operation, maintenance and upgrading water treatment systems [24]. Moreover, primary economic uses of water tend to be agriculture, manufacturing and other similar industrial uses and power generation. With this access to water, however, comes responsibility to protect that water and other users. Weak governance swaying to the economic imperative, industry managers' lack of awareness and the use of inefficient or inappropriate technology often collude to prevent responsible industry [21]. Governments have the responsibility to create and enforce effective regulatory frameworks of policies, laws, subsidies, incentives and generally set standards [4]. Given the growing trend of transnational corporations transcending regulations, transnational corporations and industry should be accountable and bound to ethical guidelines, like governments [4].

Inclusion: Inclusion of local knowledge builds social and human capital and allows solutions to be more culturally and socially appropriate [4]. Dialogue between stakeholders assembles expertise and explores the room for consensus, compromise, agreement and concerted action among widely diverging scenarios and futures that are being envisioned by the stakeholders [25]. Overall, the complexity of problems can be better addressed. The complexity of water issues makes authentic public participation especially important. Thus a water ethic should include the participation principle. All affected, including the poor, women and all levels of policy makers, should be considered stakeholders [3, 19]. Yet, not only does the shared nature of water mean full participation is essential, but water can also be a tool for community development, peace building and preventive diplomacy [4]. For equitable and sustainable water-use management,

the Bonn Keys advocate decentralising water management to the local level, where national policy meets community needs [23]. This idea builds on the *Dublin Statement*'s call to decentralise decisions to the lowest appropriate level [19]. This decentralisation brings improved responsiveness to problems, better transparency and fuller participation [23]. This inclusion of all groups is a central concern of environmental justice. Therefore, [21] recognize water education as an "entry point to developing a new ethic for water governance" [3]. Thus, resources are important to enable people to participate in decision-making processes; and to empower local people and local authorities to act at the local level. Information about the resource-including degrees of uncertainty, spatial and temporal scales and the complex interactions among them-improves decision making and governance regimes. Governments are responsible for provision of clear, well-defined and sufficiently detailed goals and guidelines for terms of reference, outcomes and implementation.

CONCLUSIONS

For human settlement feasibility and ecosystem health, water's finite and variable nature requires conservation and protection of its sources from overuse and pollution. Because of water's nature as a common-pool resource, sharing among users and uses must be devised with equity and sustainability in mind. Moreover, intragenerational equity is at the basis of water security to meet basic water needs for drinking, cooking, sanitation and basic food security. Furthermore, an ethical argument was objectively constructed for explicit address of water conservation and an expanded sense of moral consideration in decision making.

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