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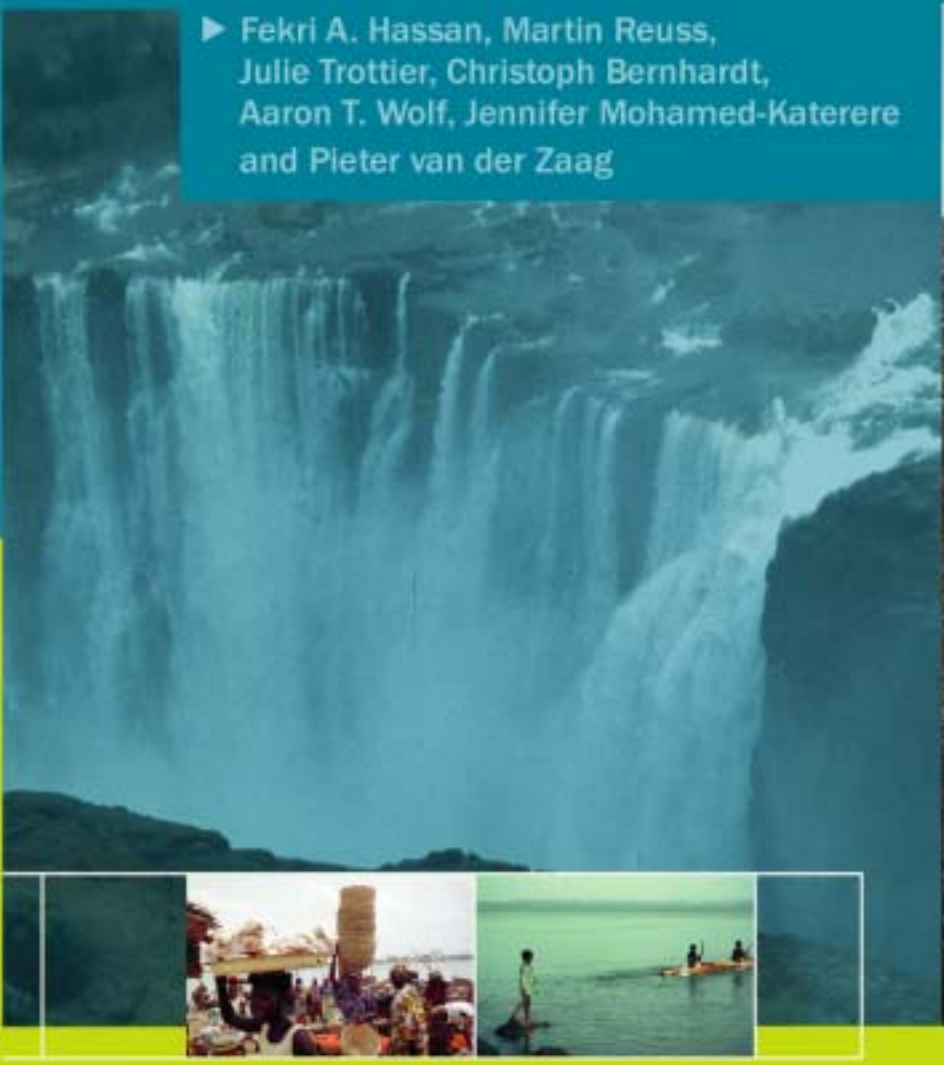
History and Future of Shared Water Resources

Fekri A. Hassan, Martin Reuss, Julie Trottier, Christoph Bernhardt, Aaron T. Wolf, Jennifer Mohamed-Katerere and Pieter van der Zaag



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WATER FOR PEACE: A CULTURAL STRATEGY

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WATER FOR PEACE: A CULTURAL STRATEGY

We are embedded in culture to the extent that we are often unaware that no fundamental change in the way we live can be sustained without drastic changes in the way we view the world, others, and ourselves. We cannot therefore hope to resolve conflicts over water and mobilize water for peaceable relations among neighbours without a clear cultural strategy. In such a strategy we are guided by a transcultural set of ethics that extol sharing, equity, and justice that have a long evolutionary history. We are moving toward a higher state of social integration, bringing together as nation-states peoples from different ethnic, religious, and occupational backgrounds. The cultural means for water for peace include effective communication and a socially acceptable and feasible plan of action with visible rewards in successive stages to win trust and support. Well-trained and informed individuals placed in the right social circles are key ingredients as ferment for change. Professionals have a critical role to play as mediators between the public and policy makers. They should be motivated to transcend the trap of technocracy, narrow specialization, and dissociation from social engagement. Genuine dialogue with the public to encourage people to participate fully in water management and in transnational cooperative undertakings is the only long-term guarantee for successful water for peace. Water, with its transcultural symbolic signification, not only has the power to unite us to resolve conflicts over water, but also to provide the basis for a new world of global cooperation for peace and prosperity.

1. INTRODUCTION

> The real problem to be faced in this final assessment is not that of establishing a timetable for resource or environmental frictions. It is taking the measure to the institutional and attitudinal changes that will be required of future generations, and of weighing the various means by which society can enforce whatever means by which society can enforce whatever adaptional or transformational changes will be necessary for survival.
>
> (Heilbroner, 1980, p. 171)

Conflict and cooperation are social processes embedded in a deeper cultural matrix. As such, any attempt to transform situations of conflict or potential conflict must entail an understanding of social change. In this article, I aim to elucidate a cultural strategy for implementing sustainable changes in societies with symptoms of conflict.

In developing this strategy, I recognize the role of individuals as the active agents of social actions who operate on the basis of genetic endowments of long-term biological ancestry and cultural traditions internalized through a process of socialization (at all stages of life). Parents, family members, educators, politicians, priests, and professionals impart cultural traditions, and other traditions involved in various social institutions or specific segments of society. The transmission of cultural norms, values, orientations, and even modes of thinking, communicating, and acting is carried out directly or indirectly by various communications media.

Societies are neither homogeneous nor are they static, passive recipients of traditional lore. This is because societies consist of cognizant, purposeful individuals who process information to make decisions. A society is a society of minds: minds that are in a state of dialogue in order to create viable corporate entities for doing the work and taking the actions that ultimately lead to the survival, welfare, or demise of the group.

Modern societies are in the arena of transactions structured by governmental state organization, financial and economic corporations, military establishments, educational institutions, science and technology foundations, and organized religious orders. The "public" consists of individuals who belong to a matrix of regional communities, occupational associations, and socio-economic segments.

In water conflicts, there has been a tendency to regard such conflicts as a matter of inter-governmental concern that can be resolved or reversed through treaties. However, the role of individuals (either as members of government or the "public") is rarely considered as the primary locus of social change (Saunders, 1999). Harold Saunders, who has been involved in conflict resolution for more than two decades, has aptly concluded:

> Recognizing the human dimension of conflict opened the door to seeing peacemaking as a process not limited to the work of governments. Important as that work was, it depended in fundamental ways on changes in human relationships—an arena well beyond the reach of governments alone. As that insight became more concrete, it enlarged the concept of the peace process
>
> (Saunders, 1999, p. xix)

In conceptualizing an effective strategy to transform potential conflict to profitable cooperation and a peaceable coexistence among contenders, the process must also be regarded as much more than that involved in "negotiations." Genuine social change cannot be brought about without a change of "heart" among a significant majority or an influential minority in society. By "heart," I mean here the unfathomable domain of

emotions, passions, and feelings that often permeate perceptions of conflict and confrontation. We are not only dealing with individuals in or outside governments, we are also dealing with pronouncements, actions, and reactions that are motivated by emotive causes generated by social messages that appeal to cardinal lineaments of the self as a socialized entity (patriotism, religious beliefs, ethnic lore, or self worth).

Change in societies, in the long run, is a function of the differential adoption of novel ideas, modes of behavior, belief systems, technical innovations, or social institutions. Such innovations may prove to be ephemeral or permanent. Their permanency depends on their compatibility with pre-existing cultural modalities and their perceived benefits weighed against their perceived ill effects.

Innovations may be adopted by the masses or by non-governmental associations, leading to a tide that may force a gradual or revolutionary change in government. Alternatively, governments may dictate innovations. In general, governments may co-opt mass movements (for instance, Christianity or trade unions) and the public may eventually transform a governmental dictate to a popular belief.

The strategy for "water for peace" must thus realistically work both with governments and the "public" as individuals in organized movements or groups, whose ideas and arguments are largely inseparable from an emotional ingredient.

Change in societies is a process involving the deep beliefs of many actors and the transformation of complex institutions with their own actors who have vested interests in the status quo, and who are interdependent and co-dependent on other institutions. Therefore, change in societies is a long-term process with sequential phases entailing:

1. Inception.
2. Incubation.
3. Proliferation, diffusion, dissemination, spread (or arrest).
4. Amplification and reinforcement.
5. Racination (taking root).
6. Propagation.
7. Transformation.

These stages are not linear and may coexist. Certain stages may be skipped, but for social change within the span of decades (intra-generational) to become a cultural change it must survive from one generation to another and must spread from one community to many others. This cannot take place without a process of racination, in which an innovation takes root as a fundamental, axial notion in the minds of people – becoming a founder notion of deep significance in the making of self and its view of the world (for example, notions of cars and mobility, of monotheism, of status and its material manifestations, of democracy and parliaments).

Innovations that have proved to be viable, becoming cherished axes of human perception and action, may come under attack by other societies, or may even become suspect in the same milieu where they first appeared, either as a result of unforeseen consequences or as a result of the social tensions that their adoption and racination engenders (for instance, resistance to secularization by a religious establishment, the cumulative, long-term effect of industrial pollutants, escalating water demands of industry threatening free or subsidized water allocation to farmers). This is a reflection of the short-term perceptions, subjective estimates of risk and probabilities, lack of sufficient data, and complexity of social processes that lead inevitably to decision-making under various degrees of uncertainty.

I will argue in setting the stage for the development of a strategy aiming at a "water for peace" paradigm that such a great notion cannot be effectively persuasive unless it is founded on a trans-cultural ethical foundation of the concept of justice. Peace is far more than the short-term containment of hostilities. A lasting peace must

be grounded in notions of justice and equity among nations and within societies. This point is discussed in the first part of this contribution (Sections 2–7). I will also argue that social change leading to a sustainable cultural transformation must take into consideration the role of communication in promoting notions of cooperation or conflict. Communication is not the neutral transmission of information but a process of reception and rejection that requires the cultivation of effective communication channels and a proper communication style. Furthermore, communicated ideas cannot be lodged in the human psyche without successive demonstrations of their efficacy, beneficial rewards, and their role in mitigating danger and averting harm. A "water for peace" strategy must thus involve the active pursuit of actions with tangible benefits and the demonstration of the ills of conflict and confrontation.

A recognition of the process of social change provides a blueprint for a water for peace strategy based not solely on "social indicators," a paradigmatic strategy employed a means for early warning (Buer, 1966; Sheldon and Moore, 1968). Such a strategy fails to move beyond the recognition of symptoms to remedy. Only a causal analysis based, as I argue here, on the recognition of agency and process, on the role of ideas, beliefs, emotions, communication, and actions, and on the stages of social change, will serve as a foundation for assessing directions, techniques, and priorities in moving societies from confrontation to cooperation, and from animosities to constructive, sustainable, peaceable interactions.

2. BACKGROUND: OUR MEANINGLESS DIFFERENCES

Cultures in different parts of the world have emerged as normative formulations to facilitate communication, minimize disagreements, and enhance concord among individuals within circumscribed regions. The making of culture is a social human endeavor necessitated in the first place by the relative advantage of living in a group. The survival of human beings as a species is primarily a function of sociality and intelligence. Sociality – a biologically inherited trait, enhanced and elaborated by learned behavioral practices – is a highly developed characteristic of all human groups. These groups exist as societies consisting of interrelated communities. The size of a community is often governed by the number of people that can be supported within the physical parameters of a territory delimited by the mode of travel across the landscape.

For millions of years, people depended on hunting, gathering, foraging, and fowling – eking a livelihood from the natural abundance of wild resources. Under such conditions local communities consisted of no more than a few families interacting with others in their proximity. The local communities or bands could not survive biologically without intermarrying with their neighbors. Although in general hunters and gatherers were well fed, accidents and the lack of the medical benefits we enjoy today made them succumb to death at an early age. In the long run, the small groups faced extinction. In the short run, they faced occasional shortages of marriageable mates, which were overcome by seeking partners from neighboring bands. Statistical calculations and computer modeling reveal that societies with a population of less than 1,000 people are likely to face extinction within a period of hundreds of years.

Under hunting and gathering conditions, a society of 1,000 people covered a very large territory because the amount of food available was not sufficient to sustain a high density of people. In fact, most bands were on the move, with interim encampments until food in the neighborhood ran out or until another food resource became seasonally available elsewhere.

The high spatial mobility and inter-group transactions of mates were the basis for a constant flow of genes. No community was an island. Those that were cut off because of physical barriers or self-imposed isolationism were doomed. In our family

tree, *Homo sapiens sapiens*, members of the same sub-species had many branches at the beginning from 5 million to about 1 million years ago. With the emergence of *Homo erectus*, with traditionally famous examples retrieved from a cave near Beijing (Peking), we entered a genetic course that has led to the transformation of our ancestors as a single global breeding unit.

In a remarkable development, the emergence of our immediate ancestors (modern humans) in Africa 200,000 to 100,000 years ago was quickly followed with the spread of these genetically modified creatures across the globe. Although anthropologists may debate the Out-of-Africa theory, they are in agreement concerning the unity of our species. By 40,000 years ago, our humankind was biologically one and the same everywhere in the world.

Regardless of the color of hair, the shape of our eyes, lips, and noses, we are all of same flesh and blood – we are all blood-kin. Our physical differences are not essential – they are the imprints of living under different weather and geographic conditions and of regional effects caused by marriage distances.

Geographic distances also lead to the emergence of localized modes of behavior, communication, ideas, and artifacts. As a function of behavioral interaction, people who engage in frequent encounters develop specific traits that they then pass to their children – the result is the genesis of local cultures. In the long run only those social traits that do not endanger the group and reduce its potential for survival are retained. An initial set of valuable traits becomes then the host of new traits. Traits that are not compatible with pre-existing successful traits are likely to be short-lived.

Human groups thus create their own social environment embedded within the natural world where ultimately no social construct could violate and survive. This mechanism of socially mediated interaction with nature has ensured that in the long run only those traits that are compatible with natural constraints, with society, and with neighboring societies are viable. The result is that humans not only share a fundamental, universal biological constitution, but they are also the inheritors and perpetrators of a common cultural heritage.

3. THE BASIS FOR UNIVERSAL ETHICS

Differences in language, customs, or manners – in political organization, religion, or ideology among human groups – are primarily a result of localized, regional manifestations of particular developments. Such differences are products of distance and are proportional in magnitude to social and geographic separation. Thus, differences within a large society can be far greater than those between certain groups of different societies. The differences only last as long they do not threaten the survival of coexisting groups. Hence societies often develop mechanisms to eliminate life-threatening differences. Societies will also promote traits that facilitate and promote positive interactions within and between societies. This is the basis of universal ethics.

Already in the dim past of our prehistory (technically a period that precedes the appearance of writing) – a period dominated by roaming, small bands at the mercy of nature – one of the positive mechanisms for human survival was sharing. A hunter shared his prey with other members of the band. This was an insurance against a time when luck was not on his side – when he and his family could not procure the food that ensured their survival. Men and women who came together for pleasure faced eventually the consequences of having helpless babies. Exposed, abandoned or uncared for, the death of infants would have doomed the survival of the group. Caring, nurturing, protecting, and supporting children not only by biological means (for example, nursing), but also by social traits like clothing, healing from sickness, training, and sheltering, became the hallmark of a human survival strategy. Human

infants depend on adults for their survival, and without effective social mechanisms of parenting, human groups are biologically doomed.

There is undoubtedly an element of instinctive love inherited from our mammalian ancestors. Dogs, cats, and birds, unlike reptiles, survive because they instinctively care for their offspring when they are born. The emergence of this mode of parental care marks an evolutionary milestone that must be seen as the foundation of compassion, kindness, and love. These survival virtues were also effective social virtues when extended beyond the family to the community. The rise of these virtues was the birth of ethics and the recognition of what is right and what is wrong, what is good and what is evil. Groups sanctioned these virtues and made them sacred. They were so essential for survival and the good life (minimizing harm and maximizing pleasure) that they were passed from one generation to the next and from one group to another not as "situational," socially constructed ethics but as transcendental, extra-social principles. Their origin was often attributed to deities or a god who were/was not of this world.

It is not therefore surprising that one would find the message of "love," "compassion," "mercy," and "peace" in world religions. It is equally not surprising to find the same message in those religions and beliefs that predated Judaism, Christianity, Islam, and Hinduism.

4. INTERSUBJECTIVITY: SOCIETY AND SELF

The virtues of love and compassion in human beings are intertwined in human minds with the capacity to transcend their bodily interactions in the world and their circumstantial situations. This exceptional mental power, which can be traced in our cousins among the primates, is magnified to such an extent that it sets us apart from other animals. Transcending the tangible world, developing, storing, processing, and retrieving ideas in a world of "virtual reality" was tantamount to an evolutionary threshold – indeed a revolutionary achievement that has enabled us to survive under very different environments from the arctic to the tropics, from parched deserts to rainforests, and from valley bottoms to mountain tops. This exceptional intelligence allowed us to solve problems, not the least of which is living with others who are different from us. In fact, sociality was the womb of intelligence. In turn, intelligence is the guardian of sociality.

There are often more problems to solve in a social environment than those encountered in dealing with natural environments. As emotional animals with the proactive mind of a thinking primate, we are prey to swings of moods and flights of fancy – some can bring us close together, while some can repel, threaten, or endanger others. The mind thus becomes a powerful game-playing tool. Its individual reality (subjectivity) must be harmonized with that of others if the individual is to survive. As such, there is no such thing as individual subjectivity. Subjective views are embedded in a socially constructed inter-subjectivity – the only kind of objectivity we know. To know others or the world without human eyes and cultural lenses and filters constituted by our being in society, which is in turn a channel in the braided stream of human culture, is an impossibility. For us, absolute objectivity is a meaningless notion.

5. IDENTITY AND TRANSCULTURAL JUSTICE

In our world, interaction with others is based on mutual recognition. That sense of recognition is channeled through various media of communication ranging from non-verbal communication to written texts and pictorial signs. A recognition of affinity and difference is processed through signals of identity. The grimace of a chimpanzee or

the way a cow nurses a calf sparks a certain degree of affinity. A smile or a hug, even among strangers, carries a sense of affiliation and reciprocity – an affirmation of belonging together. Speaking is at once a means of sharing a common ability – recognition of the humanity of another – but it is also a means of establishing degrees of affinity. The ability to identify with others through the medium of written words on intellectual, emotional, and aesthetic levels also establishes bonds of affinity even with those who are long departed, those who participate or participated in different cultures. The ability to translate from one language to another, even with the loss of some information, is also a declaration of affinity and, more importantly, a means of discovering common intellectual, aesthetic, and emotional trans-cultural identity.

The question of identity is not one of individuality, but of similarity denoted better by the word "identification" with the sense of designation as a member of a class (identifiable with). Recognition and identification of others thus gives rise to the notion of our common humanity, of a class of beings who belong to the same category of creatures. Reciprocal recognition also gives rise to the notion of the ethical principle of justice as the application to the same responsibilities and obligations to others and oneself. In respecting others and endorsing their rights we are justifying the obligation by others to respect and endorse our rights (cf. Kantian ethics). Those who violate the rights of others, that they claim for themselves, undermine the basis for their humanity. Degrading the human principle of universal justice opens the road to extinction as a species. It is for this reason that utilitarian ethics is not to be framed within the limited scale of daily transactions, but must instead be embedded within the universal principle of justice.

In the limited perspective of the moment, and within the scope of social transaction, the wisdom of the notion of universal justice is blurred by short-term advantages and selfish tendencies (as a sense of self is also born as an anchor of the mind in a body differentiated from others including those of the same category). This is the source of "evil" – a threat to our primordial sense of justice, encoded in our cultural inheritance, the legacy of generations of human beings who curate justice as an ideal for humanity.

Humanity – the notion of belonging to a category greater than oneself of which the person as a constitutive part based on mutual recognition and trans-self identification with others – is the basis for furthering social virtues beyond the simple recognition of equality. It is the foundation of solidarity, cooperation, and collaboration – to labor and operate together as one. Clearly, even if there were no immediate benefit from such collaboration to one of the partners, in the long run all benefit from this behavioral strategy, thus elevating it to a moral principle beyond short-term transactions. The success of this moral strategy is a function of uncertainty. We are never certain of the perpetuation of our fortunes or of the conditions that guarantee such fortunes. We may pray for greater powers to preserve our health and prosperity, but we are ultimately left on our own, as God's will is beyond our reckoning. We need the psychological succor of belief in greater powers, but it is only by being good in this world that we are rewarded now and in the thereafter. Believers and non-believers alike are bound to social ethics as a function of their being in society.

6. THE SOURCE OF EVIL

When, some 10,000 years ago, new food processing technologies and social and subsistence strategies permitted foragers to shift to farming and herding to overcome periodic food scarcities, humanity was transformed and reconfigured. For example, it became possible to store food and to claim possession of fields, pastures, and waterholes. The preferential access to resources and the pursuit of different

subsistence tracks created possibilities for conflict and cooperation. Among foragers, there was no advantage to spending time fighting with others over meager resources. The energy expended in fighting was more than the energy needed to procure the same resources. There was no wealth. Feathers, cowry shells, or beads were of social significance but were not of monetary value. The appearance of valuable commodities (stored foods, tools, or goods that are labor-intensive to make) was paralleled with a very important social phenomenon – the dramatic increase in the number of people in a community and the potential for sedentary life. This development – made possible by the high productivity and stationary agricultural resources – created regional clusters that had much less need to interact continuously with others from neighboring regions than foragers did. The survival of regional clusters was also ensured by modes of political organization that enhanced group cohesion, giving rise to notions of ethnicity. In certain situations, regional polities were amalgamated into large trans-regional political entities dominated by kings. Management of large groups required supra-local mechanisms leading to the emergence of governments. It also became possible, and efficient under agrarian societies, to support skilled artisans, scribes, and priests, thus shifting the social structure from independent families or communities to an interdependent matrix of regions and occupational segments of society.

Differential access to wealth in society became bound with a structure of power that had in the long run tended to mark economic, social, and legal inequalities. Such inequalities were inherently unjust and could only be perpetuated by various tactics and stratagems aimed at keeping the disadvantaged at bay. The stratagems varied from religious justifications to coercion and promises of a better life later or in the thereafter. The agrarian mode of production was not economic – it was cultural. The rise of an elite, initially legitimated by its services to the community, was paralleled by the notion of the inequality of peasants and superior power brokers. History is replete with instances of peasant rebellions, which were either brutally crushed to break down the spirit of peasants, or managed to ensure their obedience, servility, and submission. In various regions, and in different times, the spirit of rebellion was never crushed and could never be crushed, because justice is ingrained in the human condition of being with and recognizing others (see above). Peasant wars continued into the twentieth century. Laborers in industrial nations also suffered from inequality and rebelled. Their demands were initially met with repression and violence, but eventually led to compromises and negotiations. The spirit of justice and equality not only works in the sense of the right to enjoy the fruits of one's intensive labor, but also in desiring what others have. This means that as the rich get richer, the poor become progressively poorer even as improvements in production expand the pie that they share. Justice is thus not about a satisfaction of minimal needs or basic requirements, it is about equal access, equal opportunity, and equal gain.

The breakdown of peasant societies and their incorporation in international commercial economic ventures releases a social power of unprecedented magnitude. As the social matrix of traditional agrarian systems is eroded, the immoral constraints that kept them in submission are shaken. Modernization (the process of transforming traditional peasant societies to serve the industrial order) carries within it a revolution in information and communication. The children of peasants or of rural urbans who are drawn to cities for job opportunities are co-opted through education to work in factories, government offices, or commercial posts. Learning to read shatters the social silence which peasants have been condemned to endure. Not only can they read the Bible or the Koran, they can also learn about human rights, freedom, and liberty – products of those who fought injustice and inequality maintaining the universal principle of human ethics.

Printed matter is now coupled with radio, television, and the Internet. Power holders can no longer depend on ignorance to maintain an order of inequality. By

undermining the monopoly over knowledge by local authorities or governments, or even traditional religious beliefs, the global information network contributes to a resurgence of social power of incalculable force.

Colonial regimes shook the world and entailed their own demise as they brought traditional societies in collision with powerful industrial nations. All the immoral justifications of colonialism were countermanded by the ideals of liberty, freedom, equality, and justice that the colonialists reserved for themselves.

Today, the world is undergoing a major cultural transformation as the foundations of the industrial order are undermined by the information revolution and trans-national economics. The juxtaposition of post-modernity and traditional societies occurring within the short span of decades has sent shock waves across the world. Today, the injustices of the past are compounded with those of the present to motivate ethnic, sectarian, and anti-globalization movements. In many instances the beliefs in a greater power than that of the power holders on earth triggers trans-national movements combining religious zeal with the chauvinism bred in modern times by ultra-patriotic nationalism.

7. WATER AND THE NON-ZERO GAME

Conflict over water today cannot be thought about without consideration both of this cultural context and of ethics in a changing world. If a resolution to conflict is to be found it cannot be by a perpetuation of older models of governance and exploitation. A resolution certainly will not be achieved by unilateral action, whether military or economic. A peaceful resolution to conflicts over water must be managed by references to the universal ethics of humankind, the current post-modern trans-cultural forces, the potential of the booming information networks, and the persistence of traditional models of culture. The solutions we explore below are based on the notion that we have more in common as human beings than we sometimes think, and that cooperation is the only long-term option for human survival and prosperity. An in-depth exploration of the role of cooperation in the evolution of civilization has been brilliantly attempted by Robert Wright, who, in a book entitled *Non-Zero: History, Evolution, and Human Cooperation* (Abacus, London, 2000), reveals the hidden logic of cultural evolution as an outcome of long-term profitable payoffs if contenders adopt a strategy of cooperation, thus increasing the range and variety of payoffs. For example, competition over Nile water may be replaced by a strategy to cooperate among contenders in economic and cultural fields thus creating the potential of much greater gain for each contender than they would gain from a limited share of water. Such cooperative ventures also eliminate the cost of conflict, especially if such a conflict escalates to a military confrontation involving loss of lives and diversion of much needed financial resources to a wasteful effort.

8. INTRODUCING CHANGE

A change from conflict to cooperation is much more than conflict resolution. The aim is to transform the situation in a manner that ensures cessation of hostile confrontation and disputes and the creation of an environment that could sustain cooperation. Such a change is a process that involves individuals, social groups, governments, and institutions.

Individuals are dynamic entities of groups of people related in different degrees and by bonds that vary in their strength. Each individual is socialized as soon as he or she is born by his or her parents, family, and greater society (represented by schools, mass media, governmental agencies, religious institutions). As the individual matures, his or her own thoughts and practices begin to shape a personality that will eventually

influence his/her ideas and behavior. Individuals may separately converge to similar ideas. They may then coalesce to further their ideas. A society changes in response to the degree by which new ideas are incorporated in older structures that are conserved and guarded in the name of tradition, authenticity, and identity. Swift and dramatic changes can be short-lived and/or catastrophic. Conflict between old and new is normal because change threatens the security engendered by what is familiar. The emotional comfort of the ways of the ancestors may and often does create a barrier against innovations which entails troublesome re-adjustments of cherished notions and practices.

The ideas held by an individual vary in their cultural weight – the mass associated with an idea as an expression of the effort needed to dislodge it. Some ideas, particularly related to religion or morality, may be deeply seated. It may be also stated that no change will be long-lasting or socially effective (entailing broad social transformations) unless it succeeds in courting deeply seated ideas, tweaking them, and eventually transforming them. The history of European societies provides vivid and clear examples of changes in religious ideology that legitimated radical transformations in economy, science, industry, and the arts. Our approach to water as a commodity, a common good, or a gift from God to humanity is bound with deeply seated ideologies. In a similar way, mining was once regarded as a sinful violation of the Earth, interest on loans a form of abominable usury, sculpture as an unlawful pagan practice, and the ideas of Gallileo Galilei and Charles Darwin as heresies. The change of attitudes in Europe toward evolution, mining, banking, and the arts was bound with ideological changes. The change in ideology was a result of a combination of factors related to social performance and communication.

9. IDEOLOGY, ETHICS, AND SOCIAL PERFORMANCE

With a few exceptions, individuals do not change their minds overnight. The process of change is gradual and cumulative; first with the content of novel ideas followed by structural adjustments and so on until the structural rearrangement of ideas becomes a selective force in its own right as individuals at the threshold of radical transformation seek to strengthen their newly emerging outlook by seeking and practicing what their ideas prescribe. At a certain point social and historical contingencies create and facilitate the dissemination of key ideas. The adoption of the ideas by certain individuals provides nuclei for social change. Ideas may emerge within the downtrodden, but such individuals rarely have the clout or the know-how. However, their views, which are often emotionally camouflaged or alloyed with despair and anger, may elicit suppression and repression. The suffering and humiliation of the downtrodden, however, may be recognized by the media, national authorities, or international agencies. Whatever the motivation, the call for change in order to remedy the problems suffered by the downtrodden has throughout history acquired a "biblical" dimension, the aura of a sacred imperative, no doubt brought about by the evolutionary validation of the ethics of equity as a social strategy.

The recognition of the plight of more than 1.2 billion human beings who live in poverty with no access to safe drinking water and of more than 2.5 billion having no access to proper sanitation has now created an outcry echoed by various international bodies. This outcry is being translated into action and recommendations for action such as those spelled out in the Bonn Ministerial Declaration (December 2001), which includes:

1. Secure equitable access to water for all people.
2. Ensure that water infrastructure and services are delivered to poor people.
3. Promote gender equity.

4. Appropriately allocate water among competing demands.
5. Share benefits.
6. Promote participatory sharing of benefits from large projects.
7. Improve water management.
8. Protect water quality and ecosystems.
9. Manage risks to cope with variability and climate change.
10. Encourage more efficient service provision.
11. Manage water at the lowest appropriate level.
12. Combat corruption effectively.

This declaration, signed by forty-six ministers responsible for water affairs from countries worldwide, is a positive step toward improving the current situation. The declaration must be viewed as both a step in a process and the outcome of previous efforts by UNESCO, IHP, and other international organizations such as World Forum that have served to mobilize people and institutions all over the world.

Purposeful change begins with the recognition of a problem, finding its causes, providing the means to generate solutions to it, and finally implementing the solutions. This apparently simple model is deceptive because it masks the social process in the "rational" process of thinking – a process that is not wrong for being a matter of reasoning, but is faulty and defective because it is "abstract" – divorcing thought from the process by which thought is expressed, generated, and translated to action.

The ministerial declaration must be viewed as an element in the social process of creating an increasing awareness of the water problem and a preparation for the next steps. Ministers responsible for water affairs are not necessarily representatives of their governments as a whole or of public opinion, but they are well placed to transmit their views to the ministerial cabinets of their countries and to engage ministers of information, education and culture, university professors, research institutions, NGOs, and grass-root associations and alliances to work with them to mobilize public support, disseminate information, and implement change. A full, effective, and pervasive national discourse on water for peace and prosperity is beyond the domain and capability of ministers responsible for water affairs. UNESCO and other international organizations must seek to develop an integrated package that countries can use to generate a national discourse on water for peace and prosperity. This integrated package would involve strategies and procedures to engage the media, ministers, universities and research institutions, schools, children, and communities to debate, discuss, and develop national programs.

Discourse is a powerful ingredient in change, but for discourse to be effective it must engage appropriate local cultural expressions of universal relevance. Slogans for democracy for example are effective within Europe, but may be regarded as vacuous notions or even manipulative ideological propaganda in other countries where a call for "equity" and "alleviation of poverty" may be far more effective. Calls for "education," "better living conditions" or "improved health care" are less ideologically laden and find universal acceptability. Democracy is the outcome of a process of social change and not a deified ideal that may attract converts and believers solely on its own abstract merits. Democracy will emerge as an outcome of hope for better conditions engendered by education and tangible improvements in the health and living standards of the poor and disadvantaged.

The social performance of ideas is the measure of their validity and sustainability. Ideas are strengthened, amplified, and multiplied by the outcome of the actions they foster. Hence, within and between nations, mistrust and self-centered policies require open communication and tangible sharing of benefits associated with a discourse on water for peace and prosperity.

10. COMMUNICATION, INFORMATION, AND CHANGE

Communication is the process by which we share ideas and command action. The emergence of the capacity to talk as a biological feature in becoming human added immensely to our survival as a species. The cultural history of our species is bound, in fact, with our ability both to process information and to share it. In succession, the main revolutions in human history are tied not as much with the modes of production, but with the mode of reproducing ideas and processing symbols by socially pervasive communication systems. The invention of writing marks a revolutionary change in as much as it enabled communication in absentia, across generations and between people who are not in immediate physical proximity. The use of papyrus and then paper as a means of long-distance transmission of information, the alphabet as a means to atomize symbols for a more effective language, the change from scrolls to bound books improving the preservation of manuscripts, the onset of printing ushering a phase of mass communication, and multimedia as a means of combining images, text and sounds, and finally the Internet as a powerful networking tool are milestones in the history of humanity. They mark and are key elements in the change from a monopoly of knowledge by a priestly elite to a progressive democratization of knowledge. Equally important is the role of developments in communication in creating and sustaining increasingly larger interactive groups with common polities.

Today, the spread of a discourse on water for peace and prosperity is related to the mechanisms by which information is interchanged and processed. The world is facing glaring disparities in its communicative abilities and potentials. There will be no effective discourse without recognizing the range of existing communication modes and an effort to engage all societies in the Information Age. The latter, again, cannot be achieved overnight, but cannot be ignored either. Printed matter in books, newspapers, pamphlets, leaflets, brochures, and posters is still a powerful medium in most countries. The problem of the high cost of books, a result of the publishing industry, can be addressed directly through the use of local printing firms, inexpensive paper, and recycling. Attention to translations into local languages and to local idioms is of paramount importance for the success of national discourse beyond that of the knowledge-elite. Water literacy should join in the fight against illiteracy.

Communication today is also made more effective by using audio and video cassettes, which can be disseminated at a subsidy to schools, teahouses, and places of social gathering. Plays, art exhibits, and other forms of artistic endeavor can be an effective medium of communication supplementing the written or spoken word.

Development of a discourse on water using multimedia and the most up-to-date information technology is not only essential for developed countries, but is also a means by which advances in IT in developing countries can be tied to water issues. No matter how negligible a contribution in this direction may be, it is the seed of change that must be planted and nurtured in developing countries.

A successful and sustainable discourse on water for peace and prosperity not only requires the simplification and popularization of complicated issues of water management and water sciences, but also requires recognition that knowledge is a social process and that "instructions" and "ready-made" solutions to water problems by scientists or policy makers may generate resentment, alienation, and even resistance. What scientists believe as facts ought to be separated from interpretations, speculations, and policy decisions. The public as well as national bodies should be made aware of the process by which certain kinds of information concerning water become facts, and how they can participate in fact-finding. There is also a need to disseminate the tools for processing information from different perspectives to assess the outcome of decision-making using certain parameters. Building a national capacity for water knowledge is a primary task toward the

development of a global water community. A discourse on water may also become more effective in resolving or uprooting conflict by disseminating the findings of social scientists on how human mind-sets are influenced by sentiments steeped in cultural traditions, and how the rhetoric of conflict, war, prejudice, and stereotyping is used to inflame the masses for the gain and profit of certain groups who do not sincerely guard the interests of the nation or humanity, but only their own.

11. THE MEDIUM AND THE MESSAGE

Change is a multistage process with multiple actors. Successful facilitation of change lies in how to phase the process of change; how to involve key individuals and organizations in the successive stages, and what ideas, practices, or institutions to target first. The choice of the "right" individuals, not necessarily those in official positions, is a key factor in guiding change. The individuals are the medium of change and are in essence an integral part of the change as a process.

Within societies, the individuals, as agents of change, should be capable and diverse in their knowledge and social position. They must include power-holders in government, civic institutions, the private sector, and non-governmental institutions, as well as those who communicate with and express the views and hopes of local communities. Every effort must be made to inform and engage local communities and to encourage their access to the opportunities for leadership training, financial support, and educational resources. International organizations are needed to work with all stakeholders in order to ensure equitable access to the decision-making process, the development of adequate infrastructures and institutions, as well as sharing of benefits.

International organizations must also play a major role in fostering cooperation among nations, especially those sharing river basins, watersheds, aquifers, lakes or glaciers, as well as those who belong to a cultural area with common historical links. In fact, such a frame for action and water management can facilitate cooperation among countries that do not share water resources in fields related to technology transfer, capacity building, and funding. This makes more sense when sharing hidden (latent) water resources is considered. The idea of "virtual" water and the potential for transporting water (via pipelines, tankers or floats, or bottled drinking water), as well as the possibilities of cloud-seeding and the impact of climate change on current water resources, encourage a consideration of trans-national cooperation parallel to and in conjunction with the management of shared (manifest) water resources.

Although bilateral cooperative efforts are important, they may be viewed with suspicion and alarm by other countries in the region. Long-term sustainability of water projects depends on multilateral cooperation.

Such cooperative efforts must proceed at all levels with diplomatic and political negotiations guided by discussions and dialogs among hydrologists, engineers, social scientists, and civic groups, with incentives from the international community rewarding positive developments.

12. OUT OF CONFLICT

Conflict and cooperation are a matter of group dynamics, a function of leadership, cultural background, context, past history of animosities/friendships, magnitude of potential impact, and the perceived size and immediacy of losses or rewards. Politicians may not respond to the "real" issues as expounded by hydrologists or engineers, but more to social risk based on public opinion. Considerations of political risk for agents cannot be ignored in a pragmatic scheme of change. It would also be

foolish to bypass cultural traditions of conflict resolution, authority, and power relations.

13. MOTIVATION AND COUNTER-MOTIVATION

There is no change without the motivation to work for change and overcome the forces that counteract change. In communicating and disseminating information, it is not only the technical aspects of water management and water facts that must be shared. A public awareness drive must aim at combating cynicism, despair, despondency, escapism, and exclusive self-centered interests. On a global level, fascism and demagoguery erode in the long run whatever economic gains they may create and leave behind a legacy of hatred and devastation detrimental to a sustainable peace. Attention must also be paid to the role of trans-national corporations and super-states who could risk their leadership and gains if they engage in global hegemonic actions that are likely to engender resistance and prepare the ground for counter forces beyond the control of nation-states and traditional state law enforcement agencies. The moronic slogan of war as a means of peace is not only illegitimate in logic, but also an insidious strain that resists cure and promotes relapses into cycles of violence.

War or the threat of war over water resources must be eliminated as an option, and discarded as a relic of a phase of national strife that has painted war not only as an option, but as a necessity embedded in "human nature," a notion that confuses and conflates various unrelated social issues. Human nature consists of potentialities and limitations, but does not mandate specific modes of behavior, which are socially constituted by interactions among people and their habitats, with a strong historical component of culturally inherited ideas and practices. Cultures are malleable and no culture-specific set of behavior is prescribed or inscribed by genetics. Our genetic code provides the foundational potential for a variety of cultural manifestations and the ultimate limits on what we can do – systematic war is one of the cultural mechanisms that has become, with the emergence of the means of mass destruction, distance killing. With increasing economic and ecological interdependency, war is a harmful vestige exploited only by those who benefit from the sale of weapons against the interests of humankind.

14. MANAGING COOPERATION

Cooperation is a process that need not begin with conflict. It is a process that may be promoted on the basis of greater mutual gain. The idea of non-zero outcome with a higher gain for each participant is an incentive for cooperation. The incentives for cooperation must address rewards or payoffs that are not just economic, they must include a sense of satisfaction on issues related to pride, honor, status, and recognition. Mutual respect is an essential element in initiating and maintaining cooperation. Incentives for genuine cooperation include:

- Greater openness (less secrecy).
- Good faith.
- Agreement on conflict resolution process.
- Agreement on confidence building measures.
- Confidence and trust building, toning down demagogic and insulting verbal hostilities and showing gestures of support, an understanding of the position of others, and empathy with their position in order to invite an understanding and sympathy for an opposing position.

- Promotion of social interchanges involved in extended family practices such as exchange gifts, ceremonial gathering and festivities, and humanitarian aid.
- Clear identification of specific issues of conflict/cooperation to generate discussion and solicit contributions from different stakeholders, and to develop a cross-cultural, multi-disciplinarian, pluralistic forum for developing guidelines for conceptualizing issues in order to defuse conflicts and encourage cooperation.
- Identification of points of agreement before engaging in a discussion of issues of disagreement.
- Exploring dividends of peace and cooperation to create an objective for common action that is greater than the narrow aim causing conflict.
- Bypassing difficult issues through creative alternatives or link them with progress in other domains.
- Recognition of the dividends of peace.

15. A SOCIOLOGY OF CONFLICT AND COOPERATION

Conflict and cooperation are social processes based on perceptions of signals, indicators, and proxies. The signals are perceived by some individuals and are transmitted to others. As a social process signals have to be adopted by the media, the policy makers, or key institutions in society, and a resolution of conflict or an incentive for cooperation must reside in recognizing how signals are picked up, who picks them up, and what the motivations are for mobilizing others to conflict or cooperation.

Awareness of a conflict may lead to a process of inflammation and escalation or de-escalation. This depends on media activity, impact on "sensitive" social/cultural issues and normative views, perceptions of risk and level of danger, and access to information. For these reasons the roles of media and civic institutions are vital in managing conflict and defusing disputes at the first signs.

There is also a need to recognize how different societies deal with conflict, especially water conflicts, and how potential conflicts are resolved (through institutions, traditions, personages, authority). This demands a historical, social, and anthropological outlook. It requires a close examination of schemata and worldviews; how people organize knowledge, and how they conceptualize problems and problem solving. The role of display and management of emotions and the patterns of effective styles are essential components guiding attitudes and habits of action.

The involvement of the media should not be confined to passing information to them but must be extended to examine the efficacy of the media, the constraints imposed upon it, and the patterns of differential access to information.

The next element in dealing with conflict situations lies in the interpretation of causes and consequences. Here questions may be raised concerning who is entrusted with this task and if it involves responsible institutions or is a matter of individual initiative. Constraints on interpretation, motivation, and interests are clearly issues of concern here.

It is important in interpreting signals of conflict to investigate the roots and history of conflict and disputes, that is, to link the present with the past in order to understand similarities and differences in how issues of water crises have been dealt with in the past, and to recognize new variables and structures. These would include, for instance, increase in population size, urbanization, squatter settlements, industrial needs, new farming technologies, new water technologies, attitudes toward water quality and health (for example, bottled water), tourism, and notions of what water is (for example, virtual water).

16. CONCLUSIONS

16.1. Conclusions: 1

- The survival of humanity is a product of genetic and cultural selection of a combination of traits promoting sociality and intelligence.
- The act of sharing enabled groups of individuals to survive better than other groups who did not subscribe to this social practice.
- Human groups create their own social environment mediating interactions with nature and generating mechanisms for the selection of innovations on the basis of their computability of pre-existing social norms and relative advantages.
- Traits favorable for human survival and welfare are enshrined in codes and sacred practices. The survival value of such traits is culturally situated and hence may come under scrutiny in different cultural situations. Nevertheless, certain traits have proven to be universal, assuming the guise of transcendental, extra-social principles because they have been shown to be essential for human survival through the experiences of human beings throughout history and in all societies (for example, love, mercy, compassion, respect for human life, justice). Such principles are compromised by particular social conditions, but have never been overthrown by any particular usurpation of such principles.
- Human beings live in societies with a long cultural trajectory. The human past has been characterized by significant genetic inbreeding maintaining a common biological constitution among all human beings. Biological variations are superficial modifications resulting from adaptations to local environments and geographical distance between human populations.
- Human beings are the inheritors of a deep cultural patrimony as a result of the confluence of cultural traditions in a common "subterranean" reservoir from which societies draw their knowledge.
- Post-modern claims of "subjectivity" fail to realize that individual perceptions and cogitation are embedded in a cultural and a linguistic matrix. Individual subjectivity is a "personal idiolect" of a cultural specific language, which in turn is embedded, in a universal structure of the human mind.
- Although trans-cultural ties since its inception have bonded our human species, the separation of human groups into particular groups inhabiting certain territories has led to the illusion of fundamental ethnic and national differences. The notion of distinct and superior nations or "races" has been exploited by nation-states, especially with the rise in recent history of the modern European State, With increasing interdependence among nations and the realization of the common fate of humanity in the face of global population, ecological, and security problems, the "universal" ethics of sharing, mutual support and fraternity must now be recognized as trans-cultural ethics, and that geographical boundaries are no longer the markers of social belonging.
- Social inequalities with a marked differential access to power have characterized human societies since the birth of agrarian economics permitted the emergence of an elite who manipulates others through persuasion and/or coercion. This social differential has created a source of dissatisfaction and envy causing major transformation in social organizations over the last 5,000 years. Over the last 100 years, the disparity in wealth, opportunity for development, and comfort within and between nations, with serious implications for the sense of self-worth and hope, is precipitating a global malaise of serious consequences for everyone on the planet. The threat to the privileged elite is no longer limited to that from a territorially based "enemy." The threat is endemic and contagious. Conflicts may not be viewed anymore as inter-governmental. The most serious conflicts are trans-governmental and inter-governmental.

16.2. Conclusions: 2

- Conflicts over water are not solely due to governmental policies but are simultaneously local, among communities and populations, and global, involving multinational corporations (directly or indirectly involved in the management or exploitation of water resources) and international monetary and regulatory bodies.
- Purposeful change begins with the recognition of the problem, followed by an identification of the core causes (not just the symptoms or social indicators).
- The rhetorical declarations of global summits are vacuous unless they are translated to a plan of action to achieve the declared objectives. The plan must involve allocation of funding, specific activities, a timetable, and stated short-term goals.
- A full, effective and pervasive discourse of water for peace and prosperity is beyond the domain of ministers of water affairs. UNESCO, in association with other international organizations, must develop an integrated program of action beginning with an information package.
- Although a common message expressing a common global water for peace strategy is essential, the channels of communication and the style of communication to disseminate the message must be adapted to local ideals, norms, and political and socio-economic conditions.
- Water for peace strategy must not be hitched to global ideological battles. Instead, tangible benefits to local communities are likely to be far more effective than slogans or ideological rhetoric.
- Mistrust, grievances, and historical enmities are obstacles to resolving water conflicts, which are often embedded in a historical context of emotional dimension.
- The process of negotiations cannot succeed without dealing with underlying values, feelings, and salient social attitudes.
- Engaging the public will provide the social environment that will steer politicians and future governments toward water for peace. Government officials also have a role to play as citizens and civic functionaries in promoting public participation in resolving water conflicts.
- A continuation of dialogue among civic groups on all sides of a conflict, especially among intellectual leaders, journalists, and media practitioners, must be sustained and supported by international organizations.
- For each case, the general model of social change outlined above must be translated to a local model identifying, key actors (individuals, organizations and groups), the prevailing conceptualizations of the conflict, the stage of conflict, the current modes of conflict management, the potential for diffusing conflict, and the traditional modes of conflict resolution.
- Conflicts must be analyzed from the prevailing cultural attitudes to 1) ethics in general and those specifically related to water, 2) the prevailing practices of water use, 3) the current technical aptitudes, 4) the legal framework of the conflict, and 5) the ideological platform of governmental bodies and the public.
- Resolution of water conflicts is more likely to emerge as an element in a broader context of economic and security arrangements.
- Parties to conflict must be encouraged by international institutions to sustain dialogues and undertake measures of trust building with milestones with beneficial rewards for staying the course of peacemaking. None should be rewarded for derailing dialogues or engaging in disruptive tactics.
- Agents of change must be identified and encouraged. Efficacious agents are likely to be respected and renowned members of society situated within a socially effective network.

- Public dialogues are inseparable from inter-governmental processes involving mediations and negotiations. The public creates the momentum for peace.
- Dealing with past animosities and grievances through reconciliatory mechanisms is essential for establishing a positive milieu for dialogue.
- Conflicts are complex issues that may be split into smaller topics or points with the aim of establishing task forces to resolve specific issues. This must be done in tandem with other measures of trust building and with a recognition and allowance for the interdependency of conflictive topics. Cardinal core issues cannot be left to the end, but must be addressed mid-way in the process after the establishment of a modicum of trust.
- Resistance to change is to be expected. Snags and frustrations are likely to mar a dialogue. Motivations and dynamics of resistance must be understood and addressed, but serious obstacles encountered in one task may be postponed to allow progress and further successful dialogue on other tasks.

16.3. Conclusions: 3

- It would be a mistake to confine the current water crisis to inter-governmental conflicts. Such conflicts are embedded in a global matrix of interdependency.
- Conflicts resulting from water scarcity are a function of factors influencing 1) quantity and quality of water, 2) adequacy of water storage and transportation, 3) modes of water uses and rates of consumption, 4) rates of water pollution, and 5) magnitude of water recycling.
- In most regional cases, all factors related to water availability when and where needed, from treatment of pollution to improved methods of water recovery and recycling, are a function of ignorance or water illiteracy, inadequacy of professional knowledge, and poor management (including lack of a water authority or conflict among various authorities, and lack of appropriate funding).
- The solution of many regional conflicts and the process of establishing a water for peace strategy thus is neither a purely political issue nor a simple issue of conflicting views that can be resolved by governmental instruments (negotiations, mediation, legislation) or verbal dialogues. Such mechanisms are inseparable from the institution of economic and educational measures to establish the foundation of peace and prosperity. This cannot be achieved without genuine efforts by rich nations and international organizations to alleviate poverty and create equitable opportunities for regional development.
- International aid does not mean the will to transform all local modes of water management within a purely "Western" technological or "ideological" paradigm. Respect for local knowledge and traditional systems must be conjoined with the desire to create a management system that ensures equitable access to water, balances water demands among users, protects water ecosystems, and permits community participation in decision-making.
- Water conflicts are not to be viewed as purely political issues left to diplomats, policy makers, and legislators. A great deal of water conflicts may be resolved through technical applications, economic business planning, and social endeavors. An essential element in conflict resolution on the road to water for peace is to recognize the role of professionals and the interdisciplinary nature of the process. Diplomacy is far more effective when it is implemented in the context of professional advice and effective participation in problem solving.
- Water economics and technology are elements of political solutions. Ultimately, however, notions of "rights" and "cooperative ethics" provide the motivation for undertaking dramatic shifts in policy.

The greatest threat to world peace and stability, as astutely predicted by Robert L. Heilbroner in the 1970s, is that the current tendencies in global consumption, pollution, population increase, and urbanization will create serious problems. Industrial nations with massive urban complexes, giant corporations, and dangerous military depots will be tempted to create centralized hegemonic regimes blending "religious" orientation with "military" discipline (Heilbroner, 1980). The covert struggle between world economic blocs over resources including oil and water is likely to focus their attention not on a global solution to world problems in poor countries, but to political means to guarantee or even monopolize control over resources, not the least of which is water, required for industry, services, transportation and agriculture. Certain conflicts involving water will be overlooked as long as they serve the overall objectives of a powerful economic block. War and the threat of war will indeed be used as means to control and eliminate competitors, as well as a means to weaken and dominate poor countries. In the long run this strategy, which will be legitimated by ideological slogans, is doomed to fail for two reasons. First, the cost of military confrontations and operations will mount disproportionately to a point where it will overtax the centralized regime. Second, instability and poverty will diminish the productive potential to be exploited by the dominant power and poor industry and chaotic development will only worsen current rates of global pollution, slum urbanization, overpopulation and epidemics, not to mention resistance and hatred thus requiring further costly endeavors to maintain control and prevent further deterioration in global conditions.

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HISTORICAL EXPLANATION AND WATER ISSUES

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CONTENTS

HISTORICAL EXPLANATION AND WATER ISSUES

Historical analysis of transboundary water conflicts enlarges perception and supplies necessary context. It offers a critical correction to the prescriptive solutions of politicians and engineers. History shows that humans do not always perform rationally or in their best interests; indeed that is a major reason why conflicts occur in the first place.

Historical analysis also supplies a useful cautionary note to statistical analysis. Correlations between two or more series of events give the investigator useful leads for further study, but they never offer empirically valid conclusions about cause and effect. They are descriptive, not explanatory, devices. Negotiators of transboundary river conflicts must understand the unique historical, geographical, and cultural context that characterizes a particular basin or body of water. It is precisely history's emphasis on the unique that separates the discipline from the more generic analyses of the social sciences. Historians suggest which forces may be critical in specific circumstances and often test the normative assumptions that underpin technical standards and specific solutions. Historical analysis not only supplies us with the stories that explain the past but the perspective to understand the present. It reminds us of the emotional and aesthetic significance of both technological objects and the physical world. It shows the stability within change and the change within stability.

History suggests that in the postmodern world planners must be sensitive to values and to group identities and not simply to academic models of river basin management. Indeed, to be successful, political and technological responses to water disputes must embrace identifiable values that, if modified, must be dealt with justly.

The use of history is often neglected or at least misunderstood. At its core is the ability to distinguish between fad and trend, between significant shifts and momentary aberrations. This article elaborates this point in the hope of stimulating more discussion and insight.

1. INTRODUCTION

Historical analysis of transboundary water conflicts enlarges perception and supplies necessary context. It offers a critical correction to the prescriptive solutions of politicians and engineers. History shows that humans do not always perform rationally or in their best interests – indeed that is a major reason why water conflicts occur in the first place – and what appears imminently obtainable at the conference table falls short of implementation in practice. Moreover, while social scientists seek descriptions of human behavior that transcend political and institutional boundaries (and engineers and politicians appear most comfortable with such generic approaches), historians often focus on the unique and local. Their analyses suggest which forces may be critical in specific circumstances and often test the normative assumptions that underpin a prescriptive approach. Among other things, these assumptions touch on natural resource allocation, institutional stability, and the security of the state. Historians' models generally are not ones of stability but of change, of opportunities and challenges that move peoples and institutions in various directions and make the study of humankind vastly instructive but impervious to reductive and formulaic description.

Historical analysis also supplies a useful cautionary note to statistical analysis. Correlations between two or more series of events give the investigator useful leads for further study, but they never offer empirically valid conclusions about cause and effect. They are descriptive, not explanatory, devices. For instance, a high correlation between intensive rainfall and war in a particular region certainly calls for further investigation, but the data cannot support any assertion that intensive rainfall "causes" war. It may be that the meteorological event leads to some activity that increases militancy; historical analysis is the only way to show that. Or it may be that the correlation is entirely coincidental. For instance, heavy rainfall may occur at a certain time of year when entirely unrelated events increase the chances of war. The use of correlations to show basins "at risk" is an exercise in probability analysis at best. The historian's toolbox is needed to refine the analysis further and deepen understanding.

None of this means that historians cannot deduce "lessons learned" from case studies, but it does suggest prudence. Historians will emphasize the unique circumstances and long and short-term factors (including particular personalities) that mold attitudes and policies and may lead to peace or war. In the last two decades, several models have emerged to help them frame historical thinking. One is called "social constructivism" and focuses on language and culture to explain everything from technological development to individual values. Human behavior results from human interaction rather than from either external environmental influences or internal biological mechanisms and intellectual preferences (Bijker et al., 1987). Another is called "actor network theory," a concept first advocated by the French sociologist Bruno Latour (1987) and suggests that both process and institutions result from a network of actors that extend far beyond a particular group (including international and national institutions). "Discourse analysis" examines the ways people communicate with one another with the aim of identifying specific normative values and preferred methods of reaching agreement. "Social ecology" focuses on the particular ways in which the physical environment helps shape culture, including social and political structure and values, and vice versa – the impact of culture on place. This approach is highly interdisciplinary and may have particularly useful application in dealing with questions of public health, pollution, and quality of life. Additionally, various students of government have developed public policy models to explain the allocation of resources (Blatter et al., 2001; Francis, 1990). Naturally, we need not accept any of these models – many historians question them – but they do remind us

that, like the proverbial iceberg, much of what affects our lives lies submerged in barely recognized spatial and temporal dimensions.

History is not simply description. In fact, it is largely interpretation, using selected facts drawn from available and trustworthy sources. Historians interpret both interaction among humans and human interaction with the environment. They construct the story in a compelling, logical sequence that explains and analyzes consequences, influences, relationships, and priorities among a host of institutional, individual, cultural, political, environmental, and other factors. The journalist's standard questions of who, what, when, where, how, and why need to be asked, but the historian's skills come to bear most clearly in answering the last two and most difficult questions: how and why. While participants and social scientists have written descriptions of water conflicts, analytical, interpretive histories of many disputes still remain to be written. Appendix A provides some idea about how a historian might go about writing a history of a transboundary water dispute.

Historians create the past based on careful research and analysis, but everyone uses history. Indeed, historical consciousness helps define our very humanity and guides us in our everyday lives. In matters dealing with water, engineers use historical data to calculate annual stream flow or to determine probable flood levels and precipitation. Choices of construction material and location are often influenced by experience and by comparison with analogous situations elsewhere. Even the setting of codes and standards is based on historical experience (Reuss, 1992, p.1). Of course, this use of history is narrowly circumscribed. It answers a specific set of work-related questions that must be answered if a successful project is to emerge. Any negotiation of water conflicts must take into account much larger questions, such as multiple and conflicting objectives, political coordination, cultural values, and environmental constraints.

In this larger universe of water resources, engineers must be socially responsive as well as technically competent. Economic, political, and even psychological factors will influence subsequent design and construction as much, if not more, than engineering experience. For instance, while durability, safety, and economy are shared engineering objectives, engineers value them in accordance with cultural and political biases. When designing dams, engineers may find that the psychological security provided local residents by a monumental, gravity reservoir dam argues more compellingly than the mathematics and modeling that suggest a smaller, less costly structure. Normative assumptions and technical standards, in short, generally possess geographical dimensions. They are tied to particular regions and institutions despite the similar formal education engineers may receive. Indeed, they may provide powerful forms of professional identification and association. Knowledge of history illuminates these important distinctions within the engineering and associated professions.

While this article contributes to an investigation of transboundary river conflicts, we begin with the proposition that these conflicts or disputes in many cases magnify, but do not substantially modify, general problems relating to river and river basin development. Some of the following analysis treats these underlying issues. It is our contention, we hope not controversial, that negotiators must first understand these issues before placing them in the unique historical, geographical, and cultural context that characterizes a particular basin or body of water. Finally, it is worth emphasizing that historical analysis not only supplies us with the stories that explain the past but the perspective to understand the present. This use of history is often neglected or at least misunderstood. At its core is the ability to distinguish between fad and trend, between significant shifts and momentary aberrations. This article elaborates this point and, we hope, will stimulate more discussion and insight.

2. FACTORS IN WATER RESOURCES PLANNING IN THE POSTMODERN WORLD

The technology of water resources development has not changed significantly for a long time. Mathematical rationalization at the end of the nineteenth and beginning of the twentieth centuries led to the last major innovations in engineering design (that is, arched dams and the trial-load method). Also, beginning in the mid-twentieth century, computers allowed us to design water systems to meet divergent social objectives more precisely. In construction, too, we now use reinforced concrete and steel, as well as rock, stone, and earth, to build levees, floodwalls, jetties, and dams. Nevertheless, recent innovations have been mostly in the details. Indeed, the most interesting thing about water resources technology is its essential atemporal nature: lessons learned 2,000 years ago in ancient China or 200 years ago in Napoleonic France may well be equally valid for current water management and engineering.

However, four major factors have promoted significant changes in our approach to water resources planning. In no particular order, these factors are as follows.

2.1. Increased Involvement of Local Communities in Global Politics and Vice Versa

This process, labeled "glocalization" by Roland Robertson, assumes not just horizontal interaction among states and territories but vertical interaction from village to international community. It recognizes the growing importance of global and local concerns in contrast with the decreasing role of the state. New communications and transport systems bring regions and localities together, increase the number of actors involved in negotiations, and allow them to exercise enormous influence around the world, while state influence becomes less decisive (Robertson, 1985; Blatter et al., 2001). Indeed, the impact of local arrangements and practices on global conventions and markets may be more significant than the reverse. For instance, local approaches to pollution control may undermine the application of any international standards or objectives. An instructive analogous situation occurs within nations. Regional and local governments may either weaken (or, less often, strengthen) national laws and policies in places as diverse as China, India, Germany, and the United States.

2.2. Increased Focus on Social and Environmental Concerns when Planning Water Projects

Once predominantly the preserve of lawyers, engineers, and economists, water disputes now engage sociologists, biologists, chemists, and geologists, to name only a few of the involved professions. The response to water problems becomes less the manipulation of nature and more the manipulation of people. More attention is paid to reducing or eliminating negative effects on fish and wildlife.

Emerging social values force us to re-examine traditional planning objectives. Rather than maximizing economic efficiency or optimizing the opportunity to meet public objectives, planners – especially in industrialized countries – now often set limits to growth. Often a certain inherent moral value is granted to non-humans that establish a system of competing claims, which ultimately limit human population, patterns of consumption, and technological development. Any equitable solution to these problems of competing claims with non-humans requires the application of a system of ethics and a notion of justice that substantially modifies the value systems of many cultures.

This new planning world compels us to ask many questions and share some very real concerns. Can benefits and costs be weighted according to ethical criteria? Are moral obligations to be assigned values that somehow are commensurable, and who is

to determine these values (government, a public-private sector committee, an "ethics court," or some other body)? In short, does quantification work? Can decision arenas identified primarily in terms of water control or market preferences be used in a meaningful way to adjudicate competing claims between nature and civilization?

2.3. New Approaches to Probability Analysis and Risk Uncertainty

Going back to the early twentieth century, hydrologists used probability analysis. While helping to bring order from disorder, such analysis describes relationships without providing precise predictive tools or showing anything more than an acceptable range in correlations between, for instance, rainfall and runoff. It allows the extrapolation of physical relationships into the future and expands human control, although the extent of control varies with one's faith in numbers. In the end, probability analysis confers scientific authority on its practitioners, even if many are neither scientists nor engineers.

Yet history shows that the use of probability analysis has certain inherent limitations that become more acute as we begin to understand the complex natural forces involved in the hydrologic cycle. The first and most obvious one is that its predictive power directly relates to the amount and accuracy of available historical information. Frequency curves extrapolated from inadequate or faulty data can be worse than useless. For instance, in the United States the Colorado River Compact of 1922 assigned water to states (and to Mexico) in the Colorado River basin based on a hydrograph that showed years of unnaturally high water. More data would have led to a significantly different apportionment (Jones, 1996, p. 116). The same could no doubt be said for other rivers that have been the subject of regional disputes. Second, is that the use of frequency curves implicitly encourages planners to plan for extremes – droughts and floods – and planning for extremes can be both expensive and unresponsive to multiple objectives. Third, the approach invites political pressure. A small change in a frequency curve can spell the difference between a ten or fifteen-year flood, between an economically viable project and one that neither meets funding constraints nor social objectives. Alternatively, probability analysis can lead to an abdication of authority, with political leaders deferring to scientific authority: if floods or droughts are destined to occur once in so many years, the argument goes, communities just have to assume the risk and forge ahead.

The assumption of risk is precisely where we are changing our ideas. Rather than planning for extremes, we now pay more attention to planning for the means. This involves assuming far greater risk but it also reduces the cost and encourages non-structural solutions and conservation measures. It may involve resettlement and various kinds of land-reform schemes. The emphasis is on the relationship between land and water and not on maximizing water use. It dovetails with the environmental planning noted above, for it also suggests that planners must exhibit restraint and must think holistically. In the case of hydrologists, "holistically" refers to both the natural and human worlds, to a comprehensive view of the hydrological cycle, including groundwater, and to the multiple social objectives that water resources development is usually meant to serve. Moreover, it implicitly reflects the incontrovertible fact that in a "glocalized" world, water supplies are stressed. In other words, the areas where water is, or is rapidly becoming, an issue continues to grow. Too many localities suffer from inadequate or poor quality water. The situation will certainly further degenerate in the absence of changes in human attitudes towards water.

Finally, global warming further confuses the picture. New precipitation models are complex and often contradictory. Yet, their reliability is critical to water planning. Models dealing with changes in biome regions also are subject to conflicting interpretations, although it appears clear that global warming will result in changes in various growing periods and vegetation zones. Most water resources plans have been based on the assumption that from region to region climate is more or less stationary.

Climate change challenges this historical approach and raises questions about the data we have used for water planning.

2.4. New Meanings About Water

No longer is water valued just as a necessity of human existence. Even the traditional uses of water, such as navigation, irrigation, municipal and industrial water supply, and hydropower no longer serve as the only justifications for water resources development. Especially in the industrialized world, increased attention focuses on the contribution of water to entertainment, sports, and leisure – in sum, to a certain kind of lifestyle. The most visible sign of this shift is in the increasing popularity of bottled water. Moreover, anthropologists and historians draw our attention to the communal value of water: the meaning of the Ganges River to the Hindu culture or Niagara Falls and the canals of Venice to tourists and lovers. In every case, the waters are not just naturally constructed, but socially constructed monuments with values not easily reduced to monetary terms.

These factors reflect a postmodern world, one in which the principles of both classical welfare economics and modern watershed planning may succumb to cultural and group identification and values. It is a world of ambiguity and of irreconcilable realities, where adherence to historical centers of political and economic power is loosening. Outside of traditional military bureaucracies, command and control no longer depend on a strict hierarchy, but on an ongoing, continuous balancing of individual and community preferences. Formal and informal ties among regional and local public and private organizations may be more powerful than traditional state authorities.

3. FUNDAMENTAL QUESTIONS ABOUT WATER MANAGEMENT

The management of water, especially in a transboundary setting, raises significant political, social, and scientific issues. Some of these issues apply to water administration no matter where the location. Others have special relevance to areas of potential conflict. Some are of relatively recent origin; others reflect changes in degree over time. In any case, successful negotiations over water may well depend on understanding the manner in which these questions – and their answers – apply to specific circumstances. To do this requires some historical analysis.

3.1. Can Water Control be Subject to Rational Decision-Making?

Perhaps the greatest conceit of twentieth-century engineering was that engineers could not only solve technological problems and manipulate nature, but also develop systems that both encourage and respond to rational human control. In the postmodern era, engineers have become less confident of their power in this regard, but there still remains the belief – or hope – that engineers and scientists can resolve complicated political problems by imposing rational "scientific" solutions. However, only in command and control economies, where governments dominate both the social and economic processes, has the belief successfully, even if sporadically, grown into reality. In democratic pluralist nations, the actors involved in water issues are too numerous, divergent, and changeable to admit of any easy "rational" solutions. Plans are constantly sacrificed, while planning continually evolves. Rather than focusing on objectives, negotiators might well set their sights on ensuring a fair and equitable process to meet changing needs.

3.2. Who Represents Nature?

While bankers, settlers, engineers, and politicians from all levels of government might be represented at the negotiating table, the representative of nature is not always clear. Engineers in good faith might attempt to represent environmental values, and they certainly provide essential information to assess an area's capability to support human growth without sustaining ecological damage. Nevertheless, engineers generally support technological solutions that stimulate development. Politicians may also share this perspective. Given these circumstances, can we be sure that the solution provided ensures environmental survival and stability? Resource scientists familiar with the region need to be consulted and offered the opportunity to review possible conflict solutions.

3.3. Which is the Greater Divide: Water or Culture?

The answer to this question could well determine approach, objectives, and success or failure in any water negotiation. If, in fact, culture, not water, is the real divide, then any resolution of water disputes may build confidence between the conflicting parties but it will not in itself suffice to eliminate friction. Conversely, as Eran Feitelson (1999–2000) argues in the case of Israel and its neighbors, the settlement of water disputes may well depend on addressing larger cultural issues, including historical memory and present perceptions, whether true or false. It may also depend on a country's ability to use ingenuity and to adapt to declining resources through the use of technology and conservation measures (Homer-Dixon, 1999, pp. 25–7). At the same time, as Patricia Sippel reminds us in the case of the Japanese, common assumptions about cultural perceptions need to be tested through historical analysis. In her study of Japan's Nagara River, Sippel shows that the widely held notion that the Japanese live close to nature cannot be reconciled with Japan's aggressive exploitation of its water resources (Sippel, 1999–2000, p. 294).

3.4. Do People Have a Right to Water?

There have been several recent attempts to write into international law the inherent right of people to enjoy a standard of living adequate for health and well-being. Implicit in these statements is access to adequate and clean water. Some international water conventions have drafted statements that explicitly recognize the right to water, and the United Nations has at the very least supported the right of children to clean drinking water (Gleick, 2000–2001). In practice, however, this right has rarely been translated into a set of legal obligations imposed on states. One may argue that the right to water is rooted in widely recognized moral and legal principles, but the state may still not be the appropriate institution to provide it. Rather, the burden should be left to local and regional authorities. An even more controversial position suggests that those who insist on living in arid regions do not have the right to adequate water. Nevertheless, even subsistence living deserves an equitable distribution of water. One may well question, for instance, the construction of Israeli swimming pools in the West Bank in sight of Palestinian villages with access to far less water. The right to water – and how much water per annum that might be – remains controversial.

3.5. Where Does Science End and Applied Resource Management Begin?

This problem transcends issues dealing specifically with water. It may apply, for example, equally well to forestry or to soil conservation. However, in transboundary water disputes, the problem becomes more urgent. The issue clouds the distinction between pure science and applied resource management, between scientists as

managers and managers who use science to enhance their professional authority. It raises significant historical questions dealing with the relationship between natural science and resource management, between the science that seeks to control and the science that seeks to understand. Inevitably it leads to the question of where does nature end and culture begin. For instance, are the hatchery-bred salmon in the Pacific Northwest in the United States products of nature or products of culture? The question raises issues dealing with the extent to which scientists dictate managerial controls and decisions and, conversely, the extent to which politicians and managers use science to enhance their authority. In a period of increased environmental sensitivity, the role of physical and natural scientists – not to mention the occasional social scientist – can become pivotal.

4. LEGAL AND ECONOMIC EVOLUTION OF RIVER BASIN PLANNING

River basins form an organic whole and have an areal identity that easily marks them as distinct resource regions. In terms of water control, a basin's functional unity has undeniable appeal. However, when economics (that is, hydropower) and politics (political boundaries) intrude, the problems multiply and worsen. Planners then have to cope with issues unrelated to water control. Transboundary disputes further exacerbate problems. To cope with these disputes requires new approaches – or a return to some that have been forgotten.

4.1. Legal Aspects

The earliest legal instruments did not deal with basins but with rivers, and drafters paid little attention to the relationship between land and water. Early in the organization of states, governments asserted power over all the waters within a state's borders. Rather than accepting the international nature of transboundary rivers, governments formed riverine boundaries according to some arbitrary measure. In practice, riparian communities and peoples controlled navigation and commerce. Both local and national governments understood that navigation could provide revenue, directly through taxes and tolls, and indirectly, through economic stimulation. During the French Revolution, the ruling party declared that watercourses were the common and inalienable property of all riparian states. Later, United States President Thomas Jefferson declared that under "natural law" the Mississippi River was open to all inhabitants.

While river navigation was extensive in the ancient world, irrigation may have been even more important in many arid regions. Rulers of fluvial civilizations built canals and dams, drafting and regimenting huge labor forces in the process. Between states, agreements parceled out water (often invoking divine sanction). For instance the Mesopotamian city-states of Umma and Lagash agreed to divide the waters drawn from the Euphrates. However, the agreement had been imposed by the upper riparian state, Lagash, and Umma, the lower riparian, seized the first opportunity to repudiate it. Under Roman law, anyone could use stream water who could prove long-standing use and who did not impair navigation. From Roman times on, Europe accepted strong government regulation of water use and the role of custom – sometimes contradictory patterns. In practice, state control was remote, and customary use was usually determinative (Teclaff, 1991).

After the Congress of Vienna (1815), freedom of navigation more or less existed on the Rhine River, although regulations created various restrictions. No such freedom existed on the Danube, mainly from fear of antagonizing Russia, which became a Danube Riparian state as a result of wresting Bessarabia from Turkey at the Congress.

Following the Crimean War and Russia's expulsion from the Danube delta, conditions remained unchanged. However, the Treaty of Paris (1856), which concluded the Crimean War, established a commission that eventually was transformed into an independent international organization to promulgate navigation regulations for the Danube.

European powers may have viewed freedom of navigation with suspicion, but they had no hesitation in applying the concept to the Congo and Niger rivers in Africa during the colonial period, with the colonial powers exercising some degree of regulation.

At the beginning of the twentieth century, multipurpose river development and new concepts dealing with geomorphology coalesced to initiate an interest in river basin development. River basin committees emerged around the globe to develop various countries' water resources. In 1956, the UN Secretary-General declared, "River basin development is now recognized as an essential feature of economic development" (Teclaff, 1991). Yet, the growing understanding of the river basin as an organic whole did not lead to a coherent system of water law regarding river basins.

As early as 1911, in the Madrid Declaration of the International Law Institute, participants stated two necessary principles:

- When a stream forms the frontier of two states . . . neither state may, on its own territory, utilize or allow the utilization of the water in such a way as to seriously interfere with its utilization by the other state or by individuals, corporations, etc., thereof.
- When a stream traverses successively the territories of two or more states . . . no establishment . . . may take so much water that the constitution, otherwise called the utilizable or essential character of the stream shall, when it reaches the territory downstream, be seriously modified.

(Teclaff, 1991, p. 67)

In 1956, the International Law Association (ILA) declared:

> So far as possible, riparian states should join with each other to make full utilization of the waters of a river, both from the viewpoint of the river basin as an integrated whole, and from the viewpoint of the widest variety of uses of the water, so as to assure the greatest benefit to all.
>
> (Teclaff, 1991, p. 68)

Ten years later, the ILA defined an international drainage basin:

> An international drainage basin is a geographical area extending over two or more States determined by the watershed limits of the system of waters, including surface and underground waters, flowing into a common terminus.
>
> (McCaffrey, 1991, p. 141)

In discussion of this article, the ILA made clear that the definition extends to the tributaries of the main stem stream forming a boundary.

At its meeting in Belgrade in 1980, the ILA stipulated that States should ensure that:

a. The development and use of water resources within their jurisdiction do not cause substantial damage to the environment of other States or of areas beyond the limits of national jurisdiction.

b. The management of their natural resources (other than water) and other environmental elements located within their own boundaries does not cause substantial damage to the natural condition of the waters of other States.

In 1986, the ILA advised:

> Basin States, in exercising their rights and performing their duties under international law, shall take into account any interdependence of the groundwater and other waters, including any interconnections between aquifers, and any leaching into aquifers caused by activities in areas under their jurisdiction.

Despite these and other related attempts by the United Nations International Law Commission (established by the General Assembly in 1947), legal efforts to reformulate the riparian rights doctrine in accordance with the physical unity of a river basin have not been successful at either the municipal or international level (Teclaff, 1991). In general, upper riparian states have been most reluctant to accept this approach. A key challenge facing transboundary water resource negotiators is to convince states that in the end a holistic approach based on resource, not political, boundaries (or some sort of economic efficiency model) makes the most sense (McCaffrey, 1991).

Finally, the 1997 United Nations Watercourses Convention, which an overwhelming majority of UN members approved, stated in Article 7:

1. Watercourse States shall in utilizing an international watercourse in their territories, take all appropriate measures to prevent the causing of significant harm to other watercourse States.
2. Where significant harm nevertheless is caused to another watercourse State, the States whose use causes such harm shall, in the absence of an agreement to such use, take all appropriate measures, having due regard for the provision of articles 5 and 6, in consultation with the affected State, to eliminate or mitigate such harm, and, where appropriate, to discuss the question of compensation.

(Wouters, 2002, p. 21)

Several articles of the Convention require riparian states to protect ecosystems and the environment, as well as to attain optimal and sustainable utilization of an international watercourse. Parties are to accomplish this in accordance with principles of equity and reason: a two-edged sword that could actually be used in some cases to prevent ecosystem protection or preclude effective sustainable development. A traditional deference to the principles of state sovereignty may also interfere with attempts to restore or protect the environment, and the Convention, some argue, offers no fixed formulas for determining legal entitlements. In short, the Convention will likely have minimal effect in states without strong institutional mechanisms to ensure enforcement. Nevertheless, it is an important step forwards (Wouters, 2002).

4.2. Economic Factors

The use of water to improve quality of life is hardly a new proposition, but the use of welfare economics, which maximizes economic efficiency, to achieve that end was initiated in the mid-twentieth century. Dominating much water resources thinking, the model generally focused on a river basin as a viable "decision arena." However, many political scientists doubted that the approach could succeed because it tended to ignore or simplify political issues. Over time, economists began to share some of these doubts, partly because technological advances reduced the importance of

watershed boundaries, and partly because the economics tended to focus on production, not consumption. Then too, regional administration depended (and depends) on accurately defining problems, developing priorities, and finding solutions that can actually be implemented. The quantification inherent in economic modeling based on welfare economics promised much in this regard; however, it usually failed as an accurate predictive tool in the face of political, institutional, and social realities. Finally, the objective of maximizing economic efficiency turned out to be somewhat naïve. For instance, "Pareto Efficiency" – a state in which no individual can be made better off without making someone else worse off – was appealing and popular, but policy changes almost inevitably produce winners and losers.

Other weaknesses, originally thought less critical, also intruded on the application of welfare economics to river basins. Welfare economists emphasized individual market preferences and downplayed community responses, even though individual and community responses might be quite different. Moreover, no distinction was made among individuals. Benefits or income accruing to the wealthy had the same social value as benefits accruing to the poor – a methodology that bothered even the formulators. It implicitly left to the politicians the decisions on whether economically inefficient objectives should be accommodated, a position that strengthened the argument of those who believed that rational water allocation required both political and economic calculations.

To replace welfare economics (inherent in much of what is called in the United States "benefit–cost analysis"), a group of engineers and social scientists at Harvard University developed multi-objective analysis in the late 1950s. This form of analysis addressed all the objectives sought by the planners, including non-economic values such as environmental quality or ethnic diversity. It involved a mix of complex computer calculations using "synthetic hydrology" and political trade offs to choose among several possible future scenarios. The process involved close cooperation among planners, politicians, engineers, and consumers and producers most affected by the water project or – more likely – projects. However, the creation of various options involved more money and time. Often, it appeared, those in charge of funding questioned the efficiency (though not necessarily the effectiveness) of the approach.

Today, social scientists identify socially feasible choices and probable consequences. Rather than developing formal criteria for policy decisions, they organize data to be used to develop a rational framework for making decisions. They may also, on occasion, raise questions about the ethical judgments inherent in economic evaluation, although many may retain their hope that a way might still be found to establish an administrative "rule of reason" untouched by power politics. However, democracies will always witness the sacrifice of economic efficiencies to the political will, and social values expressed in political process will be the final arbiter (Reuss, 1992, pp. 133–4).

For planners and policymakers involved with resolving transboundary water disputes, the lessons from this brief overview of economic analysis become clear: economic efficiency must be subordinated to social and political objectives. At the same time, politicians must understand the economic losses involved when efficiency is sacrificed to social requirements. Moreover, transboundary water conflicts usually involve disputes among communities. We cannot assume that any resolution of these disputes will resolve individual grievances, which can occasionally become critical to the future of the region's political and economic development. A process that is firmly grounded in an equitable notion of justice that is not an abstract concept but embedded in the region's institutions has the best chance of success.

In order to ascertain how well planners and policymakers plan, we should apply historical analysis to the planning and negotiation process, an exercise the eminent American geographer Gilbert White calls a "post-audit" (White, 1988). Did the project or agreement meet expectations? If not, why not? Though historical in nature, the

analysis should be firmly interdisciplinary in expertise. An analytical comparative analysis of various projects and conflicts should lead to better planning and negotiation.

5. WATER CONFLICT AND COOPERATION

Water projects hold out the promise of reducing social tension and improving quality of life, but water itself, pre-eminent among natural resources as a necessity for human existence, is more often the source of division. In the postmodern world, conflicts over water may contribute to more instability than has heretofore been the case. Inadequate or unsafe water is seen as a security issue, much as one might view a heavily armed military force mobilizing across the border. Both threaten survival. Poorer regions of the world, with less capital and often mushrooming population, find fewer options to accommodate or resolve issues; water is less easily obtained, and inadequate facilities exist to treat the water that is available. Wealthier regions are generally more adaptive, and find it easier to innovate, both in technology and trade, to secure the water security they need. Energy conservation is also an option open to more developed nations and regions; those less advanced economically will find it difficult, if not impossible, to reduce water use.

Open warfare over water has rarely occurred and, when it does, usually it is on a limited sub-national scale and is entangled with other grievances. Indeed, one may argue that national states have prevented warfare over transboundary water issues, which might otherwise have erupted between riparian rivals. This point also undoubtedly holds true for intrastate water disputes. Nevertheless, water issues have contributed to ethnic, political, and cultural strife, whether among Dutch polders, Californian mining camps, Italian city-states, or the states of modern India or the United States. (For more, see Beach et al, 2000.)

Homer-Dixon argues that water conflicts constrain economic development and contribute "to a host of corrosive social processes that can, in turn, produce violence within societies" (Homer-Dixon, 1999, p. 69). Certainly, an absence of sufficient and clean water retards industrialization, threatens public health and sanitation, reduces agricultural production (and with it the country's security), undermines economic growth, and endangers the environment and natural resources in natural freshwater ecosystems. It hardly need be emphasized that government policies that promote water development to support government programs or placate voters or special pressure groups may in fact invite all or some of these problems. A prime example is the demise of the Aral Sea.

According to Gleick (1998), conflicts over water result from one or more of the following:

1. Water as a military and political goal:
   a. Jordan River Basin (Syria, Israel, Jordan)
   b. Colorado River Basin (Arizona and California)
   c. Cauvery River (Karnataka and Tamil Nadu)
   d. Danube River (Slovakia and Hungary).
2. Water as an instrument or tool of conflict:
   a. Han River (North Korea and South Korea)
   b. Euphrates River (Turkey, Syria, and Iraq)
   c. Water Import and Redistribution (Malaysia and Singapore).
3. Water and water systems as targets of conflict:
   a. Iraqi destruction of Kuwaiti desalination plants.
4. Inequities in water distribution, use, and development:

a. Many international rivers throughout the world, including the Mekong, Ganges, Jordan, Tigris, Orontes, Colorado, Indus, Brahmaputra, Rio Grande, Amazon, Parana, Congo, Zambezi, Niger, Senegal, Orange, Okavango, and Nile.

This categorization and examples clearly overlap. The Colorado River may be viewed as a political goal, but addresses the issue of equitable distribution. The same may be said for the Jordan River, although the problems are infinitely more complex. Progress has been made, especially in the Israel–Jordan Peace Agreement of 1994, but it remains to be seen whether agreements over water allocation can overcome more fundamental issues separating the two countries.

A more telling concern about Gleick's approach is that it focuses on the nature of the conflict rather than on the root problems. In other words, it does not give us underlying causes, whether ethnic, economic, environmental, or some combination of problems. An example of this concern is water in the former Soviet Republics of Central Asia (the Kyrgyz Republic, Kazakhstan, Uzbekistan, Turkmenistan, and Tajikistan). The Kyrgyz Republic wished to market its relatively plentiful supply of water to neighboring republics. In 1993, it requested that Uzbekistan purchase a certain amount of Kyrgyz hydroelectric power in return for the free water Uzbekistan received from rivers originating in Kyrgyzstan (the Kyrgyz Republic also established water pricing for some of its internal irrigation users). Uzbekistan refused and five years later cut off natural gas supplies to Kyrgyzstan because of non-payment for supplies already supplied (Turkmenistan had done the same thing to Ukraine the previous year). In a thinly veiled threat, Kyrgyz politicians responded that water, like gas and oil, comes with a price. In 2001, the Republic passed legislation formally declaring water a commodity. Clearly, the establishment of a water market similar to other natural resource markets attracts Kyrgyz leaders. Yet, such a market may induce other nations to use their own resources to coerce more water from the Kyrgyz Republic (Cyber Uzbekistan, 1998; Early Warning Resources, 1998; Klotzli, 1994).

Ethnic divisions also affect water issues in Central Asia. A major problem is the Fergana Valley, where the Kyrgyz Republic, Tajikistan, and Uzbekistan share borders and ethic minorities reside (O'Hara, 1999–2000, p. 378). Valdimir A. Kolossov, Olge Glezer, and Nikola Petrov concluded that twenty-six potential "ethno-territorial" conflicts existed in the five former Soviet Republics. The greatest problems centered on rivers where one ethnic group controlled upstream use and another group or groups lived further downstream (Klotzli, 1994). In Central Asia this was most evident in the two river basins emptying into the poisoned Aral Sea – the Syra Darya and Amu Darya (Oxus) river basins (Klotzli, 1994). To some extent all four of Gleick's categories apparently cover the situation in Central Asia. However, any understanding of water conflicts there requires research into the political, economic, cultural, and environmental differences dividing the region.

Hydrologic knowledge is also necessary to resolve water disputes and depends on both empirical and historical research. Some key questions are:

1. How much water is unclaimed or has multiple claims?
2. What are the scarcities by location and season?
3. What is the effective soil moisture and runoff by season or month?
4. Which or whose vested rights are superior?
5. Where are the wetlands?
6. What non-human species require protection?
7. How much water is needed for non-consumptive purposes?
8. How much of the flow resides in channels, wetlands, and soils and how much is in the human-built infrastructure?
9. What external and unmanageable factors exist that might impinge on workable hydrologic rules?

(Partly based on Warshall, 2001)

No matter what the resolution of the dispute, stable institutions are necessary to sustain rules and regulations. Otherwise, disenfranchised and bitter residents will cheat on water allocations. Rules need to be workable and responsive to both local needs and changing conditions.

Emergency situations (usually droughts and floods) can considerably exacerbate transboundary water conflicts. Temporary releases or impoundments of water may ameliorate the situations, but mutual suspicions, often seasoned with cultural differences, remain. In such situations, independent engineering expertise can reduce immediate tensions and allow negotiators (and planners) to focus on long-term solutions. Countries without the funds, expertise, or necessary levels of cooperation to support technological solutions require assistance from the international community. Under the auspices of the United Nations, a "United Nations Emergency Engineering Team" (UNEET) might be developed as a virtual worldwide engineering team of high-level, non-political, public and private sector engineering talent linked by computers. The team would be called upon to respond to emergency situations that habitually arise in various parts of the world. As needed, designated team members could also meet on-site. The team would not cost much money – volunteerism could be encouraged – but could provide an invaluable service. The emphasis would be on cost-efficient and equitable solutions.

However, an insecure environment imperils technological solutions. It is becoming increasingly apparent that many countries will need some guarantee of security if technology is to have a positive impact and if water projects are to be equitably managed and maintained. In many cases, such guarantees can come only from third parties, whether from individual nations or from international organizations. Such commitments from third parties will come only when we consider water conflicts and emergencies as problems of the world community and not just of the parties directly involved. The connection between living conditions and environmental security must be realized; an improvement in living standards and increased economic output are often necessary for the success of sustainable and equitable development. Credible guarantees of security must be struck.

6. COOPERATION VERSUS CONFLICT: THE CHALLENGES

6.1. Globalization and Privatization

In the post-cold-war world, free trade, deregulation, global financial markets, and large transnational companies define a development model generally called "globalization." Emerging from a particular strand of predominantly Anglo-American political and economic history, globalization insists on a *laissez-faire* economic approach and, some would argue, the subordination of individual rights to capitalism (Barlow and Clarke, 2002, p. 82). Proponents argue that globalization can improve the economy worldwide, enhance quality of life, and stimulate the growth of democracy.

One aspect of globalization, the rise of transnational companies, particularly concerns us. Hundreds of mergers over the last decade and a booming stock market in the 1990s created conglomerates with enormous financial and political power. Global production and marketing became increasingly concentrated in fewer companies, such as ExxonMobil, British Petroleum-Amoco, International Paper, and General Foods. Some transnational companies believe that water services may be targets of opportunity. For example, Vivendi and Suez (ranked 91st and 118th,

respectively, in the Global Fortune 500) own or have controlling interests in water companies in over 130 countries on all five continents (Barlow and Clarke, 2002). As corporations, they are immune from most private suits that might otherwise result from claims of damage to people, property, or environment. The fact that some companies have exhibited corrupt (sometimes involving government officials) and even illegal practices raises additional concerns.

However, private companies might provide an important service to many parts of the world without adequate infrastructure and impure and limited water supplies. For countries desperately short of funds, privatization provides an alternative to borrowing and its resulting debt and deficit problems. Private companies could help restore water distribution in transboundary areas as well; however, they will be more expensive and will wish protection for their investment (military as well as financial, if necessary). In this capitalist arrangement, water becomes commodified, and profit becomes the eternal objective. It is difficult, if not impossible, to reconcile this objective with any assumed or established principle of a human right to water. Moreover, recent history hints that water companies may not follow their initial construction investment with sufficient investment in operations and maintenance (Barlow and Clarke, 2002, ch. 4–6). In short, it appears that state and international institutions must devise legal instruments to ensure that the private sector fulfills moral as well as corporate responsibilities as a water service provider.

6.2. Water Scarcity, Funding Scarcity

Many writers have noted the increasing scarcity of water. Barlow and Clarke write, "Suddenly it is so clear: the world is running out of fresh water" (Barlow and Clarke, 2002, xi). Homer-Dixon flatly states, "Scarcity of freshwater will be one of the chief resource issues of the twenty-first century" (Homer-Dixon, 1999, p. 66). Postel (1999) writes, "A growing scarcity of fresh water is now a major impediment to food production, ecosystem health, and political stability in many parts of the world." Recently, Lomborg has challenged this assessment; however, his statistical analysis of available water supplies and of demographic distribution has itself generated significant scientific opposition. He concluded that realistic water pricing, conservation measures, desalination (still expensive although the cost has gone down), and a movement away from self-reliance in food production in arid regions of the world – Israel is an example – will provide adequate water (Lomborg, 2001). To this list, Postel, though still far more pessimistic than Lomborg, adds biotechnology as a means of developing new breeds of plants which may withstand aridity better, grow faster and reduce the growing season, or grow in cooler climates (Postel, 1999, pp. 61–2). In short, the question raised is the extent to which the problem is insufficient water or inadequate water management. A related issue is whether inadequate water in poor countries reflects more a lack of funds than a lack of will.

An attempt to answer the question of whether there is sufficient water for the human population faces several problems. Perhaps, the major one is that our information about freshwater resources is not accurate. Approximations are the rule. The impact of population growth can also exclude easy analysis. For example, Engelman argues that the disproportionate share of the world's energy used by the United States results more from the 3 percent annual population growth the country experienced in the nineteenth century than the 1 percent annual growth of more recent times (Engelman, 1999, p. 126). Clearly, in many parts of the world, water, agricultural land, and fisheries are already in peril because of population growth, but it is the long-term consequences of that growth which may be most traumatic and politically explosive.

Finally, debate continues over the amount of water necessary to sustain an individual for a year. Hydrologist Malin Falkenmark developed a water stress index,

which attempted to establish the approximate minimum amount of water per person necessary to sustain an adequate quality of life in a moderately developed country. Although the approach still rests to some extent on subjective evaluation, many organizations, including the World Bank, have used it. The index assumes that human beings need about 100 liters of water per day for drinking, household needs, and personal hygiene. Gleick would cut this estimate in half, to 50 liters per person per day: sufficient, he argues, for cooking, drinking, sanitation, and bathing (Gleick, 1998, p. 44). Others have suggested that agriculture, industry, and energy production will consume another 500 to 2,000 liters per person per day. Were the supply of water to fall below 4,660 liters per person daily, the country concerned could be expected to experience at least sporadic periods of water stress. Not surprisingly, the water stress level during the dry season will be even higher in most countries (Lomborg, 2001, pp. 152–3). The most obvious – and profound – conclusion one can draw from all this is that neither the world of politics nor science can totally answer the question about freshwater sufficiency. Rather the answer lies at the intersection of both worlds.

What has all this to do with transboundary water disputes? The answer to this question depends on the responses to the numerous issues raised earlier in this article. If humans, for example, have a "right to water," the equitable distribution of water becomes a paramount objective in resolving transboundary water disputes. To do this requires some agreement on the amount of water to be allocated per capita and the amount of funding – and specific contributions – necessary to create the appropriate infrastructure. Quality of life enhancements that require water in excess of the minimum also invite discussion and a search for consensus. Here both cultural and political issues enter the negotiations. Inevitably, negotiators find themselves multiple objectives that may become more or less important as both population and the economy develop. The reconciliation of these objectives may necessitate the use of elaborate computer programs that not only show potential hydrographs under various natural and human-made conditions, but also the specific economic, ethnic, and social impacts to, for instance, a particular hamlet, style of living, or nascent industry. The entire negotiating environment is far more complex than that which existed half a century ago. Under such circumstances, developing a fair process for project development, including adaptive management to meet new requirements, may become more important than establishing specific social and political goals.

7. CONCLUSION

Historical analysis provides necessary context for the negotiations of water disputes and reminds us of the emotional and aesthetic significance of both technological objects and the physical world – the world of land, sky, and water. History teaches us about the importance of developing planning processes and water projects that are caring rather than narrowly parochial. It also suggests the mutability of human vision; what seemed so obvious and relevant in one decade may seem outmoded in the next. In a constantly changing world, engineers and politicians must accept responsibility for both short and long-term consequences of their projects, and, like the country doctor, must be on the lookout for new ways to keep the body politic healthy and happy. The challenge is continuous.

Successful negotiations of transboundary river issues usually require both political and technological responses. History shows that these responses do not emerge from some sort of "objective" apolitical vacuum but, in fact, embrace identifiable values that successful negotiators must understand and appreciate. Any viable modification of these values will require more than simply the application of welfare economics or of statistical probability. Rather, negotiators must apply some democratic notion of justice; they must liberate rather than constrain, offer

opportunity rather than control, and make change that empowers all and not just the fortunate (usually politically powerful) few. We mobilize our intellectual resources to understand the physical presence of the land and basin. It is no less important to understand the peoples whose values and hopes so much shape water conflicts, both large and small.

APPENDIX A: HISTORICAL EXPLANATION AND TRANSBOUNDARY WATER DISPUTES

Any historical analysis of water conflicts and their resolution necessarily intertwines a wide variety of factors, and each historian will approach these factors in different ways. Yet, few historians will simply dismiss any of them in developing their own narrative. Below is a suggestive outline that provides some guidance on what long-term and short-term factors historians might consider. With some modification, they probably could be applied to almost any case study involving institutional interaction, either transboundary or among rival groups within a country. The division into short and long terms necessarily involves some arbitrary distinctions and will certainly vary with each historian. The factors are not presented in any particular order, and they are meant to apply to all parties to an issue or dispute. As always, the historian's duty is to interpret the relationships among all these factors in an analytical, integrated, well-written story based on solid research in primary (correspondence, speeches, journals, diaries, and so on) and secondary (interpretive) sources.

Long-Term Factors

a. Physiographic details about the basin, including quantity and quality of water, soils, and climate changes.
b. Rivalries, including ethnic and religious rivalries with other countries, and within the country or region.
c. Economics, including domestic production, distribution of wealth, infrastructure strengths and needs (transportation, communication), municipal and domestic water supply, and trade.
d. Population demographics, possibly including literacy, public health problems, age and gender characteristics, and housing.
e. Technological advantages/needs.
f. Natural resource advantages/needs: not only water but also other resources that may lead to conflict or cooperation and may bear on the water issue.
g. Institutional capability: long-term stability of political, economic, and social (including religious) institutions.
h. Legal and judicial constraints and flexibility, especially focused on water. Common law and statutory interpretations, cultural/religious influences, and political susceptibility.
i. Ethnic and religious disputes that may affect water requirements/conflicts. These may be either transboundary or wholly internal disputes.
j. Public perceptions/misperceptions regarding water rivals.
k. Military power: long term investment in the military; military relationship with political power.
l. Diplomatic/military alliances with other countries that may influence water relationships
m. "National character"/cultural context. This is a very difficult factor to define and is susceptible to misuse. It may be entirely misplaced if applied to a young nation or region without a consensus about its history, values, and goals. Nevertheless, when properly focused on the political, economic, and social institutions and values of a country, the historian may be able to develop some helpful generalizations.

Short-Term Factors

a. Sources of cooperation/conflicts.

1. Initial incidents
2. Specific/urgent requirements
   i. Resources issues/movement towards disorder or order. Overall stability or instability.

b. Political/military leadership: specific personalities and policies, control of military and political institutions.
c. Public perceptions/mass media: the involvement of the press, NGOs, religious/ social institutions in developing popular perceptions.
d. Diplomatic initiatives, including role of NGOs and third party countries.
e. Mediation/arbitration/negotiation: objectives of parties, obstacles to success, breakthroughs, results.
f. Further incidents.
   1. Leadership responses.
   2. Public responses.
   3. Institutional responses (including churches and legislatures).
g. The "point of no return": any steps that seem irrevocable and lead towards conflict/cooperation (note: any observations on this factor should be stated tentatively as few steps can be shown to be truly irrevocable in light of subsequent history).
h. Ongoing diplomatic/military considerations.

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THE NEED FOR MULTISCALAR ANALYSIS IN THE MANAGEMENT OF SHARED WATER RESOURCES

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CONTENTS

THE NEED FOR MULTISCALAR ANALYSIS IN THE MANAGEMENT OF SHARED WATER RESOURCES

In recent years, the water war and water peace discourses have focused on whether or not interstate wars will be (or have been) waged over water. Restricting the analysis of water conflicts to the international scale can be quite misleading. It prevents us from observing and analyzing the intricate array of competitions and cooperations that are woven around water over many widely different scales by a great variety of social actors. The mechanisms at work within this intricate set of relations are driving water conflicts and/or their resolution. Understanding them necessarily requires a multiscalar analysis. Such an approach allows us to understand how the competition to "spell out the rules" concerning water use, water allocation, and water access affect various sectors, various industries, and various social groups differently, whether these be defined along ethnic, linguistic, religious, economic, or gender lines. The alliances and the power plays existing among these social actors drive international water conflicts. The resolution of such conflicts requires first and foremost a clear understanding of such mechanisms so that they may be altered.

This article will identify four mechanisms that deeply affect water conflicts or their resolution: gender, territorialization, ethnicity, and uneven economic development. They are by no means the only mechanisms contributing to the creation of second-order water scarcity and the generation of water conflicts.[1] They are generally judged to be irrelevant by those studying water war and water peace. This article will explore how such mechanisms do in fact structure international water relations for the better or for the worse. It will finally turn to the question of how to identify these mechanisms in order to develop multiscalar methodologies to research water conflict potential as well as the potential for the resolution of such conflicts.

1. MULTISCALAR ANALYSIS

Various social actors deploy strategies over varying spatial scales when competing or cooperating in accessing, using, or allocating water. They also deploy strategies over widely varying scales when competing to spell out the rules governing each of these activities. Farmers may resort to oral customary law to regulate their access and use of a neighboring spring or river for irrigation. This is often the case in the south of France, where new rules and regulations, especially those introduced by the European Union, clash with this customary law.[2] A very similar situation is also often found in the developing world as examples in both the Middle East and South Africa illustrate.[3] At the other end of the scalar spectrum, diplomats may consider the entire water resources lying in an international basin when negotiating a treaty with a riparian state. Is it conceivable that these two sets of actors act in full independence from each other? Is it possible that water conflicts and competitions occurring at local and national levels are irrelevant to understanding international water conflicts and conflict resolution? Those researching water wars have often assumed such independence between the various scalar levels of water conflict. This assumption has its roots in a perception of the state as the sole actor capable of spelling out the rules of social control, and as the sole actor capable of mobilizing legitimate means of violence. Why such assumptions have grown to the point of preventing researchers from observing a contradictory reality has been explored elsewhere (Trottier, forthcoming).

Any understanding of international conflict over water, and any successful conflict resolution proposal, need to rely on a multiscalar analysis of the competitions and conflicts concerning water. Such an analysis explores the various competitions and conflicts occurring over several scales, and it explores the interactions between the actors active over different spatial and social scalar levels. Such interactions, once examined, reveal a huge array of contradictory competitions and cooperations. The sum of these constitutes what is often reduced to "an international water conflict."

2. GENDER

The relation to water is extremely gendered. Water projects throughout the developing world have been trying more or less successfully to incorporate that gender dimension in their construction. In much of the developing world, fetching water, the household use of water, and many irrigation tasks are performed by females. The power distribution induced by the varying relations men and women have with water has been the object of numerous studies that extended over a local scope (see for example: Steinmann, 1993). Such research has been driving development organizations to rethink their water projects in an attempt to empower women (see for example: Joshi, 2001).

Interestingly, as studies devoted to water increase their geographical scope, they seem to devote an inversely proportional attention to the issue of gender. The latter is virtually absent from all of the literature devoted to international water conflicts. Researchers dealing with these subjects often say that such issues as local water politics or gender questions are irrelevant to their case studies. Are they? As feminist theories of war put it "Where are the women?" In this case, while women appear as clear actors within one scalar level of analysis, where have they gone within the other level?

Investigating the degree to which militarization is a gendered process means asking how much of militarization is a process that will not work unless men accept certain norms of masculinity and women abide by certain strictures of femininity, argues Cynthia Enloe (1993, p. 120). Similarly, asking to what degree international

water conflicts are gendered processes means asking how much of the competitions around water use, allocation, and access is a process that involves men accepting certain norms of masculinity and women abiding by certain strictures of femininity. It also means asking the same question concerning the competitions over who is empowered to spell the rules governing the competitions over the use, allocation, and access to water.

Understanding how gender participates in water conflicts is only possible through a multiscalar analysis. By the time the international level of analysis is reached, women seem to have disappeared. Statesmen (only exceptionally stateswomen) negotiate agreements that appear based on gender-neutral physical calculations of freshwater resources in relation to riparian populations. Yet, whether or not such agreements will induce water scarcity, plentiful crops, or sufficient hygiene to ward off epidemics is fundamentally dependent on a multitude of women accepting a division of labor whereby they carry water, care for children, or perform many agricultural tasks for very low or non-existent wages.

Is an international water agreement sustainable? Will it bring about further conflicts or increasing cooperation? The answer to such questions essentially depends on the intricate array of power relations structuring the management of water within every state that is party to the agreement. Gender is one of the key factors structuring these power relations. If the social construction of masculinity or femininity changes, the entire power structures will be affected. This may induce more or less tension concerning water. Understanding the complex ramifications of the construction of gender on water scarcity is only possible via a multiscalar analysis. Such understanding can be harnessed constructively to influence the gender construction in a manner that will foster international cooperation in water conflicts.

> Militarization is occurring when any part of a society becomes controlled by or dependent on the military or on military values. Virtually anything can be militarized. Toys, marriage, scientific research, university curricula, motherhood – each can be militarized. . . . Each one of these processes involves the transformation of meanings and relationships. Rarely does the transformation happen without the use of public power and authority.
>
> (Enloe, 1993, p. 100)

The same holds for water development: it rarely happens without the use of public power and authority, and it transforms meanings and relationships within a society. The parallel with militarization is all the more relevant when one considers that some states have attempted militarizing their relation to water.

3. TERRITORIALIZATION

A state territorialization process occurs when a state tries to invest a new space for its own legitimization, whether it is physical, rhetorical, or symbolic, argues P. Faggi (1990). Water projects have often provided occasions for states to develop their territorialization process over a previously uncontrolled area. Faggi distinguished between the productive and the strategic logic of water projects. The productive logic that is put forward, generally aims at increasing agricultural production or domestic water supply. The strategic logic aims at introducing some state control over matters that were previously decided by other social actors.

Massive water infrastructure projects systematically alter the former relations to water, whether customary law regulated them or not. They bring new technology that requires experts, thereby removing control of water use, access, and allocation from

local communities that previously used lower level technology every inhabitant could master. Such massive infrastructure projects are generally accompanied by new rules and regulations, spelled out by the state, that are supposed to replace the former rules. This process whereby the state appropriates the right to spell out rules governing social control is what Faggi refers to as state territorialization.

Such a process accompanies all massive water infrastructure projects, including those relating to decentralization. A state always strives to preserve its right to spell out the rules governing social control. It may delegate the execution of tasks to other social actors and call this decentralization. It may also delegate to other social actors the power to lay down some rules, but it will always strive to retain (or acquire) the right to decide which social actors are empowered to do this.

With his model of weak states and strong societies, Joel Migdal has observed how most of the states born out of decolonization entered into competition with a multitude of other social actors over the right of spelling out the rules governing social control. In most cases, the state lost that competition and had to settle for a compromise with various formal and informal institutions already spelling out these rules (Migdal, 1988). Migdal later refined this initial model to produce his state-in-society model (Migdal, 2001). Whenever the state attempts to extend its power over a given sphere, various state institutions interact with the social actors they are attempting to control or influence. This dynamic process changes the groupings themselves, their goals, and, ultimately, the rules they are promoting (Migdal, 2001, p. 23).

> State leaders view the state as a mechanism to create a single jurisdiction – a rule of law in which the rules are the same from border to border. This is a desideratum of the modern state. These strongmen, whether they are village chiefs, urban caciques, or rich peasants, work for precisely the opposite effect. They seek to maintain their own rules, their own criteria for who gets what, within much more limited bounds. . . . Struggles for domination take place in multiple arenas in which the parts of the state are related not only to one another but each is a single social force in a field of interacting, at times conflicting, social forces.
>
> (Migdal, 2001, p. 91 and p. 100)

Such interactions are especially salient in the case of water. As state institutions attempt to extend control over the use, access, and allocation of water they are engaged in a multiplicity of interactions with a great variety of social actors who are already exercising an aspect of this control. These social actors invest the state institutions and the resulting situation is often one where "the idea of the state" does not correspond to "the practices of the state."

Researchers investigating international water conflicts have virtually never tried to understand how these strongmen, urban caciques, or rich peasants actually affect the water policy of a state as it spills over into its foreign policy. Often, the compromises reached within this complex array of interactions induce second-order water scarcity. The weaker a state feels towards its domestic array of social actors involved in water competition, the stronger is the temptation to denounce a need for more water resulting from an unfair international water agreement.

States do not design the social control of water in the manner an engineer designs a network. States are immersed in a complex dynamic process whereby their institutions interact with non-state institutions both within and outside the national territory. Understanding such a process sufficiently to determine whether an international water agreement is sustainable is only possible through a multiscalar analysis.

4. ETHNICITY

Ethnic conflicts have seemingly multiplied since the end of the cold war. Superficial observers may resort to conservative theories that ascribe such conflicts to age-old hatreds, but close scrutiny often reveals a more prosaic truth. Societies that include clearly distinguishable ethnic groups often show an uneven spatial distribution of such groups over the national territory. Villages may contain only members of one ethnic group, and the position of every village in relation to water access means a varying degree of access to water for various ethnic groups. Even in the case of multi-ethnic villages, the spatial distribution of the households and plots of land may advantage the ethnic group located upstream over the other group located downstream.

Suzanne Steinman produced a brilliantly studied example of such relations existing along the river Todgha in southern Morocco (Steinmann, 1993). The villages located in the north of the river basin were inhabited by the Ahl Todgha tribe and benefited from a more or less continuous use of the river in spite of the high fluctuation of its flow. The villages located further downstream were inhabited by the Ait El Hart tribe, ethnically distinct from the Ahl Todgha. Although both of these groups owned land, the downstream access to water greatly limited the agriculture the Ait El Hart could practice via irrigation. The Ahl Todgha used everything they needed, and the Ait El Hart could only access whatever flow was left over. Traditionally, the Ahl Todgha had dominated the Ait El Hart, who often worked in their fields as laborers.

A third ethnic group, the Ait Atta, inhabited villages even further downstream. They had been forced into sedentarization by the French after 1931. This third ethnic group enjoyed the least access to the river water and its members often worked the fields of the Ait El Hart as laborers.

This unequal access to water based on ethnic lines was further complicated when some of the Ahl Todhga and Ait El Hart started emigrating to take up paid labor. This induced the monetarization of the local economy and allowed richer families to acquire pumps used to draw water directly from the aquifer, independently of the location along the river course. This suddenly improved the water access of the Ait El Hart, many of whose members had emigrated and sent cash home, while it did not help the Ait Atta, none of whom had been able to emigrate.

Regulating the pumping of water from the aquifer became a touchy ethnic question. The appearance of pumps had revolutionized the power relations between the ethnic groups. Limiting their use would mean the promotion of the old order. Such ethnic differences in water access and allocation are quite widespread. Perhaps the fact that Morocco was not in the throb of an international water negotiation allowed researchers to focus on the mechanisms whereby ethnicity affects water use, access, and allocation. Such mechanisms are also crucial in other areas, such as the West Bank, where the international dimension of the water competition has stolen the limelight. Here, over 500 springs and nearly 400 wells are managed according to communal property regimes whereby some groups of families own water shares and others do not. The unequal access to water on the basis of ethnic belonging appears clearly in villages such as Ein Arik, where the ancient village that has rights over the spring is built over one slope of the valley. A refugee camp was set up on the opposing slope after 1948. The refugees can come to the spring to fill water bottles for domestic use. But they are not entitled to water shares for irrigation, which only belong to the families of the old settled village. An outside observer might classify both the refugees and the villagers as "Palestinians," but their belonging to various clans directly affects their access to water.

Researchers of international water conflicts have too often brushed aside the mechanisms ethnicity introduces in the competition to control water. Such mechanisms play a crucial role, however. Various ethnic groups have differing access to state institutions. More often than not, the state representatives will belong to the dominant ethnic groups, and will be constrained by these groups in any case. Conversely, any international water agreement has consequences for domestic rules and regulations concerning water. Changing these rules generally means altering the power relations among ethnic groups. Developing states rarely have enough authority to achieve this. Any such attempt will propel some ethnic groups to resist. In international basins where the same ethnic groups may live on both sides of an international border, such issues become very sensitive.

Ethnicity generates mechanisms that affect the competition for the control of water at the local, national, and international scale. Once again, only a multiscalar analysis can show us how these mechanisms are constructed and how tensions can be defused.

5. UNEVEN ECONOMIC DEVELOPMENT

The various uses made of water can fuel economic activities of greatly varying profitability. Customary and informal water institutions governing much of the water use in the developing world have often emerged as a means to manage water for irrigation purposes. Local water management institutions have survived outside the relatively restricted zones of large-scale irrigation projects in the developing world. They have also emerged independently in the industrial countryside, to the point that a majority of the world's irrigated land relies on small-scale, hand-built, gravity flow canal systems, managed by local groups of farmers (Mabry, 1996, p. 6).

J. A. Allan pioneered the concept of virtual water to describe the quantity of water necessary to produce a given quantity of imported food (Allan, 1992). He advocated a switch in the water use of water-scarce states. Using water in industry and services would generate more added value than using the same amount of water in agriculture. This added value could then be used to import more food than could have been produced locally. Reallocating water from agriculture to industry and services could generate virtual water and solve the scarcity problem. Allan therefore advocated a switch from a concern with food production self-sufficiency to a concern with food security.

Although this argument is flawless at the international scale, a multiscalar analysis raises several thorny issues concerning such a proposition. The social groups that benefit from the use of water in irrigation via customary water management institutions are rarely the same that benefit from the new types of economic development induced by a reallocation of water to industry or services. Such a reallocation may often bring about an uneven economic development that benefits the groups advocating the reallocation and marginalizes the groups engaged in agriculture. Such an occurrence is not limited to the developing world alone, as examples in the Arteguy basin have illustrated in France (Punjabi, forthcoming).

Of course those social groups that feel threatened by an uneven economic development deploy strategies to secure their access to water and their use of the water. Few governments feel strong enough to face securely a peasant revolution; none welcomes a mass influx of waterless peasants into the city slums. Many a state could agree to international water sharing agreements that restrict its use of water providing mechanisms exist that will allow a smooth switch to virtual water. Only a multiscalar analysis allows us to understand whether these mechanisms exist and how they could become successful.

The case of Jericho offers a striking example of such a situation. In 1999, 943 people had water rights over the Ein Sultan Spring (Trottier, 2000, p. 86). These water shares were measured in time and concerned the length of time during which water was diverted, through the irrigation network, to the plot of the water shareholder. These water shares varied greatly in size, from 32 hours a week for a very "water-rich" shareholder to two and a half minutes a week for a rather poor water shareholder. Ein Sultan Spring's flow was estimated to be 680 cubic meters an hour in 1998. The spring has traditionally served the inhabitants' domestic needs as much as they wished and the leftover water was channeled to the various plots of land via the irrigation network. The domestic use had long been negligible given the small population and the abundant flow of the spring. The share of water pumped by the municipality towards domestic needs reached an all time high of 300 cubic meters an hour in 1999. Indeed, the town's population had boomed with the arrival of the Palestinian Authority and the 1997 census recorded 14,674 inhabitants. The farmers were still receiving the same water shares in terms of time, but much less of the spring's flow was allotted to them during that time. Jericho is a rare instance in the West Bank where the farmers do not themselves control the various diversions that will lead water to one plot or another. Instead, *qanawatis* who are hired by the municipality cycle along the various channels in order to proceed to the various openings and closures of the channels and thereby direct the water according to the schedule recorded in the municipality.

The farmers with water shares can be considered roughly as the old landed elite, whose families were living in Jericho before Israel ever came into existence. The new inhabitants, who were creating an increased pressure on the spring's water, can be considered roughly as the new elite, whose capital was invested essentially in services, the most obvious being the casino and hotels that sprouted up after 1994. Clearly, the irrigating farmers felt threatened by the growing use of water in services and perceived this as uneven economic development that was going to marginalize them.

The farmers reacted to the situation by creating the Ein Sultan Water Users' Association (ESWUA) upon the occasion of an IFAD (International Fund for Agriculture Development) funded project. They elected as secretary-general Daoud Erekat, a very respected and old-time member of the PLO, who happened to be the cousin of Saeb Erekat, the Minister of Local Government. The ESWUA obtained in 1998 decree no. 38, signed by Y. Arafat, which grants it the responsibility of providing the Jericho Area with the necessary water in terms of drinking and irrigation water needs. This decree, published in Arabic, was in flagrant contradiction with the Palestinian water law in preparation, available in English. It reflected a compromise that the Palestinian Authority had to accept in order to appease a local social force, that of the Jericho landed elite, which wanted to secure its allocation of water for irrigation. The fact that the municipality declared in 1999 that it simply did not recognize this decree shows how far the practices of various state institutions can contradict each other, especially when the state is still building itself.

The case of Jericho shows the mechanisms both of territorialization and of uneven economic development at work in determining an international water competition. What posture can the Palestinian Authority adopt when it enters negotiations concerning water sharing with the Israelis? Accepting a water share that implies a dependence on virtual water alone as far as food production goes is unacceptable. It implies a situation that would be impossible to manage because no mechanism exists that will allow a smooth switch to virtual water. The Palestinian Authority needs to make high demands at the international level in order to manage competition induced by an uneven economic development at the national level.

6. A METHODOLOGY FOR MULTISCALAR ANALYSIS IN THE MANAGEMENT OF SHARED WATER RESOURCES

International water conflicts and agreements are negotiated by state representatives with complex agendas. They make huge assumptions concerning the sustainability of a gendered division of labor. They face complex domestic institutions invested by a variety of social actors intent on preserving their water rights and privileges. They participate in ethnic rivalries and in uneven economic development that sharpens the pressure of competing claims concerning water. Moreover, these state representatives do not negotiate solely with "foreign" representatives. Much of their domestic constituency has already woven a thick mesh of interactions with other social actors in neighboring states as well as with international organizations and NGOs.

Despite this, the negotiations such state representatives carry out are generally studied without any attention being paid to the mechanisms that drove them to their positions and severely limit the compromises they could accept. Perhaps the formidable challenge such a multiscalar analysis represents explains why researchers have shied away from it. We need methodologies that will allow us to carry out such multiscalar analyses. A useful methodology can use conflicts as its unit of analysis and qualitative methods of investigation to expose the social actors involved and the interactions among them.

Conflicts are precious occasions where raw tensions are revealed, where competitive and cooperative relations are exposed, where unexpected social actors emerge as key players. Any conflict concerning water should be useful in this respect. Instead of treating villages' disputes over the sharing of a well's water or a village's refusal of a water project as anthropological curiosities, we need to give them serious consideration. Investigating such disputes allows us to discover what rules and regulations are considered as legitimate by the social actors that are party to the dispute. It allows us to discover which sources of law are considered legitimate. It makes it possible to identify the water users who want to preserve their access and allocation, and the means they employ for such ends. Do they resort to national, customary, or another sort of law? Do they seek the help of a ministry or that of a foreign NGO? What links is each of these social actors cultivating with counterparts in the other riparian states? More often than not, surprising links of cooperation emerge between social actors of various nationalities. This does not prevent such social actors from subscribing to a vision describing the neighboring riparian as "the other" who steals "their" water and creates the scarcity.

Using as a starting point of the analysis as extensive as possible a series of local scale water conflicts therefore allows us to deconstruct the states' official discourses and to uncover the mechanisms that drove them to adopt that discourse. Once such mechanisms are understood, conflict prevention or conflict resolution appear less elusive. Identifying how gender, territorialization, ethnicity, and uneven economic development participate in the building of international water conflicts, for example, allows us to find ways of defusing these conflicts.

Using local water conflicts as starting points to understand, ultimately, international water conflicts is only one aspect of such a methodology. The investigation of these conflicts needs to be carried out through qualitative methodologies. The study of international water conflicts has been obscured by an overwhelming concern with quantitative research. What amount of renewable resources lie in each riparian state? How much per capita? What salinity? The perception of the scarcity (or of the absence of scarcity) has often proved to be much more of a determining factor in the build-up of a conflict than the actual quantity of water available. The perception of a scarcity, of its root causes, of its possible

solutions, needs to be investigated because it determines the strategy each social actor deploys. Uncovering these perceptions and the resulting strategies cannot be carried out through surveys and statistical analysis. The relation to water is often a rather intimate one, which few social actors active over a local scale would reveal easily. Building trust is an essential part of carrying out this research. Handing a form to a statistically significant number of water users is the surest manner to acquire fictitious information. The interviewees will only write down what they perceive as the politically correct answers. Semi-structured interviews and other techniques of participant observations are much more appropriate for such investigations because they allow the building up of trust. They also allow the various social actors to articulate their own analysis of the situation, thereby enabling the researcher to ask the right questions to uncover the strategies being deployed. When such a methodology is used, questions that had initially been considered insignificant for understanding an international water conflict eventually appear as crucial and central.

Water is the object of many myths, among the research community as elsewhere. Deconstructing such myths is crucial if we are to understand the complex array of interactions that give rise to water conflicts. It is also crucial in giving us the keys to solve them. Only qualitative methods that pay due attention to perceptions and discourse analysis can achieve this.

8. HOW A MULTISCALAR ANALYSIS CAN CONTRIBUTE TO CONFLICT RESOLUTION AND PREVENTION

A multiscalar analysis allows us to identify the numerous social actors that enter competitions to use, access and allocate water. It allows us to understand the web of interactions they have woven among them over local, national, and international water issues. The assets that can be used to carry out conflict resolution and conflict prevention lie in these interactions; they make up social capital. Cooperation among water professionals of diverse nationalities, previously unsuspected sources of social control that prevent water thievery, perceptions of the origin of water scarcity, all emerge from a multiscalar analysis. They can all be harnessed to prevent or resolve water conflicts. Assets that emerge from the multiscalar analysis of the role played by gender, territorialization, ethnicity, and uneven economic development can take many shapes. Demographers have known for decades that the rate of population growth is inversely proportional to the level of female access to education. Literacy has proved much more powerful a tool to curb overpopulation than forced sterilization campaigns. This is because education affects the gendered distribution of power. Similarly, the impact of female literacy on water conflicts could shed much light on possible conflict prevention and resolution. The compromises achieved by a state within its territorialization process can help us understand why an agreement that seems perfectly sound within a "drawing-board" logic is doomed from the start, and to see which other agreement, perhaps less efficient from an engineering point of view, might fare better.

The need for a multiscalar analysis in order to prevent and resolve international water conflicts does not mean that farmers, poor women, ethnic representatives, and water vendors must attend international negotiations. It means that the mechanisms whereby the intricate web of power relations they have woven among them affects water scarcity need to be understood so that mechanisms will be suggested within international agreements for a sustainable water management. Treaties that offer a mere water sharing agreement are bound to be denounced sooner or later because the maze of local, national and international interactions around water is forever changing and cannot possibly be satisfied by a fixed allocation to each riparian state.

Treaties that build on existing constructive mechanisms affecting water management, recognize the importance of the role played by non-state actors, and offer new mechanisms to manage the competitions among them withstand the test of time much better.

NOTES

1. Second-order water scarcity has been defined by L. Ohlsson in opposition to first-order water scarcity. The latter is a lack of the resource itself, whereas second-order water scarcity is the lack of political, social, and economic adaptive capacity to manage the resource successfully. Second- order scarcity can therefore occur in cases when there is no first-order water scarcity (see Ohlsson, 1999).
2. Frederic Andrieux, irrimieux project, Draguignan, France, private communication.
3. For a Middle East example, see Trottier, 2000.

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Index: Territorialisation, multiscalar analysis, water conflicts, ethnicity and natural resources

PCCP PROCESSES IN HISTORY: THE MODEL OF THE UPPER RHINE REGION

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CONTENTS

PCCP PROCESSES IN HISTORY: THE MODEL OF THE UPPER RHINE REGION

The article addresses some of the problems and conflicts that human uses of the Rhine have caused over the last 200 years. It also analyzes new forms of cooperation that were developed to combat these problems. In six sections, paradigmatic examples of PCCP processes along the Rhine over a period from 1800 up to 2004 are presented. Nineteenth century, problems and concepts of agriculture, flood defense, and navigation are analyzed. The twentieth century history of water pollution, shipping, and hydropower policies, concepts for flood defense including biodiversity, and the project of a transboundary "garden across the river" between the cities of Strasburg and Kehl are discussed.

Section 1 shows the problems that the project of straightening the upper Rhine in the early nineteenth century had to overcome. It is shown how the plans were realized against widespread protests, and were succesful in terms of drainage and improvements of health conditions, although floods continued.

The Section 2 deals with problems of navigation in the nineteenth century. It focuses on the famous example of the first Rhine Navigation Convention of 1831, which provided a legislative framework for the work of the Central Rhine Commission. The convention and the commission represent the first true supranational organization and international court in this area and a nucleus of twentieth-century European unification.

The water pollution problem, which Section 3 deals with, shaped the twentieth-century debates on the river, calling very early for environmental interventions. Massive pollution was caused by rapid industrialization and urbanization, provoking serious conflicts among users of the Rhine water and a decline in the number of fish species. This pollution was only reduced from 1945 onwards. The article analyzes the role of hazards and of the International Commission for the Protection of the Rhine against Pollution (ICPR) in combating pollution, and of the implementation of programs to improve water quality and restore biodiversity, such as the international Aktionsprogramm Rhein and the action plan Salmon 2000.

In Section 4, the consequences of nationalist policies in the fields of shipping and hydropower are demonstrated, taking the two competing water engeneering projects of the so-called "regulation" of the river and the constructing of the Rhine side channel as examples. After the side channel had caused serious land degradation and nationalist resentments, negotiations between French and Germany after 1945 led to far-reaching modifications and close cooperation: a very prominent example of a successful PCCP-process.

Nevertheless, the interventions in the riverbed caused massive loss of floodplains and serious flooding up the 1990s, which called for large programs for floodplain restoration. These programs are presented in Section 5. Ambitious plans to restore floodplains and promote biodiversity met with serious and long-lasting resistance from riparians. The same happened on a local level in a different way to the "garden of the two riversides" that the German city of Kehl and the French city of Strasburg are jointly planning to complete in 2004. Changes to the plans that a new local government of Strasburg asked for provoked stagnation in transboundary cooperation and changes of plans, so that the project will only be realized on a smaller scale than had been intended.

The article argues that the history of the Rhine can teach us much about the serious problems that humanity's uses of water have provoked, as well as about the dynamics and successes that transboundary cooperation can achieve.

1. INTRODUCTION

Humans have fundamentally shaped European Rivers, and especially the Rhine, for more than 2,000 years. These rivers form part of the European cultural and natural heritage. This article addresses some of the problems and conflicts that humankind's uses of the Rhine (for shipping, energy production, waste disposal, agriculture, and so on) have caused over the last 200 years, such as floods, pollution, and loss of biodiversity. It also analyzes new forms of cooperation that were developed to combat these problems.

An historical analysis of six paradigmatic examples of PCCP processes along the Rhine (from the Central Commission for Navigation on the Rhine established in 1815 to the cross-border garden exhibition planned around Strasburg for 2004) is intended to lead to a better understanding of today's conflict and cooperation in the field of water policy.

The Rhine has a length of 1,320 km and a catchement area of 145,000 km^2 shared by nine countries. From its origins in the Alps it drops from an elevation of 2,340 meters to the North Sea. The slope varies in the different sections from more than 1.6 percent (Alp-Rhine), 0.88 percent (Upper Rhine), and 0.09 percent (lower Rhine) (Köhler, 1996; Internationale Kommission für die Hydrologie des Rheingebietes 1993).

Conflicts and processes of cooperation follow a specific logic in the different sectors of water policy and are shaped by the historical period they belong to. In the context of an institutional analysis approach that is used here, it is claimed that every PCCP process has specific critical periods and turning points in which new solutions and institutions are created (see Figure 2). Furthermore, conflicts between upriver and downriver riparians and between actors on the local and the central scale of water policy are considered to play a key role in this context. Consequently four of the case studies focus on the regional scale of the Upper Rhine; two studies analyze catchment-wide conflicts and cooperations (Reinhard, 1995/6, pp. 1ff.; Bernhardt, 1998, pp. 293–319).

The Upper Rhine is geomorphologically defined as the area between Basle and Bingen. The regional case studies presented here are mainly taken from the area between Basle and Mannheim.

2. AGRICULTURE AND FLOOD DEFENSE (1800–1876)

The morphology of the Rhine as we know it today is mainly a result of nineteenth-century water management. This is especially true for the upper Rhine. Here the riparian states of Baden, Bavaria, and France realized from 1817 onwards the greatest, and up to that point most difficult, water engineering project in German history, following plans drawn up by the Badian Colonel Johann Gottfried Tulla. The Upper Rhine was given a firm bed and the path of the river between Basle and Worms was shortened by 81 km or 23 percent, thus reducing it to 273 km. This project affected about 200,000 people on both sides of the Rhine. In the long run – up to the 1880s – approximately 10,000 hectares that had previously been periodically flooded were won for cultivation, and health conditions improved considerably, as malaria and typhus decreased significantly (Honsell, 1885, pp. 65ff.; Centralbureau für Meteorologie und Hydrographie im Großherzogtum Baden, 1892, pp. 238–9).

The states were motivated to start the gigantic project because of the problems of flooding, diplomatic conflicts regarding the course of the border along the Rhine, and the requirement of land for food production. First, flooding had seriously worsened during the late eighteenth century and had caused widespread damage, for

example, in 1778 and again in 1817 in the region around the Badian capital Karlsruhe. Second, the permanent changes in the course of the river and especially of the thalweg – the main channel that marked the border – caused constant disputes not only between Baden and France about the location of the border but also between Badian and French communities about the ownership of riverside land and the numerous islands in the Rhine. Third, the severe problems of famine that periodically appeared in catastrophes such as that of 1816–17 inspired the governments to develop (in executing the political concept of the so-called "Physiokrats") large drainage programs to gain land (Musall, 1969, pp. 151–65).

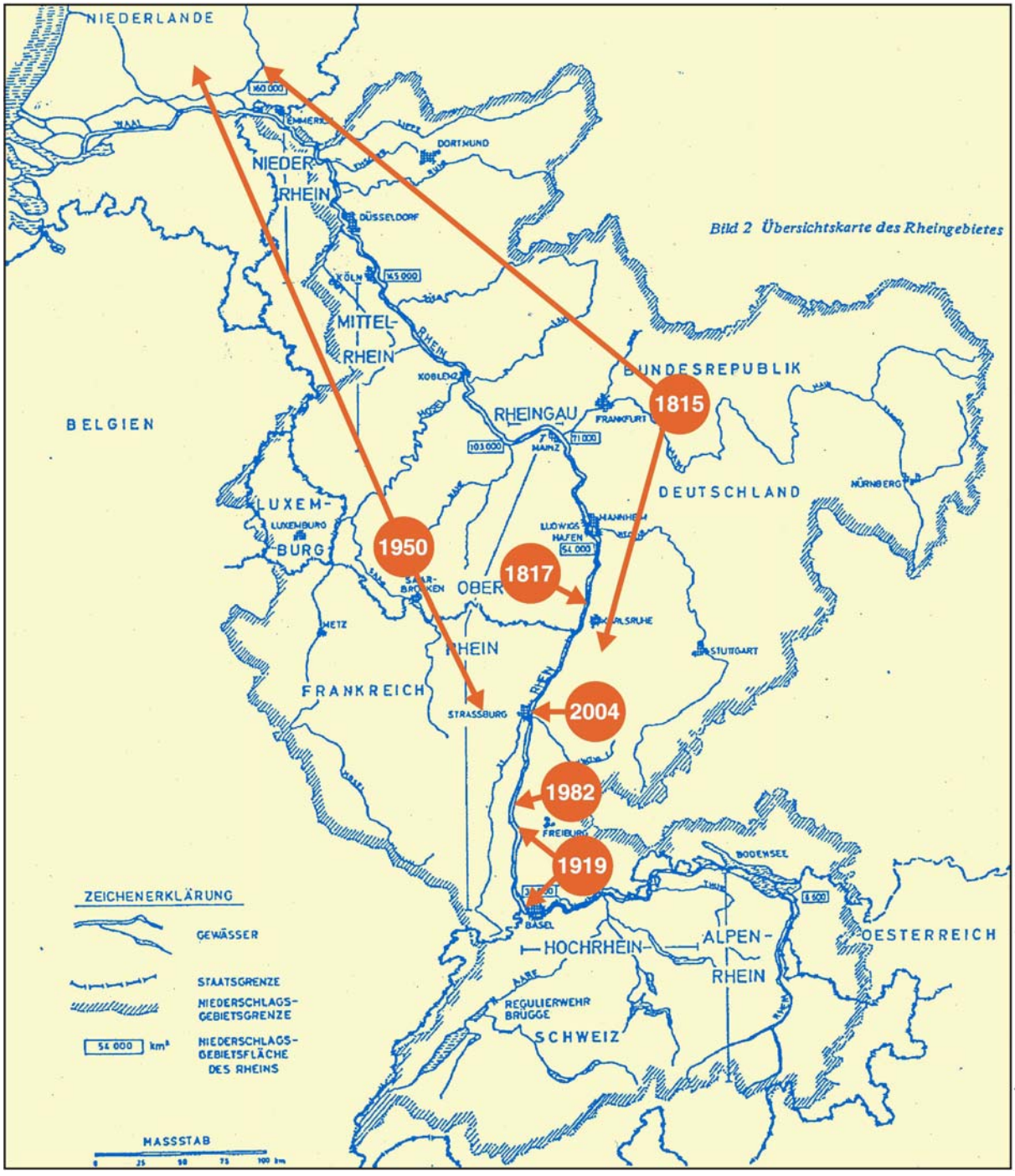

Figure 1. Rhine river basin, PCCP processes

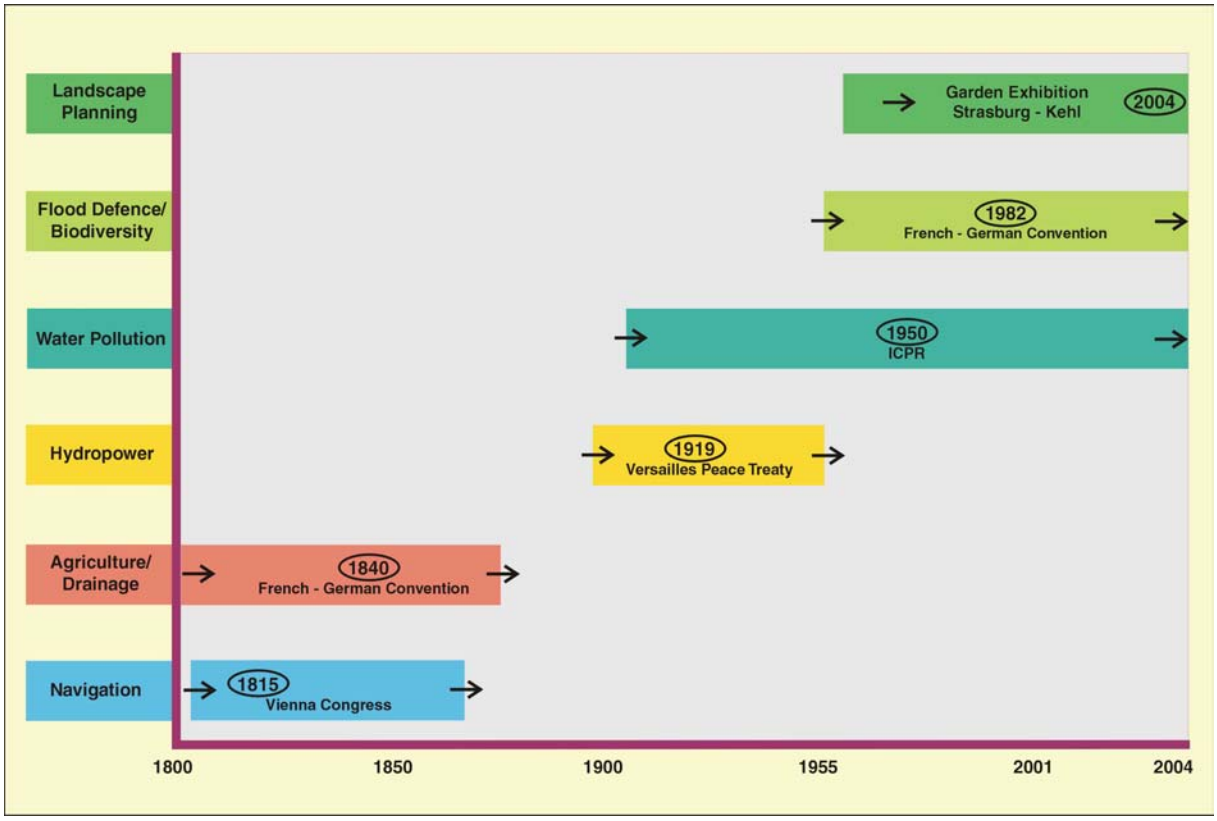

Figure 2. Critical periods and turning points of water-related PCCP processes 1800–2004

The correction project was the first large-scale water engineering project in southwestern Germany after hundreds of local interventions in the previous epoch had, in most cases, caused serious problems of flooding for other riparians. From the beginning the Tulla project met with severe resistance from three groups of actors: the rural population, the urban population, and the downriver riparian states of Hesse, Prussia, and the Netherlands.

At first, the inhabitants of the villages (especially around Karlsruhe, where the first cut was to be made in 1812) violently resisted the preliminary work because of fears of losing land. At that time, if a meander were to be cut, the land falling on the other side of the new bed of the Rhine would change ownership and fall to the neighboring village without any compensation. Even after this problematic effect had been changed with the treaties of Paris (1814–15) the first cut near Karlsruhe could only be carried out in 1817 with the help of a military occupation of a village. It was "environmental fears" that caused the resistance of the rural population. They expected that bringing the river closer to the village by cutting the leap would increase the danger of flooding and physical destruction. However, when the large floods of 1824 spared the community, affecting only villages further down river, the rural population completely changed their minds within only a few years and enthusiastically supported the project. So, finally the state of Baden had won acceptance with a solid political and engineering concept, in which large investments for paved banks, higher dams, and financial compensation for the losses of the landowners played an important role (Bernhardt, 1998, pp. 297–9).

But just at the time when this agreement was achieved the urban population and the downriver states, especially Prussia, began massive protests against the project. The opposition of the cities of Mannheim, Speyer, and Mainz was made public in 1825 by, amongst others, public brochures written by urban citizens. They not only rejected the scale of the "gigantic plan" as over-sized but also argued that it would cause a

faster passage of water at the narrower places downriver and would threaten cities such as Mannheim and Mainz. Furthermore, they saw bends in the river as a "well meant invention of nature" (André, 1828; see Bernhardt, 2000, p. 192) and pleaded for a concept of nature as a self-regulating system and for respect for the "laws of nature" (Van Wijck, 1825). Moreover, the city of Speyer expected to lose its position along the Rhine, its status as a port city, and a lot of profits because the projected cut in this region would have moved the Rhine away from the city. In the end the planned cuts criticized by Mannheim and Speyer were not carried out, contrary to the cuts in the rural areas. This can be seen as a sign of the relatively stronger power of the cities and their political and commercial interests.

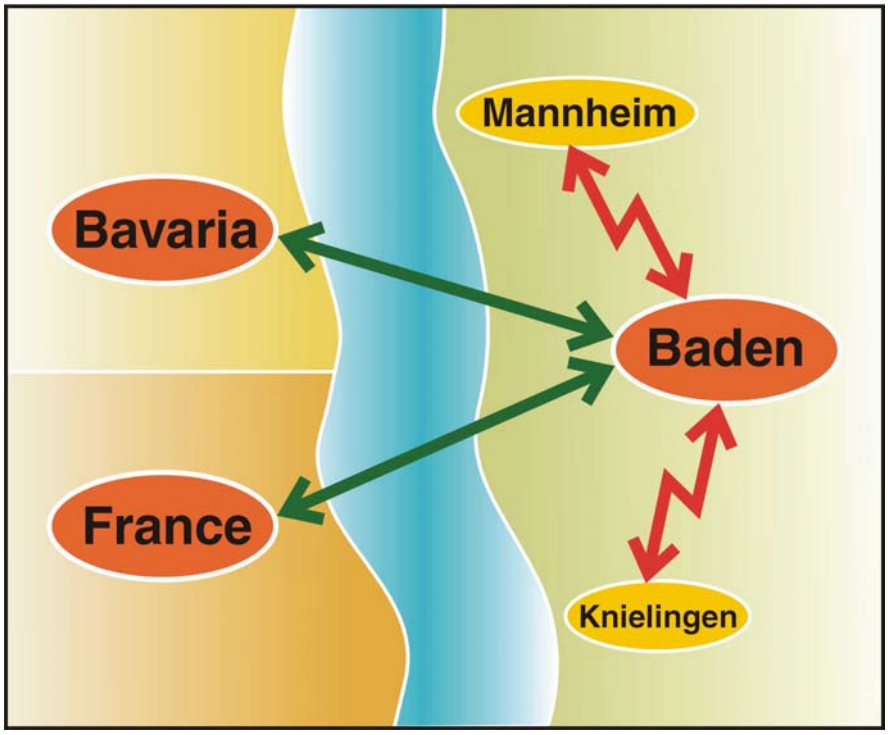

Figure 3. $PCCP_1$: trilateral interstate cooperation and intrastate conflicts

Note: The graphs for each of the six historical PCCP processes illustrate different patterns of conflict and cooperation. Green arrows indicate cooperation and red arrows stand for conflicts.

Not surprisingly, the diplomatic interventions that the most powerful German state of Prussia started in 1825 threatened the realization of the project even more. The Prussian water engineering authorities stated, like the urban citizens cited above, that "nature was being violated" by the correction. Furthermore, they argued that the danger of flooding downriver would increase immensely because of the stronger erosion and silting up of the riverbed downstream. This danger would even increase because of the closer proximity of the high tides of the Rhine and its tributaries (such as the Neckar and the Main). As a consequence, along the Middle Rhine between Bingen and Koblenz, houses and villages would have to be abandoned or relocated to higher ground, the Lorelei Rock would collapse, and so on (Honsell, 1885, pp. 12ff.).

The massive protests by Prussia led to negotiations that concluded with a compromise in 1832. Four of the sixteen cuts were not carried out whereupon Prussia gave up its opposition. The crucial modification in the Prussian view was that the four most northerly cuts were not carried out, in other words those closest to Prussian territory, which even today are the only tight bends left on the Upper Rhine. The Prussian engineers regarded the area of northern Baden between Speyer and

Mannheim as a basin to prevent the risk of flooding. If, according to the Prussian demands, no cuts were made in this area, the high water levels and floods coming from the south would be most likely to spread out there, thus diminishing the danger for the Prussian Rhine province. These calculations by the Prussian engineers illustrate very clearly that not only the states, but also the other groups of actors such as the urban inhabitants acted in terms of risk management, trying to keep the increased potential risk of flooding away from their own territory and move it to the socially and politically weaker areas (Bernhardt, 1998, pp. 304ff.).

Contrary to what one might expect the compromise of 1832 proved to be successful, at least in the short term. Prussia accepted that the other cuts should be carried out, and Baden protected its downriver regions against flooding with large investments in dams, paving of the riverside, and other measures. In 1840 Baden and France completed the project by making a new agreement on a huge drainage program for the southern Upper Rhine region.

In the following decades, as a consequence of a fundamental shift in economy and water engineering, critics such as the urban citizens and the Prussian authorities changed their minds completely about acceptance and even asked for the correction to be continued. The reason was mainly that for several decades no serious flooding occurred along the Rhine, so the inhabitants became less sensitive to the risk of living close to the river and changing its course. Moreover, steamship companies and the trade chambers in the larger cities became increasingly powerful at that time and saw the cuts and the concept of straightening the river as very helpful for navigation. Together with the water authorities of the riparian states, in which a new generation of engineers sustained the politics of "navigation first", they formed a strong lobby for further corrections of the river, especially along the northern parts of the Upper Rhine. In concluding our discussion of this very prominent and complex PCCP process we have to take into account that the famine problems diminished in importance as a consequence of the correction and other complementary developments, whereas flood disasters reappeared from the 1880s onwards.

3. NAVIGATION (1803–1868)

The Final Act of the Vienna Congress of 1815 established with Articles 108 et seq. the basic principles of European river navigation law. It not only put an end to the feudal epoch by guaranteeing freedom of navigation for the first time in history but also started to establish a uniform legal system for the entire Rhine River. In the feudal epoch a system of local tolls and taxes had caused innumerable conflicts for hundreds of years and had seriously blocked shipping and trade on the Rhine. In 1831, the riparian states of Baden, Bavaria, France, Hesse, the Netherlands, and Prussia established the first Rhine Navigation Convention of Mainz and the Central Rhine Commission, which acted as the first true supranational organization and international court in this area. The Rhine Commission is also regarded today as being a nucleus of twentieth-century European unification (Zentral-Kommission für die Rheinschiffahrt, 1918; Meissner, 2000, pp. 237–44).

At the time of the French revolution, the liberalization of trade and far-reaching territorial reforms represented the driving forces of this process. It had in fact been started at the end of the post-revolutionary war between France and Prussia by the imperial decision of Napoleon. In 1803, the French emperor imposed in the "General *reces* of the German Empire" a unique system of taxes for the whole river and a supranational institution for its administration (the so-called "central administration of the octroi"). After half a century of multilateral cooperation the Mannheim Convention of 1868 in a way completed the process, which continues today. Increasingly the Commission had begun to control the state of the river by continuous observation, by

discussing water engineering problems and projects, asking for interventions to improve the course of the river, and making decisions about conflicts in all fields. One key legislative area of the Mannheim Convention was the prohibition of discrimination against any nation in terms of transit navigation (Van Eysinga and Walther, 1994).

This early and very prominent PCCP process shows the long-term effect of an authoritarian top-down intervention by Napoleon leading to a long-lasting and very successful international legal institution. For several decades the process concentrated on "immaterial" institutional reforms such as tax legislation and conflict management. Since the second half of the nineteenth century, the Central Commission and the shipping lobby along the Rhine have also started to call for modifications of the morphology of the river. (See Figure 4.)

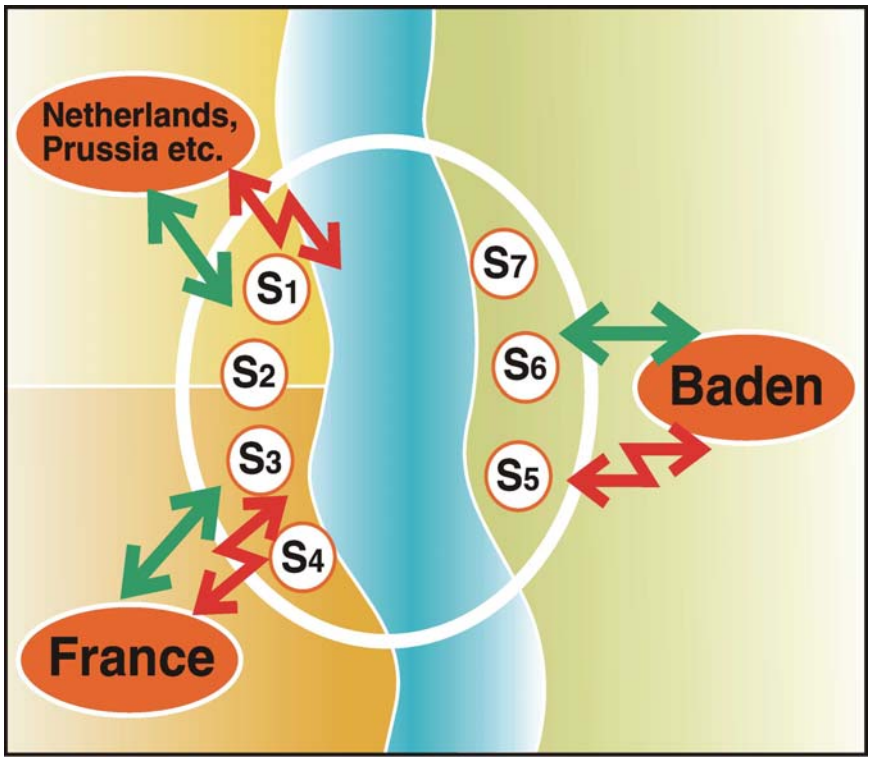

Figure 4. $PCCP_2$: multilateral interstate commission and moderation of conflicts

4. WATER POLLUTION POLICIES IN THE TWENTIETH CENTURY

Of all the problems caused by the different uses humankind has made of the Rhine, water pollution might be regarded as the key problem dominating the twentieth century. Pollution first emerged in the second half of the nineteenth century under the influence of massive urbanization and industrialization. It reached its peaks at the beginning of the twentieth century, again in the decade after the Second World War, and once more in the 1970s. Public awareness and interventions periodically led to serious attempts to control pollution. This began on a local scale with the construction of communal wastewater treatment and continued after the Second World War on an international scale with conventions to minimize water pollution. But it is only since the 1970s that these efforts have been successful resulting in pollution continuing to decrease considerably up until today. In dealing with pollution, as with flooding,

conflicts between upriver and downriver riparians played and still play a most prominent role; they represent one of the key issues of PCCP processes.

Severe pollution problems arose as a consequence of the dynamic population growth of most of the cities along the Rhine (in most cases they at least quadrupled between the 1860s and 1920s). In the same period, industry expanded rapidly. Industry produced increasing amounts of pollution and some new chemical substances, and discharged most of their wastewater into the river – as did the cities (Tittizer and Krebs, 1996, pp. 42–51). As early as around 1900 riparian cities like Worms protested massively against the diffusion of the wastewaters of upstream cities like Mannheim into the Rhine, which polluted the drinking water as well as the water taken for industrial purposes such as brewing (Rommelspacher, 1989, pp. 48–9). (See Figure 5.)

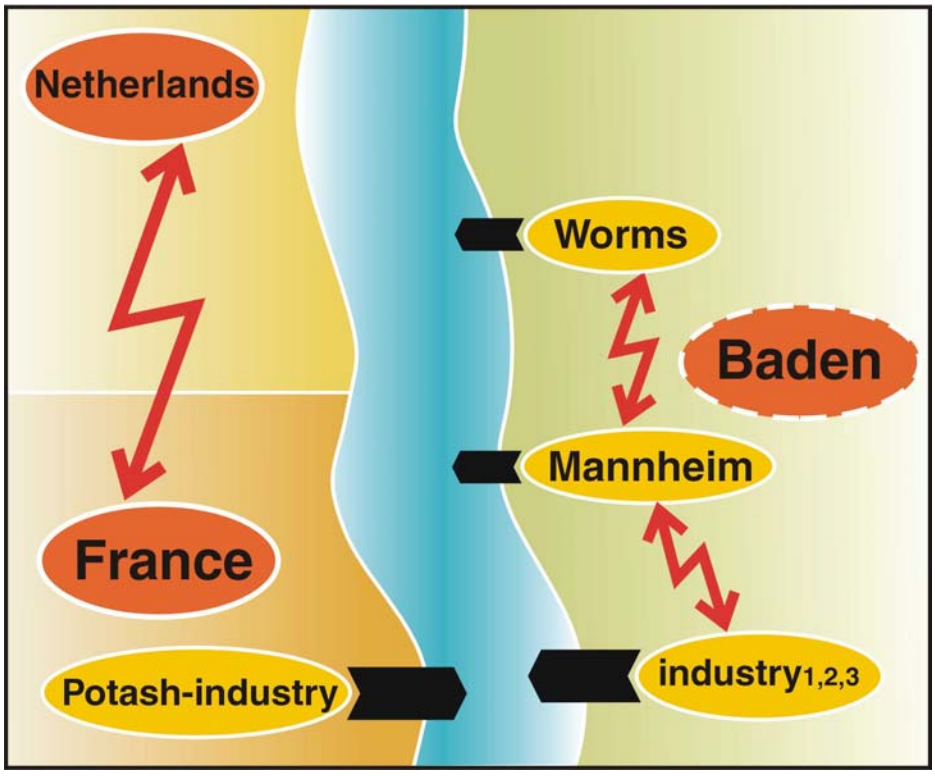

Figure 5. $PCCP_3$: Interstate conflict and cooperation and interregional conflicts

Even if the German states became aware of the problems, as was the case for Prussia, which intervened against the pollution caused, for example, by the city of Cologne and the chemical industry of Leverkusen, legal rules and public intervention had only limited effects. The general argument of many experts and politicians that the self-cleansing capacity of the river was strong enough to cope with the problems far outweighed environmental concerns (Büschenfeld, 1997, pp. 123–5). In fact serious pollution was still concentrated in certain areas and on the local scale. Furthermore, there was a general lack of methodology and technology to identify and categorize pollution in scientific terms. All in all, those and other problems of pollution resulted in a serious decline in the number of fish species, which fell from around 45 (1880) to around 25 (1950) (Köhler, 1996, p. 30). This was regarded to be of minor importance compared to the problems of urban sanitation and industrial development. In other words, industrial society gave a clear priority to social and commercial uses of water and accepted environmental damage.

4.1. The 1950s: Start of International Cooperation

Early attempts of civil movements such as the "Internationale Vereinigung gegen die Verunreinigung von Flüssen, Luft, und Boden" which around 1900 tried to promote environmental protection, failed nearly completely. It was only in 1950 when (based on an initiative from the Netherlands) the International Commission for the Protection of the Rhine against Pollution (ICPR) was founded by Germany, France, Luxemburg, the Netherlands, and Switzerland. It was at that time that public opinion began to perceive pollution as a threat to public welfare and industrial production, and a powerful lobby for cleaning and protecting the Rhine was emerging. In addition to the Netherlands as the downriver riparian, it was the waterworks that became the second major driving force of this movement. It was the Netherlands waterworks that were the first to build a national association: Rijncommissie Waterleidingsbedrijven (RIWA) in 1951. Following on from RIWA were the Arbeitsgemeinschaft Wasserwerke Bodensee-Rhein (AWBR) in 1968 with members from five states, and in 1970 the Internationale Arbeitsgemeinschaft der Wasserwerke im Rheineinzugsgebiet (IAWR) in which (in 1995) 119 water companies from seven states cooperated (Köhler, 1996, p. 77).

4.2. From Monitoring to Intervention: ICPR, the Role of Hazards, and the 1970s Turn

For a number of years ICPR concentrated on monitoring and elaborating coherent scientific measurement schemes as a precondition for improvements of water quality. With the Bern Convention of 1963, ICPR received competences to organize and evaluate research on all aspects of pollution, to propose programs for the protection of the Rhine, and to prepare international agreements. But still the main achievement was, seen from today's perspective, the successful emergence of informal cooperation and the building of "trust capital" between the leading water engineers and politicians across national borders. Programs for technical intervention could only be realized very slowly so that improvements of water quality were hardly achieved in the first two decades of the existence of ICPR.

Hazards such as the disaster of the Hoechst chemical plant at Griesheim in 1968, and long-lasting diplomatic efforts like those of the Netherlands, who protested for decades against the French potash loads from the mines in Alsace, finally opened the way for more effective international cooperation. In the context of an increasing environmental awareness by the public and strong citizens movements a number of conventions took place such as the Water Charter of the European Council (1968), a Chemistry Convention and a Directive of the European Community (both from 1976), the 1972 potash convention, and the International Rhine Convention (1976). These conventions fixed agreements symbolizing a movement towards a reduction of pollution. Models of a joint financing of the potash compromise and many more agreements had to be elaborated (Tümmers, 1994, pp. 75–6).

One should keep in mind that the decontamination of the river was also, to a large extent, realized by national programs and local governments which, since the 1950s had spent huge sums to construct wastewater treatment plants and other measures in cities and rural areas. Step by step a legal system of environmental regulations was implemented, for example a special tax on industrial water pollution at the end of the 1960s. In 1986 yet again a major hazard occurred: the well-known "Sandoz"-disaster in Basle, which brought large quantities of insecticide and other chemicals into the river. Hundreds of thousands of fish and many ducks were killed, waterworks and wells had to be closed, and severe ecological damage was noticed.

As with other hazards before the Sandoz disaster, this proved to be an opportunity for a new water policy initiative, and this was realized in the international

"Aktionsprogramm Rhein" in 1987. For the first time water quality standards were strictly fixed and connected to a control system and a time schedule based on an ecological approach intended to restore the ecosystem of the Rhine. Since that time, the quantities of many toxic substances have been considerably reduced and, with the Master Plan of the Rhine and the action plan "Salmon 2000," an ambitious policy to restore biodiversity in the river has developed. In many ways the Rhine, in the context of European unification, turned from a border and line of conflict to the backbone of integration for regions and nations.

5. SHIPPING AND HYDROPOWER IN THE CONTEXT OF NATIONALISM: REGULATION AND RHINE SIDE CHANNEL (1900–1970s)

In the first half of the twentieth century two alternative concepts of water engineering as a part of antagonistic national politics marked a period of strong conflict between the riparian states of Germany and France. For several decades the two projects of regulating the river to promote navigation executed by Germany and Switzerland since around 1900, and of constructing a side channel for energy production realized by France, caused enormous costs and large environmental damage. It was only after the Second World War that this clash of interests and concepts turned, in a historically singular way, into close cooperation.

5.1. 1900–1945: The Emergence of Two Contradictory Projects

Since the late nineteenth century, the major target of the riparian states of Baden, France, and Switzerland was to make navigation possible for big ships in the upper part of the Rhine south of Mannheim, where up until then large-scale navigation was not possible because of the problematic structure of the riverbed. Alsatian, Badian, and Swiss politicians, engineers, and trade chambers developed competing concepts of regulating the existing river bed or building a side channel. It was in 1907 when a plan designed by Max Honsell (successor of the famous Tulla as chief of the Badian water authorities and later Minister of Finances) was realized. The plan intended to deepen the main course and diminish the problem of "wandering" gravel pits with the help of groynes and ground ramps. In only a few years this project, which by using these relatively "smooth" technologies caused practically no environmental problems, proved to be successful. Shortly before the First World War Strasburg was connected to the Atlantic for large navigation (Tittizer and Krebs, 1996, p. 30; Bernhardt, 2000, p. 81).

After the war, in a context of political hostility between Germany and France, several treaties and conventions fixed the two contradictory projects of continuing a regulation of the existing riverbed between Strasburg and Basle and of constructing a side channel in the same area. It was the 1919 Treaty of Versailles (article 358) that gave France the right to direct Rhine water to any channel and the monopoly for energy production by hydropower along the Upper Rhine. Nevertheless, Switzerland and Germany decided to continue regulation and, in a treaty of 1926, envisioned connecting Basle to large shipping. Preliminary works had already begun south of Mannheim from 1924 onwards and were completed, by undertaking large investments, in 1962 (Muth, 1986, pp. 478–9; Tümmers, 1994, p. 149).

In the mid-1920s France, which did not take part in this project, started the construction of the side channel and of the first hydroelectric power plant at Kembs south of Basle, which was based on an agreement with Switzerland. The plant was completed between 1928 and 1932 and with it the first part of the channel, which with a depth of 12 meters and a width of 80 meters (at the river bed; the width at the

surface is 150 m) was larger than the Suez and Panama canals. This first step in the larger canal and hydropower project caused two major problems: On the one hand it isolated the canal from the main course of the river as well as from the groundwater, causing a serious lowering of the water table in both areas. On the other hand, the hydropower plant with its 840 Mio. kWh production per year proved to be oversized in respect of the energy demands (Tümmers, 1994, p. 150). This second argument, and a shortage of finances, blocked the continuation of the canal construction downriver to Strasburg until the end of the Second World War. (See Figure 6.)

5.2. 1945–1978: From Conflict to Cooperation: Achievements and Environmental Problems

After the Second World War politicians and engineers found themselves confronted with the manifold problematic consequences of their contradictory and uncoordinated policies during the previous decades. In addition to that, the quantity of water in the river was not sufficient to supply both of the projects. Furthermore, the building of what were in fact two parallel competing courses of navigation made no sense in economic terms, not to mention the severe environmental problems. It took considerable effort to correct the planning, and decades to deal with its consequences and to establish a more sustainable policy.
But what was most remarkable in this paradigmatic PCCP process was the change in the relationship between France and Germany from hostility and confrontation to compromise and cooperation.

For some time the regulation of the riverbed was continuing on the basis of another convention from Switzerland and France up as far as Basle. The main target of giving the Rhine a width and depth which allowed large ships to navigate to Basle was achieved, but at the same time erosion was forced, the groundwater table was lowered, and the river was isolated from its wetlands (Muth, 1986, pp. 478–80). Furthermore, soon after its completion the "old Rhine" lost its function as a waterway, which was taken over by the channel. In the context of an increasing energy demand, and with the help of money from the Marshall plan, France constructed in a couple of years the hydropower plants of Ottmarsheim (1952), Fessenheim (1957) and Vogelgrün (1959) and completed the channel up to a length of 52. 95 kilometers (Kunz, 1975, P. 71; Tümmers, 1994, p. 151).

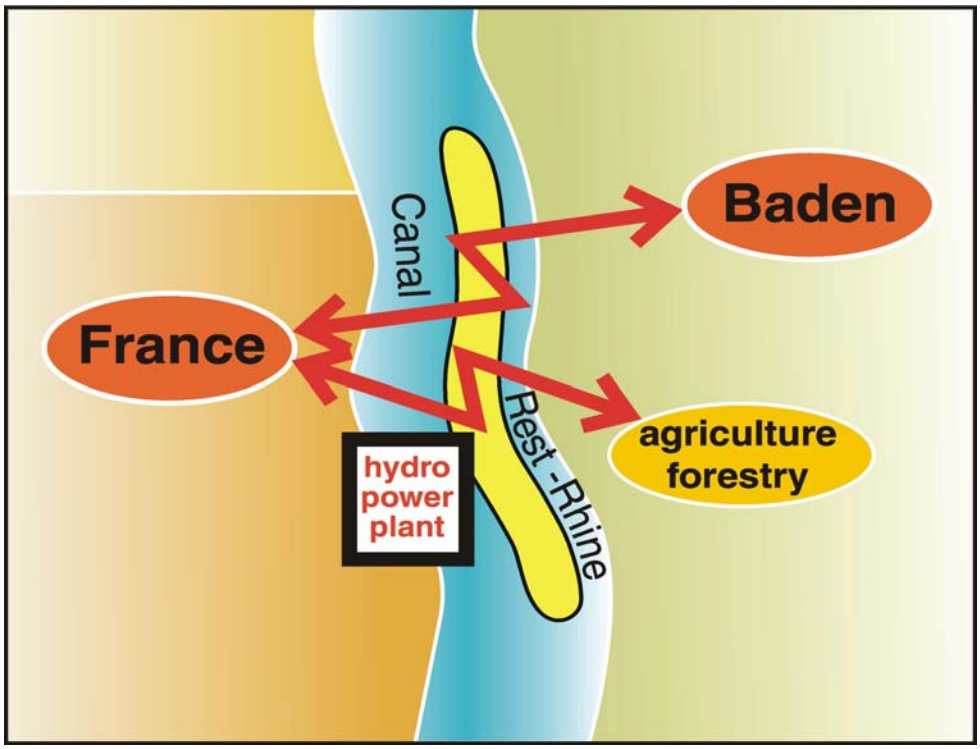

Figure 6. $PCCP_4$: Interstate and interregional conflicts

The channel not only took nearly all the water of the Rhine which from that time on was in danger of periodically falling dry, but also inspired a broad popular movement that had been growing since the early twentieth century and increased in the time of National Socialism in Germany. Massive protests arose against the so-called "desertification of southwestern Germany". Indeed, agriculture and forestry in the German southwest suffered from substantial environmental damage and financial losses because of the lowering of the groundwater table by up to seven or more meters. In addition, the self-cleansing capacity of the "Rest-Rhein", as it was – and still is – called, was minimized and costly new infrastructure had to be installed to clean the wastewater. Last but not least, the channel, which was planned to be expanded up to Strasburg, threatened to isolate German port cities like Breisach from the river depriving them of profits from shipping and trade (Tittizer, and Krebs, 1996, p. 33; Tümmers, 1994, p. 151). Therefore a broad movement of local governments, citizens and peasants groups, trade chambers, political parties, and other actors continued to demand a halt to the French channel plan.

A compromise between France and Germany to change this policy and modify the plans for new hydropower plants and a progressing of the canal was made in 1956. With the so-called "Treaty of Luxemburg" (treaty between the RFA and France on the construction of the upper Rhine between Basle and Strasburg) France agreed to construct four other plants – Marckolsheim (realized 1961), Rheinau (1963), Gerstheim (1967), and Strasburg (1970) – using a new concept. This new concept, the so-called "sloop solution" implemented only short channel tracks on a limited distance along the river, saving most of its original course. But, it must be said; the "sloop solution" (which in effect meant that France abandoned some of its interests and rights on the Rhine) could only be realized in the context of political bargaining in which Germany agreed to canalize the Mosel River (Kunz, 1975, p. 71; Tittizer, and Krebs, 1996, p. 33).

The politics of compromise and partnership that was embedded in a general policy of close cooperation and friendship between France and Germany culminated in

the building of the two power plants of Gambsheim (1974) and Iffezheim (1977). Both power plants were co-constructed on the basis of a common capital stock by the Electricité de France and the German Badenwerk AG. In the bilateral commissions and planning boards that steered the planning, realization, and working of the plants the partners worked without major conflicts, as actors have reported (Tümmers, 1994, p. 153).

Three most remarkable conclusions can be drawn from the experience of this period. First, the political confrontation in terms of competing rather than coordinated projects proved to be extremely costly and a failure in economic terms as it produced a kind of double infrastructure. Second, the example of French and German cooperation since 1945 shows an unexpected capacity to turn severe conflicts in history into cooperation. But, third, international cooperation did not necessarily lead to the implementation of sustainable concepts but in part continued to be a problematic policy in environmental terms.

6. FROM FLOOD DEFENSE TO BIODIVERSITY (1950–1980s)

In the second half of the twentieth century, the consequences of 150 years of intervention into the morphology of the river, from the early nineteenth-century Tulla project up to the side channel, proved to be increasingly critical in respect of desertification – as mentioned above – and flooding. As to the desertification, the lowering of the groundwater table continued, depriving fish and many other species of their habitats and deeply transforming the landscape and the contexts of agriculture and forestry.

At the same time serious flooding in 1947 and 1955 showed that the dramatic loss of floodplains, which had been reduced from 1000 km^2 (1820) to 270km^2 (1950), seriously increased the danger of flooding. The areas downstream of the side channel north of Iffezheim in particular became much more endangered than they had been before. France and Germany, in particular the German state of Baden-Württemberg, started an ambitious program, developed in several steps over a period of fifty years, to study flooding and restore floodplains. But in spite of these efforts, and contrary to the successes in fighting pollution, flood disasters still cannot be prevented today. The situation has even worsened, as has been shown by the extreme floods of the 1990s (1993 and 1995) along the Rhine (Hochwasservorsorge am Rhein. 2000, pp. 85–6; Unterseher, C. 1992, pp. 57–67).

The first effort for the sake of flood prevention was the "sloop solution" of the channel concept mentioned earlier. Even if a good part of the floodplains were saved, and much less lost than was foreseen by the previous planning, another 130km^2 were abandoned after 1955 between Basle and Iffezheim (Tittizer and Krebs, 1996, p. 162). As in other fields of water management along the Rhine, a fundamental institutional shift that opened the way for the restoration of flood plains occurred around 1970. It was exemplified by the installation of an "International Flood Research Commission" in 1968 and the foundation of the "International Commission of the Hydrology of the Rhine" (KHR) in 1970. While the KHR since that time has organized research on all aspects of hydrology and water balances, the Flood Research Commission devoted ten years to studying the history and background of flooding along the Rhine in scientific terms.

As a consequence of the report given by the International Flood Research Commission in 1978 (Schlußbericht, 1978), France and the state of Baden-Württemberg fixed a convention in 1982 in order to restore floodplains for 212 million cubic meters of water, of which Baden-Württemberg should restore floodplains for 127 million cubic meters. But from the beginning the interventions of spatial planning that were needed to realize these objectives met with strong resistance from local citizens

groups as well as from regional authorities. So, for example, the Regierungspräsidium Freiburg, the authority responsible for regional water planning, did not approve the concepts because they did not fit with environmental legislation. Moreover, hunters, associations for the protection of wild animals, and homeowners strongly resisted both the concept and its consequences, which became apparent in preliminary controlled flooding of the first large polder near Altenheim. Contamination of floodplains caused by polluted water stemming from the Rhine was another point of issue (Landesamt für Umweltschutz Baden-Württemberg, 1991, pp. 388–91).

As a result of a debate lasting six years, far-reaching modifications were made, and the Baden-Württemberg government approved an "Integrated Rhine-Program" in 1988 as a new conceptual framework. The most important change was the integration of environmental considerations into the program: the restoration of wetlands and conservation of biodiversity became, besides flood defense, a second "environmental pillar" of the water management programs for the Upper Rhine. Another major modification was the limitation of the maximum altitude of controlled flooding to 2.50 m. Consequently the concept of building large polders, the first of which had been realized at Altenheim, had to be replaced by that of a larger number of smaller polders (Oberrheinagentur, 1996).

Nevertheless, the conflicts between the authorities and several groups of riparians on the restoration of floodplains continued, leading to serious delays as well as high costs. Upriver riparians, who were expected to accept major changes in the use of land – in the fields of agriculture, housing, and leisure – blocked the realization of the program despite the massive protests of endangered downriver riparians. Consequently, fourteen years after it was started only a small part of the restoration program has been achieved so far. In those areas where polders were established, large expenditure was required for pumps to prevent a rising of the groundwater table in residential areas behind the dikes. Meanwhile, in other areas of the southern Upper Rhine (which had fallen dry because of the lowering of the groundwater table) precious new habitats and ecosystems had developed. Local citizens groups and nature protection authorities called for a preservation of these dry habitats and for another major modification of the wetland restoration program (Landesanstalt für Umweltschutz Baden-Württemberg, 2000). If we draw a conclusion, this PCCP process, representing an ambitious environmental policy based on European cooperation, was seriously disturbed and slowed down by local citizens movements.

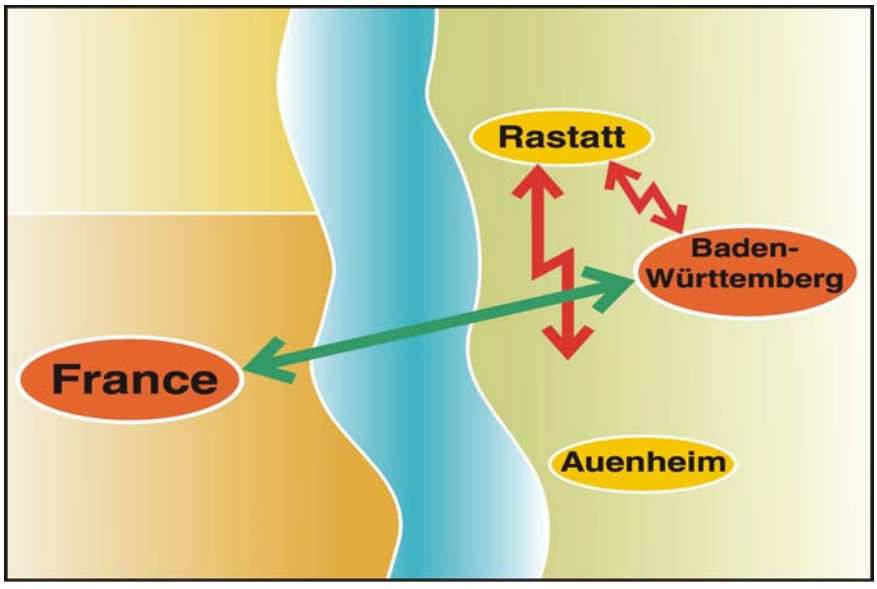

Figure 7. $PCCP_5$: Interstate cooperation and intrastate and interregional conflicts

7. "LE JARDIN DES DEUX RIVES": COOPERATION AND CONFLICTS ABOUT A GARDEN ACROSS THE RIVER

"The garden of the two riversides" is an ambitious transboundary project that the German city of Kehl and the French city of Strasburg are jointly planning to complete in 2004. The basic strategy is to organize a "Landesgartenschau," this is an exhibition that is held annually in another region of Baden-Württemberg, but in 2004, for the first time in its history, will be a cross-border event. The long-term benefit of the "Landesgartenschau" will be the provision of a remodeled riverside. The vision is to create, with the help of urban and landscape planning, a park that integrates both sides of the Rhine, bringing together the two cities and their inhabitants. In this vision the Rhine is regarded as a backbone of the region instead of a border. An attractive green open space is to be developed as a meeting point for citizens. The project, which is dedicated to a sustainable urban and regional development, brought a number of challenges for the actors involved. They had and still have to deal with diverging interests along the river – shipping versus bridges and green spaces and many others – as well as with different national planning systems and administrative peculiarities. (Details about the project were taken from http://www.lgs-kehl.de/)

7.1. The Background: The Emergence of Transboundary Landscape Planning Along the Southern Upper Rhine

The idea of a "garden of the two riversides" could only emerge on the basis of a transboundary network of planners and politicians, which has grown over several decades (Becker-Marx and Jentsch, 1996). In the mid-1990s, members of this network developed a mold-breaking plan for regional open spaces across the border (*Regionales grenzüberschreitendes Freiraumkonzept Oberrhein*, Regionalverband Südlicher Oberrhein, 1998) that set the general conceptual framework, and the garden exhibition in 2004 represents the first pioneering project. A crucial experience for the landscape planners involved in the development of the regional open spaces has been that barriers of understanding caused by different languages, national planning philosophies, and administrative systems represent a major problem of transboundary professional cooperation. Even key terms in the languages of the three professional planners expressed different meanings and approaches. So, for example, the term "landscape" was closely connected to "cultural heritage" and perceived as a coherent concept by the French planners, whereas their Swiss colleagues focused on the aspects of natural resources, while their German partners concentrated on the subcomponents of landscapes. The planners answered this challenge by developing a mutual understanding of the three different concepts and languages and integrating them as key elements in a "three-pillar model" of transboundary open spaces planning (Regionalverband Südlicher Oberrhein, 1998, pp. 18–19).

One of the major objectives of the "Freiraumkonzept" was to achieve a transboundary regional sustainable development by synchronizing cross-border spatial planning in the fields of economy, flood defense, and biodiversity. Special attention was given to the restoration of the wetlands in order to win back flood plains and save natural areas and biodiversity. Extended preparatory works had to be undertaken, such as documentation of the legal rules, compiling environmental and spatial data, and a landscape analysis to a 1:250.000 scale. Furthermore, the program included an evaluation of the situation regarding open spaces and an assessment of the potential consequences of future developments. This work could only be done with financial help from local and regional authorities and by the European Union funding program "Interreg" (Regionalverband Südlicher Oberrhein. 1998, pp. 14–16).

7.2. The Garden Exhibition: The Idea, the Planning, and the First Steps

The transboundary open spaces concept required a great deal of cooperation because the interests of agriculture, shipping, flood defense, traffic, and natural protection had to be negotiated, under the overall objective of an sustainable development, by a multitude of local, regional, and national authorities. The "garden of the two riversides" proved to be, even on a local scale, not easier but more difficult to manage. First of all it intended to expand the regional open spaces corridors to inner urban green spaces, creating green axes across the river as well as along both sides of the river. In the southern area of the two cities this concept could be realized so that inner urban spaces are connected to floodplains at the urban periphery. In the northern areas this was not possible because of harbor areas.

In order to achieve a final plan, a European-wide competition was organized in 1998 and won by the German team Arbeitsgemeinschaft Brosk/ Agirbas+Wienstroer. The concept proposed a transboundary park in a form of a circle with a promenade at its edge and a bridge in the southern part of the park. A new quarter was planned for development on the French side near to the park, and it was expected that a neighboring lower-class residential area would raise its social status. The Parisian architect, Marc Mimram, won another competition for the new bridge project in May 2000, and soon afterwards the local councils approved the planning. A complex agreement was made which fixed the financial budget and the responsibilities in respect to financing, detailed planning, and construction between the two cities (see *Kehler Zeitung,* May 23 2000).

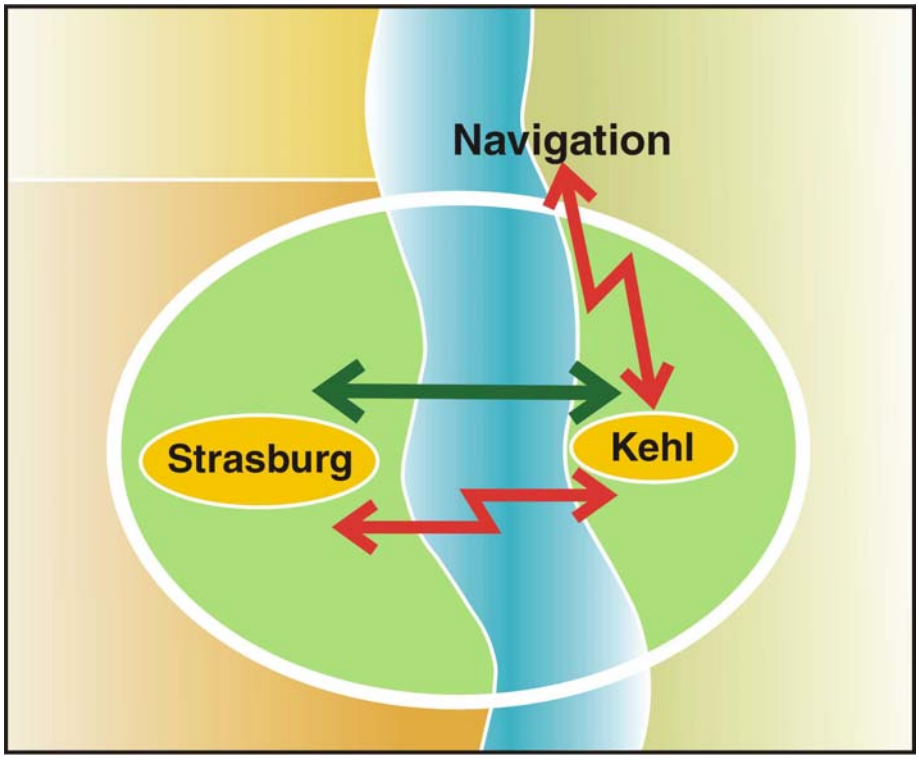

Figure 8. $PCCP_6$: Interregional cooperation and conflicts

7.3. From Cooperation to Stagnation

At the start of 2001, two major complications appeared to stop the project. Interventions by the waterway authorities who saw serious difficulties for shipping blocked the bridge concept, but the architect succeeded in solving the problem by

moving the bridge farther to the north. The factor that endangered the whole project to a large extent was the fact that the newly elected local government of Strasburg asked for major changes to the plans provoking stagnation in transboundary cooperation. Even if, after a serious delay in the time schedule, the process is continued, crucial elements of the original concept – like the new quarter on the French side – have been abandoned, and the "garden of the two riversides" will only be realized on a smaller scale than had been intended (see *Badische Zeitung,* June 29 2000; *Kehler Zeitung,* July 11 2001 and September 18 2001). The initial ambitious plans have failed to some extent – the differing size and status of the two cities playing an important role – but the actual concept reflects the limitations of regional transboundary cooperation even on such an advanced level as is to be found in the upper Rhine region.

8. CONCLUSION

Viewed from a global perspective of conflicts and cooperation in the water sector, during the last 200 years the Rhine has seen numerous conflicts from local up to international scale, the vast majority of which were non violent. The lack of a serious water shortage problem and the advanced standards of transboundary cooperation and international law in Western Europe might be two possible explanations for this fact, which only transnational comparative research could explain scientifically. Nevertheless, the river has to be qualified as a heavily modified, industrialized, and for a long time massively polluted water body. But it also became a kind of role model in the two crucial fields of international cooperation and environmental protection. Even if from the historical long-term perspective transboundary cooperation has very much advanced along the Rhine, actors from the local and regional scale have periodically strongly resisted the programs from central governments. It seems that resistance has even been growing in recent years and that more moderation is needed for reform projects in the water sector along the Rhine. Historical analysis can help us to understand the variety of conflicts and processes of cooperation and to develop specific PCCP-strategies in the different types of conflicts and fields of water policy.

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CONFLICT AND COOPERATION

Survey of the Past and Reflection for the Future

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CONTENTS

CONFLICT AND COOPERATION

More than 260 watersheds cross the political boundaries of two or more countries. They cover about 45 percent of the land surface of the earth, contain about 40 percent of the world's population, and account for well over half the global river flow (Wolf et. al., 1999). Management of these basins is especially difficult, not least as regional politics often exacerbates the already difficult task of understanding and managing complex systems. Disparities between riparian nations add further complications. Furthermore, riparian relations occurring at multiple scales often influence each in disparate ways. Development, treaties, and institutions are often seen as inefficient and occasionall, as a new source of tension themselves. Nevertheless, riparians have shown tremendous creativity in approaching regional development, often through preventive diplomacy, and the creation of "baskets of benefits" that allow for positive-sum allocations of joint gains. One interesting pattern that emerges is that while many international water negotiations begin with differing legal interpretations of rights, whether measured by hydrography or chronology, they often shift rather to needs-based criteria for water allocations, as measured by some mutually agreeable parameter such as irrigable land or population. Mostly, one is struck by the creativity of the negotiators in addressing specific language to each very specific local setting and concerns.

1. INTRODUCTION

Transboundary water disputes occur whenever demand for water is shared by any sets of interests, be they political, economic, environmental, or legal. Conflicts over shared water resources occur at multiple scales, from sets of individual irrigators, to urban versus rural uses, to nations that straddle international waterways. Transboundary waters share certain characteristics that make their management especially complicated, most notable of which is that these basins require a more complete appreciation of the political, cultural, and social aspects of water, and that the tendency is for regional politics regularly to exacerbate the already difficult task of understanding and managing complex natural systems.

At the international level, security studies have only recently come to recognize the mutual destabilizing forces of poverty and insecurity. The process of poverty alleviation is often hampered in regions where human security is at risk. As a consequence, much of the thinking about the concept of "environmental security" has moved beyond a presumed causal relationship between environmental stress and violent conflict to a broader notion of "human security" – a more inclusive concept focusing on the intricate sets of relationships between environment and society.

Within this framework, water resources – including scarcity, distribution, and quality – have been named as the factor most likely to lead to intense political pressures, while threatening the processes of sustainable development and environmental protection. Water ignores political boundaries, evades institutional classification, and eludes legal generalizations. Worldwide, water demands are increasing, groundwater levels are dropping, water bodies are increasingly contaminated, and delivery and treatment infrastructures are aging.

From the Klamath to the Jordan, transboundary water issues are a priority at state, national, and international levels. Although wars over water have not occurred, there is ample evidence showing that the lack of clean freshwater has been linked to poverty and has led to intense political instability, and that acute violence has occasionally been the result. While these disputes also occur at the sub-national level, the human security issue is subtler and more pervasive. As water quality degrades – or quantity diminishes – over time, the effect on the stability of a region can be unsettling, nowhere more so than in basins which cross political boundaries.

There are 261 watersheds that cross the political boundaries of two or more countries. These international basins cover 45.3 percent of the land surface of the earth, contain about 40 percent of the world's population, and account for approximately 60 percent of global river flow (Wolf et. al., 1999). Disparities between riparian nations – whether in economic development, infrastructural capacity, or political orientation – add further complications to water resources development, institutions, and management. As a consequence development, treaties, and institutions are regularly seen as at best, inefficient, often ineffective, and occasionally as a new source of tension themselves. Despite the tensions inherent in the international setting, riparians have shown tremendous creativity in approaching regional development, often through preventive diplomacy, and the creation of "baskets of benefits" that allow for positive-sum, integrative allocations of joint gains.

2. THE INTERNATIONAL SETTING

A closer look at the world's international basins gives a greater sense of the magnitude of the issues. First, the problem is growing. There were 214 international basins listed in 1978 (United Nations, 1978), the last time any official body attempted to delineate them, and there are 261 today. The growth is largely the result of the

"internationalization" of national basins through political changes, such as the break up of the Soviet Union and the Balkan states, as well as access to today's better mapping sources and technology.

Even more striking than the total number of basins is a breakdown of each nation's land surface that falls within these watersheds. A total of 145 nations include territory within international basins. Twenty-one nations lie in their entirety within international basins; including these, a total of thirty-three countries have more than 95 percent of their territory within these basins. These nations are not just smaller countries, such as Liechtenstein and Andorra, but include such sizable countries as Hungary, Bangladesh, Belarus, and Zambia (Wolf et al., 1999).

A final way to visualize the dilemmas posed by international water resources is to look at the number of countries sharing each international basin. Nineteen basins are shared by five or more riparian countries: one basin – the Danube – has seventeen riparian nations; five basins – the Congo, Niger, Nile, Rhine, and Zambezi – are shared by between nine and eleven countries; and the remaining thirteen basins – the Amazon, Ganges–Brahmaputra–Meghna, Lake Chad, Tarim, Aral Sea, Jordan, Kura–Araks, Mekong, Tigris–Euphrates, Volga, La Plata, Neman, and Vistula (Wista) – have between five and eight riparian countries.

3. WATER, CONFLICT, AND COOPERATION

Development on waters that cross political boundaries has additional complexities brought on by strains in riparian relations and institutional limitations. Recent studies, particularly in the field of environmental security, have focused on the conflict potential of these international waters. Some stress the dangers of violence over international waters (see, for example, Gleick, 1993; Homer-Dixon, 1994; Remans, 1995; Westing, 1986; Samson and Charrier, 1997), while others argue more strongly for the possibilities and historic evidence of cooperation between co-riparians (see Libiszewski, 1995; Wolf, 1998; Salman and de Chazournes, 1998). The fortunate corollary of water as an inducement to conflict is that water, by its very nature, tends to induce even hostile co-riparians to cooperate, even as disputes rage over other issues.

Much of the recent thinking about the concept of "environmental security," though, has moved beyond a presumed causal relationship between environmental stress and violent conflict to a broader notion of "human security" – a more inclusive concept focusing on the intricate sets of relationships between environment and society, and encompassing issues of internal stability and sub-acute tensions (those which fall short of violence). It is important to understand in this context there *is* history of water-related violence: it is a history of incidents at the sub-national level, generally between ethnic, religious, or tribal groups, water-use sectors, or states/provinces. In fact, there are many examples of internal water conflicts, ranging from interstate violence and death along the Cauvery River in India, to California farmers blowing up a pipeline meant for Los Angeles, and to much of the violent history in the Americas between indigenous peoples and European settlers. Recent research on internal disputes, in fact, suggests that as geographical scale drops, the likelihood and intensity of violence rises (see, for example, Giordano et al. 2003). There is also an extensive history of sub-acute tensions between, for example, Arabs and Israelis, Indians and Pakistanis, and even between non-contiguous nations such as Egypt and Ethiopia.

4. THE TRANSBOUNDARY FRESHWATER DISPUTE DATABASE

To aid in the assessment of the process of water conflict resolution, we have been working over the past five years to develop the "transboundary freshwater dispute database," a project of the Oregon State University Department of Geosciences, in collaboration with the Northwest Alliance for Computational Science and Engineering. The database currently includes:

- A digital map of the world's 261 international watersheds.
- A searchable compilation of 300 water-related treaties, along with the full text of each.
- An annotated bibliography of the state of the art of water conflict resolution, including approximately 1,000 entries.
- Negotiating notes (primary or secondary) from fourteen detailed case studies of water conflict resolution.
- Comprehensive news files of all reported cases of international water-related disputes and dispute resolution (1950–2000).
- Descriptions of indigenous/traditional methods of water dispute resolution.

Within the context of the database project, Wolf, Yoffe, and Giordano (in review) attempted to assess the indicators of settings with a high potential for water disputes. By correlating each of the incidents of water conflict and cooperation against the biophysical, geopolitical, and socioeconomic setting that existed when each event occurred, they made a preliminary identification of those international basins at the greatest risk for potential dispute in the near future. It is to be hoped that the appropriate international agencies might then be able to focus energy and resources on these "basins at risk" for activities of preventive diplomacy, in order to ameliorate the potential for conflict.

The hypothesis of the study was as follows:

> *The likelihood of conflict rises as the rate of change within the basin exceeds the institutional capacity to absorb that change*.

This suggests that there are two sides to the dispute setting: the rate of change in the system, and the institutional capacity. Clearly, one of the most rapid rates of change within a basin, with an attendant risk for conflict, occurs when a dam or major development project is constructed (the other is the "internationalization" of national systems, as will be explored below). The likelihood of dispute over such a development rises with low institutional capacity, for example when there is no treaty or other regional agreement, or when relations are especially bad over other issues.

In order to cut through the prevailing anecdotal approach to the history of water conflicts, the study attempted to compile a dataset of *every* reported interaction between two or more nations, whether conflictive or cooperative, which involved water as a scarce and/or consumable resource or as a quantity to be managed – that is, where water is the *driver* of the events – over the past fifty years.[1] The study documents a total of 1,831 interactions, both conflictive and cooperative, among two or more nations over water during the past fifty years, and found the following:

First, despite the potential for dispute in international basins, the record of acute conflict over international water resources is historically overwhelmed by the record of cooperation. The last fifty years have seen only thirty-seven acute disputes (those involving violence) while, during the same period, 157 treaties were negotiated and signed.[2] The total numbers of water-related events between nations of any magnitude

are likewise weighted towards cooperation: 507 conflict-related events, versus 1,228 cooperative, implying that violence over water is neither strategically rational, nor hydrographically effective, nor economically viable.

Second, nations find many more issues of cooperation than of conflict. The distribution of cooperative events is shown below and indicates a broad spectrum of issue types, including quantity, quality, economic development, hydropower, and joint management. In contrast, almost 90 percent of the conflictive events relate to quantity and infrastructure. Furthermore if we look specifically at extensive military acts – the most extreme cases of conflict –almost 100 percent of events fall within these two categories.

Third, at the sub-acute level, water acts as both an irritant and a unifier. As an irritant, water can make good relations bad and bad relations worse. Threats and disputes have raged across boundaries with relations as diverse as those between Indians and Pakistanis and between Americans and Canadians. Water was the last and most contentious issue resolved in negotiations over a 1994 peace treaty between Israel and Jordan, and was relegated to "final status" negotiations – along with other of the most difficult issues such as Jerusalem and refugees – between Israel and the Palestinians.

Equally, international waters, despite their complexities, can also act as a unifier in basins where relatively strong institutions are in place. The historical record shows that international water disputes *do* get resolved, even among bitter enemies, and even as conflicts erupt over other issues. Some of the most vociferous enemies around the world have negotiated water agreements or are in the process of doing so, and the institutions they have created frequently prove to be resilient over time and during periods of otherwise strained relations. The Mekong Committee, for example, has functioned since 1957, exchanging data throughout the Vietnam War. Secret "picnic table" talks have been held between Israel and Jordan since the unsuccessful Johnston negotiations of 1953–5, even although these riparians until only recently were in a legal state of war. The Indus River Commission survived through two wars between India and Pakistan. And all ten Nile riparians are currently involved in negotiations over cooperative development of the basin.

In the absence of institutions, however, changes within a basin can lead to conflict. To avoid the political intricacies of shared water resources, for example, a riparian, generally the regional power, may implement a project that affects at least one of its neighbors.[3] This might be to continue to meet existing uses in the face of decreasing relative water availability – as for example Egypt's plans for a high dam on the Nile or Indian diversions of the Ganges to protect the port of Calcutta – or to meet new needs and associated policies, as with Turkey's GAP project on the Euphrates. When projects such as these proceed without regional collaboration, they can become flashpoints, heightening tensions and regional instability, and requiring years or, more commonly, decades to resolve. Evidence of how institutions can diffuse tensions is seen in basins with large numbers of water infrastructure projects. Co-riparian relations have been shown to be significantly more cooperative in basins with treaties and high dam density than in similarly developed basins without treaties. Thus, institutional capacity together with shared interests and human creativity seem to ameliorate water's conflict-inducing characteristics, suggesting that an important lesson of international water is that as a resource it tends to induce cooperation, and to incite violence only in exceptional cases.

The choice for the international community, then, is one between a traditional chronology of events, where unilateral development is followed by a crisis and, possibly, a lengthy and expensive process of conflict resolution on the one hand, or, on the other, a process where riparians are encouraged to get ahead of the crisis curve through crisis prevention, preventive diplomacy, and institutional capacity-

building. It feels both counterintuitive and precarious that the global community has often allowed water conflicts to drag on to the extent they often do – the Indus treaty took ten years of negotiations, the Ganges thirty, and the Jordan forty – while all the while water quality and quantity degrade to where the health of dependent populations and ecosystems are damaged or destroyed. A re-read through the history of international waters suggests that the simple fact that humans suffer and die in the absence of agreement apparently offers little in the way of incentive to cooperate, even less so the health of aquatic ecosystems. This problem gets worse as the dispute gains in intensity; one rarely hears talk about the ecosystems of the lower Nile, the lower Jordan, or the tributaries of the Aral Sea: they have effectively been written off to the vagaries of human intractability.

4.1. Multiscalar Studies and Institutional Capacity

Multiscalar studies are regularly ignored in water resources management research. Much literature on transboundary waters treats political entities as homogeneous monoliths: "Canada feels . . ." or "Jordan wants . . ." Analysts are only recently highlighting the pitfalls of this approach, often by showing how different subsets of actors relate very different "meanings" to water (see, for example, Blatter and Ingram, 2001). Rather than being simply another environmental input, water is regularly treated as a security issue, a gift of nature, or a focal point for local society. Disputes, therefore, need to be understood as being more than "simply" over a quantity of resources, but also over conflicting attitudes, meanings, and contexts. In the western United States, as elsewhere, local water issues revolve around core values which often date back generations. Irrigators, Native Americans, and environmentalists, for example, can see water as tied to their very ways of life, and increasingly threatened by newer uses for cities and hydropower.

This shift means that water management must be understood in terms of the specific local context. History matters, as do power flows: the "meaning" of water to its users is as critical to understanding disputes, and sometimes more so, than its quantity, quality, and timing. For this new world, new tools for analysis are being added to the traditional arsenal, including network analysis, discourse analysis, and historical and ethnographic analysis, each of which can be bolstered and made more robust through the judicious application of appropriate information technologies.

One highlight of these new approaches is that the results of conflict analysis are very different depending on the scale being investigated. To clearly understand the dynamics of water management and conflict potential, then, thorough assessments would investigate dynamics at multi-scales simultaneously. María Rosa García-Acevedo (2001), for example, puts what is nominally a "United States–Mexico" dispute over the Colorado into its specific historic context, and tracks water's changing meanings to the local populations involved, primarily indigenous groups and US and Mexican farm communities, throughout the twentieth century. The local setting strongly influences international dynamics and vice versa.

What one notices in the global record of water negotiations is that many of those surveyed begin where many western United States issues are now: that is, with parties basing their initial positions in terms of rights – the sense that a riparian is entitled to a certain allocation based on hydrography or chronology of use. Irrigators in the Klamath basin in Oregon, for example, invoke rights under the Reclamation Act while environmentalists refer to the Endangered Species Act. Upstream riparians often invoke some variation of the Harmon Doctrine, claiming that water rights originate where the water falls. Downstream riparians often claim absolute river integrity, claiming rights to an undisturbed system or, if on an exotic stream, historic rights based on their history of use.

The Columbia Basin offers another case in point. Water resources issues in the Columbia River basin underwent a transition from intra-national to international in 1944 as Canadian and US planners recognized that cooperative development might well be superior to individual actions, and both countries requested the International Joint Commission (IJC) to study the feasibility of cooperative development in the Columbia Basin. By 1964, the Columbia River Treaty and Protocol were ratified by the governments of Canada and the United States. The treaty is one of the most sophisticated in the world, particularly because it circumvents the zero-sum approach to allocating fixed quantities of water, instead allocating to each country an equal share of benefits derived from the shared basin. Hydropower production, flood control, and other benefits are quantified and shared annually, and there is little dispute across international boundaries.

Yet at the sub-national level, and in response to the weaknesses of top-down legislation over locally generated issues such as non-point source pollution, management authority is slowly being diffused to local watershed councils. The effectiveness of these councils is directly linked to the availability of information. Access to data and effective decision-making tools have been regularly named as critical to building institutional capacity at this local level, but sophisticated water models are generally neither user-friendly nor inclusive of the types of non-physical data so critical to effective management.

5. INTERNATIONAL INSTITUTIONS

Just as the flow of water ignores political boundaries, so too does its management strain the capabilities of institutional boundaries. While water managers generally understand and advocate the inherent powers of the concept of a watershed as a unit of management, where surface-water and groundwater, quantity and quality, are all inexorably connected, the institutions that have developed to manage the resource have historically followed these tenets only in the exception.

Frederiksen (1992), for example, describes principles and practice of water resources institutions from around the world. He argues that while, ideally, water institutions should provide for on-going evaluation, comprehensive review, and consistency among actions, in practice this integrated foresight is rare. Rather, he finds a rampant lack of attention to quality considerations in quantity decisions, a lack of specificity in rights allocations, disproportionate political power in the hands of power companies, and a general neglect for environmental concerns in water resources decision-making. Buck, Gleason, and Jofuku (1993) describe an "institutional imperative" in their comparison of transboundary water conflicts in the United States and the former Soviet Union. Feitelson and Haddad (1995) take up the particular institutional challenges of transboundary groundwater.

To address these deficiencies at the international level, some have argued that international agencies might take a greater institutional role. Lee and Dinar (1995) describe the importance of an integrated approach to river basin planning, development, and management. Young, Dooge, and Rodda (1994) provide guidelines for coordination between levels of management at the global, national, regional, and local levels. Delli Priscoli (1989) describes the importance of public involvement in water conflict management. In other work (1992), he makes a strong case for the potential of "alternative dispute resolution" (ADR) in the World Bank's handling of water resources issues. Trolldalen (1992) likewise chronicles environmental conflict resolution at the United Nations, with a chapter on international rivers.

After decades of institutional risk-aversion and a general lack of leadership in international waters, the 1990s and 2000s are turning out to be a period of

tremendous momentum at the global level, at least as judged by public proclamations and political awareness. One result of the Rio Conference and Agenda 21 has been a tremendous expansion of international freshwater resource institutions and programs. The World Water Council, a self-described "think tank" for world water resource issues created in 1996, has hosted two World Water Forums: gatherings of government, non-government, and private agency representatives to discuss and collectively determine a vision for the management of water resources over the next quarter of a century. These two forums have led to the creation of the World Water Vision, a forward-looking declaration of philosophical and institutional water management needs, as well as the creation of coordinating, implementing, and assessment agencies such as the World Commission on Water for the Twenty-First Century and the Global Water Partnership. The Second World Water Forum also served as the venue for a Ministerial Conference in which the leaders of participating countries signed a declaration concerning water security in the twenty-first century. Continued momentum of these recent global water initiatives is supported by a number of interim appraisal meetings to review actions taken since the Rio Conference. Progress towards the objectives outlined in Agenda 21 was due to be evaluated in 2002, for example, in the Dublin +10 conference, and implementation of the World Water Vision to be assessed during the Third World Water Forum scheduled for 2003 in Japan.

None of these statements or declarations, however, focuses exclusively on international freshwater sources. Additionally, despite the efforts over the past decade to expand global institutional capacity over freshwater resources, no supranational agency exists to manage transboundary resources globally. Thus, while many of the principles of national water management apply to international rivers and lakes, the political, social, and economic dynamics associated with transboundary waters can require special consideration.

Yet in recent years, there has been movement on the ground as well: the World Bank and UNDP have collaborated to facilitate the Nile Basin Initiative, which looks close to establishing a treaty framework and development plan for the basin, and the Bank is taking the lead on bringing the riparians of the Gurani Aquifer in Latin America to dialog. The US State Department, a number of UN agencies, and other parties have established a Global Alliance on Water Security aimed at identifying priority regions for assistance, which may help countries get ahead of the crisis curve. The Global Environment Facility (GEF) is now active in fifty-five international basins. The UNECE has programs on ten European and Central Asian basins, and supports the International Water Assessment Center. SADC and ESCAP have been taking the lead in establishing transboundary dialogs within their respective regions. And UNESCO and Green Cross International have recently teamed up for a broad-based multi-year project called, "From Potential Conflict to Cooperation Potential," working also with the Organization for Security and Cooperation in Europe on their project on international waters.

Getting beyond the imperative of "integrated international basin management," a practice that is in actuality the exception rather than the rule, has been an important step in some basins. Even friendly states often have difficulty relinquishing sovereignty to a supra-legal authority, and the obstacles only increase along with the level of suspicion and rancor. At best, in many regions, one might strive for coordination over integration. Once the appropriate benefits are negotiated, it then becomes an issue of "simply" agreeing on a set quantity, quality, and timing of water resources that will cross each border. Coordination, when done correctly, can offer the same benefits as integration, and be far superior to unilateral development, but does not threaten the one issue all states hold dear: their very sovereignty.

6. INDICATORS OF TENSION

In Wolf, Yoffe, and Giordano (in review), traditional parameters often cited as indicators of conflict were assessed in an effort to help identify tomorrow's areas of potential tensions, but found that most of the parameters commonly identified are actually only weakly linked to dispute. These parameters include: climate, water stress, dependence on hydropower, dams, or development *per se*, or level of development. In fact, our study suggests that institutional capacity within a basin, whether defined as water management bodies or treaties, or generally positive international relations are as important, if not more so, than the physical aspects of a system. As mentioned earlier, it is when the rate of change within a basin exceeds the institutional capacity to absorb the change that we find tensions.

If institutional capacity were a driver, then it would stand to reason that the most significant indicators would be related to extremely rapid changes, either on the institutional side or in the physical system. The most rapid changes institutionally are associated with "internationalized" basins: that is, basins whose management institution was developed under a single jurisdiction, but was shattered as that jurisdiction suddenly became divided among two or more nations. On the physical system side, the most rapid change is typically the development of a large-scale dam or diversion project. But here, too, the institutional capacity makes a difference. In other words, high levels of animosity and/or the absence of a transboundary institution can exacerbate the setting, while positive international relations and/or the presence of transboundary institutions can mitigate the negative effects of such projects.

By taking as indicators these parameters of rapid change – internationalized basins and major planned projects in hostile and/or institutionless basins – the basins with settings that suggest the potential for dispute in the coming five to ten years were identified. These basins include: the Ganges–Brahmaputra, Han, Incomati, Kunene, Kura–Araks, Lake Chad, La Plata, Lempa, Limpopo, Mekong, Ob (Ertis), Okavango, Orange, Salween, Senegal, Tumen, and Zambezi.

Almost more important than helping identify the basins at risk themselves, these indicators allow us to monitor for "red flags," or markers which may suggest new basins at risk as they arise, among them tenders for future projects and nations with active nationalist movements.

7. FROM RIGHTS TO NEEDS[4]

Most international negotiations surveyed begin with parties basing their initial positions in terms of rights: the sense that a riparian is entitled to a certain allocation based on hydrography or chronology of use. Upstream riparians often invoke some variation of the Harmon Doctrine, claiming that water rights originate where the water falls. India claimed absolute sovereignty in the early phases of negotiations over the Indus Waters Treaty, as did France in the Lac Lanoux case, and Palestine over the West Bank aquifer. Downstream riparians often claim absolute river integrity, claiming rights to an undisturbed system or, if on an exotic stream, historic rights based on their history of use. Spain insisted on absolute sovereignty regarding the Lac Lanoux project, while Egypt claimed historic rights against first Sudan, and later Ethiopia, on the Nile.

In almost all of the disputes that have been resolved, however, particularly on arid or exotic streams, the paradigms used for negotiations have not been "rights-based" at all – neither on relative hydrography nor specifically on chronology of use – but rather "needs-based." "Needs" are defined by irrigable land, population, or the

requirements of a specific project (see Table 1).[5] In agreements between Egypt and Sudan signed in 1929 and in 1959, for example, allocations were arrived at on the basis of local needs, primarily of agriculture. Egypt argued for a greater share of the Nile because of its larger population and extensive irrigation works. In 1959, Sudan and Egypt divided future water from development equally between the two. Current allocations of 55.5 BCM/yr. for Egypt and 18.5 BCM/yr. for Sudan reflect these relative needs (Waterbury, 1979).[6]

Likewise along the Jordan River, the only water agreement for that basin ever negotiated (although not ratified) until very recently, the Johnston Accord, emphasized the needs rather than the inherent rights of each of the riparians. Johnston's approach, based on a report performed under the direction of the Tennessee Valley Authority, was to estimate, without regard to political boundaries, the water needs for all irrigable land within the Jordan Valley basin that could be irrigated by gravity flow (Main, 1953). National allocations were then based on these in-basin agricultural needs, with the understanding that each country could then use the water as it wished, including diverting it out-of-basin. This was not only an acceptable formula to the parties at the time, but it allowed for a breakthrough in negotiations when a land survey of Jordan concluded that its future water needs were lower than previously thought. Years later, Israel and Palestine came back to the subject of needs in the Interim Agreement of 1995, where Israel first recognized Palestinian water rights on the West Bank – a formula for agriculture and per capita consumption determined future Palestinian water needs at 70-80 MCM/yr. and Israel agreed to provide 28.6 MCM/yr. towards those needs.

Table 1. Examples of needs-based criteria

Treaty	Criteria for Allocations
Egypt/Sudan (1929, 1959, Nile)	"Acquired" rights from existing uses, plus even division of any additional water resulting from development projects
Johnston Accord (1956, Jordan)	Amount of irrigable land within the watershed in each State
India/Pakistan (1960, Indus)	Historic and planned use (for Pakistan) plus geographic allocations (western vs. eastern rivers)
South Africa (South-west Africa)/Portugal (Angola) (1969, Cunene)	Allocations for human and animal needs, and initial irrigation
Israel-Palestinian Interim Agreement (1995, shared aquifers)	Population patterns and irrigation needs

Needs are the most prevalent criteria for allocations along arid or exotic streams outside of the Middle East as well. Allocations of the Rio Grande/Rio Bravo and the Colorado between Mexico and the United States are based on Mexican irrigation requirements; Bangladeshi requirements determined the allocations of the Ganges; and Indus negotiations deferred to Pakistani projects (although estimates of needs are still disputed and changing, particularly in these latter two examples).

One might speculate as to why negotiations move from rights-based to needs-based criteria for allocation. The first reason may have something to do with the

psychology of negotiations. Rothman (1995), among others, points out that negotiations ideally move along three stages: the adversarial stage, where each side defines its positions, or rights; the reflexive stage, where the needs of each side bringing them to their positions is addressed; and finally, the integrative stage, where negotiators brainstorm together to address each side's underlying interests. The negotiations here seem to follow this pattern from rights to needs and, occasionally, to interests. Where negotiators may initially see themselves as Egyptian or Israeli or Indian, where the rights of their own country are paramount, over time one must come to empathize to some degree and notice that even one's enemy, whether Sudanese, Palestinian, or Pakistani, requires the same amount of water for the same use with the same methods as oneself.

The second reason for the shift from rights to needs may simply be that rights are not quantifiable whereas needs are. We have seen the vague guidance that the 1997 Convention provide for allocations: a series of occasionally conflicting parameters that are to be considered as a whole. If two nations insist on their respective rights of upstream versus down, for example, there is no spectrum along which to bargain, no common frame of reference. One can much more readily determine a needs-based criterion – irrigable land or population, for example – and quantify each nation's needs. Even with differing interpretations, once both sides feel comfortable that their minimum quantitative needs are being met, talks eventually turn to straightforward bargaining over numbers along a common spectrum.

8. FROM ALLOCATING WATER TO SHARING BASKETS OF BENEFITS

One productive approach to the development of transboundary waters has been to examine the benefits in the basin from a regional approach. This has regularly required the riparians to get past looking at water as a commodity to be divided – a zero-sum, rights-based approach – and rather to develop an approach that equitably allocates not the water, but the benefits derived there from: a positive-sum, integrative approach. The boundary waters agreement between the United States and Canada, for example, allocates water according to equal benefits, usually defined by hydropower generation. This results in the seemingly odd arrangement that power may be exported out of basin for gain, but the water itself may not. In the 1964 treaty on the Columbia, an arrangement was worked out whereby the United States paid Canada for the benefits of flood control and Canada was granted rights to divert water between the Columbia and Kootenai for hydropower. Likewise, the 1975 Mekong accord defines "equality of right" not as equal shares of water, but as equal rights to use water on the basis of each riparian's economic and social needs. The relative nature of "beneficial" uses is exhibited in a 1950 agreement on the Niagara, flowing between the United States and Canada, which provides a greater flow over the famous falls during "show times" of summer daylight hours, when tourist dollars are worth more per cubic meter than the alternate use in hydropower generation.

In many water-related treaties, water issues are dealt with alone, separately from any other political or resource issues between countries: water *qua* water. By separating the two realms of "high" (political) and "low" (resource economic) politics, or by ignoring other resources which might be included in an agreement, some have argued, the process is either likely to fail, as in the case of the 1955 Johnston accords on the Jordan, or more often to achieve a sub-optimum development arrangement, as is currently the case on the Indus agreement, signed in 1960. Increasingly, however, linkages are being made between water and politics, between water and other resources. These multi-resource linkages may offer more opportunities for creative

solutions to be generated, allowing for greater economic efficiency through a "basket" of benefits. Some resources that have been included in water negotiations include those described in Sections 8.1–8.5.

8.1. Financial Resources

An offer of financial incentives can occasionally circumvent impasses in negotiations. World Bank financing helped resolve the Indus dispute, while United Nations-led investments helped achieve the Mekong Agreement. Cooperation-inducing financing has not always come from outside of the region. Thailand helped finance a project in Laos, as did India in Pakistan, in conjunction with their respective watershed agreements. A provision of the Nile Waters Treaty has Egypt paying Sudan outright for water to which they both agreed Sudan had rights, but which it was not able to use.

8.2. Energy Resources

One increasingly common linkage being made is that between water and energy resources. As noted above, in conjunction with the Mekong Agreement, Thailand helped fund a hydroelectric project in Laos in exchange for a proportion of the power to be generated. In the particularly elaborate 1986 Lesotho Highlands Treaty, South Africa agreed to help finance a hydroelectric/water diversion facility in Lesotho: South Africa acquired rights to drinking water for Johannesburg, and Lesotho receives all of the power generated. Similar arrangements have been suggested in China on the Mekong, Nepal on the Ganges tributaries, and between Syria and Jordan on the Yarmuk.

8.3. Political Linkages

Political capital, like investment capital, might likewise be linked to water negotiations, although no treaty to date includes such provisions. This linkage might be done implicitly, as for example the parallel but interrelated political and resource tracks of the Middle East peace talks, or explicitly, as talks about Turkish acquiescence on water issues have been linked in a *quid pro quo* with Syrian ties to Kurdish nationalists.

8.4. Data

As water management models become more sophisticated, water data is increasingly vital to management agencies. As such, data itself can be used as a form of negotiating capital. Data-sharing can lead to breakthroughs in negotiations. An engineering study allowed circumvention of an impasse in the Johnston negotiations when it was found that Jordan's water needs were not as extensive as had been thought, allowing for more room in the bargaining mix. Conversely, the lack of agreed criteria for data in negotiations on the Ganges has hampered progress over the years.

Data issues, when managed effectively, can also allow a framework for developing patterns of cooperation in the absence of more contentious issues, particularly water allocations. One approach is to delegate data gathering to a trusted third party or, better, to a joint fact-finding body made up of representatives from the riparian states. Perhaps the best example of this internationally is on the Mekong, where the Mekong Committee's first five-year plan consisted almost entirely of data-gathering projects, effectively both precluding data disputes in the future, and allowing the riparians to get used to cooperation and trust.

8.5. Water-related "Baskets"

Some of the most complete "baskets" were negotiated between India and Nepal, in 1959 on the Bagmati and the Gandak, and in 1966 on the Kosi (all tributaries of the Ganges). These treaties include provisions for a variety of water related projects, including irrigation/hydropower, navigation, fishing, related transportation, and even forestation: India plants trees in Nepal to contain downstream sedimentation. While Nepal has expressed recent bitterness about both these accords, the structures of these treaties are good examples of how broader "baskets" can allow for more creative solutions.

9. WHY MIGHT THE FUTURE LOOK NOTHING LIKE THE PAST?

The entire basis of this study rests on the not unassailable assumption that we can tell something about the future by looking at the past. It is worth stopping at this point, then, and challenging the very foundation of that assumption. Why might the future look nothing at all like the past? What new approaches or technologies are on the horizon to change or ameliorate the risk to the basins we have identified, or even to the whole approach to basins at risk?

By definition, a discussion of the future cannot have the same empirical backing as a historical study: the data just are not there yet. Yet there are cutting-edge developments and recent trends, which, if one examined them within the context of this study, might suggest some possible changes in store for transboundary waters in the near future. What follows, then, are four possibly fundamental changes in the way we approach transboundary waters, the results of several brainstorming sessions among the "Basins at Risk" team at Oregon State University.

9.1. New Technologies for Negotiation and Management

Our event dataset goes back to 1948. In some ways, water management is very similar now to what it was then (or, for that matter, what it was 5,000 years ago). But some fundamental aspects are profoundly different. Institutions are getting better and more resilient, management and understanding are improving, and these issues are increasingly on the radar screen of global and local decision makers. But most importantly, the twenty-first century has access to new technology that could not be dreamed of in 1948, which adds substantially to the ability both to negotiate and to manage transboundary waters more effectively:

- Modular modeling systems (MMS's) such as STELLA, Waterware, and Riverware can now be used for comprehensive modeling of hydrologic and human systems. Because of their modular design, they can also act as a facilitation tool by allowing managers/negotiators to build the model cooperatively, increasing the joint knowledge base and communications.
- GIS and remote sensing allow several spatial data layers, encompassing biophysical, socioeconomic, and geopolitical parameters, to be viewed and analyzed graphically.
- Real time monitoring tools, such as radio-controlled gauging stations, add new options for real time management, and allocations based on existing hydrologic settings rather than fixed quantities.
- Graphical user interfaces (GUIs) allow for each component to be brought together into an intuitive, user-friendly setting.

While new technologies and data cannot replace the political goodwill necessary for creative solutions, and are not widely available outside the developed world, they can if appropriately deployed allow for more robust negotiations and greater flexibility in joint management.

9.2. Globalization*:* Private Capital, WTO, and Circumvented Ethics

Very little of the recent attention to globalization and the World Trade Organization (WTO) has centered on water resources, but there is a definite water component to these trends. One of the most profound is the shift of development funds from global and regional development banks such as the World Bank and the Asia Development Bank to private multinationals, such as Bechtel, Vivendi, and Ondeo (formerly Lyonnaise des Eaux). Development banks have, over the years, been susceptible to public pressures and ethics and, as such, have developed procedures for evaluating social and environmental impacts of projects, and incorporating them in decision making. On international waters, each development bank has guidelines generally prohibiting development unless all riparians agree to the project, which in and of itself has promoted successful negotiations in the past. Private enterprises have no such restrictions, and nations eager to develop controversial projects have been increasingly turning to private capital to circumvent public ethics. The most controversial projects of the day – Turkey's GAP project, India's Narmada River project, and China's Three Gorges Dam – are all proceeding through the studied avoidance of development banks and their mores.

There is a more subtle effect of globalization, though, which has to do with the WTO and its emphasis on privatization and full cost recovery of investments. Local and national governments, which have traditionally implemented and subsidized water development systems to keep water prices down, are under increasing pressure from the forces of globalization to develop these systems through private companies. These large multinational water companies in turn manage for profit and, if they use development capital, both push and are pushed to recover the full cost of their investment. This can translate not only into immediate and substantial rises in the cost of water, disproportionately affecting the poor, but also to greater eradication of local and indigenous management systems and cultures. If there is to be water-related violence in the future, it is much more liable to be like the "water riots" against a Bechtel development in Bolivia in 1999, in which eight people were killed, than "water wars" across national boundaries.

As WTO rules are elaborated and negotiated, real questions remain as to how much of this process will be *required* of nations in the future, simply to retain membership in the organization. The "commodification" of water as a result of these forces is a case in point. Over the last twenty years, no global water policy meeting has neglected to pass a resolution that, among other issues, defined water as an "economic good," setting the stage at the 2000 World Water Forum for an unresolved showdown against those who would define water as a human or ecosystem *right*. The debate looms large over the future of water resources: if water is a commodity, and if WTO rules disallow obstacles to the trade of commodities, will nations be forced to sell their water? While the idea seems far-fetched now (even though a California company is challenging British Columbia over precisely such an issue under NAFTA rules), the globalization debate between market forces and social forces continues to be played out in microcosm in the world of water resources.

9.3. The Geopolitics of Desalination

Twice in the last fifty years – during the 1960s nuclear energy fervor, and in the late 1980s with "discoveries" in cold fusion – much of the world briefly thought it was on the verge of having access to almost free energy supplies. "Too cheap to meter" was the phrase during the Atoms for Peace Conference. While neither the economics nor the technology finally supported these claims, it is not far fetched to picture changes that could profoundly change the economics of desalination.

The marginal cost of desalinated water (between $0.80 and $1.00 per cubic meter) makes it currently only cost-effective in the developed world where:

- The water will be used for drinking water.
- The population to whom the water will be delivered lives along a coast and at low elevations.
- There are no alternatives.

The only places not so restricted are those where energy costs are especially low, notably the Arabian Peninsula. A fundamental shift in either energy prices or membrane technology could bring costs down substantially. If either happened to the extent that the marginal cost allowed for agricultural irrigation with seawater (around $.08/$m^3$ on average), a large proportion of the world's water supplies would shift from rivers and shallow aquifers to the sea (an unlikely, but plausible, scenario).[7]

Besides the fundamental economic changes that would result, geopolitical thinking about water systems would also need to shift. Currently, there is inherent political power in being an upstream riparian, and thus controlling the headwaters. In the scenario for cheap desalination above, that spatial position of power would shift from mountains to the valleys, and from the headwaters to the sea. Many nations that are currently dependent on upstream neighbors for their water supply, such as Israel, Egypt, and Iraq, would by virtue of their coastlines suddenly find roles reversed.

9.4. The Changing Sources of Water and the Changing Nature of Conflict

The worlds both of water and of conflict are undergoing slow but steady changes that may obviate much of the thinking in this report. As surface water supplies and easy groundwater sources are increasingly exploited throughout the world, two major changes result: quality is steadily becoming a more serious issue to many than quantity, and water use is shifting to less traditional sources. Many of these sources, such as deep fossil aquifers, wastewater reclamation, and inter-basin transfers, are not restricted by the confines of watershed boundaries, our fundamental unit of analysis in this study. Moreover, population-driven food demand will grow exponentially in coming years, putting unprecedented pressures on water demand.

Conflict, too, is becoming less traditional, increasingly being driven by internal or local pressures, or more subtle issues of poverty and stability. The combination of changes in water resources and in conflict suggests that tomorrow's water disputes may look very different from today's.

10. WHAT TYPES OF POLICY RECOMMENDATIONS CAN ONE MAKE?

Given these lessons, what can the international community do?

10.1. International Institutions

Water dispute amelioration is as important as conflict resolution; it is also more effective and less costly. Watershed commissions should be developed for those basins that do not have them, and strengthened for those that do.

This recommendation is informed by three characteristics of international waters: the fact that conflict is invariably sub-acute, that tensions can be averted when institutions are established early, and that such institutions are tremendously resilient over time. Early intervention can be far less costly than conflict resolution processes. In some cases, such as the Nile, the Indus, and the Jordan, as armed conflict seemed imminent, tremendous energy was spent getting the parties to talk to each other. In contrast, discussions in the Mekong Committee, the multilateral working group in the Middle East, and on the Danube, have all moved beyond the causes of immediate disputes on to actual, practical projects that may be implemented in an integrative framework.

10.2. Funding and Development Assistance Agencies

Water-related issues need to be coordinated and focused: relating quality, quantity, groundwater, surface water, and local socio-political settings in an integrated fashion. Funding should be commensurate with the responsibility assistance agencies have for alleviating the global water crisis.

Ameliorating the crux of water security – human suffering – often rests with agencies that, given the size of the crisis, are extraordinarily under funded. One can contrast the resources spent on issues such as global change and arms control (laudable for their efforts to protect against potential loss of life in the future) to the millions of people now dying because they lack access to clean fresh water. Agencies such as USAID, CIDA, and JICA have the technical expertise and experience to help, yet are hindered by political and budgetary constraints. Funding agencies often are hamstrung by local politics. A powerful argument can be made that water-related diseases costs the global economy $125 billion per year, while ameliorating the diseases would cost $7–50 billion in total (Gleick, 1998). Programs such as USAID's Project Forward, which integrates water management with conflict resolution training, offer models for the future.

10.3. Universities and Research Agencies

Universities and research agencies can best contribute to alleviation of the water crisis in three major ways:

- Acquire, analyze, and coordinate the primary data necessary for good empirical work.
- Identify indicators of future water disputes and/or insecurity in regions most at risk.
- Train tomorrow's water managers in an integrated fashion.

The Internet's initial mandate is still one of the best: to allow communication between researchers around the world to exchange information and enhance collaboration. The surplus of primary data currently threatens an information overload in the developed world, while the most basic information is often found to be lacking in the developing world. Data availability not only allows for greater understanding of the physical world but also, by adding information and knowledge from the social, economic, and political realms, makes it possible to identify indicators showing regions at risk.

10.4. Private Industry

Private industry has historically taken the lead in large development projects. As the emphasis in world water shifts to a smaller scale, and from a focus on supply to one on demand management and improved quality, private industry has much to offer.

Private industry has three traits that can be harnessed to help ameliorate the world water crisis: the companies have a reach that transcends national boundaries, their resources are generally greater than those of public institutions, and their strategic planning is generally superb. Historically, private companies such as Bechtel and Lyonnaise des Eaux have been involved primarily in large-scale development projects, while the smaller-scale projects have been left to development assistance agencies. Recently, a shift in thinking has taken place in some corporate boardrooms. Bank of America, for example, was not involved in the California-wide process of water planning until recently, when its president noticed that practically *all* of the bank's investments relied on a safe, stable supply of water. This was true whether the investments were in microchip manufacturing, mortgages, or agriculture. When the bank became involved in the "Cal–Fed Plan," it brought along its lawyers, facilitators, and planning expertise, and its financial resources. Subsequently, progress was made in several areas where previously there had been impasse.

10.5. Civil Society

Inherent in our recognition that the most serious problems of water security are those at the local level, is the attendant recognition that civil society is among the best suited institutions to address local issues.

One recurrent pattern in water resources development and management has been a series of projects or approaches in opposition to local values, customs, and other cultural processes. Examples of these include large projects such as dams that have displaced hundreds of thousands of people and wiped out sites of cultural and religious heritage, projects promoting water markets among religious groups for whom the idea is sacrilege, or activities as seemingly minor as cutting down a tree sacred to a village djinn. In recent years, as a consequence, those affected by a project have been increasingly involved in the decision-making process, and such efforts must be strongly encouraged.

NOTES

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1. Excluded are events where water is incidental to a dispute, such as those concerning fishing rights, access to ports, transportation, or river boundaries. Also excluded are events where water is not the driver, such as those where water is a tool, target, or victim of armed conflict.
2. The only "water war" between nations on record occurred over 4,500 years ago, between the city-states of Lagash and Umma in the Tigris–Euphrates basin (Wolf, 1998).
3. "Power" in regional hydro-politics can include riparian position, with an upstream riparian having more relative strength *vis a vis* the water resources than its downstream riparian, in addition to the more conventional measures of military, political, and economic strength. Nevertheless, when a project is implemented which impacts one's neighbors, it is

generally undertaken by the regional power, as defined by traditional terms, *regardless* of its riparian position.

4. This section draws from Wolf, A. (1999) Criteria for Equitable Allocations: The Heart of International Water Conflict, *Natural Resources Forum,* Vol. 23, No. 1, February, pp. 3–30.

5. Here we distinguish between "rights" in terms of a sense of entitlement, and legal rights. Obviously, once negotiations lead to allocations, regardless of how they are determined, each riparian has legal "rights" to that water, even if the allocations were determined by "needs."

6. It should be pointed out that not everyone's needs were considered in the Nile Agreements, which included only two of the ten riparian states – Egypt and Sudan – both minor contributors to the river's flow. The notable exception to the treaty, and the one that might argue most adamantly for greater sovereignty, is Ethiopia, which contributes between 75 to 85 percent of the Nile's flow.

7. While the shifts described here are very dramatic, current trends suggest that desalinated water is becoming more attractive in the developing world as well. It should also be noted that desalinated drinking water also becomes available as wastewater, which can be treated for agricultural and industrial uses (Asit Biswas, personal communications, 2001).

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WATER MANAGEMENT AND EARLY CIVILIZATIONS: FROM COOPERATION TO CONFLICT

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CONTENTS

WATER MANAGEMENT AND EARLY CIVILIZATIONS: FROM COOPERATION TO CONFLICT

Water scarcity is a function of cultural activities. Throughout our long journey from the dim past of prehistory to the present our demand for water has spiraled, and on balance our needs have often exceeded water availability in the successive stages of our cultural evolution.

The transition from hunting-gathering to agriculture signaled a major change in our relationship with water as irrigation canals transported water beyond its natural setting. As cities emerged, the need to supply them with water climbed as they grew more crowded and bigger. Industry not only created more demands for water but also began to modify and pollute water resources in an unprecedented way.

The means for dealing with the relative scarcity of water created by increasing demands relative to water available when and where it is needed have included (1) technical innovations, (2) social transformations, and (3) normative and ethical formulations. Our current situation, which involves local scarcities to certain users, cannot be resolved solely by technical fixes or economic measures (e.g., pricing) without implanting social institutional changes and a common vision based on transcultural ethical considerations.

1. INTRODUCTION

Water is the mainspring of civilization. This was recognized at the dawn of civilization in Mesopotamia and Egypt. Water was conceived as the source of all things, eternal and primeval.

In Mesopotamia, Iraq, the god of water, Enki, was entrusted with "me," the universal law governing all existence. Enki, whose mother Nammu was no less than the goddess of wisdom, poured water to make the earth fruitful, stocked marshes with fish, and erected sheepfolds. Wisely, he also appointed special deities to oversee his works and innovations.

This early recognition of the link between water management and civilization is the subject of this article. My aim is to clarify how the development of early civilizations and water management has evolved together with mutual interactions.

I will argue that water shortages are nothing new, and that throughout the history of our common human civilization various solutions were implemented to overcome water scarcities and enhance water security. However, I will submit that such solutions were always short-lived — a temporary relief — because the social and cultural consequences of each solution led to a gradual, cumulative increase in the demand for water.

Civilizations are constrained directly by the quality and quantity of available safe drinking and subsistence water. They are also constrained indirectly by the influence of water on food, energy, transportation, and industry.

Human societies have throughout history found new means to secure availability of water where they settled. They have devised ingenious methods to harvest, transport, and store rainwater, spring water, groundwater, and even air moisture. Human societies will thus continue to search for new sources of water, but the cost of procuring water is a function of the combined cost of extraction/harvesting, transportation, treatment, storage, and delivery. There is thus inevitably an economic aspect of water availability. As water scarcity increases, the cost of water also increases. Accordingly, the fundamental issues throughout history have been: can we afford to meet the increasing cost of waterworks? who pays?, and who benefits? These questions imply that there are various social and political aspects to water economics. In turn, social issues are never divorced from beliefs concerning the world, the social order, and ethics.

This leads to the further conclusion that current water scarcities cannot be overcome simply by new technologies**.** All technological innovations aimed to relieve water scarcity are embedded in a social and an ideological matrix. All such innovations also have an impact on society and its ideology.

My main thesis is that water shortages have been an engine of human innovations; propelling, motivating, and prodding societies to devise, accept, and perpetuate solutions to water scarcity. Water is thus the mainspring of civilization and its entire works. However, the key element in my thesis is that relief mechanisms have so far always entailed, in the long run, greater demands for water than what is available at prevailing withdrawal, transport, and treatment cost. The reasons for this paradox lie in the fact that the historical solutions to water scarcity involved**:**

- increasing population size
- greater water consumption per person
- progressive depletion of utilized water resources
- progressive deterioration in the quality of water.

Water as an essential ingredient to life is one of the fundamental resources utilized by human societies. Individuals in any society operate in groups to perform certain tasks

that enhance their chances of survival and well-being. Among such tasks is food gathering and procuring water for domestic use. Beyond this fundamental level, societies have developed means by which they can overcome occasional food shortages, ensure sufficient water supply, protect themselves against external dangers, manage intra-societal conflicts, and maintain a viable mating network. It is too simplistic to think of how societies work only in terms of "adaptation" to an external environment, since the internal dynamics in any society as its members seek to meet multiple objectives lead to social and cultural innovations. As society as a whole copes with such innovations, its pre-existing relationships with resources change. In general, human societies have evolved from small, mobile bands of subsistence foragers to huge conglomerates of sedentary communities as complex nation-states. This evolutionary development, which was not unilinear, gradual, or universal, was marked by a major transformation in the way societies managed their water resources. In this brief overview, I have attempted to highlight the sequence of key benchmarks, the thresholds in water history that signaled dramatic changes in water management issues and were, in turn, of significant historical consequence over the last 25,000 years.

2. FORAGERS IN NATURE

We begin at first with hunter-gatherers, situated in sub-arid drylands during the coldest maximum of the last Ice Age, between 25,000 and 16,000 years ago.

These foraging ancestors were faced with extremely dry, arid conditions. Wild game diminished and vegetation was thinned. They survived by developing traps and the bow and arrow to capture small animal game, and by devising grinding and pounding equipment to retrieve food from nuts, rhizomes, and cereal grains. Geographic and climatic conditions played a key role here governing the distribution of surface (rivers, lakes, ponds) and groundwater accessible at the surface (springs). Throughout human history until that time gathering plant foods, hunting wild animals, fishing, and fowling were the main source of subsistence. Rainfall and temperature played the key role in the distribution of wild plants and animals. As foragers and hunters, people were tuned to seasonal variations in edible resources. In general, the available yield from wild resources for human consumption was only sufficient to sustain a small number of people within the perimeter of a territory determined by a day return journey to home base. The size of a local group at any one time of the year thus rarely exceeded fifty persons, and was often between fifteen and twenty-five people. Even such small groups could not survive in the same locality all year round because of seasonal variations in food availability. As such, seasonal scarcities or abundance in certain desirable resources prompted people to relocate frequently in tune with the seasonality of rainfall and temperature variations which were critical for the growth and maturation of plants and the movements of animals. In certain areas, particularly deserts, the low density and patchiness of resources necessitated frequent movements regardless of the season. Before the invention of pottery to store water, hunters and gatherers did not live far away from drinking water resources. They chose locations neither too distant from water nor very close to it, in order not to scare wild game or suffer from insects drawn to humidity. Containers from wood or bamboo were probably used, but in areas where ostriches were abundant, ostrich eggshells were used as water containers to be used on hunting trips.

Water was clearly a limiting factor during prehistoric times. Average annual rainfall and seasonal variability limited biomass and the critical portion of that biomass containing high quality protein necessary for healthy human growth. The evolution of food extraction and processing tools was markedly slow. Implements (tools) fashioned

from stone (and therefore more likely to survive than other tools) reveal that it was not until approximately 25,000 years ago that the tempo of technological change was accelerated. Although modern humans (*Homo sapiens sapiens*) appeared and spread in a period from approximately 200,000 to 60,000 years ago, the technological take-off manifest in the manufacture of composite tools and the widespread use and sophisticated manipulation of very small stone tools (microliths) happened many millennia after our own ancestors inherited the earth.

In tracing back our relationship with water, it is important to keep in mind the overall size of the world human population and the size and density of local populations. Certainly, one of the causes of the current local scarcities of clean water is a result of a very large world population and huge concentrations of people in urban centers. By contrast, our primeval conditions were characterized as mentioned above by roving small bands that interacted in regional kin-groups of 500 to 1,000 people. The world population could have rarely exceeded 10 million people, and their impact on natural resources was accordingly far less than that characteristic of later periods.

3. AGRICULTURE: OVERCOMING CLIMATIC VARIABILITY

By 16,000 years ago, and especially after the global warming and until approximately 10,000 years ago, the world experienced frequent climatic oscillations as global climatic conditions were undergoing major changes in the heat budget and the differences between ocean and earth temperature. In certain localities wild cereal grains proved to be a viable staple food, allowing communities to settle near fields to harvest and process foods, utilizing a new technology based on sickle stone tools. The use of grinding stones to process cereals also became widespread. The wild cereals proved to be an alluring resource. Although it required a relatively higher amount of work per unit of yield to extract tiny seeds from small weedy grasses, and at that time the cereal plants were scrawny grasses, the amount that can be harvested from extensive grass fields was sizeable. Moreover, in arid conditions, it was possible to store cereal grains to be consumed when food was scarce. A diet of cereals with small supplementary amounts of legumes and pulses is also fairly nutritious.

In Southwest Asia, a return to ice age conditions from 13,000 to 11,500 years ago transformed the landscape and influenced the distribution of wild cereal stands and animal game. These changing climatic conditions encouraged some groups to become fully committed to growing wheat and barley as a staple food in Southwest Asia. In China, some communities began to depend on rice as a significant source of food. In Southwest Asia, goats and sheep were added to the subsistence base *c*. 10,000 years ago. In the Egyptian Sahara, where foragers were taking advantage of the greening of the desert due to an increase in rainfall associated with post-glacial warming, episodes of reduced rainfall forced communities to depend on seasonal ponds or springwater. One of the remarkable recent discoveries is the growing evidence for cattle keeping in Africa almost at the same time as sheep and goats were domesticated in Southwest Asia.

The beginning of a strategy focusing on keeping goats, sheep, or cattle with or without horticulture appear to have been initiated in the natural habitats of these crops and animals. In the long run, large aggregation of people close to the stands of cereals and legumes was associated with a trend toward year-round settlements. One of the reasons for this was to guard stored food resources. Another was the nuisance of having to carry the heavy food processing stones now needed in large numbers to cope with the large volume of food to be processed. Although initially the co-residential communities were still only slightly larger on average than the size of bands, it was advantageous to have a large number of women, men, and children to

harvest wild grain when it matured. In its wild state, the grains were easily detached from the stem and thus if not harvested within weeks of maturation it was practically lost. The beginnings of a trend to increase, even slightly, the number of inhabitants, and to remain for most if not the whole year in a settlement significantly altered the relationship between people and their resources, including water.

One of the most important changes was the impact on local wild animal populations. Over-hunted or alarmed by intensive human predatory activities, wild animals either retreated to safe areas or began to dwindle in numbers. This encouraged people to either keep animals in the settlements, exchange grain for game captured by specialized hunters, or grain for meat or milk from herders. A commitment to keep animals entailed providing them with water or taking the herd to a waterhole or a stream. Vessels made of baked mud (pottery), for which there is now evidence in China and North Africa predating 9,000 years ago, proved to be advantageous for keeping water in houses and in transporting water from lakes, streams, or springs distant from the settlement. The use of goatskins to carry water was an added value to having goats for milk and meat.

For some groups, the idea of relocating settlements close to permanent springs and streams was another solution to the problem. This idea had other merits because of the availability of cultivable land close to streams. Natural irrigation provided water needed for growing crops. Dependency on water from streams also mitigated against the capricious pattern of rainfall in arid and semi-arid lands. Not only is rain seasonal with marked variability from one year to the next, but also it is also not certain that rain will always fall in the same area.

4. EARLY STATE SOCIETIES: THE BENEFITS OF COOPERATION

Having overcome the major problems associated with dry farming, the earliest generations of farmers in river valleys found themselves after a few generations eventually faced with periodic water shortages when the rivers dried up, silted, or changed their course. In response, they dug canals and drains, and constructed dikes and earthen dams in order to either get rid of excess water or bring water to parched fields. In a sense, the first attempts to manage drainage and irrigation water, no matter how feeble or elementary, marked a revolutionary shift in the way people interacted with water.

There were also other changes that proved in the long run to have been equally revolutionary. People from neighboring villages made deals and mutual support pacts with their neighbors. This included cooperating to repair a breached embankment or dig a canal. They suffered equally from flood disasters, and went hungry when droughts ruined their crops. Sharing grain and other foodstuffs in regional networks, using boats or donkeys whenever available, was a successful mechanism to buffer local communities against food shortages.

Goat and sheep or cattle herders still faced the capricious variations in rainfall. They too needed to trade with farmers. Droughts coupled with the high cost of animals relative to grain also encouraged food exchanges between farmers and pastoralists. The nomads eventually became a major force in history because their lifestyle lent itself to raiding and militancy. In good years, herds are plentiful and herders prosper and become numerous. However, when pastures wither and waterholes dry up, especially when farmers are better off, the peaceable pact between pastoralists and farmers may break down.

During the riverine phase of farming, aggregation of settlements near favorable flood basins constrained the options for population movement and encouraged local

groups to remain together. This seed of enhanced group cohesion was in sharp contrast with the ethos of fission, roving, and roaming that once characterized hunters and gatherers. Even the pastoral nomads were no longer weakly organized like the regional agglomerates of foraging bands. The importance of waterholes and pastures led to a sense of territoriality and organization (coordination) within and between groups of movements over long and short distances. This encouraged the emergence of a managerial strategy based on tribal affiliations and political organization.

In rural settlements emergent problems were sanitation, occasional food shortages, and relative scarcity of animal protein, which added a heavy disease load to children and adults. This heavy disease load was compounded by malaria and infectious diseases promoted by frequent exposure to others from one's family and community, as well as close contact with animals.

The initial riverine/pastoral phase was thus an eventful period heralding changes in the way people interacted with water resources but, perhaps more importantly, it also created the conditions for some of the fundamental changes in the organization of human societies and how they interacted with other societies.

5. KINGS AND PRIESTS: THE IDEA OF ORDER

By 5,200 years ago, complex state societies made up of coalitions of regional groups united by a king, emerged in the context of riverine societies to coordinate the social affairs of neighboring villages, defend them from marauders, and manage interregional economic exchanges. In Mesopotamia, the royal institution was linked to the increasing role of temples and priests in social affairs. Kings referred to themselves as Ensi (stewards) of the God, Lugal. Temples became economic foundations with their own estates. The Mesopotamian state was in essence a city-state, with the temple as a central focus of social power. In the Nile Valley, the statelets that existed as regional polities strung along the banks of the Nile were unified in a country-state ruled by a king under the umbrella of a religious ideology from a capital city. The emphasis in Egyptian religion was on funerary rituals that linked the ruling king to departed ancestors who descended from a family of gods. In India, a loose federation of towns emerged over a vast area (65,000 square kilometers enlarged later to 544,000 sq. km). In China, the Shang state dates to 1766 B.C. It was based on a system of lineages (shi) and clans (xing). The shi were corporate units whose members were loyal to their heads. The king (wang) assigned particular lineages to serve as royal personages or high aristocrats. Clans were assigned territories in order to extend the geographic power of the state. The state consisted of a network of walled towns dominated by a royal capital.

The rise of state societies implied greater managerial capabilities for waterworks, resolving disputes within and between regional groups, and facilitating the transfer of famine relief food when needed. The state also entailed a dramatic shift in worldview, social organization, and relationships between societies. The state was in essence linked with the rise of a power elite and state functionaries and with the potential for coercion and persuasion using an extra-local apparatus. The initial phases of the state were dominated by lineages and coalitions of territorially based, kin-related political organizations. Eventually, the role of kinship as a basis for social organization was marginalized and confined to a provincial level as elements of a bureaucratic, extra-local managerial center of power were nudging the political system toward an ideology focused on the person of the king as a steward of God or even the son of God.

6. EARLY STATES: MANAGING INEQUALITY

The early states were a curious mix of centralized authority and semi-autonomous provincial polities with a spectrum from non-kinship to lineage-based organizations. The state was not responsible for or involved in massive irrigation programs, and nowhere is there any evidence in early civilizations for a centralized despotic organization based on elaborate waterworks. In addition, although there are indicators of feuds and skirmishes, systematic warfare with standing armies was to emerge much later. The state appears to have gained its legitimacy initially from acting as an arm of the God(s) to settle disputes and instill a sense of order in a changing world of chaotic events that ranged from disastrous floods and pest infestations destroying crops to attacks by marauders. The king embodied or mediated the forces of nature by his cosmic connections and ensured prosperity (naturally the people were blamed for any catastrophes because they either did not appease the gods or acted in a way that angered them). Nevertheless, the kings were able to mobilize human labor at a scale much greater than that at a village or regional levels.

A reasonable estimate for the population of the early Egyptian country-state is approximately 400,000 climbing later to about 2 million, with regional units consisting of 10,000 to 20,000 persons at the start. Although the percentage of the adult male population that could be mobilized for hard labor or military operations was smaller than that available at a local level, in absolute numbers, the state could command a much higher number. Marshalling 10 percent of adult males from ten provinces, for example, provided no less than 2,000 men. With 5 percent of all adults from a population of 2 million, the king could mobilize 20,000 men. The king also received revenues from the various districts of the kingdom and it was thus possible to accumulate capital that could be used to undertake emergency relief actions.

The success of this strategic move buffered local rural societies against periodic agrarian failures. However, the rise of the state created a destabilizing force. This force consisted of a greater demand for food to meet the progressive increase in the number of non-food-producers, from the king and his court to the scribes and the carpenters. This force gained more intensity as the demand of each of the non-food-producers soared to fit their elevated social status. With an increasing demand for food, the farmers were forced to work harder, to work longer hours, and to beget more children to increase the size of the labor force. Social and ideological mechanisms were put in place to ensure that farmers remained in the fields, living in misery and destitution in hovels and huts.

At the same time, the state elite, the supporting cast of priests, scribes, soldiers, and artisans, retreated to palaces and town houses on royal estates in capital cities and provincial towns. This was the beginning of one of the major forces in world history: social inequality and poverty.

Greater productivity, to feed the peasants and the rising number of non-food-producers, could only mean that more water was needed, especially when the stretched system of production suffered from lack of rain or poor floods. The answer was for the kings to dig longer canals, construct bigger dikes, and, on occasions, to reform the organizational bureaucracy. The earliest major waterwork is the Sadd el-Kafara dam in Egypt. It stands 14 meters high and consists of two rockfill sections with an inner fill of rockwate and rubble. The surface was covered with limestone ashlars arranged in the form of stairs. It dates back to 2690 B.C. to 2950 B.C., at the time when the Egyptians were perfecting pyramid-building technology. The dam was apparently built not to store water but to protect installations in the valley from torrential rain coming down the wadis (ephemeral streams). However, it was in 2100 B.C. that Egyptian kings of the Middle Kingdom embarked on one of the most

ambitious waterworks ever attempted hitherto. Responding to a calamitous drop in Nile floods over a period of forty years that plunged the country in an age of terror and political disorder, the kings:

1. Dredged and re-activated an old Nile arm which connected the Faiyum depression to the main Nile River.
2. Cleared and drained potentially arable land in the depression.
3. Constructed a permanent irrigation and drainage system.

7. THE PROTO-URBAN SCENE: WATER FOR CITIES

In some state societies, urban centers for the state elite, craft specialists, priests, and scribes led to the emergence of the earliest large cities with populations of as many as 20,000 to 40,000 persons. The permanent locations of these cities required protection from floods, transport of water, supply of goods through water canals, storage of water in tanks or ponds, and water distribution and sewage systems.

7.1. Greeks and Romans: Globalizing Water Technology

The pace of technological advancement was slow as a result of a closed system of absolute monarchy and monopoly, a religious ideology structured around the glorification of the king, as well as a low rate of economic agrarian growth. The numbers of literate scholars was small. They were not organized in national or international organizations, and their learning devices were not geared for practical knowledge.

The basket remained the only water-lifting device in Egypt until the New Kingdom (*c*. 3,500 years ago) when the shaduf was introduced, 3,500 years after the beginning of agriculture in Egypt and 1,500 years after the rise of the nation-state. It was not until 1,000 years later that the water wheel and the Archimedean water screw were developed in Alexandria. Archimedes (287 to 212 B.C.) worked with scholars from all over the world in the largest think tank ever developed until that time – the Mouseion associated with the Library of Alexandria. Founded by the Ptolemies (kings of Greek origin who ruled Egypt from 323 B.C. to A.D. 30), the Mouseion hosted scholars such as Euclid and Archimedes who made significant advances in mathematics of cones and cylinders as well as differential equations leading to major advances in hydraulic engineering. The achievements of the Alexandria scholars definitely represent a breakthrough in water history, because they laid the foundations of theoretical hydrology in connection with practical applications.

The Ptolemies who inherited the Macedonian empire from Alexander the Great benefited not only from the knowledge of Egyptians priests and savants, but also from the scholars of Persia. Persia came under the fold of Greek rulers following the defeat of the Persians in 333 to 331 B.C.

The Persians had already made an ingenious contribution to hydraulic engineering by developing a water delivery system known as "qanats" – a subterranean system of tunnels connecting wells and dug using vertical shifts designed to collect and transport water, sometimes over distances more than 50 kilometers long, to extend farming to marginal desert areas by utilizing underground, long-distance transport of groundwater from mountain springs to low-lying farming land. The system was definitely developed by the middle of the third millennium B.C. since there are remains of qanats introduced by the Persians to Egypt at that time.

This method for utilizing groundwater spread from Persia to dry lands in Iraq, Syria, Jordan, Palestine, Egypt, Algeria, and Cyprus. Qanats also diffused to Arabia,

the Gulf states and Oman, as well as to Pakistan, Afghanistan, and China. Qanats, in addition, were introduced by the Muslims to Spain, to be exported subsequently to Mexico (Tehuacan), Peru (Nazca), and Chile (Pica and Matilla). This is one of the major early historical examples of the diffusion of water technology from one civilization to another. Although the mechanisms of diffusion have not been fully worked out, they are were in general linked with movements of people, but more importantly linked with ideas in a world that already was becoming a global village with effective networks of communication and transport, both maritime and overland. The Romans, who in essence capitalized on the knowledge accumulated and generated by the Ptolemies and the Persians, were instrumental in the spread of hydraulic engineering to various parts of their empire. The Nabateans who occupied the desert region in Jordan and Palestine and inherited desert hydraulic techniques dating back to the fourth millennium B.C. came under Roman rule in A.D. 62. The Nabateans had by then constructed more than 1,000 small reservoirs using small gravity dams. The Romans transported the idea to Italy in the reign of Emperor Nero (A.D. 54–68) on the River Arniene, about 50 km east of Rome. Gravity dams were also introduced by the Romans to Turkey, Syria, North Africa, and Spain.

In A.D. 270, the Romans combined their knowledge of arched bridge construction with that of gravity dams to build two large weirs near Shushtar in Iran. This ushered a phase of building weir bridges in Persia that lasted until the tenth century, well into the Islamic period. It was during that century that Muslims in Spain began to develop and improve Roman hydraulics. In Spain dam-building boomed and the country reached its zenith as a world power in the sixteenth century.

Greece and Rome thus left a lasting legacy – that of a cosmopolitan world that permitted the flow of information, ideas, and gadgets on a global scale. This was in a sense the first global information age.

8. THE CLASH OF EMPIRES: THE THIRST FOR WATER

The Persian-Greek wars and the subsequent clashes between the Romans and the Ptolemies and the Persians were the culmination of a phase of clashing empires. The age of ancient empires culminated in the third century B.C. with the emergence of the Roman Empire (272 B.C. to A.D. 410) – an empire that extended over the whole Mediterranean littoral.

This stage in world history began with the rise of the first empires in the Near East, with Egypt joining *c*. 1500 B.C. The cradle of civilization from the Euphrates to the Nile was the theatre of warfare as Sargon of Akkad annexed Sumer *c*. 2300 B.C in a first step to establish an empire that extended to include northern Syria, most of northern Mesopotamia, and parts of western Iran. Sargon maintained a standing army of 5,400 soldiers. The clash of empires in the region entered a new phase when the army of Alexander conquered Egypt and Persia and pushed farther east to India.

This phase in the history of civilization marks the emergence of military officers and mercenaries as a major force within and between societies – a force of heavy economic demands and a powerful set of ideologies and practices. The age of empires from 2300 B.C., culminating *c*. 1500 B.C., until the founding of the Roman Empire, followed in the wake of the establishment of city-states in Mesopotamia and the nation-state in Egypt beginning *c*. 3200 B.C. This was mainly a result of the voracious appetite for revenues and trade goods by the state elite.

In addition, a thousand years of agrarian developments under state rule pushed the early agrarian societies to their uppermost level of production, and large-scale military operations by armed forces dedicated to warfare was a novel strategy to secure more land and more laborers, and to guarantee the flow of coveted exotic

goods for the consumption of the elite. It may be said that conflict over water rarely leads to war. But we fool ourselves if we do not consider that water is an indirect cause for many conflicts. Wars for agricultural products, for example, are wars for the water resources essential for farming. Wars for cotton, sugar, or rubber are wars for water. The spread and expansion of waterworks under the Romans and the world pre-occupation ever since with hydraulic engineering and water technology is an excellent indicator for a thirst for water as the indispensable ingredient for economic activities from agriculture to mining. Water scarcity under the Romans was a result of greed for water – a greed precipitated by the desire for greater production to meet the demands of the imperial elite.

It may also be stated that war and conquest only mean that resources are re-allocated from one region to another, increasing the misery of many regions for the benefit of one country. Grain shipped from Egypt to Rome only meant that the suffering Egyptian peasant had to work even harder and had to sire more children. The oppressive conditions under the Romans led to many peasant revolts. When the revolts were crushed, peasants fled to the hills abandoning the fields. Sadly, this situation continued from that time on to an extent that alarmed the Ottomans when they took possession of Egypt about 1,500 years later. In a rare historical document, an Ottoman decree obligated the peasants on pain of heavy penalties to their families and their villages to remain tied to their fields.

The concentration of resources by an imperial power also meant that ambitious reclamation projects could be undertaken, as the Ptolemies did in Egypt, reclaiming the Faiyum province and desert oases. It is remarkable that the Roman period, which entailed an unprecedented phase of economic boom, land reclamation, intensification of agrarian production, and trade on a global scale, was also a period of worsening conditions for peasants and for those who had the misfortune to become slaves.

9. THE METROPOLIS: WATER ARTERIES FOR URBAN LIFE

The Roman Empire left another glorious or inglorious legacy, depending on how you look at the metropolis. Greater Rome had a population of as many as 500,000, more than ten times that of earlier cities. Ptolemaic Alexandria in its heyday also approached 400,000 people.

The water demands of both Alexandria and Rome were met by ingenious solutions. In Alexandria, the city more or less floated on top of hundreds of cisterns fed from a canal connected to a branch of the Nile. In Rome, aqueducts and tunnels were constructed to deliver water to a city that not only needed water for drinking and domestic use, but also for public baths.

A subterranean water tunnel, the Aqua Appia, ten miles (sixteen kilometers) long, was dug, providing 16 million gallons of water per day. By 140 B.C., at great expense, a new aqueduct, Aqua Mercia, supplied Rome with water over a distance of fifty-six miles from the water springs of Subiaco. The aqueduct was elevated over arches and water was diverted into several branches. Every day, over 100 million gallons of water passed through the city, compared with 1 million gallons today in the River Tiber!

10. THE MOSLEMS: WATERWORKS AND WATER COURTS

With the collapse of Rome, the world entered the second phase of global information as Moslems, effectively from the eighth to the twelfth century, integrated sources of knowledge from China to Spain, paving the way for a wealth of world information that was passed on to the Europeans in the late Middle Ages.

Rome had also brought the fold of civilization to the people around the northern Mediterranean littoral, setting in motion forces of change that have since re-shaped the world. The Byzantine Empire also had an impact on the people of the Middle East and Arabia, where Islam emerged in the seventh century A.D.

Under the Moslems (a people who were originally from a barren desert) irrigation waterworks, aqueducts, subterranean qanats, watermills, baths, and fountains spread to many parts of the world.

Moslems also introduced a system of water management and water courts. Attention to hydraulics by the Arabs was one of the main sources both of modern mechanics and industry – the forces that were to shape the world to come.

11. THE RISE OF THE WEST: INDUSTRY AND WATER

Following the defeat of the Arabs in Spain and the weakening of the Ottoman Empire, Western Europe (later to become "The West" as a means to differentiate it from the "Orient", the reference point by which Europe defined its global position), as the beneficiary of world knowledge, began a phase of economic and cultural development based on trade, banking, and maritime exploration. The Ottomans, who ruled and bankrupted a huge tract of the world, and clashed with and subjugated Christian and Moslem countries alike in their quest for imperial power and its economic bonanzas, set the precedent for disguising the clash of empires for water resources and economic goods as a clash of religions and civilizations.

By 1650, the advent of mechanized industry and the introduction of food crops from the New World were associated with a phase of urbanization based on manufacture or commerce – both were under the patronage of the king or the temple. Manufactured goods were exclusively for state functionaries and to be awarded by the head of the state. The expansion of manufacture and trade in later times were not only related to advances in technology, but also to the breakdown in the monopoly of manufacture and trade by divine kings, allowing many individuals to engage in such activities and raising the number of consumers by allowing commoners to have access to luxury goods.

In Europe, the development of medieval towns linked to trade and crafts in a climate of competition and warfare not only made it necessary to secure water for city dwellers, but also made use of water for defense, mills, tanners, and paper makers. Sewage, sanitation, and water pollution became issues of concern, and had a major role in transforming water management methods.

The prevalence of a scientific outlook, however, was instrumental in alerting communities to the danger of deforestation and the drying of wetlands. Science also provided other means for manufacture that eliminated putrefaction and reduced the ravages of epidemics. With increasing affluence, the cities enjoyed the benefits of parks, tree-lined boulevards, and fountains – the Renaissance legacy of a landscape of meadows, fountains, and nymphs.

Fountains became the symbols of the triumph of the city over its water problems and of its prosperity and affluence. Fountains were, in fact, the new temples to water gods.

Canals and water mills in the late eighteenth century paved the way to a world where water is controlled and manipulated. Canals also paved the way for the rise of nation-states by strengthening inter-regional links within water basins.

Egypt, we must recall, became one of the first world nation-states because it was connected by the Nile as a water highway.

The rise of the modern nation-state was closely connected with the management of water on an inter-regional scale for transport, commerce, and industry. Water was

now not only needed for agriculture and domestic uses, but also as a raw material for industry and as a source of energy.

Industrialization, over the last 200 years, often in association with urbanization, has thus created great demands for water, competing with the growing demands for water to produce food for the ever-increasing masses of humanity. Industrial water pollution from suspended solids, organic materials, heavy metals, synthetic chemicals, and acidic waste is now compounded with that of pollution by modern farming, such as contamination by nutrients, pesticides, and animal waste.

Industrial farming, involving use of farm machinery, fossil fuels, fertilizers, and waterworks on an industrial scale, as well as scientific methods of breeding and management, provided the possibility of supporting very large populations who in turn became the source of a huge labor force. They became also the consumers of agrarian and industrial goods, with great profits to landowners, bankers, and industrialists. A part of the profit was re-invested in science and technology to increase the margin of profit.

The share of profit was greater for the industrialized West, at the expense of colonial possessions and less developed nations. The frightful result of this disparity was that poverty was worsened by a population explosion, as large family size for the poor became both beneficial and feasible. More food and modern medicine reduced mortality. Unlike in the West, where industrialization, education, and pensions made small families desirable, leading to a reduction in births as health conditions improved, families in poor countries wanted more children to provide more income and security in old age.

The rise in population since 1650 was also associated with an increase in urbanization. Urbanization was faster in European countries, but it is now accelerating in non-western nations. Urbanization creates severe demands on water and involves serious pollution of water resources, especially in poor countries where urban planning is absent or too costly. Today, more than 1 billion persons have no access to clean water.

12. PRESENT PAST: THE MAKING OF A WATER CRISIS

Poor countries are now facing the dilemma of having to undergo rapid industrialization to face growing population numbers, migration to the cities, and greater demands for the amenities of urban living and a middle class lifestyle. In the process they are stressing existing water resources, hastily and rather inefficiently developing new water resources, overlooking degradation and breakdown of urban water and sewage infrastructure, and failing to minimize or prevent water pollution from modern farming and industrial installations.

Dams and still more dams are developed at the expense of local ecosystems and indigenous populations as demands for both water and energy soar.

Industrial nations face the increasing demand for energy, industry, services, and urban growth. They are inter-linked with non-western countries through a web of economic transactions, and have, accordingly, to cope (for the sake of economic sustainability and world peace) with the relative scarcity of water, water pollution from unclean modern farming, dirty industry, ecologically damaging dams, irresponsible withdrawal of groundwater, and unsanitary water management in urban slums in their own countries and elsewhere in the world.

13. WATER WISDOM

The fates of nations until 300 B.C. were independent. Rome, with a population of 54 million persons (about one fourth of the total world population) in Europe, Asia, and Africa, was the culmination of the growing interdependency of the world nations of early civilizations, the closest to a global civilization in antiquity. The fall of Rome, in my opinion, was not only a result of a threat from its northern neighbors, but also from the heavy cost of a military establishment and an unprecedented stress on water resources, even in the desolate Egyptian oases, with diminishing returns.

Investments in waterworks and water technology were too costly to sustain. In Rome, graft, corruption, ostentatious consumption, and greed prepared the way for the demise of the first global society.

Today, we suffer from the same ills: urbanization, technological advances at great cost that offer diminishing returns, the threat of global climatic change, and a precarious global economy. However, as in ancient Rome, we also suffer from vast, unjust disparity in wealth, development potential, and education.

Did the Roman Empire collapse because it had failed to produce a philosophy of equality and social justice to match its advanced water engineering feats and military prowess? Did Rome, with its great democratic institutions, conquer the world, but fail to conquer its vanity, greed, and blinding, misguided notion of who is Roman and what is truly the national interest of Rome?

Marcus Aurelius was an exceptional emperor. We should not forget these words from his *Meditations*:

> To expect that bad men will not sin is madness;
> it is demanding impossibility.
> To allow them to injure others, and demand that they should not injure you,
> is foolish and tyrannical.

I have surveyed the past with a broad brush, overlooking many details and specific cases, in order to place our present predicament in a long-term perspective. My conclusions are that human societies must always cope with unforeseen natural forces. They are most vulnerable when they are stretched to a meta-stable condition – a point of living dangerously when minor perturbations can plunge society into a state of chaos

Today, climatic change, mostly as an external force, now destabilized by anthropogenic (human-induced) variables, could suddenly and significantly influence the hydrological cycle, air-mass movements, and regional distribution of water resources with serious socio-economic effects.

History also reveals that our problems are not without precedent, except that:

1. Our water demands are rising sharply.
2. Our ability to pollute is global.
3. Our pollutants are more deadly.
4. Our interference with ecosystems is both far-reaching and nefarious.
5. All societies are closely inter-linked so that any regional catastrophe can have global repercussions.

With the change in the scale of our relationship with nature and other societies, we are still constrained by the sentiments, ideologies, and world views shaped in our remote and recent past by nation-states, religious divides, racial discrimination, elitism, consumerism, so-called “rational” economic thinking, faith in technological

fixes, and anthropocentrism (the view that we are the masters of nature and that the world was created for our pleasure).

Although I firmly believe that we are at a stage where we cannot forgo advanced technology – indeed we must have recourse to new technological measures to alleviate our current water shortage situation – I am equally convinced from historical hindsight that what we need first is a new vision and a new heart. The current scarcity is a function of uneven distribution of financial and technical resources, as well as an explosive demand for worldly goods.

In my opinion, there is no long-term solution without a change of heart to re-allocate resources to wherever they are needed, regardless of national boundaries, religious barriers, and racial differences, for a better management of our global water resources. Water could, in fact, serve as the midwife for a new just, and hence peaceful, global society. In our dim past, villagers came to each other's aid to dig a canal to bring water to a parched field or to build a dyke to save a town from catastrophic flood.

Let us also consider the collapse of the Egyptian Old Kingdom, 4,200 years ago, when a series of severe, unforeseen low Nile floods led to a devastating famine. The starved peasants were reduced to eating filth and then their children. Communications were disrupted; the peasants rioted and began to plunder places and tombs. The government collapsed and the social order was overturned.

The country, shattered and dying of hunger, was put back together by rulers who realized that a civilization could not be sustained without two things: (1) attention to water management; and (2) an ethical code of justice and compassion. The kings who succeeded in putting the country back together undertook major hydrological projects. In addition, they were no longer rulers by divine right. They proclaimed instead that they were sent by the Gods to protect the poor, feed the hungry, and help their neighbors. For the first time, the names of the kings were conjoined with the name of Ma'at, the Goddess of justice.

Allow me to finish with a reference to Antoine de Saint Exupéry**,** writing at a time when Europe was threatened by destructive forces of its own making. In his *Flight to Arras*, written during the shattering days of the Second World War, he was able to transcend the calamity that claimed his own life in 1944. He exhorted his fellow humans to reflect upon civilization and to assume responsibility. During this ordeal, Antoine de Saint Exupéry felt that he was at one with France. But he also felt that France was responsible for the world it shared with others. His group – he served as an aeroplane pilot – volunteered for service elsewhere against aggression, in Norway and again in Finland. Each, they proclaimed, was responsible for all.

Today, as the world faces alarming shortages of water, we cannot afford to ignore this message from a man who gave his life to save the world in order to save France. We must begin, as Antoine de Saint Exupéry remarked:

> by recovering the animating power of our civilization which has become lost. That animating power is the power of hope, the power of joy; that we freely experience together as children in the river of life.

Index entries: history of water, dams, water crises, history of water management

WATER WARS: THE RISE OF A HEGEMONIC CONCEPT

Exploring the making of the water war and water peace belief within the Israeli–Palestinian Conflict

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CONTENTS

WATER WARS: THE RISE OF A HEGEMONIC CONCEPT

Hegemonic concepts exist within every society. They structure our cognitive maps and therefore contribute to shape our perception of the world, our definition of the issues we face and the analyses we can achieve. The idea of wars being waged for water has grown over the last twenty years to the point that it could become a new hegemonic concept. This idea is now widely contributing to shaping the perceptions of many present international situations. This article will investigate the issue of water wars as a hegemonic concept. It will first detail what a hegemonic concept is, how it is constructed and propagated. It will then turn to the issue of water wars and examine the pre-existing hegemonic concepts that provided the background enabling the emergence of this new hegemonic belief. It will then examine the manner in which the water war concept has been challenged over the last decade and how this matches a war of position as Gramsci defined it. It will tentatively identify the categories of social actors who benefit from either the water war or the water peace discourse and the categories of social actors who propagate these concepts.

Most of the water war literature has focused on the Middle East. This article will therefore explore the mechanisms whereby the water war has been constructed and propagated in Israel and in the Palestinian Territories as a case study.

1. WHAT IS A HEGEMONIC CONCEPT?

The concept of hegemony was developed by Gramsci in order to explain how a state managed to assert its power over a population living in a given territory. State power, said Gramsci, does not consist only of coercion. The means of repression at the disposal of a state are only the most visible element of its power. The other fundamental element of state power, and probably the most important one, is persuasion. A social group can become dominant and gather state power in its hands only if it succeeds in developing its hegemony within the civil society by persuading the subordinate groups to accept the values and ideas that it has adopted and by building a network of alliances based on these values (Simon, 1991, p. 18).

The hegemony of the dominant group is therefore very much ideological in nature. The dominant group generates "common sense," the uncritical and partly unconscious way in which people perceive the world. This common sense is maintained by the relations existing within the civil society, as churches, political parties, trade unions, mass media, and other institutions propagate it. Gramsci therefore distinguishes the state apparatuses, which have a monopoly over the legitimate use of violence and coercion, from the civil society institutions, which build and maintain the hegemonic common sense that allows the population to accept the state's power as legitimate.

Gramsci defined civil society as the set of all institutions that do not belong either to the state or to the realm of economic production. The media, churches, and trade unions all belonged to this civil society within which hegemonic concepts took root and flourished. He included schools within civil society, on the basis that the educative relation is essentially a voluntary one even though the state usually subsidizes schools and sets the curriculum (Gramsci, 1957).

Other authors have defined civil society differently, and bodies such as the EU commonly consider private companies to be part of civil society. Private enterprises clearly play an important role in propagating hegemonic concepts that structure the modern common sense concerning water and water wars, and institutions such as the media are often private enterprises. Their role will therefore be included in this article along with that of the other members of civil society.

> Ideologically hegemonic conceptions provide stabilizing distortions and rationalizations of complex realities, inconsistent desires, and arbitrary distributions of valued resources. They are presumptions that exclude outcomes, options, or questions from public consideration; thus they advantage those elites well positioned to profit from prevailing cleavage patterns and issue definitions. That hegemonic beliefs do not shift fluidly with changing realities and marginal interest is what makes them important. That they require some correspondence to "objective" realities and interests is what limits their life and the conditions under which they can be established and maintained.
>
> (Lustick, 1993, p. 121)

Gramsci paid much attention to what he termed a "war of position." Such a struggle is subtle and nonviolent. It is conducted in the press, in educational and religious institutions, and in the political arena (Gramsci, 1957). The outcome of a war of position is either the persistence of ideologically hegemonic concepts, the destruction of formerly ideologically hegemonic concepts, or the emergence of new ones. Such wars of position certainly do not imply any kind of conspiracy. Various social groups promote certain values and certain definitions they wish to become hegemonic. This will in turn affect the resilience of other hegemonic concepts in an unpredictable

manner. Many social groups and many institutions act as vehicles for the propagation of hegemonic concepts without benefiting from them at all. The example of the female vote in Europe illustrates this very well. The idea of females voting seemed, at best, preposterous a hundred years ago. In England, a number of suffragettes were sent to Holloway Prison because of their activism. Their war of position proved successful and no one in the European political landscape now challenges the legitimacy of the right to vote for women. This successful war of position later affected many other hegemonic concepts concerning gender, such as the legitimacy of women's presence in the work force. Whether or not a social group is successful at imposing or toppling a hegemonic concept largely hinges on the echo it will find for this idea among other institutions and social groups.

This article will examine the rise of the hegemonic concept concerning water wars. It will investigate the mechanisms whereby such an idea emerged and was propagated. It will also briefly examine the war of position that is now being waged against the concept of water wars.

2. THE EMERGENCE OF THE CONCEPT OF WATER WARS

Hegemonic concepts are not created in a vacuum. They emerge within a context where other hegemonic concepts have already taken hold and where other wars of position are being waged. Before examining empirically the emergence of the concept of water wars, other hegemonic concepts concerning water and concerning war will need to be reviewed. These, and the accompanying wars of position, are the soil in which the concept of water wars is taking root and is growing.

2.1. Water Development

The idea according to which "water should be brought where it is needed" has a long history in western society and has led to the emergence of a hegemonic concept of "water development." The water literature is rife with introductory declarations concerning the great quantity of freshwater available on the planet and the crucial necessity of redistributing this wealth more adequately. "Globally, freshwater is abundant. Each year an average of more than 7,000 cubic meters per capita enters rivers and aquifers. Unfortunately it does not all arrive in the right place at the right time" write Turner and Durbourg (1999) in a vein that is very representative of a dominant assumption.

Such a statement implies that there *is* a right place and a right time for water. It implies a clear hierarchy of values concerning water users. Some are deemed to be more deserving than others. Indeed, water will be used wherever it flows, but fish and algae living in northern Canada rate as less important than human beings in need of drinking water, food, and sanitation. Such an anthropocentric vision of water is widely shared by most social actors. It is also coherent with the conservationist trend in environmentalism. Two types of environmentalism can be distinguished: that of conservationists and that of preservationists. Conservationists want to protect nature as a resource for human use whereas preservationists seek to protect nature itself from human use (Milton, 1996).

It is fair to say that the idea of water as a basic human right is well entrenched as a hegemonic concept around the planet. The right of thirst has long been enshrined in Muslim law and is not questioned in any international forum (Faruqui et al., 2001). It satisfies the essential criteria to qualify as a hegemonic concept: anyone evoking the possibility of a distribution system that would not ensure a minimum supply of freshwater and food to every human being would apologize for mentioning such a thought. Were that person to advocate such an idea, they would be regarded as

monstrous. At best, the person would be laughed at. The organizations that struggle against the construction of big dams always put forward their adherence to the principle of water as a human right. They demonstrate how such projects, while claiming to bring water where it is needed, would actually compromise this right for the social group they defend (see for example: Roy, 1999).

This first ideologically hegemonic concept of water and food as basic human rights has provided the rationalization for what has become another hegemonic concept: "water development." As humans have a basic right to food and water, water development would bring clean water to them for their domestic needs, provide sanitation, and allow the development of irrigation to provide food. Lustick's reference to hegemonic concepts rationalizing complex realities and excluding options or questions from public consideration is very relevant here. Transferring populations from water-scarce areas to water-rich areas could have satisfied the human right to water and food. It could have been satisfied by populations deciding to prioritize their use of water and resorting to virtual water.[1] But water development came to signify exactly the opposite: water would be brought to the people for domestic consumption and for irrigation even if these people elected to settle in the middle of the desert.

Which groups, which "elites" in Lustick's terms, benefited from such an issue definition? Construction companies appear as obvious candidates, as they grew out of this version of water development. They clearly participated in maintaining this belief and in propagating it. But many other groups participated in the making of water development, as it is understood today.

Marc Reisner detailed the manner in which the New Deal came just at the right time in the 1930s to rescue big agrobusinesses in the San Joachim Valley. Extensive irrigation of this Californian desert had started after the First World War when diesel pumps became widely available. By the 1930s, the water table had been severely depleted while thousands of economic refugees had fled to California from the Dust Bowl. The construction of heavy infrastructure provided water to keep irrigating the San Joachim Valley. It provided jobs to workers who would otherwise have starved. The human right to water and food was therefore ensured by a specific form of water development that allowed agrobusinesses to become giants while externalizing most of their water costs on the taxpayers. It allowed politicians to gain support from the economic refugees who secured a livelihood as farm laborers as well as from the agrobusinesses (Reisner, 1993). All of these groups benefited from maintaining the hegemony of a very specific definition of water development. Reisner demonstrates how water development came to mean the irrigation of the Californian desert while American farmers in the east of the country, where rain-fed agriculture can be carried out, were receiving grants to leave their land fallow. Such a concept of water development provided "stabilizing distortions and rationalizations of complex realities, inconsistent desires, and arbitrary distributions of valued resources" (Lustick, 1993). This very specific definition of the term will now be referred to whenever the words appear in italic in this text.

The economic benefits derived by some social groups from such a *water development* are not the only driving force supporting its propagation. In 1958, Jordan undertook the construction of the East Ghor Canal (now called King Abdullah Canal) to bring water from the Yarmuk River 69 km along the Jordan Valley, east of the Jordan River. This canal was meant to be the first phase of a greater irrigation system that was to provide water on both sides of the Jordan River. The 1967 war and the consequent occupation of the West Bank cut this project short.

The East Ghor rural development project was funded by USAID and constituted, at the time, the largest development project ever undertaken by Jordan as well as the largest American investment in the field of development in the Arab Middle East. The project goals were spelled out explicitly in the project document. It aimed at completing the population displacement that had occurred during the war of 1948 by

making it permanent. It aimed to settle the Palestinian refugee population from what is now Israel onto Jordanian land. The United States had identified the issue of the refugees as early as 1949 as a major obstacle to the settlement of the Arab–Israeli conflict. Naively enough, it believed that bringing water to a previously arid land would allow the permanent settlement of the Palestinian refugees via a land tenure reform. These refugees would become small farmers, it was hoped, who would change their perception of their identity and would give up their claim to return to their native land (Trottier, 2000).

Unsurprisingly, the project failed to accomplish such a goal. Sutcliffe's investigation among the farmers of the Ghor canal, in the 1960s showed that the Palestinian refugees still regarded themselves as Palestinians (Sutcliffe, 1969, 1973). Nowadays, they have mostly moved out of the Jordan Valley, where Asian workers are employed as laborers on land that was put under irrigation with the explicit purpose of rooting Palestinians into Jordanian land.

In this case, *water development* certainly provided "stabilizing distortions and rationalizations of complex realities." It was harnessed within a vain effort to achieve a permanent population displacement that would be accepted as legitimate by the refugees. The idea of *water development* has played an important role within Zionist ideology, as Clive Lipchin has demonstrated (2003). It has played a crucial role as well within Palestinian institution building since 1993. Here, the focus on the development of infrastructure to bring more water to the users distracted donors' attention from the construction of democratic institutions to manage them. If *water development* only meant increasing the water supply, it did not imply building sustainable democratic and widely accepted means of allocating, using, and accessing the resource.

2.2. Violent Conflict

A main achievement of state power in modern times has been the persuasion of the population concerning the legitimacy of the use of violence. In the western world, the idea according to which the state has a monopoly over the legitimate use of violence has become hegemonic. This legitimacy or lack of it confers the status of either murder or execution to what would otherwise be, technically, the same act. State violence is referred to as "war" or "police operation" whereas violence from another source is referred to as "terrorism" or "banditism." The labeling of identical acts as war acts or terrorist acts is often enough to categorize them as legitimate or not, since the cognitive map of each citizen has been structured according to this hegemonic concept.

Any group carrying out violent acts strives to label them as acts of war in order to secure that legitimacy. In the case of a body that is not a state, this has generally implied, over the last century, claiming to be a liberation movement that will eventually create a state. The objective of creating a state became necessary to acquire this legitimacy, even for groups such as the Kurds, whose form of political organization was not the territorial state (Badie, 1992).

The water war discourse started growing in a fertile soil where a very specific definition of water development had become hegemonic and where the only legitimate violent conflicts were believed to be wars between opposing states. Of course other hegemonic concepts contributed to this fertile ground: the idea according to which the state is the only institution spelling out the rules of social control and determining who will exercise this social control, for example. Investigating this assumption, Joel Migdal demonstrated how it rarely reflects reality, especially in the developing world. He developed his state-in-society model in order to account for the interaction between the state and the multiple other institutions that spell out the rules and exercise social control (Migdal, 1988, 2001). How western hegemonic concepts concerning the state's

role in society have obscured the understanding of water conflicts in the non-western world has been explored elsewhere (Trottier, 2003).

The eventual growth of the idea of water wars as a hegemonic concept must be analyzed within the context of other pre-existing and well-entrenched hegemonic concepts that distorted and rationalized unequal distributions of resources and specific distributions of power in various societies. These acted as building blocks supporting the growth of new concepts, they limited the range of options that appeared possible and they provided fences limiting the issue definitions: states wanted *water development* at all cost, therefore states might wage war in order to secure it. Such an issue definition precluded any consideration of the fact that water development could have a different meaning for various social groups, that states may not be the only social actors that benefit from *water development*, that other social groups may actually benefit from it more than the state itself while the state may loose from it, or that states rarely choose to go to war over one issue alone.

2.3. Water Wars

"Water conflicts will cause the wars of the twenty-first century." This is more than a catchy statement. It is the object of numerous arguments and counter-arguments in the scientific community, and much effort has been devoted either to proving or disproving the causality between water scarcity and water wars.

Thomas Naff and Ruth Matson seem to have launched the debate by arguing, "water runs both on and under the surface of politics in the Middle East" (Naff and Matson, 1984, p. 181) and analyzing the role played by water in riparian state relations. A series of publications followed, which supported the concept of the causal link between water and war (Starr, 1990; Starr and Stoll, 1988; Bulloch and Darwish, 1993; Biswas, 1994; Soffer, 1994, 1999). The development of this literature led Hussein Amery to refer to "the well-established and thoroughly documented positive link between resource scarcity and violent conflict" (Amery, 2001). Clearly the idea of a causal link between water scarcity and war has grown over the past twenty years to the point that it could become ideologically hegemonic. In March 2001, even Kofi Annan was declaring "and if we are not careful, future wars are going to be about water and not about oil" (Annan, 2001). This illustrates that the concept was not confined to academic circles and was structuring the thoughts of high-level political officers. The idea that competition for water in water-scarce areas constitutes the greatest danger of war was growing to be taken as a given, an unquestionable fact of life.

This school of thought led to what Ohlsson (1999) has called "the numbers game." As the causal link between water scarcity and war remained unchallenged, the relevant question appeared to be quantitative: how much renewable water existed within the boundaries of every state? How much constituted scarcity? Engineers and hydrogeologists produced numerous studies detailing the various quantities of water available to every state in arid zones, especially in the Middle East (Elmusa, 1996).

M. Falkenmark (1990) pioneered the idea of a water stress threshold. The ratio of the quantity of renewable water within a state's territory to that state's population was held as an indicator of water scarcity. Water security was achieved if the state contained more than 10,000 cubic meters per capita. Water availability was deemed adequate if the state contained from 10,000 to 1,666 cubic meters per capita. States endowed with 1,000 to 1,666 cubic meters per capita were deemed to be water stressed. They were said to be chronically water stressed if they contained between 500 and 1,000 cubic meters per capita and to lie beyond the water barrier if they contained less than 500. This indicator of water stress was essentially based on an estimate of the quantity needed in agricultural production using irrigation. A state that

could not be self-sufficient in food production was deemed to be water stressed although these per capita water quantities were sufficient to cover domestic needs.

Disturbing charts were drawn up, showing the various renewable water endowments of Middle East states (Beshorner, 1992). According to such an indicator, Turkey, Lebanon, and Iraq were deemed to have adequate water supplies while Israel, Jordan, the West Bank, and the Gaza Strip lay beyond the water barrier. Such inequality was deemed highly dangerous as it was thought it could propel the water-poor states to wage war on the water-rich states. This became the topic of detailed international relations study and social scientists followed suit by focusing on how international law could contribute to "just" and sustainable water sharing among states, suggesting various allocations among riparian states (Lowi 1993a, 1993b; Benvenisti and Gvirtzman, 1993). It is worth noting that the majority of the water war literature focused on the Middle East.

2.4. Water Peace

A second school of thought emerged throughout the 1990s, denying the causality between water scarcity and international war. J. A. Allan developed the concept of "virtual water" to describe the water necessary to produce imported food. Importing a ton of cereal was virtually equivalent to importing the corresponding quantity of water necessary to produce it. Allan demonstrated that more "virtual water" already flowed in the Middle East than real water flowed in the Nile (Allan, 1998). Indeed, by 1999 Jordan was already importing 91 percent, and Israel 87 percent, of their cereals (Postel, 1999). Food security does not necessarily entail food self-sufficiency, he argued. Calculating water stress indicators on the basis of the agricultural production capacity does not make it possible to predict the likelihood of war among states. Arid states have far more to gain from cooperation in keeping the price of cereals low in the international market than in wars against each other to appropriate the other's water (Allan, 1992).

In what is probably the most ambitious survey of water crises and treaties around the world carried out so far, Aaron Wolf (1998) argued that water has brought about much more interstate cooperation than conflict. He analyzed 412 crises among riparian states between 1918 and 1994 and identified only seven cases where water issues contributed to the dispute (Wolf, 1999). Empirical evidence thus seems to corroborate Allan's proposition.

Much of the water war literature had concentrated on the Middle East, especially on the Arab–Israeli conflict, and so did much of the water peace literature. Arnon Medzini focused on the link between water resources and the determination of the limits of the state of Israel. He argued that water did not play a role either in demarcating the mandate's border in 1923 or in determining the 1948 armistice line (Medzini, 1997). Gershon Baskin calculated that were Israel to buy in 1993 a quantity of water equivalent to that lying in the West Bank's aquifers, it would spend 0.67 percent of its GDP. No state in its right mind would ever go to war for a stake that was worth so little, said Baskin (1994). The authors promoting this second school of thought argued that states face water scarcity rationally and cooperate in order to solve these problems, simply because that is the most rational thing to do. The UNESCO launched a PCCP program in 2000, "From Potential Conflict to Cooperation Potential," in the hope of reversing the growth of the first school of thought and of persuading educators, decision makers, politicians, and diplomats that water generated cooperation much more frequently than war.

3. THE ANTHROPOMORPHIC STATE

The water war literature tends to perceive a rather anthropomorphic state, one that deals in a unified, coherent, and rational manner with its water needs. It assumes the need for *water development* and the response to this need within the state's foreign policy. This trend is much less dominant in the water peace literature. Tony Allan, for example, shows that states have spontaneously adjusted to importing their cereals without formulating a specific policy in this respect. Yet, many proponents of the water peace concept show a firm belief in the anthropomorphic state (for example: Ayeb, 1998).

The anthropomorphic state hardly resists scrutiny, however. In a careful study of Zionist attitudes towards water, Aaron Wolf showed how Aaron Aaronsohn stressed the need to secure all water resources feeding the country within the boundaries of the mandate over Palestine. His document, dated January 27 1919, explicitly calls for the boundary of Palestine to be that of its watersheds (Wolf, 1995). The official Zionist delegation to the peace conference adopted his arguments and boundary propositions, yet the final official propositions displeased him greatly. Indeed, once at the negotiating table, the boundaries had been redrawn according to other priorities. This version of events is also corroborated by Medzini's work: the French and English preoccupations with railway routes had gotten the better of Zionist aspirations to water (Medzini, 1997). An individual cannot afford to compromise his basic need to water, but statesmen undertaking international negotiations have a different prioritization of their needs. There is a limit to the anthropomorphic vision of the state. This is a distortion that rationalizes a more complex reality. It is a hegemonic concept that underlies the discourse on water war.

4. EXPLORING THE RISE AND FALL OF WATER WAR AND WATER PEACE AS HEGEMONIC CONCEPTS

4.1. Benefiting From the Water War Concept

The social groups that benefit from hegemonic concepts are not necessarily the ones that propagate and maintain the hegemony of these concepts. Identifying who benefits from the water war concept and who propagates it is worthwhile. The same exercise needs to be carried out in the case of the water peace discourse. The water war concept has been essentially developed using Middle East examples, which prompts us to identify first such social actors within the Israeli–Palestinian situation.

Perhaps few politicians have propagated the water war concept as bluntly as Raphael Eitan when he was minister of agriculture. He ran a full-page advertisement in the *Jerusalem Post* in the late 1980s arguing that Israel had no choice but to maintain the occupation of the West Bank in order to secure its access to water. The advertisement noted the interdependence of the aquifers in the West Bank and in Israel and went on:

> This intense interdependence and the scarcity of water supplies accentuate even more the severity of the problem of authority. For under such conditions, even if some sincere and trustworthy Palestinian party could be found with whom an agreement could be made, the problem of allocating such a vital and scarce shared resource would make disputes almost inevitable. . . . It is difficult to conceive of any political solution consistent with Israel's survival that does not involve complete, continued Israeli control of the water and sewerage systems, and of the associated infrastructure, including the power supply and road network, essential to

> their operation, maintenance, and accessibility. . . . This is an important point to ponder for those advocates of Israeli concessions who believe the Jews should have a viable independent state in their ancient homeland. It is important to realize that the claim to continued Israeli control over Judea and Samaria is not based on extremist fanaticism or religious mysticism but on a rational, healthy, and reasonable survival instinct.
>
> (Reproduced in Wolf, 1995, pp. 233–4)

Although Eitan did not use the words "water war" in this advert, he was advocating the continued military occupation of the West Bank for the sake of water. In 1994, Israel signed a peace treaty with Jordan whereby it agreed to give back land while it retained the right of access and use of its water. Indeed, article IV annex II of the 26 October 26 1994 peace treaty between Jordan and Israel deals with the area of Wadi Arava that was occupied by Israel in 1967. Article IV paragraph 1 declares that Jordan has sovereignty over the wells and the hydraulic systems that were built by Israel. However, Israel will maintain their sole use and can increase its withdrawal by 10 cubic hm a year according to article IV paragraph 3. The Israeli–Jordanian peace treaty weakens Eitan's argument. It shows that Israel can give back land to an Arab regime without endangering the security of its water supply from that land. Brandishing the water war argument was useful for Eitan because it allowed him to associate water access and water use to the survival of the Zionist goal: a Jewish state. It helped obscure the fact that farmers were using most of the water at a subsidized cost. Another politician could have chosen to emphasize that switching to virtual water would decrease the dependency on West Bank water and might have made a compromise on land acceptable. Such an option would have angered Eitan's constituency, as farming was deeply linked with Zionist ideology. Eitan preferred to promote the concept of water wars, regarding anyone who suggested Israel could evacuate the West Bank as an enemy supporter aiming to endanger Israel's water security and very survival.

Another set of social actors in Israel has benefited from the propagation of the belief in water wars: the companies that would benefit from building desalination plants. In early 2001, the Israeli newspapers were forecasting an impending water crisis and were multiplying interviews with Mekorot (state water utility) officials.[2] Curiously enough, much attention was paid to the unacceptability of the idea of forbidding people to water lawns and wash cars. Such measures are common in water rich countries in cases of drought, so their portrayal as unacceptable in an arid area was surprising. This "crisis" led the Israeli government to undertake the construction of desalination plants. Whether or not such desalination plants are affordable for the Israeli taxpayer is quite debatable. In 2002, the Israeli government expected the price of a cubic meter of desalinated water to amount to less than $0.50 a cubic meter.[3] Such a cost may very well prove to be unrealistic in the future and the real costs may very well rise far above this figure.[4] Facing such potential costs, taxpayers may recoil and may prefer to stop watering lawns. Averting a water war would provide a much better motivation to accept the burden of desalination.

In March 2002, two senior figures in Israel, the National Infrastructure Minister, Avigdor Lieberman, and the chairman of Mekorot, Urie Sagie, declared that Israel would have to reduce the quantity of water it transfers to Jordan and to the Palestinians (Rinat, 2002). The 1994 Israeli–Jordanian peace treaty specifies in its annex II a yearly water exchange between Israel and Jordan. A canal was built linking the Yarmuk to Tiberias Lake and allowing winter floodwaters from the Yarmuk to be used by Israel. In exchange, Israel provides some 55 million cubic meters of water to Jordan in summer. Ever since the conclusion of the peace treaty, Israeli politicians have repeatedly threatened not to honor their water commitment to Jordan. Such

aggressive rhetoric was generally aimed at the Israeli public and may have appeased those social groups who claimed greater water quotas.

Threatening to reduce the water transfers to the Jordanians and Palestinians just as the second Intifada was worsening in intensity certainly brought out the specter of water wars. "The officials responsible for the national water economy are anxiously awaiting the operation of several large water desalination plants scheduled to begin operating within two or three years," reported the press (Rinat, 2002). Certainly the specter of water wars should entice taxpayers to foot the very heavy bill for desalination better than the perspective of dried up lawns.

In Israel, the belief in water wars is now playing a role very similar to that played by *water development* in the United States in the 1930s. Some companies are reaping great benefits from the new desalination policy. Politicians are benefiting as well and taxpayers will foot the bill because the hegemonic concepts of *water development* and water wars lead them to accept this expensive undertaking as legitimate. In 2001, Mekorot, the Israeli national water company, was hoping to secure the contract for the construction of desalination plants. It therefore emphasized the crisis situation instead of promoting cuts on lawn watering and car washing (*Jerusalem Post*, January 23 2001).

Several Palestinian social actors have also benefited from the propagation of the water war concept. In a careful analysis of the evolution of Palestinian social structure, Glenn Robinson showed how three fundamental drives weakened the power of old Palestinian notable families after 1967. First, wage labor in Israel attracted the poorest and led to the virtual elimination of the Palestinian peasantry, which decreased the rural reliance on notable patronage. Second, land confiscations carried out by the Israelis undermined the very basis of the notables' power. Third, Palestinian universities were set up after 1972 and started producing a new elite that began a process of political mobilization in the 1980s. This new elite was the first generation of West Bankers and Gaza Strip Palestinians to be educated in Palestinian universities. It originated from social classes that had not had access to higher education previously, as two-thirds to three-quarters of students in Palestinian universities in the mid-1980s came from villages of refugee camps (Robinson, 1997, p. 35).

This new elite undermined both Israel's social control in the West Bank and the power of the Palestinian notable social class. Deprived of state institutions to integrate, it organized via numerous non-governmental organizations (NGOs). These targeted areas such as health, agriculture, or water because they could not officially appear as state building bodies. The first Intifada led to a decrease in the number of Palestinians employed as wage laborers in Israel and a concomitant rise in the agricultural work force in the West Bank. Estimated at 38,400 in 1987, the number of agricultural workers in the West Bank had risen to 50,200 in 1990 (Robinson, 1997, p. 63). The leadership provided to these "new peasants" now came from the NGOs set up by the new elite educated and mobilized in Palestinian universities. The development of agriculture here is limited by the development of irrigation. The Palestinian Hydrology Group (PHG), an NGO typical of this new leadership, started an extensive program of rainwater-harvesting cistern construction and well rehabilitation. It encouraged Palestinian farmers to pump their full quota of water. Indeed, by 1990, 38 percent of Palestinian-used West Bank wells sampled by H. Awartani, were pumping 90 percent or less of the quota attributed to them by the Israelis (Awartani, 1992, p. v). PHG encouraged farmers to pump their full quota or more, portraying it as a nationalist act: whatever water was not pumped was given away to the Israelis.[5]

Whereas the old notable families had drawn their power from the client relations they established and the redistribution of resources they were able to operate, the new elite drew its power from its nationalist credentials. The idea that the Israelis had occupied the West Bank to steal the Palestinian water could only support the

legitimacy of this new elite as it was undertaking *water development* programs. This new elite probably never manipulated such a concept cynically and seems to believe it sincerely. Harnessing the water wars concept was useful whereas questioning it was destabilizing, so the new elite had no interest in doing so.

Once the Palestinian Authority was set up, it found itself competing with the elite that emerged during the Intifada in the exercise of leadership and social control. The Palestinian Authority was therefore pulled into the propagation of the water war concept as it strove to acquire as much legitimacy as possible with the Palestinian population. In fact, the concept of water wars proves to be useful to both Israeli and Palestinian politicians who may find it more useful in the short term to focus their constituency's attention on the "other," on the enemy that appropriates its neighbor's resource unlawfully, rather than on the thorny issues of conservation and management. The latter imply cutbacks for some users and prioritization of the uses. Such topics are bound to anger certain social groups. In the Palestinian case, it raises the very thorny issue of property regimes concerning water. Most of the Palestinian-used water is presently governed by local oral customary institutions according to communitarian property regimes. Such a set up prevents any sectoral reallocation or geographical reallocation from being decided by the Palestinian Authority. Any attempt by the latter to modify these existing property regimes is bound to be extremely contentious.

4.2. Propagating the Water War Concept

As for all hegemonic concepts, many members of civil society who do not benefit at all from the propagation of the water war idea have nevertheless contributed to its growth and maintenance. University researchers and graduate students have clearly played an important role here. Fieldwork tends to be short and precious for many graduate students and researchers. Any student wishing to tackle the issue of water in the Arab–Israeli conflict will encounter an imposing literature based on the anthropomorphic state assumption that does not question the concept of water wars. The temptation is great, then, to join in the numbers game and merely attempt to quantify the water available and argue in favor of this or that water sharing which would satisfy international law best. This temptation is made all the greater by the fact that the student carrying out fieldwork will initially visit NGOs interested in the water issue, the libraries of which will be stocked with such literature. The student will rarely benefit from a long enough fieldwork to be able to invalidate the anthropomorphic state assumptions and to understand the complex interactions among the numerous social groups that compete for the control and the use of water.[6]

The press also plays a crucial role in the propagation of the water war concept. References to water wars systematically provide a catchy title, of course, while a quarter-page article rarely allows a journalist to dwell in depth on the complexity of water competitions. Curiously, the *Jerusalem Post* participated in propagating the idea of water wars when it showed a map of South Lebanon, then occupied by Israel, including a point where Israelis were supposed to extract water from the Litani River. No evidence existed concerning this water withdrawal, but the idea had become widespread enough for the newspaper to use such a map without discussing it. The Israeli press regularly raises the specter of water wars as well, when it reports Israeli announcements concerning its not "giving" water to Jordan this year. The press generally fails to point to the fact this is part of a water exchange with Jordan and generally pays little attention to the fact that such threats were not implemented in the past years.

Lustick emphasized the fact that hegemonic concepts "require some correspondence to 'objective' realities and interests" (Lustick, 1993, p. 121). The

water war concept certainly does have some correspondence to reality in the West Bank. The agreement signed by Israel and the Palestinians on September 28 1995 became famous for the annex 10, paragraph 20, article 40 of the Protocol concerning Civil Affairs, which lists the quantities of water from each of the three West Bank aquifers that will be used by Israelis and Palestinians during the interim period. In total, 82 percent of the water is supposed to be used by Israelis and 18 percent by the Palestinians. Such figures have been contested lately by the Palestinians, as part of their water share was yet to be *developed* at the time of signing the agreement, and it appears that the water of the eastern aquifer is too saline for domestic use. This could in effect mean that the real proportions of water use might amount to 85 percent and 15 percent. Such a leonine sharing provides supporters of the water war concept with their best argument as it grants Israelis a far higher per capita supply of water than it does the Palestinians. The flaw of the water war theory lies in the fact that it postulates that such an unequal distribution of resources would provide a motivation for a military occupation and for its maintenance. It lies in the fact that it does not deconstruct the "competition for water" into the numerous conflicts and competitions opposing a great variety of local, national, and international social actors. Such a deconstruction shows that many social actors of both nationalities are advantaged or disadvantaged by the present water sharing and water discourse.

4.3. Benefiting from the Water Peace Concept

Identifying which social actors benefit from the Water Peace concept is important in order to understand the impact of its propagation and of its eventual success as a hegemonic concept structuring our perception and interpretation of reality. Clearly, anyone with an interest in stability in the Middle East benefits from the propagation of the water peace concept. Citizens might be less receptive to military solutions if they strongly believe that cooperation alone will solve their crucial water problems. Whereas national politicians may derive a certain benefit from the water war concept, UN diplomats or EU envoys attempting to broker a sustainable peace deal may find it quite harmful for their purposes. Construction companies may derive as much benefit from the water peace concept as from the water war concept so long as it remains associated with *water development* in its narrow sense.

Many of the social actors benefiting from the water war concept seem to deploy their strategies on a local or a national scale. Conversely, many of the social actors benefiting from the water peace concept seem to deploy their strategies on a global scale.

4.4. Propagating the Water Peace Concept

Clearly, academics have been playing a key role in propagating the water peace concept. Whereas much popular literature has been devoted to the topic of water wars, the water peace literature has always targeted an academic readership.[7] Media such as the press could eventually be harnessed in the propagation of the water peace concept, just as they have been in that of the water war concept, but do not appear to have been so far. Several hypotheses can explain this phenomenon. Conflict resolution studies have often emphasized the greater popular appeal of a call to war over a call to cooperation. This does not necessarily mean that the water peace concept is doomed never to replace the water war concept in its hegemony. For example, the population of the western world now generally subscribes to the belief that "democracies do not wage war against each other," a hegemonic concept that feeds on the other present hegemonic belief in the higher value of democracy over other forms of governments.[8] Similarly, the belief that "the need to cooperate in facing water scarcity leads governments not to wage war against each other" could

eventually rise to hegemonic status. The main difficulty such a concept would have on its way to hegemony should be the clear benefit many politicians can have from advocating the water war concept in order to mobilize their constituencies. This benefit can take the shape of preventing challenging issues from emerging within the political arena, such as a critical investigation of the present water management or justifying a war or an occupation to the population, as was illustrated earlier.

The joint Israel–Palestinian call to protect water supplies on February 1 2001 provided the water peace camp with a precious argument. This document, concluded in an Israeli, Palestinian, and American meeting of the Joint Water Committee at Erez Crossing, aimed at keeping the water infrastructure out of the cycle of violence. The document declared that

> The two sides wish to bring to public attention that the Palestinian and Israeli water and wastewater infrastructure is mostly intertwined and serves both populations. . . . We call on the general public not to damage in any way the water infrastructure, including pipelines, pumping stations, drilling equipment, electricity systems, and any other related infrastructure.[9]

Ironically enough, the same political actors putting out such a water peace statement (the Israeli and Palestinian governments) contradicted this statement both in their actions and within other declarations. Damage to water infrastructure serving Palestinian towns was carried out by the Israeli military in Salfeet in the fall of 2000 and in Nablus and Ramallah in 2002, to name but a few examples. But the fact that both governments agreed to issue this joint statement shows that they are bowing to another pre-existing hegemonic concept: that of water as a basic human right. A fertile soil thus exists for the concept of water peace to take root. The possibility therefore exists for the water peace concept to eventually replace the water war concept in its hegemony.

5. WATER WAR VERSUS WATER PEACE: A WAR OF POSITION

The international water community is now engaged in a war of position according to Gramsci's definition. It aims to reverse the emergence of a hegemonic concept – "the competition for water will lead states to wage war to each other" – and to replace it with another: "the competition for water will lead states to cooperate with each other." Whether such a war of position succeeds or not is independent of the truthfulness of the statement. Investing in slogans, posters, and various other tools of propaganda may be very successful in the short term at least.

The research community can also choose the more arduous task of facing the history of the construction of the water wars concept. Analyzing the other existing hegemonic concepts that provided the soil in which it sprouted and grew, and deconstructing many ideas that are readily held as self-evident at the moment by most professionals involved in water development would be much more useful. Such a process may prove painful at times and may not lead to the uncritical adoption of the water peace theory as a new hegemonic concept. It will have a much more lasting impact though. It will broaden issue definitions and allow the consideration of many options that seem irrelevant to many at the moment. Several case studies should address these issues:

- How did the concept of water war originate?
- What underlying beliefs made its emergence possible?
- Who propagated it?
- By which means?

- Who is benefiting from it?

Similarly, it should address the same questions concerning the competing water peace concept. This will allow researchers to identify the mechanisms whereby such ideas are used. It will allow them to understand how they have narrowed the perceptions of the problems and of the possible solutions. Finally, it will allow a more holistic understanding of the water competitions and conflicts as well as of the potentially useful solutions.

The fields of political science and history can contribute to this effort because they provide the tools to investigate such questions. They offer the resources to challenge the hegemonic concepts that limit the vision of the water development professionals. They question the political and conceptual paradigms in which engineers, hydro geologists, and politicians have evolved. They allow the identification of many conflicts and competitions that were not previously taken into consideration simply because their existence and relevance were not even perceived. They therefore empower any social actor who strives to achieve water peace.

NOTES

1. The concept of virtual water has been developed by Tony Alan to describe the water necessary to produce a given quantity of food. Importing this food is the virtual equivalent of importing that water to grow the food locally. Tony Alan has thus advocated the use of water in sectors other than agriculture in order to generate added value that can be used to import much greater quantities of virtual water.
2. See the special Water Crisis series in the *Haaretz* throughout February–April 2001.
3. Interview with the Israeli Water Commissioner, Tel Aviv, March 4 2002.
4. Interview with Jeni Colbourne, Thames Water Company, 2002.
5. Interview carried out by the author, Falamiah, West Bank, 1998.
6. A good illustration of this phenomenon appears in Annette van Edig (May 1999), *Aspects of Palestinian Water Rights*, Ramallah Center for Human Rights Studies, Ramallah. Although the study is very rigorous as a legal analysis, some of the factual information is invalidated by field observations. (See pp. 46–9).
7. Examples of popular water war literature include M. de Villiers, *Water Wars: Is the World's Water Running Out?* (London, Weidenfeld and Nicolson, 1999), and John Bulloch and Adel Darwish, *Water Wars* (London, Victor Gollancz, 1993).
8. As all hegemonic concepts, this is another distortion of the reality which most citizens accommodate by automatically downgrading one of two states involved in a conflict to the status of dictatorship, no matter whether its leader was elected or not.
9. Joint Israel–Palestinian Call to Protect Water Supply, Jerusalem, February 1 2001, website of the Israeli Ministry of Foreign Affairs, http://www.mfa.gov.il

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SUMMARY: THE HISTORY AND FUTURE OF INTERNATIONAL RIVER BASINS

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This article is a contribution from UNESCO's International Hydrological Programme to the World Water Assessment Programme. It was prepared within the framework of the joint UNESCO–Green Cross International project entitled "From Potential Conflict to Cooperation Potential (PCCP): Water for Peace," and was made possible by the generous financial assistance of the Japanese government.

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CONTENTS

SUMMARY: THE HISTORY AND FUTURE OF INTERNATIONAL RIVER BASINS

In the most recent attempt to delineate international river basins, Wolf et al. (1999) found there to be 261 international transboundary basins that together cover 45.3 percent of the earth's land surface, encompass 40 percent of the world's population, and provide 60 percent of the earth's entire freshwater volume. A total of 145 countries' land areas fall partially or completely within international basins. Access to water is essential for the survival and prosperity of every culture. Although water wars are not common, the diminishing of water quality or quantity destabilizes regions, especially within transboundary basins (Wolf, 2002). As time goes on, water resources in fact are becoming progressively diminished while population is increasing, leading to greater scarcity of water (Hassan, 2002b). A number of researchers and politicians predict an increase in conflicts over water. Kofi Annan in 2001 stated "if we are not careful, future wars are going to be about water and not about oil." However, others believe that water, by its nature, requires rational decision making and cooperation (Trottier, 2002; Wolf, 2002). This paper summarizes the results from investigations conducted by six researchers involved with the PCCP program on the history of the interaction of people with water and the possibilities for the future of international water issues.

1. INTRODUCTION: THE STATE OF INTERNATIONAL WATERS

In the most recent attempt to delineate international river basins, Wolf et al. (1999) found there to be 261 international transboundary basins that together cover 45.3 percent of the earth's land surface, encompass 40 percent of the world's population, and provide 60 percent of the earth's entire freshwater volume. A total of 145 countries' land areas fall partially or completely within international basins. Access to water is essential for the survival and prosperity of every culture. Although water wars are not common, the diminishing of water quality or quantity destabilizes regions, especially within transboundary basins (Wolf, 2002). As time goes on, water resources in fact are becoming progressively diminished while population is increasing, leading to greater scarcity of water (Hassan, 2002b). A number of researchers and politicians predict an increase in conflicts over water. Kofi Annan in 2001 stated "if we are not careful, future wars are going to be about water and not about oil."[1] However, others believe that water, by its nature, requires rational decision making and cooperation (Trottier, 2002; Wolf, 2002). Here we look at the results from investigations conducted by six researchers on the history of the interaction of people with water and the possibilities for the future of international water issues.

2. The History of Water

In *Water Management and Early Civilizations: From Cooperation to Conflict*, Hassan examines the evolution of water issues that parallel the evolution of humans and society, highlighting major shifts in our relationship to water (Hassan, 2002b). Until approximately 16,000 years ago, hunters and foragers were continually moving to find water and food sources for survival. From 16,000 to 10,000 years ago, agriculture developed, and permanent human settlements came into being. People utilized natural irrigation and could store food and keep animals for some security. At this time, inequity in resource distribution became more evident. After several generations of farming, people experienced periodic shortages of water. In response, the first state societies formed to share in the labor, risk, and benefits of agriculture. By 5,200 years ago, this had led to more complex state societies united by a monarch, who was deemed a steward of the gods. This hierarchical arrangement provided greater order and allowed for more water works and resolution of disputes over resources. However, this order also introduced institutionalized inequality into history, with peasants farming the land to provide not only for their own families, but also for the appetite of the growing upper class.

In the period around 300 B.C., increased sharing of information under the Greek and Roman empires resulted in a much increased pace of technological development and proliferation of water technology throughout many civilizations. However, the rise of empires also led to heavy economic demands and military wars over resources linked to water. The metropolises that developed under empires housed great accumulations of people and demanded a concentrated supply of water that was provided with ambitious new technology. A later stage of global information sharing occurred from the eighth to the twelfth century under the Moslems after the fall of Rome.

The rise of the West changed the face of water by creating an economy and culture that depended upon banking, trade, and sea exploration. This eventually led to the industrialization that has occurred within the last 200 years, and hence also to a great increase in demand for water. Now the West, or the "developed" countries set international standards. Poor countries are faced with having to undergo rapid

industrialization to meet the demands of growing populations and the desire for an increased standard of living. This results in hasty development of water resources at the expense of indigenous people and ecosystems. Hassan (2002b) compares our modern condition to that of Rome shortly before its fall, where there was "unprecedented stress on water resources" and "corruption, ostentatious consumption, and greed."

2.2. Legal and Economic Evolution

2.2.1. Legal

In *Historical Explanation and Water Issues*, Reuss charts the legal and economic evolution of river basin planning with an emphasis on recent historical events.[2] In the ancient world, the state often asserted power over water resources, though in practice riparian communities controlled navigation and commerce. Rulers built canals and dams, and the states parceled out the water, but this allocation was often repudiated. From Roman times on, regulations and custom became the managing mechanisms for water. Most commonly, customary practice was the deciding factor in water rights.

In Europe by the 1800s, there were generally policies of freedom of navigation with regulations imposed. By the twentieth century, multipurpose river basin development was prevalent. The Madrid Declaration of the International Law Institute in 1911 and later the International Law Association (ILA) in 1956 devised utilitarian principles that stated that one riparian nation's use of a river should not interfere with the use of another riparian. In 1980, the ILA stipulated that a nation should minimize damage to a river outside its borders, and it later expanded the stipulations to include groundwater basins. In 1997, the United Nations Watercourses Convention stated that nations should minimize damage to rivers outside their borders or mitigate the damage done.

2.2.2. *Economic*

Within the last century, economics has taken an important role in water conflicts.[3] Welfare, or cost–benefit, economics was unsuccessful in handling transboundary water issues, as it did not account for important political, social, and institutional components involved. In the late 1950s, a multi-objective approach involving many parties was developed but was not often utilized because the time and cost were deemed too great. Today, social scientists identify socially feasible choices in water issues and the likely consequences of those choices. What is evident through this history of economics applied to transboundary water issues is that social and political objectives must take priority over economic efficiency.

3. ETHICS AND WATER

3.1. The Development of Ethics and its Association with Water Issues

In *Water for Peace: A Cultural Strategy*, Hassan contemplates human ethics and how our ethical system relates to water issues.[4] Humans everywhere are nearly identical in biology, and our sociality and intelligence have ensured our survival. Ethics, both our distinction between good and bad and our sense of justice, were born from these survival strategies. Strategies that ensured survival were deemed good while others were sanctioned as evil. Sharing has always been a basic positive mechanism for survival, and can be seen in the main tenets of most religions. Identification and mutual recognition of one another gives us a sense of our common humanity and

leads to our conception of justice. Claiming rights for oneself while violating those same rights of another is unjust and therefore evil.

In relation to water issues, these universal ethics of sharing and justice need to be called upon to peacefully resolve conflicts. An understanding of ethics can help a great deal in handling or preventing water conflicts. Conflict and cooperation are social processes based on human perception. When we recognize the heavy influence that sociality and culture have on our ethics, we can come to appreciate each other's viewpoint.

3.2. Changing Our Governing Ethics: The Hegemonic Concept

Trottier explores the hegemonic concepts that often go beyond universal ethics in relation to water conflict and cooperation, focusing on the Israeli–Palestinian conflict.[5] Hegemonic concepts "structure our cognitive maps and therefore contribute to shape our perception of the world, our definition of the issues we face, [and] the analyses we can achieve" (Trottier, 2002, p. 2). A hegemonic concept functions as common sense to society, where critical thinking is not utilized in making judgments. It is maintained by civil society and in many cases is a stable distortion of reality. Hegemonic concepts change as a result of the promotion of certain values and definitions by social groups.

Water as a basic human right is a hegemonic concept throughout the world. Often this has been translated to mean that it is right to bring water to people who are in places where they do not naturally have enough water to survive. This has led to the notion of "water development," where water is brought to where it is deemed to be needed. It is within this approach to resource allocation that the concept of water war has arisen in modern times. The idea of waging war for water has grown to the point where it may become a hegemonic concept, thus shaping our perceptions of water scarcity.

In examining the Israeli–Palestinian conflict, Trottier points out parties who benefit from or propagate the concept of water wars. Both sides have at times benefited from the concept. Both Israeli and Palestinian social actors have drummed up support for themselves under the guise of fighting a war against an enemy. The press propagates the concept since conflict usually provides arresting stories. Researchers and graduate students have also naively promoted this concept by studying the topic and publishing literature on water wars.

On the other hand, anyone with an interest in Middle East stability could benefit from the alternative concept of water peace. Academics and the media could participate in propagating the idea. As hegemonic concepts are very powerful and have great inertia, a war of position may need to be waged in order to stabilize water peace as a hegemonic concept over the concept of water war.

4. FROM THE PAST FORWARD

4.1. Critical Components to Successfully Managing Water

4.1.1. *Including Local Communities*

In *Untying the "Knot of Silence": Making Policy and Law Responsive to Local Normative Systems*, Mohamed-Katerere and van der Zaag investigate issues of customary law in southern Africa.[6] In many developing countries, state-run water management systems are not robust enough to handle conflict, in large part because it overrides local customary law in its management regime. Within southern Africa, customary law is often seen as something of the past, and tainted by the influences of

colonialism. However, customary law is something that is still very important to the practices of people there. Mohamed-Katerere and van der Zaag (2002, p. 4) state that although state law is treated as "a hegemonic instrument of great power," cultural, social, and economic systems as well as institutions are what give law power. Identifying and including the positive aspects of local customary law in any location where transboundary water issues are present may greatly encourage cooperation.

4.1.2. *Asking Critical Questions*

Reuss points out important questions to ask in any situation of water planning.[7] We must ask if in a given situation water can be subject to rational decision making, and think critically whether an equitable process might not be more valuable than physical objectives. Second, we need to ensure that in every instance of making decisions about water, we know who it is within the group of stakeholders and decision makers that represents nature. Third, we must ask if the conflict at hand is rooted in water issues or in cultural issues. Fourth, we must contemplate whether people have an inherent right to water and how that needs to be reflected in laws and regulations. Finally, we need to consider the distinction between scientists who make management decisions and managers who look to science for explanation and decide what skills are the most appropriate for any given situation.

4.1.3. *Building Institutional Capacity and Moving to a Needs-Based Approach*

In *Conflict and Cooperation: Survey of the Past and Reflections for the Future*, Wolf shares results from a survey of international water disputes using the recently developed Transboundary Freshwater Dispute Database.[8] A study of 1,381 conflictive and cooperative interactions over water shows that, despite the tensions that are inescapable when dealing with international resource issues, the instances of cooperation vastly outnumber those of conflict. The existence of institutions that can broker negotiations over water disputes greatly contributes to cooperative success. Furthermore, an institution's capacity to absorb change is also a key factor in the success of resolutions. Currently, no supranational agency exists for the purpose of handling transboundary water disputes.

In addition to institutional capacity, Wolf's surveys show that successful resolutions of international water disputes have often occurred when the focus of negotiations has moved from a rights-based perspective to a needs-based approach. Examining benefits at a regional level has been shown to be effective, with a focus not on dividing the water resources but rather on an equitable allocation of benefits, which can include financial resources, energy resources, political linkages, and access to data. This positive-sum allocations approach can be called a "basket of benefits," and allows for great creativity in resolving disputes.

4.2. The Future: Conflict or Cooperation?

Whether in fear or in hopeful anticipation, we move into the future of international water issues. So how can our history help us make decisions and what new developments do we need to account for? Reuss identifies factors in the postmodern world that will make our interactions with water different from those of the past (Reuss, 2002). New and continually developing approaches to probability and risk analysis change our view of reasonable risk. Increased interaction between local communities and global politics is taking place with advanced communication and transportation. More attention is being paid to environmental and social concerns in water planning. Water is becoming more widely recognized as having value beyond the expression of monetary worth. Wolf points out that in the future new technologies

to manipulate geographical data, model systems, and get real-time data in user-friendly formats will change the way water issues are handled (Wolf, 2002).

Our history allows us to look to the past to see how to be careful in the future (Hassan, 2002b). We have the option of utilizing our understanding of different people's relationship with water and our ethical systems to come to peaceful ends to disputes. We can work to propagate the hegemonic concept of water peace (Trottier, 2002), to promote the inclusion of local communities into decision making (Mohamed-Katerere and van der Zaag, 2002), and to prevent powerful private interests from governing these issues (Reuss, 2002). The choice exists for transboundary riparians between unilateral development that will lead to a crisis or institutional capacity building and diplomacy (Wolf, 2002). UNESCO can fulfill an important role in international water issues by providing the institutional capacity necessary to promote cooperation (Hassan, 2002a). Perhaps we can move towards positive-sum "basket of benefits" approaches to water disputes (Wolf, 2002). And as Hassan states, "Water could, in fact, serve as the midwife for a new just, and hence peaceful, global society" (2002a, p. 20).

NOTES

1. Kofi Annan, question and answer session after statement (SG/SM/7742) at the Federation of Indian Chambers of Commerce and Industry, New Delhi, March 15 2001 (reported in Trottier, 2002).
2. This section is drawn from Reuss, 2002.
3. This section is drawn from from Reuss, 2002.
4. This section is drawn from Hassan, 2002a.
5. This section is drawn from Trottier, 2002.
6. This section is drawn from from Mohamed-Katerere and van der Zaag, 2002.
7. This section from Reuss, 2002.
8. This section is drawn from Wolf, 2002.

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Index entries: international waters, history of water, hydropolitics

UNTYING THE "KNOT OF SILENCE"[1]

Making water policy and law responsive to local normative systems

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CONTENTS

UNTYING THE "KNOT OF SILENCE"

Contemporary water management regimes in many developing countries have been unable to meet the expectation of efficiency and sustainability. This is despite the specific incorporation of principles into national law that are intended to promote social equity, support increased opportunity for poor people, and promote management based on ecological considerations and "sound science." It seems that these evolving state-initiated water management regimes, like other recent attempts in natural resource management, are ill equipped to contain conflict and disputes. The literature suggests that at the crux of this is the failure to develop appropriate governance regimes that can address the full complexity at the user level (Murombedzi, 2001; Campbell et al., 2001; Mohamed-Katerere, 2001a). Although the improvement of governance regimes has been a key concern, little attention has been paid to the potential role of customary law and other locally developed legal or normative systems. This is so not withstanding the increasing recognition of the value of traditional water management.[2] Against this reality we look at how such systems can be used to support the development of improved managerial regimes.

Our main focus in this article is on Zimbabwe; however we also draw on case studies from elsewhere in Africa and beyond. We begin by explaining why it is important to consider customary law approaches in developing and improving governance regimes. In the second section, through a focus on colonially imposed law, we consider the interaction between state law and locally driven normative and value systems, and the implications of this for practice. We find that despite the formal marginalization of such systems, they have remained an important aspect of local practice. In the third section, we then look at how customary law approaches tally with new developments in state-driven water law reform, and find that customary law approaches have not been adequately accommodated. In the fourth section, we consider whether the institutional frameworks for participation, under the newly reformed water law of Zimbabwe, increase the opportunity for alternative norms to be taken into account, and hence their relevance. In the fifth section, we argue that policy and law development is more likely to be successful if it can face local normative systems head on; we consider approaches to policy- and law-making as well as conflict resolution that might take us through this impasse and assist in untying the knot of silence.

1. WHY CONSIDER CUSTOMARY LAW?

The lack of understanding about customary law has meant that highly simplistic notions prevail and plague not only practice but also intellectual discourse. One consequence of this is that customary law has not been considered seriously in designing managerial regimes. To a large extent discussion around customary law in southern Africa has been shaped by the historical reality that customary law was "applied, constructed, and distorted by the colonial experience" (Bentzon et al., 1998, p. 32) in ways that stifled its development.

Several approaches to the usefulness of customary law in the arena of natural resource management can be identified. First, customary law has often been dismissed as a creation of the colonial state (Ranger, 1983), and thus not useful as the basis for developing law and policy that is more responsive to local realities. The major flaw with this approach is its failure to distinguish between, on the one hand, the state's interpretation of custom, and on the other, the interpretation of the user. A second approach is to reject the state-defined customary law, to look for customary law in the period before colonialism, and to advocate its recognition as a means of correcting the past injustice of colonialism. The predominant policy and law-making response here has been that customary law is backward and antiquated, and thus inapplicable to contemporary realities. A third approach is to argue that the concept of customary law is in itself a misnomer, as during an earlier era there was "little incentive to create rules governing the use of natural resources if there was a relative abundance of that resource" (Dore, 2001, p. 2).

A major flaw, common to these three approaches, is the seeking of "customary law" in a bygone era; this exposes a major misconception of what custom is. A custom is simply a norm that has been practiced over a long period of time, and that is reasonable and certain. In these circumstances we speak of customary law. Customary law in this sense is not something that *was* but something that *is*. Thus, it is not the law that governed a bygone age but a vibrant body of rules and principles that are flexible and constantly growing in response to a changing world. It is, as such, the law as it applies today. Addressing issues of customary law and practice is not then about romantic clamor for the past, but about how people actually operate on a day-to-day basis. Understanding customary law is therefore essential for revealing the complexity of decision making and practice at the local level. Consequently, understanding it offers increased opportunity for creating better managerial regimes that draw on the strengths of actual local practice. Other research, for example, has demonstrated that when the full legal complexity on the ground is understood, new opportunities for negotiating and resolving conflict around rights are created (Bruns and Meinzen-Dick, 2000).

Another reason for the failure to consider customary law in developing new governance approaches lies in the "environmental objective" driven approach to good governance (Katerere and Mohamed-Katerere, 2002). A major concern for promoting such practice by environmental/developmental practitioners, policy makers, and analysts is the need to create ecological sustainability. Early governance models that prioritized participation focused on "buying" the allegiance of local people through addressing user needs and giving them a stake in externally conceptualized managerial models (Campbell et al., 2001).[3] Other concerns included the desire to lower costs and make management more efficient. The recognition of the rights of users – and in particular governance rights – is hardly ever addressed directly as a

prerequisite for good governance.[4] Instead, where they are considered it is simply as a matter of expediency. The Global Water Partnership, for example, states that:

> Good water governance exists where government bodies responsible for water establish an effective policy and legal framework to allocate and manage water resources in ways responsive to national, social and economic needs and to the long-term sustainability of the available water resources.
>
> (Global Water Partnership, http://www.gwpforum.org/)

At the global level, multilateral agreements such as the Convention on Biological Diversity, for example, advocate the recognition of local interests *in order to* establish managerial systems that promote sustainable use, and not because people have an entitlement to such participation. At the national level this approach is taken up and manifested in laws and policies premised on the theory that decentralization is essential for good management, as it circumvents illegal or unsustainable practices, or because the local knowledge of resource users is more likely to be directly applicable than centrally defined approaches (Derman et al., 2000), or because a decentralized approach is more cost-effective than a centralized one (ibid).[5] Within these debates the issue of *rights of users* as the basis for legal reform is neglected. A rights approach necessarily puts users back in control and treats them as decision makers. Little attempt is made by policy and lawmakers to understand – and prioritize – the point of view of the people who are targets of the ever-growing body of rules and regulations (Von Benda-Beckmann et al., p. 83) notwithstanding the formal commitment to participation and human rights.[6]

One consequence of the prevailing approach to governance is that the value of local law systems is seen as only having relevance at the micro level. Little consideration is given to how it can be used in developing national, regional, and international law systems.[7]

2. LAW-PRACTICE NEXUS

One of the key reasons for the policy and legal failure to achieve desired outcomes is that policy and lawmakers have not understood the nexus between law and practice. Law has been treated as if it is all-pervasive – a hegemonic instrument of great power – that can change management in defined ways and create new ways of doing things that become universally accepted by the simple statement of enactment. The reality however is quite different.

The impact of law – how it is lived and experienced – is determined by its strength vis-à-vis other value and rule systems, including social, cultural, economic, and implementation systems, as well as its relationship to other institutions. Schuler, for example, argues that the law is more than just the written rule, but includes a structural component that implements, administers and enforces it, and a cultural component, which comprises the attitudes and behaviors that influence its interpretation (Schuler, 1986, pp. 22–3). The reach of the law is borne of complex social and political systems. Far from being a unilateral intervention, the law unfolds in complex and unexpected ways – and its outcomes are the products of multiple contestations, confrontations, and compromises.

The advent of colonialism ushered in new laws, across what today are euphemistically called the "developing countries," and altered existing legal systems. The impact of these imposed legal regimes varied considerably, not just between different countries but also within countries. To a large extent the success of these state interventions depended on the administrative and financial capacity and the interests of the colonial power. So, for example, in Mozambique customary systems remained largely intact. However, while there were areas where statute law became dominant, there are also areas where the reach of statute law was imperfect – leaving pockets of water use managed on the basis of customary beliefs and values. There were also systems, such as the legal system in Zimbabwe, that recognized customary law in certain statutory defined areas but not in others. However, even where there was displacement of traditional law and institutions, it hardly ever resulted in local systems being completely jettisoned – instead there is evidence of the emergence of systems that modified, and sometimes distorted, local law. In some areas, local use became a mix of state-imposed value systems and customary values in which, as Spiertz and Wiber postulate (1996, p.3), individuals in daily life are confronted with several, often conflicting, regulatory regimes. Here individuals may be seen as simultaneously belonging to many different fields. The individual choice about where they locate themselves is shaped by both experience of history and the memory of it, the understanding of and the location in the present, and the opportunities envisaged for the future. In other areas customary practices were relatively untouched. So for example, despite the imposition by the state of a water regime in the early 1950s in Zimbabwe that set up new departments, a specialist water court, new legal procedures, and technical criteria for water management that effectively favored settler and state run irrigation systems and treated indigenous African practices as wasteful and illegal, areas of customary practice remained (Bolding et al., 1996, p. 193).

The survival of customary practice is almost always overshadowed by the reality that the legal supremacy of the imposed law was clearly established. In the case of conflict between local people and settlers, or local people and the state, it is this imposed legal regime that is authoritative. This checkered, *de facto*, status of customary law and the supremacy of imposed law, as developed and modified by the new regimes, has continued into the independence era (Box 1).

Box 1. **Competing for Nyanyadzi river water, Zimbabwe (Source: Bolding et al., 1996)**

The Nyanyadzi river flows from its origins in the eastern highlands of Chimanimani district westward into the Odzi river, which in turn flows into the Save river. The Nyanyadzi river and its main tributaries, the Shinja, Biriwiri, and Makwe streams, collect water from a catchment area of 800 km^2. On its descent, the river passes through extensively used large-scale commercial farmlands, resettlement and communal areas, flowing from a lush, high rainfall area (1200 mm annually) into the dry, sparsely vegetated lowveld (400 mm annually).

Irrigation development in the Nyanyadzi catchment may date back to pre-colonial times, but major developments started early in the twentieth century. White settlers built furrows; and farm labourers, tenant farmers, and communal farmers soon followed this example. In 1934, the government started the Nyanyadzi irrigation project (420 ha), located at the downstream end of the

catchment. Already by 1938 it was found that upstream African-owned furrows competed for water with the state-initiated Nyanyadzi project. The government used the Water Act and the Natural Resources Act to squash indigenous irrigation furrows and to declare the wetland cultivation practice of *matoro* illegal. It was claimed that informal furrows were wasting water, and that wetland cultivation was destructive, causing siltation.

The Water Act, adopted in 1927, created an opportunity for the white settlers to formalize their rights to water. For African farmers, in contrast, it became a tool of dispossession. In 1952 the Water Court sent a team of water engineers to investigate the situation. Again unauthorized African furrows were declared illegal. In addition, the priority right of the Nyanyadzi project was made subservient to the more recent water rights of upstream European farms, contradicting the 1927 Act. Although the water administration established a semblance of rigid order (issuing rights to absolute volumes of water that relied on self monitoring by users), neither the Nyanyadzi river water nor its users complied.

During the late 1970s, at the peak of Zimbabwe's liberation war, groups of labour tenants and land-hungry communal farmers invaded the empty farms in the middle range of the catchment and started using the existing irrigation furrows as well as building new ones. The spatial set-up of these furrows respected the local hydrology. Management of the furrows was mostly mediated by a headman, who in using the principle of sharing of water, established a system of turn taking. Management remained outside government control.

By the 1990s, plot holders in the Nyanyadzi irrigation project were faced with frequent water shortages. The water administration, however, failed to find a suitable and lasting solution. As a consequence, the plot holders and the project's management had no option other than to take the initiative. They organized raids up the river, destroying the diversion structures of the numerous informal furrows. The raids were futile: the effect was minimal in terms of water reaching the project, and the destructive raids were opposed by politicians and extension workers in the middle range of the catchment.

Since then, the District Administrator has twice brokered a "fair" water sharing arrangement between the informal and formal irrigators. The deal was: one week the upstream furrows along Nyanyadzi river take in water; the next week they close their intakes and let the water flow to the Nyanyadzi irrigation project intake. The District Administrator deployed these principles of "sharing" water in a "fair" manner. Both principles seem to have been derived from the way the informal furrows were being managed in practice, and not from the Water Act of 1976. In fact, concepts of "water sharing" and "fairness" were foreign to this Act, which was based on the entirely different principle of "appropriation," with the oldest rights having the first call on the water.

However, the water left in the river during alternate weeks never reached the project intake: the water percolated and evaporated on its way down through a dry riverbed. Had the deal included the entire catchment area (further upstream there are many large water consumers), the fair deal might have worked.

3. LAW REFORM

In all the South African Development Community (SADC) states, colonialism resulted in authority for water being legally located in the state. State institutions became the primary vehicle for distributing and allocating water. Principles drawn from English and European continental law became the ultimate or final basis for water allocation. These included exclusive riparian rights, allocation on the basis of optimal economic

use, the recognition of priority rights (first in time, first in right approach) and the holding of rights in perpetuity (Hellum, 2001, p.9). The inherited water law in the SADC region remained largely untouched until the 1990s. Also in several countries in southern Africa, customary systems were further weakened by the newly independent states that saw traditional leaders as collaborators (as in the case of Zimbabwe), or customary law as archaic (as in Mozambique).

A bouquet of factors drives the impetus for legal reform. At the international level the drive to sustainable development, with its combination of liberalist[8] and welfarist approaches (Hellum, 2001, p. 2), was key. As a consequence, the overall regime is full of contradictions. An example is the global shift in water management from treating water as a free public good to an economic good while simultaneously recognizing the need for development. This sustainable development drive is manifested in the proliferation of multilateral environmental agreements. These include multilateral agreements such as the UNCED Declaration, the UN Water Convention, SADC Treaty, and SADC Water Protocol. These globally defined approaches dovetail with an increasing concern at the national level to address the contradictions and constraints for water management and development created by the colonial legal regime, which in turn have resulted in water management regimes with multiple, and sometimes, conflicting values. Local driving forces for reform included the increased pressures on water resources, as a result of population growth and economic development, as well as a new focus on social and economic justice. Also important was the growing perception that problems of water scarcity were increasing. A key factor in many of the southern African countries was the ceiling to development and social prosperity, which racially skewed access to resources and thus placed limits on economic and development opportunities for the poor. For example, within the irrigation sector in Zimbabwe, commercial farmers (predominantly white) use 84 percent of the available water while small-scale and subsistence farmers (predominantly black) use only 7 percent (Hellum, 2001, p. 3). Consequently, water policy and law represent the complex interplay between multiple interests, priorities, and approaches that, as Derman et al. (2000) argue in the case of Zimbabwe, are not always compatible.

Many of these reforms embrace, albeit to varying degrees, principles of equity, efficiency, ecological integrity, and sustainability. They aim to:

- manage water in hydrological rather than administrative units
- give priority to primary uses
- ensure the productive use of water
- acknowledge the right of the environment to sufficient water of sufficient quality
- acknowledge rights to water of riparian countries
- treat water as an economic good and apply mechanisms aimed at financial sustainability, such as user pays, or the polluter pays
- involve water users in water management, although their role may be limited
- devolve certain responsibilities to lower levels.

These reforms are relatively recent, and therefore how they interact with customary approaches is not always clear, although it would appear that:

> The reform process is a site of tensions and conflicts between values and principles embedded in liberal economic thinking and more welfarist concerns embedded in both human rights and African customary laws.
>
> (Hellum, 2001, p. 11)

3.1. Title

Rights within statute and custom may be conceptualized in fundamentally different ways. One key difference is the approach to title, and this has implications for managerial approaches. Several issues arise here, including the "legitimacy" of a user-pays approach, and state authority, as well as how basic needs are taken into account.

3.1.1. User Pays Approach

Throughout southern Africa the new managerial regimes, consistent with the global approach, treat water as an economic good and vest ownership in the state.[9] On this basis several southern African states established regimes to charge for non-primary use. However, the approach in customary practice and law, throughout the region, is that water is treated as a god-given resource that all are entitled to use (Bolding et al., 1996; Sithole, 2000; Mohamed-Katerere, 1996, 2001a, 2001b; Mulwafu and Khaila, 2000). The statutory law approach raises two issues at the local level – first, the state's title to water, and second, its authority to charge for it.

In Zimbabwe, for example, the Act vests title in the state and requires all users to apply for a permit to use water other than for primary purposes. That there were differences about this was evident in the consultative meetings for the establishment of the new catchment councils under the new Water Act (Sithole, 2000). Interestingly communal land stakeholders, in the Mazoe catchment area, accepted that there are circumstances under which payment might be justified, for example where a level of personal control is evident. They observed that the "person who impounds the water is the one who makes the river dry" (Sithole, 2000, p. 7). Thus, it is acceptable that water stored in dams, but not that sourced from small weirs, boreholes, and pools, should be paid for. One participant states, "this water that you want permits for, who is making it, who is its owner?" – essentially rejecting the notion that we control water that is flowing (ibid). In rejecting this, the moderator replied, "water is water, no distinction is made about source, it is use that will determine whether water is paid for" (Sithole, 2000). In what seems to be a veiled rejection of the right of the state to charge, the chiefs in Nyadiri sub-catchment stated:

> Most people did not know about permits, the meeting was the first time they were being told about such issues or indeed being asked to get involved. As far as water is concerned most people follow the ways of their forefathers and are not aware that this or that use is illegal.
>
> (Sithole, 2000, p. 8)

Writing about another district, Lue-Mbizvo and Mohamed (1993) note that where the laws prohibit local practice, these practices are continued, although in discussions inhabitants will feign compliance or ignorance. Attitudes around paying for water may be attributed to other considerations – with customary law simply becoming the vocal justification. These might include the desire to keep operating costs low, as in an increasingly competitive global economy many simply cannot afford to pay for it (Derman and Ferguson, 2000, p. 15). Skepticism around payment levies, in the Zimbabwean context, by people in communal areas may also be linked to the "plethora of failed promises for the delivery of water and water related services over the years, and the fact that they have received little access to subsidized water held in government dams" (Ferguson and Derman, 1999, p. 10).

3.1.2. Sharing vs. Private Rights

Within both statutory and customary law approaches there is a superficial convergence in the recognition of primary rights. Issues of equity and the protection of basic needs are recognized in statute throughout the southern African region.

In customary law the protection of basic rights seems to be derived from the approach that water is god-given. For example, communities along the Likangala River in Malawi assert that the water in the river is seen as a "gift from god to his creation," and consequently all people have the right to use the water for any purpose, although this right is limited by the needs of others (Mulwafu and Khaila, 2000, p. 4). Customary practice in Zimbabwe also seems to suggest that no person can be denied access to life-giving natural resources, such as land (including forests, fruits, and animals) and water.

Several tensions with state law may be identified. Superficially, the focus on equity in new water law reforms appears to be consistent with customary law approaches. However, the reality of much state law, for example in Zimbabwe, is that equity is just one principle amongst many in water allocation, and hence its application is tied up with an ability to demonstrate economic beneficial use, and so on. A further problem is that despite the formal legal commitment to equity, no measures are created to make this a reality. In Zimbabwe communal stakeholders are very aware of this. They also question what these primary needs are that statute law protects. There is some suggestion that there is no convergence here – as one chief in Nyadiri sub-catchment states, "our concern is for our tiny gardens," a use that is excluded from Zimbabwe's legal definition of primary. The statute restricts primary use to the reasonable use of water for basic domestic human needs in or about the area of residential premises, livestock watering, domestic brick making and dip tanks.

There are many misconceptions about what the principle that water is god-given means for private use and ownership. A growing body of literature, however, suggests that it does not mean that water, under customary practice, can never be subject to hierarchical or private control. For example in the Likangala community in Malawi, when an individual takes control over water and invests his/her labor in it, that person becomes entitled to its private use. Thus somebody who has dug a well is entitled to use it for any purposes to the exclusion of others. Similar arrangements are found in Botswana (Schapera, 1938, 1943, cited in FAO, 1996). Labor often defines entitlement.[10] The degree of exclusion of others that an investor may claim is, however, hardly ever absolute. Approaches to "private title" may vary considerably. It seems that any private right is limited by the basic needs of others who have a right to use water for domestic or survival purposes. This finds support within statutory laws, although here too, as suggested above, there is a difference about what is seen as essential use. Box 2 illustrates how the metaphysical affects use. In Zimbabwe, a tension is also evident between these users and well-established commercial farmers that have a vested interest in exclusive and absolute private control.[11] Sithole (2000, p. 7) sums up the attitude of commercial farmers as, "what is private remains private whatever the circumstances."

Some secondary rights to water, it seems, may be accorded a higher status than others. Literature from around Africa and Asia demonstrates that social organization and power relations may be tied up, albeit in different ways, with the allocation and use of water (Fleuret, 1985, on the Taita Hills, Kenya). In some areas of Zimbabwe, ruling lineages have "more" access to some crucial natural resources than other

members of the community. For instance, access to wetlands (a crucial resource in water-stricken Zimbabwe) is often limited to a few extended families considered to have settled there first, or to those who "conquered" them (see Box 3).

Box 2. **Sharing the fruits of the land (Chief Chitanga Chitanga)**[12]

Living in harmony is the grain of our life. We live with others, they live with us. If the customs and the laws agree, people live together in harmony. The elders initiated the young in the ways of respecting the land, the soils where the bones of their fathers and mothers rest.… Elders are nearer to the ancestors.... This marula wine we drink cannot be sold as respect for our ancestors. The elders taught that the marula tree and other fruits were not to be eaten without the elders having told the ancestors, through a small ritual, that we are now drinking what nature and the ancestors have provided. Our ancestors gave us these wild fruits. There is no human labor in the growing of these trees. Such fruits must not be sold. We now sell what was never sold in the olden days. Maize, crops, they were not for sale. They were to be shared with all.… Life is sacred, not wealth. Life is to be respected. Wealth is good, but it must be accompanied by *hunhu*, a deep humanity that is in humility. Respect is given by others not by yourself.... *Kunzi munhu vamwe.* To be called human is to be named. The good person respects the moral law of the land. The person keeps the law and the laws keep him.

Box 3. **Control over wetlands in Zimbabwe (Source: Scoones and Cousins, 1994, pp. 584–5)**

Control over the *dambo* resource for agriculture has varied over time. Claims have been made by lineage leaders, by "ordinary people," and by the state, through the imposition of environmental legislation. Each group of actors has used differing arguments to legitimize its claims. Ruling lineages claim legitimacy on the basis of "sacredness" and the "authority of the ancestral spirits"; they use this to exert control over outsiders who are in competition for use of key *dambo* resources – notably water. Claims made by others – for example, immigrant households wanting to establish a garden, the colonial state to intervene and conserve the area, or development agencies wanting to develop the area – have sometimes been opposed by political-religious arguments that support resource control being maintained by ruling lineage groups. The disrespect of outsiders is often blamed for damage to *dambo* water sources.

It may seem that the seniority principle may be likened to the "priority date" system of water appropriation and allocation, which was the cornerstone of Zimbabwe's 1976 Water Act. However, in reality no "absolute" ownership is conferred, as was the case with water rights under the 1976 Act. A case in point is rainmaking ceremonies. Often, the ruling lineages are dependent on the conquered lineages for these ceremonies to be properly conducted, since the latter will be acknowledged to

have the oldest ancestors buried at sacred places, who have to be consulted if it is to rain (see Box 4).

Box 4. **Drought and conflict in Mutema, Zimbabwe (Source: Vijfhuizen, 1999)**

In Mutema, Zimbabwe, people believe that royal ancestral spirits bring rain. In 1995 it did not rain. In a particular village of the Mutema chieftaincy it was believed that this problem was caused by a sharp division within the village about the rights and authority of two distinct groups. Chief Nyagoya originally founded the village in around 1740. In around 1800 Chief Makopa occupied the village, and from then his descendants ruled the village, and occupied most of the agricultural land. As one villager, a descendant of Nyagoya, explained:

"The present headman cannot be responsible for worshipping. He has only one forefather [buried at the sacred forest] and we have maybe seven or eight. So that forest is ours. If the present headman worships there, the forefathers will not answer him, because they are our forefathers."

The headman, who took this case to the spirit medium of Makopa, said: "The spirit medium had said: 'You should work together and cooperate.' But there is no cooperation between the descendants of the first village chief and the present one. If there is no cooperation, there is no rain."

3.2. What Constitutes Efficient Management?

There seem to be fundamental differences in how efficient management is conceptualized in state law regimes and local law. Notwithstanding an increased shift, within the legislation in Zimbabwe, to consider social equity issues and ecological needs, at the end of the day the driving consideration is likely to be the use to which the water is being put – its efficiency and economic value. These however are not value-free concepts. Customary law appears to take a much more holistic approach to management with the multiple functions of natural resources being treated as part of a composite whole (Mohamed-Katerere, 1996; see also Cullinan, 2002).

There seems to be some congruence between the concept of "ecological integrity," which is now enshrined in Zimbabwe's new Water Act through the reservation of water for the environment, and the customary practice that people should not tamper too much with a god-given resource. This, for example, is manifested not just as secular type rules but also taboos or spiritual sanctions (Box 5).

4. OPPORTUNITIES TO BE HEARD UNDER NEW WATER LAW REFORMS

All legal systems are concerned to a greater or lesser extent with how one recognizes public interests – however opportunities to be heard may take many forms. Western law often allows for public participation through recognizing a right to object to a decision rather than to be party to the original decision. In recent years these parameters have, in the area of natural resource management, been extended significantly as there is increasing awareness of the need for local acceptance of

managerial approaches. Zimbabwe's Water Act attempts to do this through the creation of catchment councils that include the full diversity of stakeholders. For proponents of the law reform initiatives it was thought that by improving the "democratic profile" of the law, new opportunities for users previously excluded would be created.

Box 5. **Irrigation furrows in eastern Zimbabwe (Source: Bolding et al., 1996)**

In a communal area in eastern Zimbabwe, farmers have long built and used irrigation furrows, but never bothered to apply for formal water rights. Some twenty furrows exist that irrigate some 50 hectares. Two furrows stand out in size: one has a length of 1,200 meters and irrigates 15 hectares; the other is comprised of a main furrow that bifurcates into two subsidiary furrows with a total length of 1,600 meters, irrigating 10 hectares. The first-mentioned furrow was built around 1900 and extended in 1932. The second was built around 1945. Irrigation in this communal area may be characterized as follows:

- No formal water rights exist, but there is a strong sense of a historical user right to river water for irrigation.
- The furrows are simple and straightforward earthen constructions that are adequately laid out, nicely meandering along the hill slopes.
- The furrow intakes at the river are not permanent structures and are made of locally available materials such as rocks and sticks. They all leak and have to be rebuilt every year. There is a taboo on making the intakes in the river from concrete.
- The furrows do not divert all water from the river. One woman irrigator explained: "the Chief doesn't allow us to take all the water". The deputy chief later confirmed this: "We can't take all the water at the intake because it may kill the water creatures (*mugadzemvura*)".
- The furrows regularly experience head- and tail-problems; that is, irrigators located near the intake of a particular furrow may find it easier to access water than those with plots at the tail end. This situation sometimes causes open conflict – however this is often avoided by the simple fact that tail-enders initiate repair and maintenance activities along a furrow, and thus increase the flow available to them.
- Water allocation is based not on a formal "Agritex[13] system" but on a "cultural" system, as an irrigator once put it. People say: "Along a furrow people just share the water." One farmer explained canal organization thus: "We work together to construct the furrow, every year we reconstruct it in April. We are from the same village. Nobody is in charge of distribution. We give each other chances." In case of conflicts, the traditional village leaders mediate (Bolding et al., 1996; Fortmann and Nhira, 1992; Mohamed-Katerere, 1996).

By and large it seems that these reforms have not fundamentally altered the relationship between different normative and law systems, and thus have not created the opportunity for "free" decision making at the local level. Several issues are worth considering here, as they shed light on the law–practice nexus and the impact of the reforms on customary law and actual practice.

First, there is an assumption that these new processes will create opportunities for local interests to be better heard and incorporated into managerial processes. This is premised on an assumption that legal equality is a sufficient condition to bring previously excluded groups into the fold. This neglects the vast global and local experience in addressing and changing rights regimes. In Zimbabwe, the issues of both gender and land are key, and several lessons are evident from the struggles involving these issues. One important lesson is that the formal creation of equality in law has not resulted in equality in practice. Sithole (2000), for example, demonstrates, in her discussion of stakeholder participation in Zimbabwe, that the reality is dependent upon more than just legal entitlement. She notes that the uneven playing field influences how the various stakeholders participate. In part this can be attributed to the fact that these new rights are not accompanied by "legal tools" that can be used by rural people to assert their interests and ensure they are taken into account. Another important factor here is that the law is not known by many rural people, and of those that do know it, many find it alienating, as the concepts used are foreign to them. Legal rights are only real when their holders are able to use them.

A second problem is that the framework for discussion is predefined and does not really allow for other approaches to addressing issues, and thus it effectively curtails and limits decision making. Water rights, for example, are set out in ways that allow for little modification. The principle of user pays could be approached more flexibly to take into account local concerns. Another example of the rigid approach of the authority of the state is the failure to accommodate or acknowledge other claims, including historical rights. This failure to allow multiple approaches is key for the current impasse ("knot of silence"[14]) and the failure to move beyond conflict-generating regimes. This overall attitude is summed up in the words of a Zimbabwean spirit medium noting that:

> One of our problems is the new wisdom. It does not accommodate the old wisdom of our peoples. There is a conflict of wisdoms. The new wisdom is the wisdom of defeat, of conquering other wisdoms. The new wisdom fought to gain its space. The old wisdom does not fight for its space. It withdrew and looked forward to the day when it will be sought once more.[15]

Box 6. **The property factor in irrigation management (Source: Coward, 1986a, 1986b)**

Irrigation development can be considered a process of property creation. As new objects of property (such as weirs, canals, water rights) are created, new relationships among people emerge. Ownership of and responsibility for irrigation works (their operation and maintenance) nearly always coincide. The group that makes the original irrigation investment often also has the responsibility for the upkeep of these facilities. By focusing on property relations, irrigation development can be improved through joining state and local actions.

Irrigation development involves interplay of state and local initiatives. The success of these is tied to the relationship between the state and local irrigators. These relationships are often problematic, and at the heart of this lies the fact that property arrangements are often ill defined.

Many local systems focus on sharing. These have clearly defined property rights. In these systems, one's property right represents a portion of the total

water supply available (or sometimes a share of time, which is a proxy measure of a share of water). Such a share system creates property rights that are a response to particular circumstances. For example, it can be an effective instrument for allocating an uncertain water supply – each share increases and decreases with the stream flow being diverted.

In many government-managed irrigation systems, the irrigators have no legally recognized water right, whether as claim to a certain amount of water or a portion of delivery time. This creates "temporary rights" in which irrigators become dependent on and compromised by state authority. In situations where the government builds a new irrigation scheme or rehabilitates an existing one, the irrigators may be excluded from the investment process. Perhaps the most fundamental consequence of this is that cultivators, as non-owners of the hydraulic property, are alienated from that property and may not act as though they are responsible for it (even though government wishes them to do so). If state investment occurs in settings with existing community irrigation facilities, the usual consequence is the destruction of existing property relationships. Consequently, these relationships no longer serve to organize social action. In such situations, irrigators typically assume that since the government built the irrigation facilities it owns them and is responsible for them.

Since the property factor is a basis for local action in irrigation activities, it is an important policy variable that needs to be incorporated in designing future irrigation development activities. The irrigation investment ought to proceed in such a way as to create hydraulic property for the group that is intended to operate and maintain the irrigation facilities that are created or improved. When such property relationships are in place, the possibility for collective action in sustaining those property objects is enhanced.

Coward (1986a) suggests three lines of action:

1. In cases where existing community schemes are being rehabilitated by the state, or incorporated into a larger, centrally managed scheme, the state should recognize and respect existing property rights.
2. The state shifts from direct investment for irrigation development (whereby it performs all activities related to scheme construction or rehabilitation) to indirect investment, whereby the state "matches" resources with resources provided by the community, without changing the property relationships.
3. Create social arrangements in which water allocation (and other fundamental tasks) is based on explicit and specified share concepts; which may induce property-based group action.

5. DEFINING APPROPRIATE RESPONSES

The challenge today is how to deal with these multiple normative frameworks and develop a water management regime that supports local people and encourages sustainable use. Such a regime must recognize that a favorable result is dependent on good social relations between people, and must encompass the complexity and extreme cultural variation (Spiertz and Wiber, 1996, p. 6) that is found locally. At the inter-state level, negotiations and allocations need to take the interests and rights of local water users into account. Given this, issues of governance need to be treated as central at all levels.

Also, there should be recognition that management and "reforms are likely to be more effective and have lower transaction costs if they build on and enhance the social capital of local institutions rather than destroying or disrupting them" (Bruns

and Meinzen Dick, 2000, p. 4). The same is true, *a fortiori*, for the material capital developed by such institutions (Box 6, Coward 1984a, 1984b). A key restraint to building such regimes is the failure to understand the local situation and to build on it in developing solutions. Thus, it is important that we make serious attempts to begin to understand customary law and local practice. As Chambers (cited in Scoones et al., 1996, p. 25) notes, this requires a reversal in established practice:

> Reversals imply a new professionalism. This is not a rejection of modern scientific knowledge, of research stations and laboratories, of scientific method. These remain potent, have their own viability, and will always have their place. Rather, it is a broadening, balancing, and up-ending, to give a new primacy to the realities and analyses of poor people themselves.

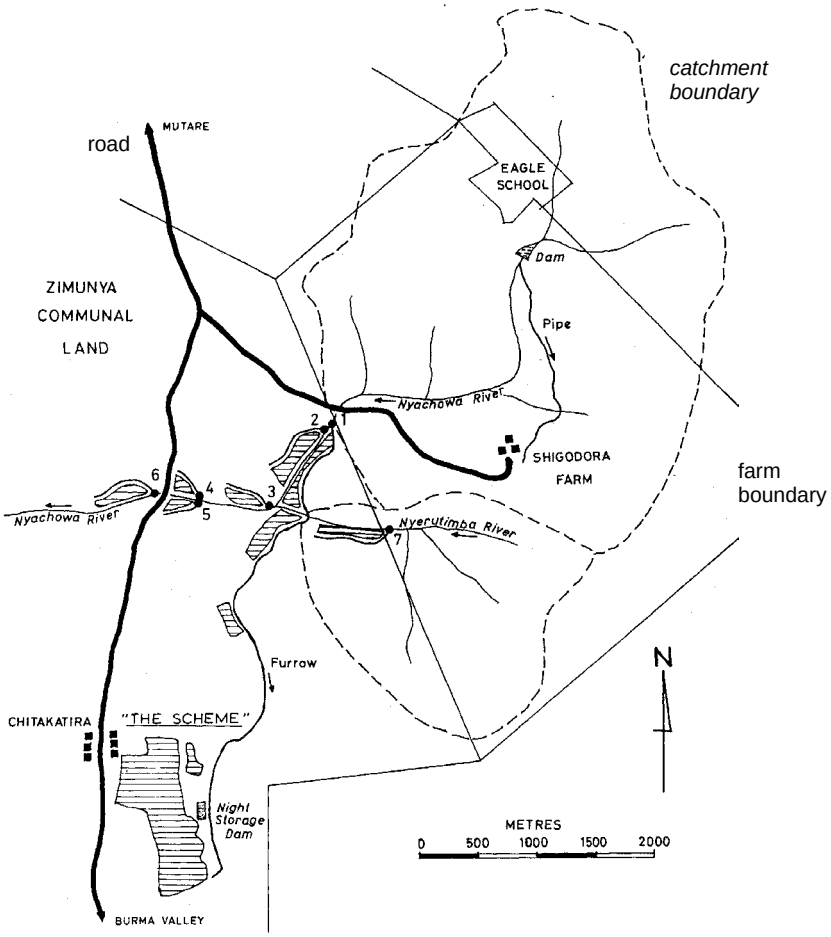
This implies that it is essential that there be a fundamental shift in the power relations between different actors in the development process (Scoones et al., 1996, p. 26).

5.1. Procedural law focus

There are several reasons why, when drawing lessons from customary law and revising governance systems to take customary law into account, it is more appropriate to focus on procedural law rather than on substantive law. First, historical experience has shown that attempts to codify and incorporate customary law into western-type systems have led to their distortion and reconstruction, and created an unresponsive and static set of rules (Ranger, 1983; Bentzon et al., 1998; Rwezura, 1995, in Bentzon 1998, p. 13; Sengupta, 2000; Vedeld, 1998; Von Benda-Beckmann et al., 1996, p. 82). In part, this is a result of the assumption that law is value-free and that the "rules" in customary law can be deconstructed and given the form of western law. This reveals a fundamental flaw in how customary law is conceptualized. Such conversions transform complex and ecologically sensitive practices into less sustainable forms. This loss is compounded by the fact that conversion usually opens non-state law to testing, on the basis of both form and context, by judges who rarely understand local modes of production or the ecological complexities in local environments (Wiber, 2002, p. 3). Second, the rules of customary law vary across societies. Thus it seems important not to elevate rules applicable in one context to another, but rather to give people a real choice about when to apply local rules. Third, the status of customary law and adherence to it varies across societies and also within societies. Increasingly, people within a single community contest its application, as the values and rules in it are held up against other normative systems, and evaluated against changing perceptions around rights, equity, and justice. Key issues here include changing perceptions about women's rights, patronage, lineage, and ancestral relationship, as well as democratic governance. A case in point is the manipulations of a traditional leader who used traditional imagery and spiritual guise to secure water for himself and other uplanders to the disadvantage of downstreamers (Box 7). Fourth, the role, legitimacy, and viability of traditional institutions are increasingly questioned as local people engage with new structures of decision making. Fifth, the role of customary law is being redefined, not only by the formal legal terrain but also by the demands of survival and shifting relations within communities. Increasingly, this means that even at the local level there may be conflicts between those that adhere to customary law and those that do not, over which legal system should have jurisdiction. Given this array of factors, legal codification that entrenches customary law rules as a solution in all circumstances is not the way forward. It is more appropriate to develop inclusive governance regimes in which real spaces for dialog about management are created. These spaces must amount to more than a rhetorical

commitment to participation, and must empower local communities to make effective choices.

Figure 1. Nyachowa catchment and its furrows



Note: The irrigation furrows in the communal area along the Nyachowa River are numbered 1–6.

Source: van der Zaag and Röling, 1996, p. 171.

5.2. Flexibility

In defining a role for local law in water resource management, note needs to be taken of its form. Although locally developed legal systems vary quite considerably, some general observations can be made about customary legal systems. A growing body of research suggests that customary law is built on principles, and these are manifested as spatially and temporally specific rules, resulting therefore in a rich and flexible legal system.

This flexibility is evident in many local law regimes in very diverse settings. Murgai (1998), for example, describes the flexibility in access regimes within a locally run irrigation scheme. In Pakistan, the traditional flexible water allocation system, that broadly followed a system of time allocation in proportion to land holding size with adjustments for seepage, soil quality, and so on, was gradually replaced by a formalized and fixed irrigation rights system. A consequence of this revision from a "rule" based on a general equity principle into a fixed rights regime has been the

Box 7. **Claims to Nyachowa water, Zimbabwe (van der Zaag and Röling, 1996)**

Nyachowa stream connects the commercial farm located at the higher end of the valley with the six downstream communal furrows located in Zimunya communal land (Figure 1). Nyachowa stream is oversubscribed: the catchment yields less than the water given out in formal water rights.

The commercial farm has the oldest water right, with a priority date of 1918. In practice this means that the farmer legally diverts nearly all water during the dry season. The communal furrows share one water right, entitling them to divert 57 liters per second from Nyachowa stream, with a priority date of 1933. In the dry season Nyachowa communal irrigators face a situation of severe water shortage. The six furrows have to share between them the little water that remains after the commercial farmer has satisfied his right.[16] This leads to conflicts among the communal irrigators.

The most upstream of these furrows (numbered 1 in Figure 1) passes first through other communal fields before it reaches a formal irrigation scheme, initiated by the State in the 1930s. This formal scheme has not received any water during the last decade or so, because the upstream water users (the so-called "illegal abstractors") take all the water. Why, one must ask, do the downstreamers not take remedial action against the head-enders?

Although there are no official gated intakes that would guide the water into their plots, the "illegal abstractors" have dug and drilled holes in the canal bed, or siphon off water to facilitate the water getting to where they need it. The claim to irrigation water by this group dates back to the time when they helped construct the furrow in 1933. The work lasted a biblical three months, three weeks, and three days, and the government paid them in kind (maize meal). Because the completion of the formal irrigation scheme was delayed, the upstream farmers started using the water. That these "illegal abstractors" had provided most of the labor during construction, and had been the first to put the furrow to use, gave them a credible claim to the furrow water.

The users of the upstream part of this furrow have in Headman Shigodora a strong leader. The headman effectively acts as a gatekeeper, but Headman Shigodora's strategy is double-edged. At the upstream end of the furrow he makes sure enough water is diverted from the river into the intake, which means checking that none of the other furrow groups tampers with the inlet. The downstream end of "his part" of the furrow is where it crosses Nyerutimba River, which is in fact a *vlei* (wetland). Here the water is led through a pipe, before it continues further down to the formal scheme. At any moment the headman may shut off the pipe, or make the water "disappear" into the swamp where some of his people have vegetable gardens and welcome it. Headman Shigodora cunningly uses metaphors, clothed in traditional wording, to further his interests. The following is an example.

Headman Shigodora scratched the words *Sadza Igona* on his side of the pipe structure before it crosses the Nyerutimba. *Sadza Igona* seems to imply that the flowing water has already been transformed into *sadza* (maize porridge) and "allows people to survive." Literally, however, it refers to a traditional healer's gourd with medicine, thus suggesting the headman's supernatural powers. On the outlet of the pipe is written *Chipo*, which means gift. These inscriptions convey a clear statement: those along the upstream part of the furrow are entitled to the water; those along the downstream end should be grateful for whatever water flows to them.

mismatch between water delivery and demand. The response of the farmers has been to collectively manage these official rights and renegotiate how entitlements will be delivered in order to address the incongruities in the state system and make them more responsive to local realities.

This feature of customary law systems holds an important lesson for dealing with management not only at a local or national level but also higher up the scale. A principle-based system has many advantages. Principles are not absolute; instead how they are played out depends on their relationship to other principles and systems of contestation, negotiation, and reconciliation. Rather than seeing this as a tension it can be viewed as an opportunity to create shared outcomes, as opposed to a right-and-wrong dichotomy that is the essence of substantive western rules. Defining basic managerial principles also avoids the pitfalls of legal codification discussed in the preceding section.

5.3. Local Law as a Resource in Dealing with Water Resource Conflicts

Conflict around the management of water resources is a growing reality. It appears that this growth is not just a matter of increasing demand, but also the result of the ongoing failure of institutional forms (the law and the mechanisms of implementation) to create meaningful solutions. Why does conflict management continue to be such a problem? First, there is the failure to grapple with the nature of conflict. Second, conflict management tends to ignore the existing social complexity. Third, conflict management is generally seen as being about dispute resolution rather than conflict avoidance. Through understanding conflict management (including resolution) systems within other normative frameworks, the possible repertoire of mechanisms and strategies is increased and may, perhaps, contribute to the prevention, mitigation, and resolution of conflicts. This is particularly important at the local level, where courts are often mistrusted and seen as protecting state or powerful interests. It may also be useful in reforming inter-state institutions and resolving conflicts emanating from state-agreed allocations that affect the rights of local people.

Box 8. **Clashing normative frameworks on a proposed dam in Arizona, USA (Source: Espeland, 1998)**

In 1981, a car full of bureaucrats representing the Bureau of Reclamation, a water development agency, drove 30 miles northeast of Phoenix (a large city in the state of Arizona, USA) to the Fort McDowell "Indian" reservation. They came to offer the 400 mostly Yavapai residents $40 million for a large parcel of their land. They wanted to build the Orme Dam at the confluence of two rivers bordering the reservation. The lake created by the dam would inundate most of the Fort McDowell Reservation.

Why did the Bureau of Reclamation in the United States, in defiance of a pro-dam development tradition, eventually decide against building Orme dam? The answer lies in understanding the traditions and normative frames of the three groups mostly affected by the dam:

- The Bureau's engineering staff ("the old guard") that advocated for the construction of the dam on its technical merits.
- The Bureau's newer staff of biologists, lawyers, and social scientists (the New Guard), who in response to a new National Environmental Policy Act, sought to

institutionalize new decision-making procedures that would expand the number and range of interest groups participating in the decision-making process; this in their view would result in a just decision.
- The Yavapai, an indigenous people, who opposed the dam because of the value they attach to the land they would lose.

While the old guard believed that the project could succeed on its technical merits, the "new guard" who had been schooled in a model of controversy management believed in achieving consensus through a process of commensuration of different values attached to the various uses and impacts of the dam.[17] The Yavapai were not interested in the technical merits of the project, or in negotiating a price that would offset their loss. They considered the land to be a part of their heritage and identity, which thus could not be bought or sold (that is, is not commensurable).

During the process of consultations on whether to construct the dam or not, the three groups constantly misconstrued each other's meaning. The new guard presumed that the Yavapai were bargaining for more money when they said that their land was not for sale. The old guard engineers believed Orme Dam was needed to regulate and store water, generate hydropower, and protect Phoenix from floods, and they were convinced of the propriety and generosity of their offer to compensate the Yavapai. They could not comprehend the Yavapai indifference to the benefits of the proposed dam, and insisted on repeating the same points *ad nauseam*. The Yavapai saw things differently. They did not understand why they should bear the costs of the mistakes of others: of building houses in the floodplain; of growing thirsty cotton in the desert; and of Phoenix residents watering into oblivion the desert that first drew them there. With more than 40 percent unemployed, and two-thirds of those with jobs making less than $5,000 annually, the Yavapai were hardly a wealthy people. Nevertheless, Yavapai leaders rejected the agency's "generous" offer, saying they would never sell their land, no matter the price. They were baffled that federal agents knew so little about Yavapai culture, and that they did not grasp that land is not a commodity.

In the end the dam was not constructed, not because the decision-making process led to a consensus according to an agreed method of commensuration of the different values expressed by the three groups, but because the impact assessment model used by the new guard proved the dam to be unsustainable for environmental reasons. Consequently, both the old guard and the Yavapai felt alienated and misrepresented by this supposedly inclusive process, because it had strictly controlled the terms under which they could express their values and interests, and the weight attributed to these.

Conflict takes multiple forms and occurs for a variety of reasons. Understanding its nature is at the root of finding solutions. Conflict may be latent, and thus its management is as much about conflict avoidance as it is about resolution. One fundamental problem with existing conflict resolution systems is the failure to distinguish between value-based conflicts and true rights-based conflicts (see for example a discussion of the problem in Katerere and Mohamed-Katerere, 2002). These types of conflicts require different approaches; nevertheless, in both of these, local law is a useful resource.

5.3.1. Value-Based Conflicts

Value-based conflicts stem from "the tugs and pulls of different identities, the differential distribution of resources and access to power, and competing definitions of what is right, fair and just" (Stedman, 1991, p. 367). In southern Africa two key causes of value-based conflicts are evident.

First, the dispossession of land, water, forests, and other natural resources experienced by local and indigenous peoples as a result of colonialism is a key conflict driver. The value basis of this was that natural resources were *res nullius,* as they had not been "captured and controlled," and thus they were available for acquisition. This was in direct conflict with the local belief that land and other natural resources belong to a people, and although capable of individual control, cannot be owned in the traditional western sense. In the post-colonial era many states have continued, on the basis of this acquisition, to use natural resources with little regard for local values and rights. The tenure regimes and institutional frameworks that entrench these state rights form the basis for conflicting perceptions about authority, and in the case of water, who is entitled to allocate it. Box 9 illustrates how a state-granted water right became a source of conflict, and that it was only when the parties negotiated directly with each other about allocation and use that a solution was found.

Second, conflict emanates from development and land use planning in relation to both resources controlled by the state and those over which local people have retained some control. Common points of conflict include the building of large dams and the establishment of game parks or conservation areas, which result in displacement. At the heart of such development conflict are the irreconcilable views of many indigenous and local cultures that favor long-term benefits and social sustainability over immediate benefits, and western development views, which until recently focused primarily on immediate benefit. Box 8 illustrates that in instances where values are at stake compromise is difficult if not impossible, because certain deep-seated values cannot be equated with, and exchanged for, short-term monetary benefits. If compromise is not possible then a cost–benefit type analysis for making decisions is not useful.

Given the structural basis of these kinds of conflicts it is evident that resolution needs to be far-reaching. In these circumstances a two-pronged approach that addresses both process and tenure is essential. A rights-based approach is a useful framework for addressing such conflict, as it establishes some fundamental values.[18] Human rights are invaluable here as they are evidence of a general global commitment to set standards. Although strictly speaking one cannot really speak of a human right to land, there is recognition of indigenous rights to land and water. The UN Commission on Human Rights Special Committee on the Elimination of Racism recommends the protection of indigenous rights to traditional hunting, foraging lands, and subsistence water. There is a growing repertoire of international human rights instruments and policy which extends these rights to all local communities, and create a firm basis for the legal recognition of historical and traditional resource rights. This tallies with the widely accepted proposition that a key impediment to conflict avoidance, and indeed effective management, is the continued reluctance to give local resource users some security of tenure. Long-term solutions may include the full recognition of title or user rights. In the latter the state may retain ownership but transfer managerial rights to local people, for example through community-based natural resource management projects. In an interesting case of restitution in South

Africa, community title to a part of a national park was recognized, and the community leased the contested land back to the state so that the land could continue to be managed as a national park (Katerere and Mohamed-Katerere, 2002).

A rights approach calls for not only a revision of tenure rights but also the development of governance rights. This requires the adoption of decision-making procedures that acknowledge the values expressed by local people rather than dismissing them as underlying sentiments, memories, and interests (Zartman, 1991, p. 299). At the second World Water Forum (March 20 2000) indigenous people demanded that governments "expand their valuation of water and other resources, beyond the material and economic, to also encompass the spiritual and the sacred." Given the legally recognized indigenous peoples' rights, as well as the strong focus in international environmental, and water, law on participation, such a process demands a respect for local people (including their knowledge and values) and requires the recognition of the equality of the parties and the right of prior informed consent.[19]

5.3.2. Competing Rights Holders

A key source of conflict between users is growing resource stress; this is primarily the result of population growth and economic development, and thus increased demand, but is also the result of poor management. Here, the challenge is about addressing competing demands and improving management systems.

In general, water scarcity and quality conflicts result from poor management, although they can also be the result of absolute shortages. In such conflicts power, poverty, environment, and hydrology converge to create what often become entrenched inequities – the rights of downstream users, women, the poor, and those with oral (as opposed to written) negotiating traditions become effectively marginalized. Given this, the solution to these conflicts must be social as well as technical. In these circumstances local law is only one of many resources that need to be drawn on.

The premise for much water management law in the southern African region is the supremacy of state law. In practice, this often means that the managerial solutions in local law systems are neglected. Local law, however, may give new insight into problems as it is based on localized knowledge and considers existing ecological and social factors. Given this, it may also consider aspects that the science that informs state law has neglected.[20] There is now an extensive body of literature suggesting that local rules that focus on time and not quantity allocations, clearly defined areas of priority use, and protecting downstream and minority rights are important for avoiding and resolving conflict as well as creating some system of local justice (Wolf, 2000; Bolding et al., 1996; Fleuret, 1985; Murgai, 1998; Sengupta, 2000). The substantive content of these rules has been considered earlier in this article. These local rules may usefully be applied not only at the local level but also in interstate relations, state–community relations, and in relations between multilateral state bodies and communities (Wolf, 2000).

Local rules may not be inconsistent with state law. For example, both state and local law systems classify priority uses. The issue here is to develop an inclusive process that can arrive at mutually acceptable decisions. Local law is insightful here. Typically, in local dispute resolution, all views are heard and few limits are set on the "witnesses" that can be called. A process in which the diverse water claims are heard (including those that are not formally recognized in state law as rights) is more likely to contribute to the prevention, mitigation, and resolution of conflicts, as it requires the treatment of the different parties as equal and all claims as worthy of

consideration. Inclusive processes need to take into account that community-based decision-making processes are often time consuming and multi-faceted. Box 9 illustrates how costly (in effort, time, and money) the failure to take the multiple claims into account can be, and that water management can really only be successful where it has local legitimacy. This is all the more important where the state's water rights allocation process is not seen as legitimate. Respecting local processes, as demonstrated in Box 9, is a first step to finding mutually acceptable long-term solutions between competing water users.

One challenge is how this should inform relations at a higher level. Despite its appeal there are numerous difficulties associated with developing such an approach, and these must be taken into account. First, the normative bases of the claims to water and the rule system in which they are located vary considerably. For reconciliation of these regimes it is necessary to determine where the responsibilities for sustainable management should lie. Second, local rights and interests need to be dealt with in the context of inter-state agreements. Questions arise here about the appropriate institutional mechanism for making these inter-state decisions. Third, national economic concerns might prioritize different types of uses over others. In the SADC region it is now widely accepted that there is a need to harmonize the laws of the member countries.

5.3.3. Processes

Understanding conflict resolution processes in local law systems may help us develop more appropriate mechanisms and institutions for resolving conflicts that involve local people, whether at the community, inter-community, community–state, or community–multilateral institution level. In many countries courts, formal dispute resolution tribunals, and arbitrations have become the chief instruments for conflict resolution. However, these are generally unsatisfactory as they are essentially adversarial, and designed to deal with rights disputes and not value-based conflicts. Additionally, in most countries in southern Africa, access to these institutions is severely constrained by distance, inadequate access to information, lack of financial resources to hire necessary expertise and so on. Also, as noted earlier, they may be alienating for cultural reasons.

Local arbitration begins to address some of these problems of accessibility; however they continue to be problematic as they are essentially adversarial and generally use narrow dispute frameworks. Consequently, conflict resolution systems need to go beyond established arbitration systems (Wolf, 2000) and develop mechanisms for addressing these value differences and taking into account wider social justice issues, as well as the peculiar nature of local law and practice.

Conflict resolution in many local law systems, including some in the Middle East (Irani, 1999) and Africa (Osamba, 2001), focus on reconciliation, forgiveness, mutual release of the problem, respect, and possibly restitution, whereas western-based law in general focuses on establishing wrongfulness. This, and the failure to understand the status of the individual in society, means that state law often poses the wrong questions or incorrectly identifies the parties in attempting to resolve conflict. For example, in conflicts around the control of water, state law may treat this as a dispute between a legal right-holder that has suffered loss and the right-abuser. In many traditional systems the individual derives identity from the community and a "processual" view of self is held. For example, in Akan society humans undergo a pro–

Box 9. **Water tenure and conflict in Tanzania (Source: Huggins, 2000)**

In the late 1980s water analysis revealed that the spring water used by the villagers of Oldonyowas had fluoride levels of 20 parts per million (ppm), way above the WHO recommended standard of 1.5 ppm. Following this revelation the local people located a spring some 15 km away that they wished to use as a water source. The Masai and the Oldonyosambu already piped water from this spring. On the advice of MS, the Danish volunteer service, they had the water tested, and finding it contained only 3.5 ppm of fluoride, applied for a Water Right. The application process took three months and involved the usual process of official notice being published in the local newspapers, and the Ward Development Committee (which represents Oldonyosambu and other villages as well as Oldonyowas) met with the hydrologist before the go-ahead was given.

With the assistance of MS and the Ministry of Water, the villagers calculated the cost of a pipeline from the spring to the village: about $165,000 including labor and equipment costs. Villagers raised about $3,000 and worked in teams of sixty per day for two days per week for a year, digging trenches for the pipeline and laying the pipes. Those who had salaried jobs and could not labor paid about $7 per month towards the cost of the project. The women of the village prepared food for the workers.

Soon after work had started, *moranis* (young men of "warrior" age) from Oldonyosambu destroyed the sections that had been completed. The Oldonyowas village council and traditional elders started talks with their counterparts in Oldonyosambu, which lasted for almost a year. Finally they got permission to continue from these village representatives, and work recommenced. About a year later the pipeline was completed. Then, three days before the scheduled opening day, *moranis* again destroyed the system. The *moranis* from Oldonyowas prepared themselves for some kind of battle with the opposing group, but were dissuaded from doing so by the village council and their traditional elders. Again meetings were held between the traditional leaders and village council officials from each village, and the Oldonyosambu voiced a number of objections. They claimed that the pipeline had severely reduced the water flow in the pipe used by the Masai in the plains. A counter-claim was that this pipeline was in urgent need of repair, as much water was being lost before it reached the watering point. The lack of storage facilities on the plains also led to water wastage. The water right was allocated after a hydrology study, which should have ensured the plains supply was maintained, so why was there a problem?

A Ministry of Water official suggested that the hydrologist did not study a wide enough range of water users when allocating the water, and may have devalued the interests of the pastoralists because of their geographically "marginal" position. As MS state, "Part of the problem seems to be lack of sufficient information – and in some cases deliberate misinformation – on the effects of the changes in the distribution of water to the various users down the stream." A further concern was that those affected apparently thought that money from the district Annual Development Levy (collected from every household in the village) had been used to fund the project.

Negotiations resumed yet again. The Oldonyosambu group agreed to let the Oldonyowas pipeline operate, if the Oldonyowas villagers undertook repairs to the Oldonyosambu pipe which leads to the plains, and constructed a storage tank for the use of the Masai and their animals. It seems as if Oldonyowas may provide the other group with a storage tank and some pipes if the Oldonyosambu group contribute some money in return.

cess of social transformation until they reach the attainment of full status as a person or community member (Coetzee, 2000, p. 280; see also Box 2). Thus local law, in contrast to western law, might focus on the overall threat the breach of agreed water rights poses for the community as a whole; here the relationship between the community of the abuser and that of the abused is key. Therefore, in local conflict resolution, forgiveness, family, kinship, patronage, and ritual are central (Irani, 1999, p. 2). In the east African context, Osamba (2001, p. 4) notes that resolving conflict was often understood to be about re-establishing relationships not only between people but also with their gods and spirits. The responsibility of the elders in this context is to negotiate a consensual agreement and achieve reconciliation, rather than establish right and wrong. In this context the solution takes precedence over the accusation. In western law, by contrast, establishing wrongfulness is essential for achieving settlement.

In many cases, given the metaphysical links of local law systems, rituals form an important part of conflict resolution. Local rituals may involve symbolic statements of mutual long-term interest or friendship (Osamba, 2001). Modern western psychology widely recognizes the value of ritual in resolving conflicts; given this convergence, the use of rituals at the local level should not simply be dismissed out of hand.

Given the adversarial–conciliatory split in dispute resolution systems, the styles of communication adopted in state and non-state law may vary significantly. At the local level adversarial styles may be alienating. In western thought contestation of an idea or claim is evidence of valuation – that is, that the idea has been taken seriously. In many local law systems mediation and negotiation are key techniques for conflict resolution (see also Boxes 4 and 9). Local mediation typically incorporates consensus building based on open discussions to exchange information and clarify issues (Creative Associates International Incorporated). As demonstrated in Box 9, the time frame for such negotiations may extend beyond those used by courts and arbitrators. Such negotiations may encourage discussion of aspects that do not appear to be directly related, as the mediator tries to situate the conflict in the disputants' frame of reference and decide on an appropriate style and format of intervention (ibid.). Consideration of this can be used to reform conflict resolution at multiple, and not just the local, levels.

6. CONCLUSION: UNTYING THE KNOT

Sustainable water management is in everybody's interest. Achieving it requires good technical knowledge and good governance. One of the realities of post-colonial countries is that legal systems have traditionally been used to exclude and dispossess local people – hence their silence on water issues. Contemporary laws have not been able to wipe the slate clean and remain full of contradictions that are caught between protecting "old" interests and creating new opportunities. This article has argued that the recognition of a rights regime that brings local communities back into management and decision making as actors is essential. Such an approach demands respect for local people, their knowledge and values, and by implication the recognition of customary law, because it reflects the reality on the ground. This article suggests that by understanding and engaging with customary law, and incorporating it through a democratic process, management can be improved. The extraction of general principles may be useful in improving resource and conflict management not

just at the local level but also higher up the scale, and thereby untying the knot of silence.

NOTES

1. Aiden Tevera Manwa, custodian of the spirit of the stone at Great Zimbabwe, cited in Hove and Trojanow (1996, p. 83).
2. Indigenous systems of water management are often effective and some have survived many centuries. For irrigation some examples include: in Africa, irrigation in the Taita Hills, Kenya (Fleuret, 1985), irrigation by the Sonjo, Tanzania (Adams et al., 1994), and rice cultivation in Basse Casamance, Senegal (van der Zaag, 1992); in Latin America, qanat irrigation in Mexico (Enge and Whiteford, 1989), irrigation in Cochabamaba, Bolivia (Gutierrez and Gerbrandy, 1998) and in Ecuador (Apollin et al., 1998). In Asia, tank irrigation in Sri Lanka (Leach, 1961), Subak irrigation in Bali, Indonesia (Geertz, 1972) and irrigation in the hills of Nepal (Yoder and Martin, 1998).
3. Campbell et al. (2001); the Communal Areas Management Program for Indigenous Resources (CAMPFIRE) in Zimbabwe is premised on such an approach.
4. The rights-based approach has been largely restricted to the right of access to water for basic human needs (see Gleick, 1999; Ferguson and Derman, 1999). This approach to rights, however, is fundamentally flawed as it excludes water for productive uses, such as water for small irrigated vegetable gardens, which are essential for the sustenance of life. Its benefit is that it limits the treatment of water as an economic good by protecting some entitlements of the poor.
5. A key driving force for Community Based Natural Resources Management (BNRM) programs.
6. One of the difficulties here is how participation is conceptualized. Nominal consultation or inclusion is often considered as participation. Borrini-Feyerabend (1996) for example argues that participation exists along a continuum – from active consultation to complete transfer of authority and responsibility to stakeholders. See also Pimbert and Pretty (1994) cited in IIED (1994, p. 19). The approach adopted here is that participation implies a right not only to express one's views and to be heard, but to have these views included in decision making and management. Participation is more than just consultation – it changes the relationship between parties in fundamental ways, shifting the balance of power and establishing equity as the basis for engagement. As Cernea (1985, cited in IIED, 1994, p. 18) states, participation requires "empowering people to mobilize their own capacities, be social actors rather than passive subjects, manage resources, make decisions, and control the activities that affect their lives."
7. Exceptions here are Wolf (2000) and Irani (1999).
8. It focuses on economic liberalization and market orientation.
9. The exceptions here are South Africa and Botswana where the state is the trustee of water resources, albeit with managerial rights (see Mohamed-Katerere, 2001a, p. 58).
10. Chief Chitanga Chitanga in Hove and Trojanow (1996, p. 116). There are many similar examples found in other countries, for instance in Kenya (Fleuret, 1985), Mexico (Enge and Whiteford, 1989), Morocco (Geertz, 1972) and Nepal (Yoder and Martin, 1998).
11. The same can be said about the South African water sector; see for example tensions between large-scale (white) and small-scale (black) irrigated sugarcane growers in the Komati river: Manzungu (2001) and Waalewijn (2002).
12. Cited in Hove and Trojanow (1996, pp. 114–18).
13. An old abbreviation for Zimbabwe's agricultural extension services, now known as AREX.
14. Aiden Tevera Manwa, custodian of the spirit of the stone at Great Zimbabwe, cited in Hove and Trojanow (1996, p. 83).
15. Aiden Tevera Manwa, custodian of the spirit of the stone at Great Zimbabwe, cited in Hove and Trojanow (1996, pp. 83–4).
16. This situation will now have changed, as the new Water Act of 1998 abolished the priority date system. During the time of the research (1995) this system was, however, still in force.

17. Commensuration may be defined as the expression or measurement of characteristics normally represented by different units according to a common metric (Espeland and Stevens, 1998, p. 315).
18. Rights approaches draw on well-established human rights and international law principles and have become prominent in development debates (see Mohamed-Katerere, 2003).
19. For a discussion on the right to prior informed consent see IUCN Inter-Commission Task Force on Indigenous Peoples (1997, pp. 89–90).
20. Science, and the position of key actors in social and political processes, have been instrumental in the construction of policy and law. The discursive creation of problems and solutions in environmental and natural resource management is a product of this. See for example Scoones (2002) and Keeley and Scoones (2000).

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16. UNESCO / Dominique Roger
17. UNESCO / A. Vorontzoff
18. UNESCO / Inguat Samayoa
19. UNESCO / Dominique Roger
20. UNESCO / Georges Malempré
21. UNESCO / Dominique Roger
22. UNESCO / Dominique Roger

23 à 28. UNESCO / Daniel Riffet & UNESCO / Dominique Roger

29. UNESCO / Andes / CZAF / AZA
30. UNESCO / Alexis Vorontzoff
31. UNESCO / André Abbé

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Constitution of UNESCO (excerpt)

London, 16 November 1945

The Governments of the States Parties to this Constitution on behalf of their peoples declare:

That since wars begin in the minds of men, it is in the minds of men that the defences of peace must be constructed;

That ignorance of each other's ways and lives has been a common cause, throughout the history of mankind, of that suspicion and mistrust between the peoples of the world through which their differences have all too often broken into war;

That the great and terrible war which has now ended was a war made possible by the denial of the democratic principles of the dignity, equality and mutual respect of men, and by the propagation, in their place, through ignorance and prejudice, of the doctrine of the inequality of men and races;

That the wide diffusion of culture, and the education of humanity for justice and liberty and peace are indispensable to the dignity of man and constitute a sacred duty which all the nations must fulfil in a spirit of mutual assistance and concern;

That a peace based exclusively upon the political and economic arrangements of governments would not be a peace which could secure the unanimous, lasting and sincere support of the peoples of the world, and that the peace must therefore be founded, if it is not to fail, upon the intellectual and moral solidarity of mankind…

International Hydrological Programme

World Water Assessment Programme