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Conflict and cooperation along international waterways [1]

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Abstract

There are 261 international rivers, covering almost one half of the total land surface of the globe and untold numbers of shared aquifers. Water has been a cause of political tensions between Arabs and Israelis, Indians and Bangladeshis, Americans and Mexicans, and all ten riparian states of the Nile river. Water is the only scarce resource for which there is no substitute, over which there is poorly developed international law and the need for which is overwhelming, constant and immediate. As a consequence, 'water' and 'war' are two topics being assessed together with increasing frequency. This paper investigates the reality of historic water conflict and draws lessons for the plausibility of future 'water wars'. The datasets of conflict are explored for those related to water — only seven minor skirmishes are found in this century; no war has ever been fought over water. In contrast, 145 water-related treaties were signed in the same period. These treaties, collected and catalogued in a computerized database along with relevant notes from negotiators, are assessed for patterns of conflict resolution. War over water seems neither strategically rational, hydrographically effective, nor economically viable. Shared interests along a waterway seem to consistently outweigh water's conflict-inducing characteristics. Furthermore, once cooperative water regimes are established through treaty, they turn out to be impressively resilient over time, even between otherwise hostile riparians and even as conflict is waged over other issues. These patterns suggest that the more valuable lesson of international water is as a resources whose characteristics tend to induce cooperation and incite violence only in the exception.

1. Introduction: water wars

'Water' and 'war' are two topics being assessed together with increasing frequency. The 261 international watersheds (Wolf et al., in review), covering a little less than one half of the land

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surface of the globe, affect about 40% of the world's population. Water is a vital resource to many levels of human survival for which there is no substitute; it ignores political boundaries, fluctuates in both space and time and has multiple and conflicting demands on its use. The problems of water management are compounded in the international realm by the fact that the international law that governs it is poorly developed, contradictory and unenforceable. As a consequence, recent articles in the academic literature (Cooley, 1984; Starr, 1991; Remans, 1995 and others) and popular press (Bullock and Darwish, 1993; World Press Review, 1995) point to water not only as a cause of historic armed conflict, but as *the* resource which will bring combatants to the battlefield in the 21st century. Invariably, these writings on water wars point to the arid and hostile Middle East as an example of a worst-case scenario, where armies have in fact been mobilized and shots fired over this scarce and precious resource. Elaborate, if misnamed, 'hydraulic imperative' theories have been developed for the region, particularly between Arabs and Israelis, citing water as the prime motivator for military strategy and territorial conquest.

The basic argument for water wars is as follows. Water is a resource vital to all aspects of a nation's survival, from its inhabitants' biology to their economy. The scarcity of water in an arid and semi-arid environment leads to intense political pressures, often referred to as 'water stress', a term coined by Falkenmark (1989). Furthermore, water not only ignores our political boundaries, it evades institutional classification and eludes legal generalizations. Interdisciplinary by nature, water's natural management unit, the watershed, where quantity, quality, surface- and groundwater all interconnect, strains both institutional and legal capabilities often past capacity. Analyses of international water institutions find rampant lack of consideration of quality considerations in quantity decisions, a lack of specificity in rights allocations, disproportionate political power by special interest and a general neglect for environmental concerns in water resources decision-making.

Legal principles have been equally elusive (as described in more detail in Wolf, 1997). The 1997 Convention on the Nonnavigational Uses of International Watercourses Commission, which took 27 years to develop, reflects the difficulty of marrying legal and hydrologic intricacies; while the Convention provides many important principles for cooperation, including responsibility for cooperation and joint management, they also institutionalize the inherent upstream/downstream conflict by calling for both 'equitable use' and an 'obligation not to cause appreciable harm'. These two principles are in implicit conflict in the setting of an international waterway; up-stream riparians have advocated that the emphasis between the two principles be on 'equitable use', since that principle gives the needs of the present the same weight as those of the past. In contrast, down-stream riparians have pushed for emphasis on 'no significant harm', which effectively protects the pre-existing uses, generally found in the lower reaches of most major streams. The Convention also provides few practical guidelines for allocations, the heart of most water conflict. Allocations are to be based on seven relevant factors, which are to be dealt with as a whole[2].

[2] These factors include: geographic, hydrographic, hydrological, climatic, ecological and other natural factors; social and economic needs of each riparian state; population dependent on the watercourse; effects of use in one state on the uses of other states; existing and potential uses; conservation, protection, development and economy of use and the costs of measures taken to that effect; and the availability of alternatives, of corresponding value, to a particular planned or existing use.

Furthermore, international law only concerns itself with the rights and responsibilities of *states*. Some political entities who might claim water rights, therefore, would not be represented, such as the Palestinians along the Jordan or the Kurds along the Euphrates. In addition, cases are heard by the International Court of Justice (ICJ) only with the consent of the parties involved and no practical enforcement mechanism exists to back up the Court's findings, except in the most extreme cases. A state with pressing national interests can therefore disclaim entirely the court's jurisdiction or findings (Rosenne, 1995). Given all the intricacies and limitations involved, it is hardly surprising that the International Court of Justice has decided only a single case regarding international water law[3].

Put all of these characteristics together — international water as a critical, nonsubstitutable resource, which flows and fluctuates across time and space, for which legal principles are vague and contradictory and which is becoming relatively more scarce with every quantum of growth in population or standard of living — and one finds a compelling argument that, in the words of World Bank vice-president Ismail Serageldin, ''the wars of the next century will be about water'' (quoted in New York Times, 10 August 1995).

This paper puts forward four arguments against the plausibility of future water wars: (1) an historic argument, (2) a strategic interests argument, (3) a shared interests argument and (4) an institutional resiliency argument. Datasets of conflict are explored for those related to water, while recent attempts at the resolution of international water disputes as exemplified in 146 transboundary water treaties and fourteen process case studies, are described.

2. Historic argument against water wars

2.1. Water and conflict

As mentioned earlier, there is a growing literature which describes water both as an historic and, by extrapolation, as a future cause of interstate warfare. Westing (1986) suggests that, 'competition for limited ... freshwater ... leads to severe political tensions and even to war'; Gleick (1993) describes water resources as military and political goals, using the Jordan and Nile as examples; Remans (1995) uses case studies from the Middle East, South Asia and South America as 'well-known examples' of water as a cause of armed conflict; Samson and Charrier (1997) write that, 'a number of conflicts linked to freshwater are already apparent' and suggest that, 'growing conflict looms ahead'; Butts (1997) suggests that, 'history is replete with examples of violent conflict over water' and names four Middle Eastern water sources particularly at risk; and Homer-Dixon (1994), citing the Jordan and other water disputes, comes to the conclusion that 'the renewable resource most likely to stimulate interstate resource war is river water'.

[3] The ICJ came into being in 1946, with the dissolution of its predecessor, the Permanent Court of International Justice. That body did rule on four international water disputes during its existence from 1922–1946. The one case decided by the ICJ was about the Gabcikovo Dam on the Danube.

A close examination of the case studies cited as historic interstate water conflict suggest some looseness in classification. Samson and Charrier (1997), for example, list eighteen cases of water disputes, only one of which is described as 'armed conflict' and that particular case (on the Cenepa river) turns out not to be about water at all but rather about the location of a shared boundary which happens to coincide with the watershed. Armed conflict did not take place in any of Remans' Remans (1995) 'well-known' cases (save the one between Israel and Syria, described below), nor in any of the other lists of water-related tensions presented.

The examples most widely cited are wars between Israel and her neighbors. Westing (1986) lists the Jordan river as a cause of the 1967 war and, in the same volume, Falkenmark (1986), mostly citing Cooley (1984), describes water as a causal factor in both the 1967 war and the 1982 Israeli invasion of Lebanon. Myers (1993), citing Middle East water as his first example of 'ultimate security', writes that 'Israel started the 1967 war in part because the Arabs were planning to divert the waters of the Jordan river system'. In fact, in the years since Israel's invasion of Lebanon in 1982, a 'hydraulic imperative' theory, which describes the quest for water resources as *the* motivator for Israeli military conquests, both in Lebanon in 1979 and 1982 and earlier, on the Golan Heights and West Bank in 1967, was developed in the academic literature and the popular press (see for example, Davis et al., 1980; Stauffer, 1982; Schmida, 1983; Stork, 1983; Cooley, 1984; Dillman, 1989; Beaumont, 1991).

The only problem with these theories is a complete lack of evidence. While shots were fired over water between Israel and Syria from 1951 to 1953 and from 1964 to 1966, the final exchange, including both tanks and aircraft on July 14, 1966, stopped Syrian construction of the diversion project in dispute, effectively ending water-related tensions between the two states — the 1967 war broke out almost a year later. The 1982 invasion provides even less evidence of any relation between hydrologic and military decision-making. In extensive papers investigating precisely such a linkage between hydro-strategic and geo-strategic considerations, both Libiszewski (1995) and Wolf (1995b) conclude that water was neither a cause nor a goal of any Arab–Israeli warfare.

To be fair, it should be noted that this analysis only describes the relationship between interstate armed conflict and water resources as *a scarce resource*. Both internal disputes, such as those between interests or states, as well as those where water was a means, method, or victim of warfare, are excluded. Also excluded are disputes where water is incidental to a the dispute, such as those about fishing rights, access to ports, transportation, or river boundaries. Many of the authors, notably Gleick (1993), Libiszewski (1995) and Remans (1995), are very careful about these distinctions. The bulk of the articles cited above, then, turn out to be about political tensions or stability, rather than about warfare, or about water as a tool, target, or victim of armed conflict — all important issues, just not the same as water wars.

In order to cut through the prevailing anecdotal approach to the history of water conflicts, we investigated those cases of international conflict where armed exchange was threatened or took place over water resources *per se*. We utilized the most systematic collection of international conflict, the International Crisis Behavior (ICB) dataset, collected by Jonathan Wilkenfeld and Michael Brecher (need citation of their forthcoming work). This dataset contains only those disputes, which were considered to be international crises by the principal investigators. Their definition of an international crisis is any dispute, where (1) basic national values are threatened (e.g. territory, influence, or existence), (2) time for making decisions is

limited and (3) the probability for military hostilities is high. Using these guidelines, they identified 412 crises for the period 1918–1994. Joey Hewitt, of the University of Maryland at College Park, searched the text files of the ICB dataset for water-related key-words and found four disputes where water was at least partially a cause. These have been researched and supplemented by three others at the University of Alabama. The complete list includes the seven disputes described in Fig. 1.

Thus, the actual history of armed water conflict is somewhat less dramatic then the water wars literature would lead one to believe: a total of seven incidents, in three of which no shots were fired. As near as we can find, *there has never been a single war fought over water*[4].

This is not to say there is no history of water-related violence, quite the opposite is true, only that these incidents are at the subnational level, generally between tribe, water-use sector, or state. Examples of internal water conflicts, in fact, are quite prevalent, from interstate violence and death along the Cauvery river in India, to California farmers blowing up a pipeline meant for Los Angeles, to much of the violent history in the Americas between indigenous peoples and European settlers. The desert state of Arizona even commissioned a navy (made up of one ferry boat) and sent its state militia to stop a dam and diversion on the Colorado river in 1934 (Fredkin, 1981).

Too, one need look no further than relations between India and Bangladesh to note that internal instability can both be caused by and exacerbate, international water disputes. At issue is a barrage which India has built at Farakka, which diverts a portion of the Ganges flow away from its course into Bangladesh, toward Calcutta 100 miles to the south, in order to flush silt away from that city's seaport. Adverse effects in Bangladesh resulting from reduced upstream flow, have included degradation of both surface and groundwater, change in morphology, impeded navigation, increased salinity, degraded fisheries and danger to water supplies and public health. Environmental refugees out of affected areas have further compounded the problem. Ironically, many of those displaced in Bangladesh have found refuge in India (Biswas and Hashimoto, 1996).

So, while no water wars have occurred, there is ample evidence that the lack of clean freshwater has lead to occasionally intense political instability and that, on a small scale, acute violence can result. What we seem to be finding, in fact, is that geographic scale and intensity of conflict are *inversely* related.

2.2. Water and cooperation

2.2.1. The transboundary freshwater dispute database

The history of water dispute resolution, in contrast to that of conflict, is much more impressive. The UN Food and Agriculture Organization has identified more than 3600 treaties, relating to international water resources, dating between 805 and 1984, the majority of which deal with some aspect of navigation (FAO, 1978, 1984). Since 1814,

[4] This in not quite true. The earliest documented interstate conflict known is a dispute between the Sumerian city-states of Lagash and Umma over the right to exploit boundary channels along the Tigris in 2500 BCE (Cooper, 1983). In other words, the last and only water war was 4500 y ago.

1948 -- Partition between India and Pakistan leaves the Indus basin divided in a particularly convoluted fashion. Disputes over irrigation water exacerbate tensions in the still-sensitive Kashmir region, bringing the two riparians "to the brink of war." Twelve years of World Bank led negotiations lead to the 1960 Indus Waters Agreement.

February 1951 -- September 1953. Syria and Israel exchange sporadic fire over Israeli water development works in the Huleh basin, which lies in the demilitarized zone between the two countries. Israel moves its water intake to the Sea of Galilee.

January -- April 1958. Amidst pending negotiations over the Nile waters, Sudanese general elections, and an Egyptian vote on Sudan-Egypt unification, Egypt sends an unsuccessful military expedition into territory in dispute between the two countries. Tensions were eased (and a Nile Waters Treaty signed) when a pro-Egyptian government was elected in Sudan.

June 1963 -- March 1964. 1948 boundaries left Somali nomads under Ethiopian rule. Border skirmishes between Somalia and Ethiopia are over disputed territory in Ogaden desert, which includes some critical water resources (both sides are also aware of oil resources in the region). Several hundred are killed before cease-fire is negotiated.

March 1965 -- July 1966. Israel and Syria exchange fire over "all-Arab" plan to divert the Jordan River headwaters, presumably to preempt Israeli "national water carrier," an out-of-basin diversion plan from the Sea of Galilee. Construction of the Syrian diversion is halted in July 1966.

April -- August 1975. In a particularly low-flow year along the Euphrates, as upstream dams are being filled, Iraqis claim that the flow reaching its territory was "intolerable," and asked that the Arab League intervene. The Syrians claim that less than half the river's normal flow is reaching *its* borders that year and, after a barrage of mutually hostile statements, pull out of an Arab League technical committee formed to mediate the conflict. In May 1975, Syria closes its airspace to Iraqi flights and both Syria and Iraq reportedly transfer troops to their mutual border. Only mediation on the part of Saudi Arabia breaks the increasing tension.

April 1989 -- July 1991. Two Senegalese peasants were killed over grazing rights along the Senegal River, which forms the boundary between Mauritania and Senegal, sparking smoldering ethnic and land reform tensions in the region. Several hundred are killed as civilians from border towns on either side of the river attack each other before each country uses its army to restore order. Sporadic violence breaks out until diplomatic relations are restored in 1991.

Fig. 1. History of acute international water conflict.

Table 1
Treaty statistics summary sheet[a]

Signatories
Bilateral 124/145 (86%)
Multilateral 21/145 (14%)
Principal focus
Water supply 53/145 (37%)
Hydropower 57/145 (39%)
Flood control 13/145 (9%)
Industrial uses 9/145 (6%)
Navigation 6/145 (4%)
Pollution 6/145 (4%)
Fishing 1/145 (< 1%)
Monitoring
Provided 78/145 (54%)
No/not available 67/145 (46%)
Conflict resolution
Council 43/145 (30%)
Other governmental unit 9/145 (6%)
United Nations/third party 14/145 (10%)
None/not available 79/145 (54%)
Enforcement
Council 26/145 (18%)
Force 2/145 (1%)
Economic 1/145 (< 1%)
None/not available 116/145 (80%)
Unequal power relationship
Yes 52/145 (36%)
No/unclear 93/145 (64%)
Information sharing
Yes 93/145 (64%)
No/not available 52/145 (36%)
Water allocation
Equal portions 15/145 (10%)
Complex but clear 39/145 (27%)
Unclear 14/145 (10%)
None/not available 77/145 (53%)
Nonwater linkages
Money 44/145 (30%)
Land 6/145 (4%)
Political concessions 2/145 (1%)
Other linkages 10/145 (7%)

[a]Source: Hamner and Wolf (1998).

approximately 300 treaties have been negotiated which deal with nonnavigational issues of water management, flood control or hydropower projects, or allocations for consumptive or nonconsumptive uses in international basins. Restricting ourselves to those signed in this century which deal with water per se, excluding those which deal with boundaries or fishing rights, we have collected the full text of 145 treaties in a transboundary freshwater dispute database at Oregon State University, in conjunction with projects funded by the World Bank and the US Institute of Peace.

Negotiating notes and published descriptions of many treaty negotiations are also being collected. Fourteen case studies have been described in some detail and in similar format for comparative purposes for forthcoming work. These cases include nine watersheds: the Danube, Euphrates, Jordan, Ganges, Indus, Mekong, Nile, La Plata and Salween; two aquifer systems: US–Mexico shared systems and the West Bank Aquifers; two lake systems: the Aral Sea and the Great Lakes; and one engineering works: the Lesotho Highlands Project. Jesse Hamner, now at Emory University, developed a systematic computer compilation of these treaties, which are catalogued by basin, countries involved, date signed, treaty topic, allocations measure, conflict resolution mechanisms and nonwater linkages. Analyses from the Database are described in more detail in Wolf (1997) and in Hamner and Wolf (1998)[5]. A statistical summary is included as Table 1.

The historic reality has been quite different from what the water wars literature would have one believe. In modern history, only seven minor skirmishes have been waged over international waters — invariably other interrelated issues also factor in. Conversely, over 3600 treaties have been signed historically over different aspects of international waters, almost 150 in this century which deal with water *qua* water, many showing tremendous elegance and creativity for dealing with this critical resource. (This is not to say armed conflict has not taken place over water, only that such disputes generally are between tribe, water-use sector or state.) Furthermore, a close look at the very cases, most-commonly cited as conflicts, reveal on-going dialogue, creative exchanges and negotiations leading fairly regularly to new treaties. The question which emerges, which is arguably more interesting than where water wars will break out, is, given all of the seemingly conflict-inducing characteristics of transboundary waterways, why has *so little* international violence taken place?

3. Other arguments against water wars

Basing an argument about the future on history alone would be disingenuous. Part of the argument for future water wars, after all, is that we are reaching unprecedented demand on relatively decreasing clean water supplies. Other arguments against the possibility of water wars

[5] Details of the fourteen case studies listed can be found in Bingham, G., A. Wolf and T. Wohlgenant. *Resolving Water Disputes: Conflict and Cooperation in the U.S., the Near East and Asia.* Washington, DC: US Agency for International Development, November 1994. (Publication #ANE-0289-C-00-7044-00.) A one-page summary of each of the 145 treaties in the Oregon State University Transboundary Freshwater Dispute Database is available on disk from the author upon request.

follow although, since we are discussing the future, each has less evidence in its favor than the historic argument.

3.1. Strategic argument

If one were to launch a war over water, what would be the goal? Presumably, the aggressor would have to be both downstream and the regional hegemon — an upstream riparian would have no cause to launch an attack and a weaker state would be foolhardy to do so. (Foolhardiness apparently does not preclude such 'asymmetric conflicts'. Paul (1994) describes eight such case studies from 1904–1982, but points out that in none did the weaker power achieve its goals.) An upstream riparian, then, would have to launch a project which decreases either quantity or quality, knowing that it will antagonize a stronger down-stream neighbor.

The down-stream power would then have to decide whether to launch an attack — if the project were a dam, destroying it would result in a wall of water rushing back on down-stream territory; were it a quality-related project, either industrial or waste treatment, destroying it would probably result in even worse quality than before. Furthermore, the hegemon would have to weigh not only an invasion, but an occupation and depopulation of the entire watershed in order to forestall any retribution — otherwise, it would be extremely simple to pollute the water source of the invading power. Both countries could not be democracies, since the political scientists tell us that democracies do not go to war against each other and the international community would have to refuse to become involved (this, of course, is the least far-fetched aspect of the scenario). All of this effort would be expended for a resource which costs about a US dollar per cubic meter to create from seawater.

There are 'only' 268 international watersheds — there are only a handful on which the above scenario is even feasible (the Nile, Plata and Mekong come to mind) and many of those either have existing treaties or ongoing negotiations towards a treaty. Finding a site for a water war turns out to be as difficult as accepting the rationale for launching one.

3.2. Shared interest argument

One is offered insight into the question of what it is about water, which tends to induce cooperation, even among riparians which are hostile over other issues, by reading through the treaties, which have been negotiated over international waterways. Each treaty shows sometimes exquisite sensitivity to the unique setting and needs of each basin and many detail the shared interests a common waterway will bring. Along larger waterways, for instance, the better dam sites are usually upstream at the headwaters where valley walls are steeper and, incidentally, the environmental impact of dams is not as great. The prime agricultural land is generally downstream, where gradient drops off and alluvial deposits enrich the soil. A dam in the headwaters, then, can not only provide hydropower and other benefits for the upstream riparian, but it can be managed to even out the flow for downstream agriculture, or even to enhance water transportation for the benefit of both riparians.

Other examples of shared interests abound are: no development of a river which acts as a boundary can take place without cooperation; farmers, environmentalists and beach-goers all share an interest in seeing a healthy stream-system; and all riparians share an interest in high water quality.

These shared interests are regularly exemplified in treaties: in conjunction with the 1957 Mekong agreement, Thailand helped funding 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 and between Syria and Jordan on the Yarmuk.

The unique interests in each basin, whether hydrological, political, or cultural, stands out in the creativity of many of the treaties. A 1969 accord on the Cunene river allows for 'humanitarian' diversions solely for human and animal requirements in Southwest Africa as part of a larger project for hydropower. Water loans are made from Sudan to Egypt (1959) and from the USA to Mexico (1966). Jordan stores water in an Israeli lake while Israel leases Jordanian land and wells (1994) and India plants trees in Nepal to protect its own water supplies (1966). In a 1964 agreement, Iraq 'gives' water to Kuwait, 'in brotherhood', without compensation. In contrast, a 1957 agreement between Iran and the USSR has a clause, which allows for cooperation in identifying corpses found in their shared rivers.

The changes of local needs over time are seen in the boundary waters between Canada and the USA. Even as the boundary waters agreements of 1910 were modified in 1941 to allow for greater hydropower generation in both Canada and the United States along the Niagara to bolster the war effort, the two states nevertheless reaffirmed that protecting the 'scenic beauty of this great heritage of the two countries' is their primary obligation. A 1950 revision continued to allow hydropower generation, but allows a greater minimum flow over the famous falls during summer daylight hours, when tourism is at its peak.

3.3. Institutional resiliency argument

Another factor adding to the stability of international watersheds is that once cooperative water regimes are established through treaty, they turn out to be tremendously resilient over time, even between otherwise hostile riparians and even as conflict is waged over other issues. The Mekong Committee has functioned since 1957, exchanging data throughout the Vietnam War. Secret 'picnic table' talks have been held since the unsuccessful Johnston negotiations of 1953–1955, even as 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 an agreement between China and Hong Kong survived strains between those two countries.

3.4. Economic argument?

It is tempting to add an economic argument against water wars. Water is neither a particularly costly commodity nor, given the financial resources to treat, store and deliver it, is

it particularly scarce. Full-scale warfare, on the other hand, is tremendously expensive. A water war simply would not cost out.

This point was probably best made by the Israeli defense forces analyst, responsible for long-term planning during the 1982 invasion of Lebanon. When asked whether water was a factor in decision-making, he noted, "Why go to war over water? For the price of one week's fighting, you could build five desalination plants. No loss of life, no international pressure and a reliable supply you don't have to defend in hostile territory" (cited in Wolf, 1995b).

To make such a case convincingly, though, one would have to show times when war *was* cost-effective and, if such a thing is possible, it is well-beyond the scope of this paper.

4. Conclusions and caveat

There is a large and growing literature warning of future water wars. They point to water not only as a cause of historic armed conflict, but as *the* resource which will bring combatants to the battlefield in the 21st century.

The historic reality has been quite different. In modern times, only seven minor skirmishes have been waged over international waters — invariably other interrelated issues also factor in. Conversely, over 3600 treaties have been signed historically over different aspects of international waters – 145 in this century on water *qua* water – many showing tremendous elegance and creativity for dealing with this critical resource. This is not to say that armed conflict has not taken place over water, only that such disputes generally are between tribes, water-use sectors, or states. What we seem to be finding, in fact, is that geographic scale and intensity of conflict are *inversely* related.

War over water is neither strategically rational, hydrographically effective, nor economically viable. It is no wonder that Delli Priscoli (1997) describes water as, "humanity's great learning ground for building community". Alam (1997) has aptly dubbed this concept of water as a resource which transcends traditional thinking about resource-related disputes, 'water rationality'. Shared interests along a waterway seem to overwhelm water's conflict-inducing characteristics and, once water management institutions are in place, they tend to be consistently resilient. The patterns described in this paper suggest that the more valuable lesson of international water is, as a resource whose characteristics tend to induce cooperation and incite violence only in the exception.

One caveat: while water wars may be a myth, the connection between water and political stability certainly is not. The lack of a clean freshwater supply clearly does lead to instability which, in turn, can create an environment more conducive to political or even military conflict. Bangladeshi instability and 'environmental refugees' brought about by the environmental degradation, which in turn was caused by Indian diversions of Ganges waters, is perhaps the best recent example. Simply because water wars will not likely be fought is no reason to reduce efforts to provide an adequate clean water supply for the world's population.

5. Policy lessons

Nations do not and probably will not, go to war over water. But neither are international institutions adequately equipped to resolve water disputes. The 145 treaties which govern the world's international watersheds and the international law on which they are based, are in their respective infancies (Hamner and Wolf, 1998). More than half of these treaties include no monitoring provisions whatsoever and, perhaps as a consequence, two-thirds do not delineate specific allocations and four-fifths have no enforcement mechanism. Moreover, those treaties which do allocate specific quantities, allocate a fixed amount to all riparian states but one – that one state must then accept the balance of the river flow, regardless of fluctuations. Finally, multilateral basins are, almost without exception, governed by bilateral treaties, precluding the integrated basin management long-advocated by water managers (see Table 1).

In order to fill this institutional gap, suggestions have occasionally been made for the creation of an international body for the resolution of water conflicts. The findings of this paper suggest two critical lessons for policymakers concerned with water disputes:

5.1. Water dispute amelioration is as important and less costly, than conflict resolution

Most often, international attention and resultant financing, is focused on a basin only after a crisis or flashpoint. Such has been the case on the Indus, Jordan, Nile and Tigris–Euphrates basins, for example. It is worth noting, though, that in the exceptions to this pattern, the Mekong and La Plata commissions for example, an institutional framework for joint management and dispute resolution was established well in advance of any likely conflict. It is also worth noting the Mekong committee's impressive record of continuing its work throughout intense political disputes between the riparian countries, as well as the fact that data conflicts, common and contentious in all of the other basins presented, have not been a factor in the Mekong. In fact, the experience of the commission such as those of the Amazon, La Plata or Mekong may suggest that when international institutions are established well in advance of water-stress they help preclude such dangerous flashpoints. As noted earlier, other basins have equally resilient institutions, which have survived even when relations on other issues were strained.

Early intervention is also beneficial to the process of conflict resolution, helping to shift the mode of dispute from costly, impasse oriented dynamics to less costly, problem solving dynamics. In the heat of some flashpoints, such as the Nile, the Indus and the Jordan, as armed conflict seemed imminent, tremendous energy was spent just getting the parties to talk to each other. Hostilities were so pointed that negotiations inevitably began confrontationally, usually resulting in a distributive approach being the only one viable.

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 which may be implemented in an integrative framework.

Of course, to be able to entice early cooperation, the incentives have to be made sufficiently clear to the riparians. In all of the cases mentioned above, not only was there strong third-party involvement in encouraging the parties to come together, extensive funding was made

available on the part of the international community to help finance projects which would come from the process.

5.2. Water is, by its nature, an interdisciplinary resource — the attendant disputes can only be resolved through active dialog among disciplines

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

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 et al. (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 and, in other work (Delli Priscoli, 1992), makes a strong case for the potential of alternative dispute resolution (ADR) in the handling of water resources issues by the World Bank and external support agencies. Trolldalen (1992) likewise, chronicles environmental conflict resolution at the United Nations, including a chapter on international rivers. Most-recently, the creation of a World Water Council includes among its four primary challenges a "global institutional framework for water" (WWC, 1995).

Regardless of the institutional framework, it is clear that no single discipline, neither law, nor economics, nor engineering, will provide all of the answers for resolving water disputes. Rather, policymakers and their institutions will have to foster an active dialog between all approaches to this critical resource.

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