

Water Is Security

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TABLE OF CONTENTS

INTRODUCTION	197
I. THE SHARED RESPONSIBILITY OF WATER	200
II. INDIGENOUS PEOPLES AND WATER	203
III. CIVIL SOCIETY PARTICIPATION AND PUBLIC EDUCATION.....	206
IV. POLLUTION	209
CONCLUSION	214

INTRODUCTION

Reasonable and equitable water resource decision-making is at the core of good governance around the world. Some solutions are as simple as rainwater harvesting. Solar powered drip irrigation requires a little more innovation — innovation that clean technology transfer can provide. Complex solutions involve geographic information system (“GIS”) training and facilitating cooperative water data analysis. Sustained water collaboration is an antidote to foreign relations disintegration.

Cooperation is more widespread than conflict.¹ Conflict resolution requires sustained interactions to find consensus. Peace building takes a variety of forms including water cooperation. Water is security. UN Secretary General Ban Ki Moon notes that, “[a]mid the diverse social and political causes, the Darfur conflict began as an ecological crisis, arising at least in part from climate

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¹ U.N. DEV. PROGRAMME (UNDP), HUMAN DEVELOPMENT REPORT 2006, BEYOND SCARCITY: POWER, POVERTY AND THE GLOBAL WATER CRISIS 19 (2006), *available at* <http://hdr.undp.org/en/media/hdr06-complete.pdf> [hereinafter HUMAN DEVELOPMENT REPORT].

change.”² Mr. Ban goes on to point out that, “[i]t is no accident that the violence in Darfur erupted during the drought. Until then, Arab nomadic herders had lived amicably with settled farmers.”³ The Secretary General concludes that, “[a]ny peace in Darfur must be built on solutions that go to the root causes of the conflict.”⁴

The conflicts in Darfur are due in part to disputes over water and other natural resources.⁵ Use of groundwater from ancient lakebeds has been able to alleviate water insecurity elsewhere throughout the Middle East and North Africa. The international community hopes that funding groundwater projects in Sudan can help decrease the tensions that have led to armed conflict. Farouk El-Baz and his colleagues at the Center for Remote Sensing at Boston University have found a buried lakebed in western Sudan.⁶ Wells drilled into similar lakebeds in neighboring Egypt are providing water to farmers.⁷ Egypt will drill twenty wells for Sudan and the United Nations will drill several additional wells.⁸ Enthusiasm is qualified by the understanding that many underground lakebeds do not retain water.⁹ Furthermore, use of groundwater may be able to alleviate water scarcity in Sudan but racial, religious, and other natural resource conflicts remain and will require broader peace-building measures throughout the Middle East and North Africa.¹⁰

Law enforcement is compromised when boundaries and access to natural resources are disputed. Joint water management commissions and authorities enhance adaptable co-riparian cooperation. Integrated protection of health and

² Ban Ki Moon, *A Climate Culprit in Darfur*, WASH. POST, June 16, 2007, at A15, available at <http://www.washingtonpost.com/wp-dyn/content/article/2007/06/15/AR2007061501857.html> (last visited Mar. 15, 2008). Mr. Ban notes that:

[t]wo decades ago, the rains in southern Sudan began to fail. According to U.N. statistics, average precipitation has declined some 40 percent since the early 1980s. Scientists at first considered this to be an unfortunate quirk of nature. But subsequent investigation found that it coincided with a rise in temperatures of the Indian Ocean, disrupting seasonal monsoons. This suggests that the drying of sub-Saharan Africa derives, to some degree, from man-made global warming.

Id.

³ *Id.*

⁴ *Id.*

⁵ John Nielsen, *Underground Lakebed Sparks Hope for Darfur* (NPR, ALL THINGS CONSIDERED radio broadcast July, 20, 2007), available at <http://www.npr.org/templates/story/story.php?storyId=12130381&ft=1&f=1001>.

⁶ *Id.*

⁷ *Water Find 'May End Darfur War,'* BBC NEWS, July 18, 2007, at 1, available at <http://news.bbc.co.uk/2/hi/africa/6904318.stm> (noting that nearly 12% of Darfur's forests have been lost in 15 years and that the ancient lake bed is roughly the size of Lake Erie — the 10th largest lake in the world).

⁸ Nielsen, *supra* note 5.

⁹ *Id.*

¹⁰ *Id.*

habitat can occur through comity and cooperation. The United Nations notes that, “[i]t is the way in which enhanced institutions and policies are being established and implemented that matters. The existence of sufficient rules and regulations means little if they cannot be enforced, due to power politics, vested interests and lack of funds, or the public’s absence from the decision-making process.”¹¹ The water governance shift towards integrated water resources management is bringing principles of equitable distribution, efficiency, and environmental sustainability into the limelight.¹² Water governance involves finding equilibrium between ecosystem integrity and socio-economic uses of water.¹³ Decision-makers include governments, civil society, and the private sector.¹⁴ Achieving good water governance requires balancing conflicting water rights, increasing intersectoral communication, broadly agreeing upon economic incentives, and deciding what constitutes fragmentation of water management and administration versus effective local water governance.¹⁵ Making such decisions requires mechanisms for public participation and conflict resolution.¹⁶

Lack of water quality and quantity policies can lead to water insecurity for everyone, yet bureaucratic obstacles such as inertia and corruption must be averted in altering water governance schemes.¹⁷ There are multiple ways to lower transaction costs and strive for optimal water use.¹⁸ Several ingredients of good water governance include: (1) broad participation through the entire decision-making process; (2) transparent flow of information; (3) equitable opportunities to increase well-being; (4) accountability from governments, the private sector, and civil society; (5) coherency of water resource measures; (6) responsiveness to changing water conditions and societal factors; (7) integrative approach to water basin management; and (8) ethical principles that resonate with varying societies based upon inclusive dialogues.¹⁹ Reasonable and equitable use of transboundary water resources can help sustain international peace and security.

¹¹ U.N. WORLD WATER ASSESSMENT PROGRAMME [WWAP], WATER FOR PEOPLE, WATER FOR LIFE: 1ST U.N. WORLD WATER DEVELOPMENT REPORT at 371, U.N. Sales No. 92-3-103881-8 (2003), available at <http://www.unesco.org/water/wwap/wwdr/pdf/chap15.pdf> (Chapter 15, “Governing Water Wisely for Sustainable Development” by UNDESA/UNDP and UNECE).

¹² *Id.*

¹³ *Id.* at 373.

¹⁴ *Id.*

¹⁵ *Id.*

¹⁶ *Id.*

¹⁷ *Id.*

¹⁸ *Id.*

¹⁹ *Id.*

I. THE SHARED RESPONSIBILITY OF WATER

Transboundary water governance is a human development issue.²⁰ Global water use rose at a rate nearly double that of population growth over the past century.²¹ Population growth offset gains in access to drinking water to 1.2 billion individuals from 1990 to 2004.²² One dollar spent in the water sector can generate an additional eight dollars in increased productivity and decreased costs.²³ Given the natural monopoly features of the water sector, governments should assess public-private partnerships with a commitment to equity and meaningful oversight.²⁴ The United Nations Development Programme's ("UNDP") Human Development Report 2006 points out that, "[t]he debate on privatization has sometimes diverted attention from the pressing issue of public utility reform."²⁵ UNDP calls upon states to provide access to water and to measure success upon performance rather than public/private status.²⁶ The Human Development Report states that, "[a]ll governments should prepare national plans for accelerating progress in water and sanitation, with ambitious targets backed by financing and clear strategies for overcoming inequalities."²⁷ Beyond such supply-side policies as dams and desalination, decision makers at all levels need to implement such demand-side policies as increased efficiency of water use through transfer of sustainable technologies and sensible subsidies.²⁸ Electricity subsidies in India and Mexico have unintentionally induced large farming operations to over-extract groundwater.²⁹ UNDP states that 1.4 billion people reside in river basins in which water use surpasses recharge rates.³⁰ As a result, rivers are shrinking, groundwater supplies are diminishing, and an unsustainable ecological debt is mounting.³¹ A global plan

²⁰ HUMAN DEVELOPMENT REPORT, *supra* note 1, at 20.

²¹ *Id.* at 14 (noting that, "[t]he 538 million people in northern China already live in an intensely water-stressed region" and that "[o]ver the period to 2050 the world's water will have to support the agricultural systems that will feed and create livelihoods for an additional 2.7 billion people").

²² Laura MacInnis, *Billions Still Lack Clean Water and Sanitation* — UN, REUTERS, September 5, 2006, at 1, available at <http://STWR.net/content/view/1102/36/>.

²³ HUMAN DEVELOPMENT REPORT, *supra* note 1, at 6.

²⁴ *Id.* at 10; see also U.N. WORLD WATER ASSESSMENT PROGRAMME [WWAP], WATER: A SHARED RESPONSIBILITY: 2D U.N. WORLD WATER DEVELOPMENT REPORT at 418, U.N. Sales No. 92-3-104006-5 (2006), available at http://www.unesco.org/water/wwap/wwdr2/table_contents.shtml (noting that contracting-out services, operation and management of the water supply, allows the public sector to take advantage of private sector technology and skills, while maintaining the ability to ensure equity of water availability).

²⁵ HUMAN DEVELOPMENT REPORT, *supra* note 1, at 10.

²⁶ *Id.*

²⁷ *Id.* at 8.

²⁸ *Id.* at 14; see also *supra* note 21.

²⁹ *Id.* at 15.

³⁰ Kemal Derviş, *Forward* to HUMAN DEVELOPMENT REPORT, *supra* note 1, at vi.

³¹ "For some, the global water crisis is about absolute shortages of physical supply. This

of action can coordinate resources and political will to establish and fund national water and sanitation plans.³²

Over a century ago industrialization increased income, but it was not until western cities addressed water infrastructure that child mortality declined and life expectancy rose.³³ Civil society was instrumental in calling for this public health reform. In England, for instance, expanding voting rights beyond landowners led to the enactment of water and sanitation legislation.³⁴ UNDP notes that, “[c]ollecting water and carrying it over long distances keep millions of girls out of school.”³⁵ Achieving universal primary education requires schools to have sufficient water and sanitation facilities for both boys and girls.³⁶ UNDP recommends, “[s]upplementing the Millennium Development Goal target of halving the proportion of people without access to clean water with an equity target of halving by 2010 the gap in service provision between the richest and poorest 20%.”³⁷ When governments clarify goals and implement regulatory capacity, leasing water operations to competent private firms can expand water availability equitably.³⁸ Genuine oversight is a crucial component of public-private partnerships.

Pollutant registries such as the United States’ Toxics Release Inventory program mandates firms to publicly disclose certain pollutant releases and transfers.³⁹ Such spotlighting approaches rely upon public scrutiny rather than sanctions to encourage green corporate decisions.⁴⁰ Such public scrutiny relies upon access to information. The Århus Convention calls for both public access to environmental information and public participation in environmental decision-making.⁴¹ As Molly Elizabeth Hall notes,

Report rejects this view. It argues that the roots of the crisis in water can be traced to poverty, inequality and unequal power relationships, as well as flawed water management policies that exacerbate scarcity.” *Id.* at v.

³² *Id.* at vi.

³³ HUMAN DEVELOPMENT REPORT, *supra* note 1, at 5.

³⁴ *Id.* at 29-30 (“In the late 1890s the infant mortality rate in Great Britain was 160 deaths for every 1,000 live births roughly the same as in Nigeria today. . . . Reform came in two great waves. The first focused on water and began in the 1840s with the Public Health Act (1848) and the Metropolitan Water Act (1852), which expanded public provision of clean water. The discovery by John Snow in 1854 that cholera — the greatest epidemic scourge — was a waterborne infection and that its spread could be halted by access to uncontaminated water supplies added to the impetus.”).

³⁵ *Id.* at 22.

³⁶ *Id.*

³⁷ *Id.* at 106.

³⁸ *Id.* at 94.

³⁹ U.S. Environmental Protection Agency, Toxics Release Inventory (TRI) Program, <http://www.epa.gov/tri/> (last visited Mar. 15, 2008).

⁴⁰ Clifford Rechtschaffen, *Shining The Spotlight On European Union Environmental Compliance*, 24 PACE ENVTL. L. REV. 161, 167-68 (2007).

⁴¹ Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, June 25, 1998, 38 I.L.M. 517, *available at*

The importance of transparency in environmental decision-making cannot be overstated. When policy-makers provide the facts, data, studies, and monitoring results on which they will base their decisions to act or not to act to the citizens who may have specific information about the geographic area, and to the organizations that may have experience protecting the environment, the quality of participation in these decisions improves, as does the quality of environmental protection.⁴²

Achieving efficient and equitable water resource allocation requires an understanding of basin riparian use, climatic conditions and other factors that can be expensive to gather.

If water management is transferred from judicial to administrative forums, provisions must be implemented to preclude regulatory capture by powerful stakeholders.⁴³ While litigation is prohibitively expensive, water disputes represent too small of a judge's docket to attract the degree of special interest lobbying directed to administrative agencies. Broad public participation in environmental decision-making can help water measures remain sustainable and equitable. The European Water Framework Directive entered into force on December 22, 2000.⁴⁴ Article 1 of the directive states that:

The purpose of this Directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which:

1. Prevents further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems;
2. Promotes sustainable water use based on a long-term protection of available water sources;
3. Aims at enhanced protection and improvement of the aquatic environment, inter alia, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing out of discharges, emissions and losses of the priority hazardous substances;

<http://www.unece.org/env/pp/documents/cep43e.pdf>.

⁴² Molly Elizabeth Hall, *Environmental Law in the European Union: New Approach For Enforcement*, 20 TUL. ENVTL. L.J. 277, 298 (2007).

⁴³ Bryan Clark, *Water Use Reform in Scotland: A Critical Analysis*, 18 J. ENVTL. L. 375, 403 (2006).

⁴⁴ Council Directive 2000/60/EC, 2000 O.J. (L 327) 1 (EC), available at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2000:327:0001:0072:EN:PDF>.

4. Ensures the progressive reduction of pollution of groundwater and prevents its further pollution; and

5. Contributes to mitigating the effects of floods and droughts.⁴⁵

Article 14 of the directive calls for the active involvement of civil society in implementing these goals.⁴⁶ Active involvement goes beyond simply making information available to the general public. Water forums can bring together interested entities and experts to coordinate with river basin associations to make decisions at the most appropriate level.⁴⁷

II. INDIGENOUS PEOPLES AND WATER

The United Nations Educational, Scientific and Cultural Organization (“UNESCO”) cautions that meeting the Millennium Development Goals should not come at the expense of indigenous populations.⁴⁸ Vast hydroelectric projects have displaced indigenous communities that have been seen as under-utilized regions.⁴⁹ Indigenous water rights have been disregarded to divert water to urban areas.⁵⁰ When small-scale family farming can no longer sustain livelihoods and cultures, people are forced to join the growing urban poor.⁵¹ The United Nations notes that, “[t]oday, half the world’s population lives in urban centres, compared to less than 15 percent in 1900.”⁵² UNESCO points out that,

In many rapidly growing urban areas, it is proving difficult to build the infrastructure necessary to deliver water supply and sanitation facilities to service the population, leading to poor health, low quality of life and, in many cases, to social unrest. To the urban demands for water must be added the increasing demands on water for food production, energy

⁴⁵ *Id.* art. 1

⁴⁶ *Id.* art. 14.

⁴⁷ Clark, *supra* note 43, at 402. Clark concludes that, “as a public good water cannot be left to the vagaries of the market.” *Id.* at 404.

⁴⁸ U.N. EDUCATIONAL, SCIENTIFIC, AND CULTURAL ORGANIZATION [UNESCO], KNOWLEDGES OF NATURE 2: WATER AND INDIGENOUS PEOPLES 1 (Rutgerd Boelens, Moe Chiba & Douglas Nakashima eds., 2006), available at http://portal.unesco.org/science/en/files/4938/11437249191WATER_complete_LR.pdf/WATER%20Bcomplete_LR.pdf [hereinafter WATER AND INDIGENOUS PEOPLES] (noting that, “[l]arge-scale hydroelectric development projects, for example, often target indigenous lands because they are dismissed as under-populated, under-utilised or even ‘wastelands’. Similarly, indigenous communities’ water sources that sustain their multiple uses and livelihood strategies are often taken away in order to provide drinking water to urban areas and metropolises.”).

⁴⁹ *Id.* at 12.

⁵⁰ *Id.*

⁵¹ *Id.* at 43.

⁵² WATER: A SHARED RESPONSIBILITY, *supra* note 24, at 89.

creation and industrial uses. Large shifts in the geographic distribution of populations occur in various contexts, often adding to water supply problems and social tension.⁵³

States seeking to meet the Millennium Development Goals may intensify use of indigenous land and water resources.⁵⁴ Equity requires indigenous involvement in local, regional, national, and international decision-making that affects “indigenous knowledge, values, land tenure, customary management, social arrangements and rights pertaining to water.”⁵⁵ UNESCO goes on to note that, “[t]he success of legal pluralism thus lies in the delicate balance between the right to equity and the right to be different.”⁵⁶ Transboundary water management must involve indigenous participation in the decision-making process and prior informed consent on issues impacting indigenous rights.⁵⁷ Common jurisdiction can enable reasonable and equitable water use, particularly when independent judiciaries uphold constitutional guarantees of ancestral indigenous rights.

Maximizing the export of raw materials and agriculture products to lower foreign debts has led to the destruction of wetlands and pollution of watersheds by agro-chemical-based intensive agriculture, deforestation, and extractive industries.⁵⁸ UNESCO cautions that, “[a] paradigm that puts a premium on the role of market forces will not attach much importance to the role and participation of indigenous peoples and local communities when water policies and programs are designed.”⁵⁹ Equity plays an important role in any measurement of the value of water.⁶⁰ Pricing water services at full cost can harm subsistence farmers and disproportionately impact indigenous communities.⁶¹

Beyond ability to pay for irrigation fees, governments need to address how revenues are reinvested to achieve universal water availability. Reducing agricultural demand for water is an important goal, the means by which require participatory decision-making. Policies that call upon indigenous peoples to stop seed-saving of traditional varieties and find the money to buy drought-

⁵³ *Id.* at ix.

⁵⁴ WATER AND INDIGENOUS PEOPLES, *supra* note 48, at 12.

⁵⁵ *Id.*

⁵⁶ *Id.* at 15.

⁵⁷ *Id.* at 16.

⁵⁸ *Id.* at 28.

⁵⁹ *Id.*

⁶⁰ Efficiency goals must be evaluated for equity dimensions. Transferring low-value water uses to high value water uses is efficient but not equitable when it results in water transfers from household farming to large-scale agriculture and industry. Similarly, diverting water from tribal communities to urban centers may achieve higher financial rewards but does not pass the equity test.

⁶¹ WATER AND INDIGENOUS PEOPLES, *supra* note 48, at 30.

resistant, genetically modified seeds have equity and economic consequences.⁶² UNESCO notes that, “[t]he use of genetically-altered crops is alarming, especially when it is driven by a market-centric mindset, blind to social and cultural implications, as well as potential ecological and health hazards.”⁶³ Transboundary water governance involves distributing water equitably based upon need, custom, and cyclical availability.⁶⁴

Surface and groundwater resources are often generated in highlands then flow to lowlands, leaving highlanders without substantial natural water storage facilities. Human designed water storage must be both reasonable and equitable. UNESCO states that,

[t]he prioritisation of water uses must be based on participatory mechanisms that enable water conservation and equitable access. Sustainable management projects require public information on the current status and availability of surface and ground water. This information is currently almost non-existent, not systematized and difficult or costly to access Legislative norms and water management forms must guarantee that water is available in terms of volume and quality, to ensure the sustainability of ecosystems and human communities and to satisfy their needs. Therefore, systems of governance, both at the basin level and nationally, must be based on existing local water authorities, such as indigenous and rural communities, irrigators’ associations, and other water users.⁶⁵

Water should remain in the public domain and water use decisions should be the outcome of consensus-based actions that balance human and ecosystem integrity in a sustainable manner.⁶⁶ Leasing water management contracts to private entities can increase efficiency, but must not compromise equity nor lose sight of water as a public good. The Indigenous Peoples Kyoto Water Declaration warns that, “[t]he indiscriminate and narrow application of modern scientific tools and technologies has contributed to the loss and degradation of water.”⁶⁷ Calling for recognition of traditional knowledge and indigenous title, this declaration challenges nation-state ownership of water, large dam construction, and commodification of water irrespective of indigenous water rights.⁶⁸

⁶² *Id.*

⁶³ *Id.*

⁶⁴ *Id.* at 42.

⁶⁵ *Id.* at 44.

⁶⁶ *Id.* at 43.

⁶⁷ *Id.* at 177.

⁶⁸ *Id.* at 178.

III. CIVIL SOCIETY PARTICIPATION AND PUBLIC EDUCATION

Knowledge and capacity are core aspects of reasonable and equitable water use.⁶⁹ As UNESCO notes,

A knowledge system extends well beyond data pertaining to physical and technical parameters. Involving civil society and increased community participation foster a greater understanding of the interactions of the complex social and environmental processes involved in water management, which enables the rethinking of approaches to effective water development. The knowledge base is made up of databases, documents, models, procedures, tools and products. It also includes knowledge that may not be explicitly available because it is contextual, cultural and relates to skills, heuristics, experience and natural talents (such as local or indigenous knowledge).⁷⁰

Effective governance involves: (1) participation in decision-making; (2) reasonable access to information from transparent institutions; (3) equitable access to sustainable development; (4) efficient, effective processes and outcomes; (5) commitment to the rule of law that is fair, enforced impartially, and respects basic human rights; (6) accountable public and private entities; (7) consistent and coherent processes and decisions; (8) versatile and responsive government, private sector, and civil society entities; (9) integration of cross-cutting issues; and (10) a willingness to implement ethical principles including traditional water rights.⁷¹

Water management can become a model for good governance.⁷² Integrated Water Resources Management involves considering ecological and socio-economic issues together within an ecosystem approach.⁷³ Increasing access to basic water data can facilitate transboundary water governance. The World Water Report notes that,

⁶⁹ WATER: A SHARED RESPONSIBILITY, *supra* note 24, at 435.

⁷⁰ *Id.*

⁷¹ *Id.* at 49.

⁷² *Id.*; see also Denise Lach, Helen Ingram, & Steve Rayner, *Maintaining the Status Quo: How Institutional Norms and Practices Create Conservative Water Organizations*, 83 TEX. L. REV. 2027, 2032 (2005). The author notes that:

Water managers at all levels and in all organizations we interviewed consistently described a common hierarchy of values for managing water resources: reliability, quality, and cost. Reliability for these managers means meeting several, often conflicting, demands: (1) water that is always there when the customer turns on the faucet; (2) water for crops on the most critical days of the growing season; (3) water for fish at the lowest stream flow; (4) water to generate hydroelectricity when demand is at peak; and (5) no substantial loss of life or property in the worst flood.

Id.

⁷³ WATER: A SHARED RESPONSIBILITY, *supra* note 24, at 185.

[t]he way information is generated, analysed, controlled and disseminated sets up the context in which perspectives are formed and solutions generated. . . [C]ooperative research, joint data collection, knowledge and information sharing are important for building the basis for collaborative planning and management.⁷⁴ Governments should also coordinate communications systems to warn communities about floods as well as multi-hazard events.⁷⁵

The World Water Report goes on to emphasize that,

Improved governance and impacts on water resources management and related services are both complex and dynamic. If a country lacks essential freedoms, like the freedom of speech and the right to organize, promoting participatory approaches in water development programmes is compromised. If citizens cannot access basic information on water quantity and quality, it seriously curtails their chances of halting environmentally unsound water projects or to hold relevant government agencies accountable. . . water provision is often less a question of available water resources than of properly functioning institutions and proper infrastructure management.⁷⁶

Participation ranging from information sharing to decision-making remains central to equitable and effective water management.⁷⁷ Yet, as the United Nations notes,

Today, due to the ever-increasing speed with which technology can collect, store and disseminate data, we are possibly encountering for the first time a situation in which human individuals and their capacities are the primary bottleneck in the chain of information processing, making people the limiting factor for further understanding. Knowledge has to be presented in a way that people can assimilate it.⁷⁸

The film *Running the Sahara* seeks to highlight the need for G8 country leadership to address the global water and sanitation crisis.⁷⁹ The film does so through a broad awareness raising approach. Some African women spend one

⁷⁴ *Id.* at 25-26.

⁷⁵ *Id.* at 348.

⁷⁶ *Id.* at 50.

⁷⁷ *Id.* at 421.

⁷⁸ *Id.* at 444. (citations omitted).

⁷⁹ *RUNNING THE SAHARA* (Live Planet Productions 2006); see also *Running the Sahara, About the Run*, <http://www.nationalgeographic.com/runningthesahara/> (last visited Mar. 15, 2008). The international team ran from Senegal to Egypt. Charlie Engle is from the U.S., Kevin Lin is from Taiwan, and Ray Zahab is from Canada. The film was directed by James Moll and narrated by Matt Damon. *Running the Sahara, supra.*

third of their caloric intake collecting water.⁸⁰ Rainwater harvesting could end much of Africa's water shortage according to the United Nations.⁸¹ Large-scale infrastructure often does not reach the needs of the poor while rainwater harvesting can soften the impact of droughts for both rural and urban dwellers.⁸² Civil society can call upon governments and donors to facilitate the broad deployment and maintenance of water gathering technology.⁸³ The Kenyan government announced plans to require new buildings to have the capacity to collect and store rainwater.⁸⁴ GIS technology enabled United Nations scientists to map rainfall patterns across nine African countries and to relate water plots with those of land use and population density.⁸⁵ As M. Husain Sadar points out, "[o]ngoing, credible, and informed advice, based on sound economic, environmental, and ecological analysis, is essential to making balanced political decisions, formulating long-term policies, and designing workable and cost-effective implementation mechanisms."⁸⁶ Individuals, non-governmental organizations, private sector experts, governments, and international institutions can expand one another's perspectives to achieve sustainable development.

The International Water Management Institute ("IWMI") mapped two kinds of water scarcity, which delineated physical and economic scarcity.⁸⁷ The IWMI explains that economic scarcity results from inadequate investment in infrastructure and inequitable water distribution.⁸⁸ Water resources that do not meet population demands lead to physical water scarcity. Careful agricultural water policies can alleviate water scarcity as well as reduce surface and groundwater pollution. One fourth of the people on the globe dwell in river basins that must contend with physical water scarcity while an additional one billion individuals live in river basins that have yet to address economic water scarcity.⁸⁹

Putting water on the national security agenda can facilitate coordinated

⁸⁰ Richard Black, *Rain Capture Answer to Water Woe*, BBC NEWS, Nov. 13, 2006, at 1, available at <http://news.bbc.co.uk/2/hi/science/nature/6143746.stm>.

⁸¹ *Rainwater Harvesting Could End Much of Africa's Water Shortage*, UN NEWS SERV., Nov. 13, 2006, at 1, available at <http://www.un.org/apps/news/story.asp?NewsID=20581&Cr=unep&Cr1=water>.

⁸² *Id.*

⁸³ *Id.*

⁸⁴ Black, *supra* note 80, at 1.

⁸⁵ *Id.*

⁸⁶ M. Husain Sadar, *Conclusion. Summary of Consensus from the Workshop Participants*, INT'L DEV. RESEARCH CTR., WATER BALANCES IN THE EASTERN MEDITERRANEAN (David B. Brooks & Ozay Mehmet eds., 2000), available at http://www.idrc.ca/en/ev-33234-201-1-DO_TOPIC.html.

⁸⁷ *Map Details Global Water Stress*, BBC NEWS, Aug. 21, 2006, at 1, available at <http://news.bbc.co.uk/2/hi/science/nature/5269296.stm>.

⁸⁸ *Id.*

⁸⁹ Lacking sufficient water to meet its domestic needs, Egypt imports over half of its food. *Id.*

strategic planning for use of water resources.⁹⁰ Climate volatility increases the need for cooperation.⁹¹ Climate change is predicted to lower the ability of the least developed states to grow a sufficient supply of food.⁹² The cost of lack of water availability to Africa is roughly five percent of African economic growth, comparable to that generated by aid received.⁹³ Poor people who must buy from private water-trucking services often pay the highest prices.⁹⁴

IV. POLLUTION

Water-borne diseases cause eighty percent of developing country deaths and illnesses, ending the life of one child every eight seconds.⁹⁵ Flush toilets use drinking quality water to transport excreta.⁹⁶ Vacuum toilets, currently in use on airplanes and boats, are water-free systems.⁹⁷ On World Water Day 300 New York restaurants raised money for UNICEF by charging one dollar a pitcher for tap water.⁹⁸ While excess carbon alters the climate, filtering water with carbon and exposing it to UV rays can reduce contaminants.⁹⁹ Restaurants are serving fancy tap water by offering costly triple-filters and “reverse osmosis” treatment. The Wall Street Journal notes that, “[t]hey’re filling carafes with Japanese charcoal, running water through special stones to add minerals, and serving house-made seltzer.”¹⁰⁰ The Journal goes on to point out that Americans drank ten percent more bottled water in 2006 than in 2005.¹⁰¹ These 8.3 billion gallons of bottled water produced a great deal of excess packaging as people in the United States seek to minimize their exposure to pollution.¹⁰² The Environmental Protection Agency notes that, “[a] common misconception is that

⁹⁰ David Loyn, *UN Urges End to 'Water Apartheid.'* BBC NEWS, Nov. 9, 2006, at 1, available at <http://news.bbc.co.uk/2/hi/business/6131922.stm>.

⁹¹ *Id.*

⁹² *Id.*

⁹³ *Id.*

⁹⁴ *Id.*

⁹⁵ Alex Kirby, *Pollution: A Life and Death Issue*, BBC NEWS, Dec. 13, 2004, at 1, available at <http://news.bbc.co.uk/1/hi/sci/tech/4086809.stm>.

⁹⁶ Liesbeth De Bakker & Willemien Groot, *Water Efficient Cities of the Future*, (Radio Netherlands radio broadcast Dec. 5, 2006), available at <http://www.radionetherlands.nl/currentaffairs/eu060512>.

⁹⁷ *Id.*

⁹⁸ Katy McLaughlin, *Latest Gourmet Offering: Tap Water; To Burnish Their Green Image, Chefs Ditch Bottles and Spiff Up Faucet H₂O*, WALL ST. J., Apr. 14, 2007, at 1, available at <http://proquest.umi.com/pqdweb?did=1254539021&sid=8&Fmt=3&clientId=44880&RQT=309&VName=PQD>.

⁹⁹ *Id.*

¹⁰⁰ *Id.*

¹⁰¹ *Id.*

¹⁰² *Id.*

bottled water is better than tap water."¹⁰³ Both tap water and bottled water have to meet the same drinking water standards.¹⁰⁴

The Royal Society for the Protection of Birds indicates that over-pumping water by water companies violates the European Union habitats directive.¹⁰⁵ The water industry responds that pumping is permitted by the Environment Agency. The latter is building a case to revoke licenses.¹⁰⁶ In response to calls to become water neutral, Coca-Cola's chairman and chief executive E. Neville Isdell points out that, "[i]f we do not act responsibly, society will not give us the social license to continue to operate."¹⁰⁷ The daily activities of governments, corporations, and individuals impact water quality. Efficiency across the board can lower water pollution. For instance, increased fertilizer use and livestock operations have doubled global nitrogen levels in the environment since the 1940s, altering ecosystems by creating off-shore dead zones, lowering soil fertility, depleting the ozone layer, and contributing to climate volatility.¹⁰⁸ Alex Kirby of the BBC notes that, "[w]orld cereal consumption has more than doubled since 1970, and meat consumption has tripled since 1961. The global fish catch grew more than six times from 1950 to 1997."¹⁰⁹ World population doubled to six billion people between 1960 and 2000.¹¹⁰ The best cropland is under intensive cultivation. Marginal land will be unlikely to fill the gap created by rapid population growth and soil degradation.¹¹¹ Furthermore, pests have become increasingly resistant to pesticides that made the large expansion of crop production possible.¹¹² Transitioning to crops that are better adapted to the projected climate volatility of a given region should occur with targeted support to those truly in need of assistance.

Facilitating such clean technology transfer as solar powered drip irrigation

¹⁰³ *Id.*

¹⁰⁴ *Id.*

¹⁰⁵ *Water Firms 'Damaging Wetlands,'* BBC NEWS, June 25, 2006, at 1, available at <http://news.bbc.co.uk/2/hi/science/nature/5114056.stm>.

¹⁰⁶ *Id.*

¹⁰⁷ Andrew Batson, *Coke Aims to Improve Water Recycling; Proposal Marks a Bid to Address Criticism in Developing Nations,* WALL ST. J., June 6, 2007, at A10, available at <http://proquest.umi.com/pqdweb??did=1283080771?&sid=1?&Fmt=4?&clientId=44880?&RQT=309?&VName=PQD>.

¹⁰⁸ "Globally, we have taken over about 26% of the planet's land area (roughly 3.3 billion hectares) for cropland and pasture, replacing a third of temperate and tropical forests and a quarter of natural grasslands. Another 0.5 billion ha has gone for urban and built-up areas. Habitat loss from the conversion of natural ecosystems is the main reason why other species are being pushed closer to the brink of extinction." Alex Kirby, *Can the Planet Feed Us?*, BBC NEWS, Nov. 24, 2004, at 1, available at <http://news.bbc.co.uk/1/hi/sci/tech/4038205.stm>.

¹⁰⁹ *Id.*

¹¹⁰ *Id.*

¹¹¹ *Id.*; see also FOOD & AGRIC. ORG. [FAO], NATIONAL SOIL DEGRADATION MAPS 1 (2005), available at <http://www.fao.org/landandwater/agll/glasod/glasodmaps.jsp>.

¹¹² *Id.*

can transition water use in a manner that will minimize hardship and maximize water efficiency.¹¹³ The International Red Cross points out that deploying clean water and sanitation teams helped avert waterborne disease epidemics in regions recovering from the December 26, 2004 tsunami.¹¹⁴ Over 1.1 billion people do not have access to safe water and 2.4 billion people around the world lack access to sanitation.¹¹⁵ Rising costs of sourcing, supplying and treating drinking water have impacted people around the world, as has more expensive treatment and disposal of wastewater. Agricultural use of water can become more efficient with better irrigation methods. Similarly, residential and industrial use of water can become more efficient by investing in infrastructure that will address extensive leaks in the supply of water. In addition to water efficiency, water must remain within rivers and lakes in sufficient quantity for ecosystem integrity. Water contamination continues to threaten human health and environmental integrity. The precautionary principal must be implemented with regard to determining safe concentrations of substances released into water supplies.

If limited resources are to be directed towards outer space exploration then priorities need to be rational. The National Aeronautics and Space Administration's Mars exploration program images suggest that water still flows on the red planet.¹¹⁶ Given the urgent need to understand climate change and water availability patterns on earth, Mars exploration is a questionable use of public funds. Inequitable policies can be undone as evidenced by the international effort to revive Iraq's marshlands¹¹⁷ or Los Angeles' return of water rights to the Owens Valley.¹¹⁸ Mexican President Felipe Calderón has criticized plans to create a concrete lining for the All-American Canal that links

¹¹³ Elizabeth Burleson, *Middle Eastern and North African Hydropolitics: From Eddies of Indecision to Emerging International Law*, 18 GEO. INT'L ENVTL. L. REV. 385, 400 (2006); see also Elizabeth Burleson, *Equitable and Reasonable Use of Water in the Euphrates-Tigris River Basin*, 35 ELR 10041, 10048 (2005).

¹¹⁴ U.N.: *1 Billion People Lack Safe Drinking Water*, CNN, Mar. 22, 2005, at 1, available at <http://edition.cnn.com/2005/TECH/science/03/22/un.water.day.ap/index.html>.

¹¹⁵ *Id.*

¹¹⁶ Warren E. Leary, *Strongest Proof Yet of Water Flow on Mars*, N.Y. TIMES, Dec. 7, 2006, at A30, available at <http://www.nytimes.com/2006/12/07/science/space/07mars.html?ex=1323147600&en=39b6ddb43c35856b&ei=5088&partner=rssnyt&emc=rss>.

¹¹⁷ Andrew North, *Iraq's Uncertain Marshland Revival*, BBC NEWS, 27 June 2006, at 1, available at http://news.bbc.co.uk/2/hi/middle_east/5120574.stm.

¹¹⁸ Sandra Jefferson-Young, tribal leader of the Lone Pine Paiute Shoshone Indians, notes that the Los Angeles water diversion project left toxic dust that has caused health problems across Owens Valley. Los Angeles has been forced to do something about the dust due to a court order. Years of litigation have resulted in Los Angeles's obligation to restore the river and wetlands — a project three years behind schedule. Carrie Kahn, *L.A. Returns Water to the Owens Valley* (NPR radio broadcast Dec. 7, 2006), available at <http://www.npr.org/templates/story/story.php?storyId=6590362&ft=1&f=1001>.

Colorado River water to Californian farms.¹¹⁹ Calderón notes that the scheme would stop groundwater from reaching Mexico and likely increase illegal migration.¹²⁰ Water availability can rise if decision-makers at all levels managed water more effectively. This involves understanding the value of water for all of its uses. Benjamin Franklin noted that, “[w]hen the Well’s dry, we know the Worth of Water.”¹²¹ Ensuring water availability is a core function of government, yet the capital of the world’s richest nation still struggles to provide water to extinguish fires. The Washington D.C. Fire Chief believes that more than twenty-five percent of the city’s fire hydrants are faulty.¹²²

In addition to water availability and fire prevention, health remains a core function of good governance. The Food and Drug Administration is reviewing the effects of drugs on the environment, given Environmental Protection Agency and independent scientific assessments that certain drugs alter sexual characteristics in fish and other aquatic species.¹²³ The United States Geological Survey has published a survey of antibiotics, hormones, pain relievers, cough suppressants, disinfectants and other products found in over one hundred waterways downstream from treatment plants and animal feedlots in thirty states.¹²⁴ Water availability and safety are in decline around the world, leaving decision-makers struggling to meet basic human needs.

Energy intensive means of increasing water supply need to be assessed in an integrated manner. As UNESCO observes, “[l]ooking at energy use and water use simultaneously generates valuable insights that do not arise from separate policy analyses of water and energy issues.”¹²⁵ Desalination needs more energy than wastewater recycling, while “[p]umping systems alone account for 20 percent of the world’s electrical energy demand and range from 25 percent to 50 percent of total energy use in some industrial operations.”¹²⁶ Groundwater has become a key constraint to further social and economic progress. The Ogallala Aquifer in the United States provides approximately one third of the country’s

¹¹⁹ Manuel Roig-Franzia, *Mexican President Criticizes 'Absurd' U.S. Border Policies*, WASH. POST, Mar. 17, 2007, at A10, available at http://www.washingtonpost.com/wp-dyn/content/article/2007/03/16/AR2007031602753.html?nav=rss_print/asection.

¹²⁰ *Id.*

¹²¹ BENJAMIN FRANKLIN, *POOR RICHARD'S ALMANACK* 132 (Barnes and Noble, 2004) (1746) (*Poor Richard's Almanack* was published yearly from 1732 to 1758).

¹²² Allison Klein, *More D.C. Hydrants May Be Broken Fire Chief Raises Estimate to 25%*, WASH. POST, May 24, 2007, at A01, available at http://www.washingtonpost.com/wp-dyn/content/article/2007/05/23/AR2007052301135.html?nav=rss_print/asection.

¹²³ Andrew C. Revkin, *F.D.A. Considers New Tests For Environmental Effects*, N.Y. TIMES, Mar. 14, 2002, at A20, available at <http://query.nytimes.com/gst/fullpage.html?sec=health&res=9B01E4D81339F937A25750C0A9649C8B63>.

¹²⁴ *Id.*

¹²⁵ WATER: A SHARED RESPONSIBILITY, *supra* note 24, at 327.

¹²⁶ *Id.*

irrigation needs.¹²⁷ Spanning from South Dakota to Texas, this source of groundwater is being over-extracted.¹²⁸ With water levels falling by three to five feet a year in certain areas, predictions for the Ogallala Aquifer's ability to supply water ranges from 60 to 250 years.¹²⁹ For a country whose fresh water supply is ninety-five percent located beneath the ground, the depletion of the Ogallala Aquifer is a national security issue. Groundwater is also a crucial issue for Bangladeshis who are drinking arsenic from wells.¹³⁰ Clean technology transfer is urgently needed to help Bangladeshis filter arsenic from their groundwater.

Capacity building can progress beyond project implementation to sustaining expertise in social development, sanitation and hygiene education. In addition to water supply, specialists that can build initial infrastructure, governments and donors should support those left with the task of operation and maintenance. Such support should be gender sensitive.¹³¹ States should enact legislation and fund access to safe water and basic sanitation. Policies that encourage small-scale water development that prioritizes basic domestic water needs should retain equitable customary arrangements.¹³² Inequitable customary arrangements such as discriminatory laws that prohibit women from receiving loans or opening bank accounts should make way for micro-credit to women and gender-sensitive organizations for improving or building water and sanitation services.¹³³ In proclaiming the water decade from 2005 to 2015 the UN General Assembly set forth the goal of enabling participation and involvement of all stakeholders, including women, in the implementation of water-related programs and projects. In launching the "Water For Life" decade, Kofi Annan stated,

We need to increase water efficiency, especially in agriculture. We need to free women and girls from the daily chore of hauling water, often over great distances. We must involve them in decision-making on water management. We need to make sanitation a priority. This is where progress is lagging most. And we must show that water resources need not be a source of conflict. Instead, they can be a catalyst for cooperation.¹³⁴

¹²⁷ *Map: The World's Water Hotspots*, BBC NEWS, Oct. 20, 2004, at 1, available at <http://news.bbc.co.uk/1/hi/sci/tech/3754520.stm#turkey>.

¹²⁸ *Id.*

¹²⁹ *Id.*

¹³⁰ *Id.*

¹³¹ UN Dep't of Econ. & Soc. Affairs [UNDESA], Comm'n on Sustainable Dev., 12th Session, *A Gender Perspective on Water Resources and Sanitation*, at 9-10, Background Paper No.2, DESA/DSD/2005/2, (2004), available at http://www.un.org/esa/sustdev/csd/csd13/bgound_2.pdf.

¹³² *Id.* at 18.

¹³³ *Id.*

¹³⁴ Kofi Annan, *Message of the Secretary-General to Launch the "Water For Life" Decade*, Mar. 22, 2005, available at <http://www.un.org/waterforlifedecade/>.

The water decade provides an opportunity for coordinating efforts to expand access to water and sanitation as set forth in Agenda 21, the UN Millennium Declaration, Johannesburg Plan of Implementation, and 12th and 13th sessions of the Commission on Sustainable Development.¹³⁵

CONCLUSION

Forums that increase the frequency of interactions build trust and form stable expectations. Clean technology transfer can facilitate informed decisions upon which egalitarian agreements can establish sustainable watershed management. Floods, droughts, and other extreme water events affect security, livelihoods and sustainable development.¹³⁶ Rapid population growth, technological innovation, climate volatility, and conflict need to be considered in an integrated manner when developing transboundary water policies.¹³⁷ Achieving good governance and sustainable development requires the political will to take a long term and integrated approach to issues. Climate change is altering the scope of global insecurity as water availability becomes less predictable.¹³⁸ Water refugees are already on the move as a result of dam displacement, floods, and droughts. Mahatma Gandhi noted that, “the difference between what we do and what we are capable of doing would suffice to solve most of the world’s problems.”¹³⁹ Reasonable and equitable use of transboundary water resources can help sustain local, regional, and international peace and security.

¹³⁵ WATER: A SHARED RESPONSIBILITY, *supra* note 24, at xi.

¹³⁶ *Id.* at vii.

¹³⁷ *Id.* at 1. See generally Elizabeth Burleson, *Multilateral Climate Change Mitigation*, 41 U.S.F. L. REV. 373 (2007).

¹³⁸ HUMAN DEVELOPMENT REPORT *supra* note 1, at 15.

¹³⁹ HUMAN DEVELOPMENT REPORT *supra* note 1, at 5 (quoting Mahatma Gandhi).

