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TROUBLED WATERS: CHARTING A COURSE TO CONFLICT OR COOPERATION?

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ABSTRACT

Water is essential for human survival. The strain on freshwater resources is attributable to population growth, economic development and pollution, as well as its access and use. In the face of growing freshwater scarcity, competition for this dwindling resource exacerbates existing high levels of political conflict already omnipresent in water stressed regions. The interaction of political, socio-economic, and cultural factors determine both the severity and outcome of water disputes. Seen through the environmental security paradigm, its effects are becoming increasingly recognized as a concern to societal stability.

History reveals water's geopolitical characteristics both as an instrument and a source of conflict; yet, select vulnerability indicators focus attention on locations prone to confrontation over water. More often water's overarching importance in all facets of human activity compel negotiated collaboration rather than conflict, provided there is political will for cooperation. Such willingness is bolstered through international law, the assistance of a trustworthy third-party and resilient institutions that create the conditions for enduring basin management.

"*Waters can divide, river basins can bring together, and there lies the hope as well as the threat*."[1]

- Robert W. Kates

INTRODUCTION

Water is essential for human survival. This scarce environmental resource is necessary for nearly every sector of human activity and is also needed to keep natural ecosystems intact. Water has substantive emotional and symbolic value, and water issues are rarely out of the headlines.[2] The strain on freshwater resources attributable to population growth, economic development and pollution, as well as its access and use are becoming increasingly recognized as a critical concern to societal stability.

The expression of water disputes varies from tension to armed conflict, both within and between states. Indeed, water disputes occur at three levels. At the local level, they can occur where groups within societies struggle over water access, or where populations adversely affected by the construction of a dam protest against regional authorities. Disputes on the national level can erupt when sectors or interests groups (including industry, agriculture, tourism and environment) compete for advantage in the determination of national water management policies. And on the international level, a

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[1]Robert W. Kates, "Editorial: Redefining Security," *Environment* 36, no. 3 (April, 1994), 1, http://proquest.umi.com/pqdweb?did=4861877&Fmt=7&clientId=65345&RQT=309&VName=PQD (accessed 1 February 2008).

[2]Mohamed Larbi Bouguerra, *Water Under Threat*, trans. Patrick Camiller (Black Point, NS: Fernwood Publishing Limited, 2006), 9.

dispute can arise over the quantity and quality of water flows from the upstream riparian to a downstream neighbour in a shared river basin. [3]

Mark Twain once quipped that whiskey was for drinking, but water was worth fighting over. In the face of growing freshwater scarcity, the interaction of political, socio-economic, and cultural factors determine both the severity and outcome of water disputes. It is the thesis of this paper that in water disputes the propensity for resolution is through cooperation rather than conflict.

This paper examines the nature of freshwater scarcity and the elements that lead to both conflict and cooperation. First, the nature of freshwater scarcity will be examined with particular emphasis on the causes and challenges that a poorly distributed and dwindling supply poses to a growing population. Next, the issue of environmental resource scarcity and its linkages to security will be established through a more comprehensive security paradigm that has emerged in the post-Cold War era. Last, the nature of freshwater tensions will reveal its geopolitical features and it will be argued that cooperative efforts better serve interdependent interests along a waterway rather than conflict.

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[3]Organization for Economic Co-operation and Development, *Water and Violent Conflict*, http://www.oecd.org/dataoecd/26/5/35785565.pdf (accessed 14 February 2008).

WATER SCARCITY CHALLENGES

Freshwater scarcity is emerging as one of the most critical resource issues because of its decisive influence on the quality of life and one's basic survival. It is suggested that water is surpassing oil as the dominant global resource concern. Unlike other resources, water has no substitute to satisfy everyday requirements.[4] As such, water scarcity appears starkest when framed in terms of declining freshwater supply despite rising demand.

Distribution of Water Supply

From space, it appears Earth has an abundance of water as it covers 71% of the planet's surface; however, 97% of it is saltwater, leaving 3% as freshwater.[5] Most freshwater is inaccessible because it is locked away in ice caps, glaciers, and unreachable ground water. As Figure 1 shows, only 1%

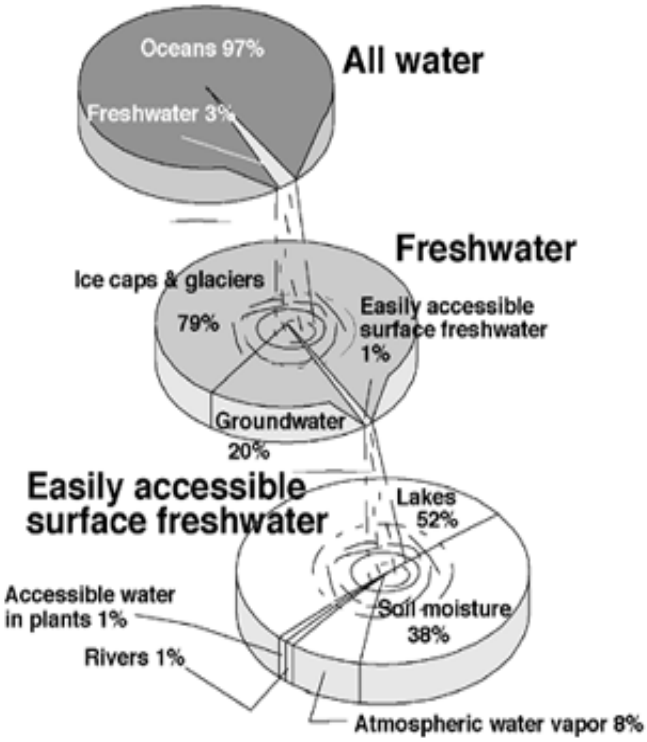

Figure 1 – World's Water Distribution

Source: Hinrichsen, Robey, Upadhyay, *Solutions for a Water-Short World*, http;//www.infoforhealth

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[4]Anne Baer, "Not enough Water to Go Round?" *International Social Science Journal* 48, no. 2 (June, 1996), 285, http://proquest.umi.com/pqdweb?did=9834609&Fmt=7&clientId=65345&RQT=309&VName=PQD (accessed 11 December 2007).

[5]Jill Boberg, *Liquid Assets: How Demographic Changes and Water Management Policies Affect Fresh Water Resources* (Santa Monica, CA: Rand Corporation, 2005), 12, http://rand.org/pubs/monographs/MG358/ (accessed 18 February 2008).

is available for use, primarily as surface water and shallow groundwater aquifers that are sustained by the hydrological cycle of evaporation and precipitation. In effect, only 1/10,000 of the world's total water supply is available for human use.[6] Globally, this amount translates into 7,000 m^3 per person, which would easily fulfil their daily needs. However, distribution of this water is uneven among human settlement patterns and/or is only available during limited times of the year.[7] Consider that two-thirds of the world's population is located in regions that receive one-quarter of the global rainfall. Unfortunately, throughout much of the developing world, seasonal rains run off too quickly for effective long-term use as the shear volume exceeds storage capacity. Developing regions are left to face long periods of drought having lost the benefit to consume their potential freshwater resources.[8] Certainly, access to the world's freshwater supply is regionally constrained.

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[6]Don Hinrichsen, Bryant Robey and Ushma D. Upadhyay, *Solutions for a Water-Short World*. Population Information Program, http://www.infoforhealth.org/pr/m14/m14print.shtml (accessed 21 February 2008).

[7]Centre for Strategic and International Studies and Sandia National Laboratories, *Global Water Futures: Addressing our Global Water Future*, http://www.csis.org/component/option,com_csis_pubs/task,view/id,3491/type,1/ (accessed 12 February 2008).

[8]Hinrichsen, Robey and Upadhyay, *Solutions for a Water-Short World.*

Freshwater Demand

Water usage has varied over time in quantity and relative usage. Since 1940, water withdrawals have increased on average 2.5% to 3% yearly. Figure 2 depicts the rising growth in water consumption, most notably in the second half of the 20th century. In the most recent decade, developing countries have increased their yearly water withdrawals by 4% to 8%. These increases are owing to population growth, industrial development, and dependence upon irrigation agriculture, substantial urbanization and rising living standards.[9] Water usage is classified into three categories: agricultural, industrial and domestic (which includes municipal). Yet, their relative usage varies across regions, as Figure 3 depicts (next page).

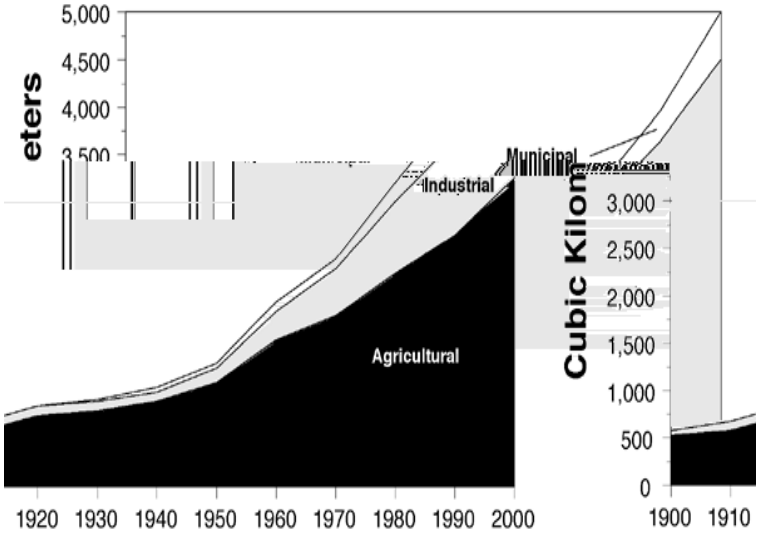

Figure 2 – Global Annual Water Withdrawal by Sector, 1900-2000

Source: Hinrichsen, Robey, Upadhyay, *Solutions for a Water-Short World,* http://www.infoforhealth .org/pr/m14/m14print.shtml.

[9] *Ibid.*

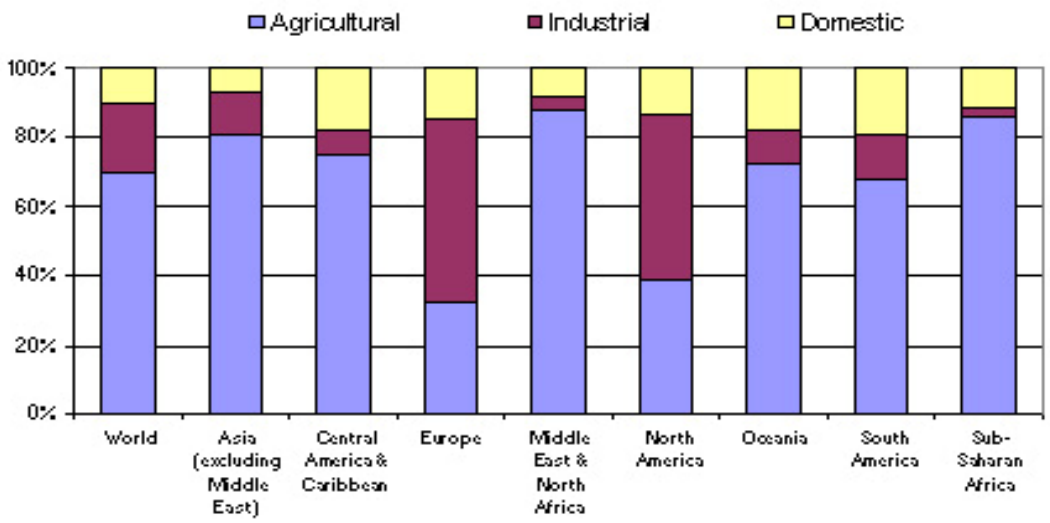

Figure 3 – Water Withdrawals by Sector

Source – Damassa, *World Resources Institute*, http:earthtrends.wri.org/updates/node/73.

Agriculture. The agricultural sector is the largest fresh water consumer, using an aggregate of 70% of the world's annual withdrawals. It is used primarily in developing nations for irrigation due to growing food requirements resulting from population growth.[10] Irrigation is an inefficient process with significant water wastage and it is estimated that 60% of the water never reaches the crops due to evaporation and runoff.[11] Compounding the issue are farmer subsidies for below cost water, giving them little incentive to conserve or implement water-saving technologies.[12]

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[10]Boberg, *Liquid Assets: How Demographic Changes and Water Management Policies Affect Fresh Water Resources*, xvi.

[11]Carmen Revenga, "World's Water Resources in Swift Decline," World Resources Institute, http://archive.wri.org/newsroom/wrifeatures_text.cfm?ContentID=3479&NewsletterID=85 (accessed 29 February, 2008).

[12]Carmen Revenga, "Will there be enough Water?" World Resources Institute, http://earthtrends.wri.org/pdf_library/feature/wat_fea_scarcity.pdf (accessed 29 February, 2008).

Industrial. Industry is the driver of economic growth and requires good quality water. The 1970s and 1980s saw developed nations exploit technological gains to re-use and reduce water, thereby adding to its efficiency.[13] The distribution of water in high-income countries is more heavily weighted toward industrial uses.[14] However, as developing countries shift their economies away from agriculture to industrial production, their distribution of water towards industry is expected to rise. This will present further challenges in pollution control, most notably in urban centres where municipal water and sanitation infrastructure compete with other pressing priorities.

Domestic. Water for domestic purposes is used for drinking, food preparation and sanitation. This sector demands the least proportion of water, but it is normally heavily monitored because of its effects on health and disease. Consequently, it remains prominent on public health and political agendas, both as causal factors in premature mortality, and in lost economic output.[15] As such, there is a direct correlation between standard of living and domestic consumption. For instance, the daily U.S. per capita consumption is 24 times the amount for Senegal.[16]

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[13]Boberg, *Liquid Assets: How Demographic Changes and Water Management Policies Affect Fresh Water Resources*, 34.

[14]United Nations, *Water for People, Water for Life* (New York: United Nations, 2003), http://unesdoc.unesco.org/images/0012/001295/129556e.pdf (accessed 29 February 2008).

[15]Boberg, *Liquid Assets: How Demographic Changes and Water Management Policies Affect Fresh Water Resources*, xvi.

[16]Baer, *Not enough Water to Go Round?*, 279.

Climate Change

The effects of climate change are adding to the complexity of the water scarcity situation. The United Nations Intergovernmental Panel in Climate Change forecasts that global warming will alter precipitation patterns that lead to changes in the intensity, severity and timing of major storms.[17] This will transform regional hydrology, water runoff and soil moisture.[18] The rise in sea level will pose flood threats to coastal populations and cause the salinization of coastal aquifers. Furthermore, lakes will have a diminished capacity to naturally cleanse themselves of pollution.[19] In 2006, the U.K Meteorological Office advised that without altering the course of climate change, the severe global droughts that occur every 50 years will be experienced every other year by 2100. Climate change is expected to result in a 20% increase in global water scarcity and will be felt acutely by those countries already suffering the most.[20]

Water Pollution and Disease

Further compounding the negative impact of climate change are the effects of pollution, which only serve to diminish the supply of freshwater. Agriculture is the

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[17]Crystal Davis, "The Multiple Dimensions of Water Scarcity," World Resources Institute, http://earthtrends.wri.org/updates/node/264 (accessed 29 February, 2008).

[18]Boberg, *Liquid Assets: How Demographic Changes and Water Management Policies Affect Fresh Water Resources*, 24.

[19]United Nations, *Climate Change 2007: Synthesis Report* (New York: United Nations, 2007), http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf (accessed 15 February 2007).

[20]United Nations, *Coping with Water Scarcity: Challenge of the Twenty-First Century* (New York: United Nations, 2007), http://www.fao.org/nr/water/docs/escarcity.pdf (accessed 14 February 2008).

biggest source of pollution with fertilizers and pesticides contaminating both aquifers and surface waters. This is a particularly vexing problem for developing nations whose water usage is more heavily weighted in the agricultural sector, yet face the most extreme physical water scarcity.[21]

Closely linked to pollution is the presence of waterborne diseases. Half the population in the developing countries endure water related health problems because 80% of all disease is spread through unsafe water. This is due to the combined effects of a lack of clean drinking water and inadequate sanitation.[22] In fact, more than 1.2 billion people do not have access to safe drinking water, and 2.6 billion are without improved sanitation, because in developing nations most household and industrial waste enters into local water systems without treatment.[23] The majority of those lacking adequate sanitation reside in Asia, however sub-Sahara Africa has the greatest proportion without water.[24] Globally, one hospital bed in two is occupied by a patient stricken by a water-related illness. Each day 36,000 people die due to unsafe drinking water and a lack of sanitation.[25] So urgent and important is this issue, the United Nations declared 2008 the International Year of Sanitation.

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[21]Hinrichsen, Robey and Upadhyay, *Solutions for a Water-Short World.*

[22]Anne E. Platt, *Infecting Ourselves: How Environmental and Social Disruptions Trigger Disease*, ed. Jane A. Peterson (Washington, DC: Worldwatch Institute, 1996), 42.

[23]D. Pimentel and others, "Ecology of Increasing Diseases: Population Growth and Environmental Degradation," *Human Ecology* 35, no. 6 (December, 2007), 654, http://proquest.umi.com/pqdweb?did=1372718251&Fmt=7&clientId=65345&RQT=309&VName=PQD.

[24]United Nations, *Coping with Water Scarcity: Challenge of the Twenty-First Century*, 20.

[25]Bouguerra, *Water Under Threat*, 126-127.

Population Patterns

Population size is the most important variable regarding water consumption. During the 20th century the world population grew from 1.6 billion to 6.2 billion, with nearly 80% in the last half of the century.[26] This spectacular growth has been attributed to mortality reductions and water quality improvements.[27] The global fertility rate during the early 1970s was 4.47 births per woman, with the fertility rate in developing nations rate as much as three times that of the industrial world. Since that time, the global fertility rate has dropped to 2.55, but the world population is still growing.[28] The projected population growth until 2050 is 2.5 billion, passing from the current 6.7 billion to 9.2 billion. This growth will be nested in the developing world whose population will rise substantially from 5.4 billion to 7.9 billion during the same period.[29]

Another significant population dynamic is the shift from rural to urban migration in developing nations attributed to the vicious cycle of droughts and prospects for economic improvement.[30] In 1950, the developing nations consisted of only 40% of the

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[26]Baer, *Not enough Water to Go Round?*, 279.

[27]Boberg, *Liquid Assets: How Demographic Changes and Water Management Policies Affect Fresh Water Resources*, 38.

[28]United Nations, *World Population Prospects - the 2006 Revision - Highlights* (New York: United Nations, 2007), http://www.un.org/esa/population/publications/wpp2006/WPP2006_Highlights_rev.pdf (accessed 18 February 2008).

[29]*Ibid*.

[30]Baer, *Not enough Water to Go Round?*, 281.

world's urban population; by 2000 it reached 68% and is forecasted to be 79% by 2030.[31] The demand on freshwater and sanitation services is overwhelming many of the growing cities in developing nations that are unable to keep up with the rapid pace of growth. These create the conditions where disease degrades both the quantity and quality of water.

Measuring Water Scarcity

Having an understanding of the factors that impact the supply and demand of freshwater, the measurement of water scarcity will direct attention towards potential regions of water-conflict. The most commonly used benchmark is freshwater volume per capita. Within this framework, three thresholds exist: a region is rated as 'stressed' when renewable freshwater per person per year is below a level of 1,700 m^3 (1.7 million litres); 'scarcity' is gauged between 500 and 1,000 m^3; and, a state of 'absolute scarcity' exists below 500 m^3.[32]

As depicted in Figure 4, an estimated 41% of the world's population in 25 countries, or 2.3 billion people live under 'water stress'.[33] By 2025, this number will grow to 48 countries affecting over 4 billion people.[34] Undoubtedly, freshwater scarcity

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[31]James F. Miskel and P. H. Liotta, *A Fevered Crescent: Security and Insecurity in the Greater Near East* (Gainesville, FL: University Press of Florida, 2006), 8.

[32]Baer, *Not enough Water to Go Round?*, 277.

[33]Tom Damassa, "August 2006 Monthly Update: Water Scarcity," World Resources Institute, http://earthtrends.wri.org/updates/node/73 (accessed 29 February, 2008).

[34]Hinrichsen, Robey and Upadhyay, *Solutions for a Water-Short World.*

will remain a critical issue that will challenge the economic, social, and political stability of all nations. Of greatest concern will be the challenges faced by countries from the Middle East and Africa where regional tensions abound. These circumstances will demand careful monitoring and possible outside intervention to promote cooperation.

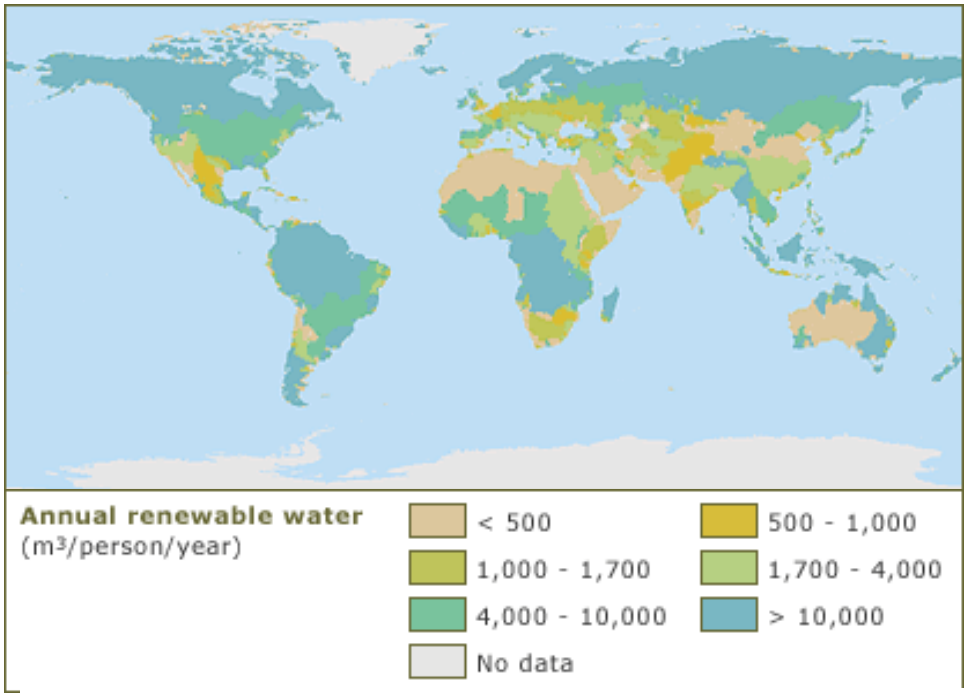

Figure 4 – Water Scarcity

Source – Damassa, *World Resources Institute*, http:earthtrends.wri.org/updates/node/73.

ENVIRONMENTAL SECURITY PARADIGM

The Cold War was characterized by superpower tensions. With its ending, neighbouring frictions and long-standing grievances were de-linked from the Soviet-Western rivalry. As such, conflicts have become more localized in regionally contained settings, and the factors that bear upon regional stability are military parity along with economic, political and cultural elements. Environmental resources are interwoven into the politics, economies and cultures of regions and have elevated environmental subjects into the broadened view of security.[35] This section examines the links between environmental and security issues and argues the legitimacy of an 'environmental security' paradigm as it pertains to freshwater scarcity.

Perspectives on environmental security differ between liberal and realist constructs. Specifically, the realist views security primarily through territorial and political integrity, with economic issues as an important second. According to realists, a state is secure when it is not in danger of having to sacrifice core values of political independence and territorial integrity. The threat to security takes either a military or economic form.[36] Environmental subjects are on the very periphery of the realist agenda.

Liberals criticize the realist approach to security for its inadequacy in considering

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[35]Brian R. Shaw, *When are Environmental Issues Security Issues?*Woodrow Wilson International Centre for Scholars, http://www.wilsoncenter.org/topics/pubs/ACFA6.pdf (accessed 16 February 2008).

[36]Neda Akram Zawahri, "The Water Weapon: Havoc and Harmony Over International Rivers" (Ph.D. thesis, University of Virginia), 8, http://proquest.umi.com/pqdweb?did=813761421&Fmt=7&clientId=65345&RQT=309&VName=PQD (accessed 15 January 2008).

the complex interplay of variables in a globalized era.[37] Environmental security extends beyond the realist construct as it is concerned with any threat to societal welfare and their populations due to stresses on the Earth's life-support systems and renewable environmental resources.[38] It recognizes that damage to common resources can significantly alter the stability of relationships between countries, which casts attention on security concerns. Not every environmental concern falls within the realm of national security. To say so would trivialize the problem.[39] Environmental resource confrontation is contextually dependent upon the relationship between countries. Consider that a water problem between Israel and Jordan over the Jordan Basin generates different security implications than the same problem between the Mexico and the United States over the Rio Grande. The impact on policy options for the affected states differs considerably.[40]

When environmental resources degrade and diminish, economic stresses are manifested through inflation, unemployment, capital scarcity and monetary instability.[41] In regions with weakly supported governments, resource scarcity has the potential to be a contributing factor to instability. When governments cannot address the conditions that

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[37]Peter H. Gleick, "Environment and Security: The Clear Connections," *Bulletin of the Atomic Scientists* 47, no. 3 (Apr, 1991), 18, http://proquest.umi.com/pqdweb?did=1822786&Fmt=7&clientId=65345&RQT=309&VName=PQD (accessed 9 February 2008).

[38]Gareth Porter, "Environmental Security as a National Security Issue," *Current History* 94, no. 592 (May, 1995), 218, http://proquest.umi.com/pqdweb?did=4458484&Fmt=7&clientId=65345&RQT=309&VName=PQD (accessed 11 February 2008).

[39]Gleick, *Environment and Security: The Clear Connections*, 18.

[40]Shaw, *When are Environmental Issues Security Issues?*, 40.

[41]Zawahri, *The Water Weapon: Havoc and Harmony Over International Rivers*, 7.

deny its populations basic survival resources, such as food and freshwater, or offer hope for economic prosperity, its people become desperate for any source of relief. These conditions fester into instability, detracting from the legitimacy of authority and constitute a threat within the region and to nations that interact there. In this era of globalization, the effects of regional instability due to environmental scarcity have a rippling effect.[42]

Water has gained visibility as a key strategic security concern even for the world's most powerful nation, the United States (U.S.). In the post 9-11 terrorist attacks, safeguarding waterways and drinking water became a Bush administration priority. In its establishment, the Department of Homeland Security was given the mandate of securing the nation's water infrastructure with an initial allocation of $548 million. Most important for the U.S. is the growing concern of its energy security, specifically that its interests in the Middle East could be threatened by water conflicts in the region. This triggers images reminiscent of the Arab Oil Embargo of 1973-74 that led to economic uncertainty. Undeniably, as the largest economic engine, a U.S. economic crisis due to energy and water scarcity would be felt worldwide.[43]

Since 1994, the U.S. National Security Strategy has cited concern regarding instability due to competition for dwindling renewable resources and environmental

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[42]Elizabeth M. Damonte, "National Security Strategy: What about the Environment?" (Masters thesis, United States Army War College), 4, http://handle.dtic.mil/100.2/ADA449663 (accessed 1 February 2008).

[43]Maude Barlow, *Blue Covenant: The Global Water Crisis and the Coming Battle for the Right to Water* (Toronto, ON: McClelland and Stewart Ltd, 2007), 148-149.

degradation.[44] Water scarcity specifically receives attention in several prominent strategic documents. The U.S. Joint Forces Command identifies trends through to 2030 that will challenge the joint operating environment. It is noteworthy that it links water to sustained globalized economic activity.[45] This globalized economy produces 'winners' and 'losers'. It will be incumbent upon the developed world that 'losers', due to freshwater scarcity, are transferred to other more viable activities, otherwise the divide between developed and developing countries will continue to widen and exacerbate tremendous societal stress. "When economic growth slows or stops, social strains emerge and political systems become destabilized." [46] Too often, the result is civil turmoil, either internally or with neighbouring countries. This phenomenon is of particular interest for potentially troubled regions where nations have security and economic interests.

To summarize, in the post-Cold War era, the environmental security paradigm provides a clear alternative to the realist construct regarding international conflicts over environmental resources. In economically disadvantaged regions, the degradation of renewable resources (including water) creates hardship and may lead to regional unrest. This reality has been acknowledged by the developed world. The challenge is to break

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[44]Damonte, *National Security Strategy: What about the Environment?*, 13.

[45]United States. Department of Defence, *Joint Operating Environment: Trends and Challenges for the Future Joint Force through 2030* (Washington, DC: U.S. Government Printing Office, 2007), 23-24.

[46]Norman Myers, "Environment and Security," *Foreign Policy*, no. 74 (Spring, 1989), 24, http://proquest.umi.com/pqdweb?did=8734252&Fmt=7&clientId=65345&RQT=309&VName=PQD (accessed 18 January 2008).

the zero-sum cycle of globalization and create positive-sum conditions that lead to prosperity and stability.

WATER: AN ELEMENT OF CONFLICT AND COOPERATION

> *"Little wonder the English language derives the word 'rival' from the Latin word "rivalis", meaning persons who live on opposite banks of the river used for irrigation."* [47]
>
> - Water Encyclopedia

Water plays a critical role along the conflict continuum and poses both a threat and an opportunity where tensions arise over scarcity. This warrants an examination of water through its geopolitical characteristics as both a source and a means of conflict. By understanding water's possible conflict causes and vulnerability indices, we are alerted to regions more prone to water disputes. However, an international legal framework, reinforced by effective institutions and trustworthy third-party participation leads to successful basin co-management. This provides the elements for cooperation rather than conflict over water.

Water Geopolitics

Instances of water, as both a source and means of conflict, have been recorded throughout history. Going back 4,500 years, Urlama, the King of Lagash, diverted water

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[47]Water Encyclopedia, "Law, International Water," http://www.waterencyclopedia.com/La-Mi/Law-International-Water.html (accessed 16 February, 2008).

to boundary canals to deprive the city of Umma of water.[48] In the U.S. Civil War, General Grant cut levees during the Vicksburg battle against the Confederates.[49] More recently in the 1999 Kosovo Campaign, NATO targeted utilities and shut down water supplies in Belgrade.[50] Yet, water's efficacy as an instrument of conflict can further political objectives. A clear example of usage as a political tool was seen in the early 1990s when Turkey threatened to restrict water flows of the Euphrates River into Syria to compel them into abandoning their support of Kurdish separatists in Turkey.[51] Water related terrorism emerged as a means of coercion for non-state actors when in 1999 the militia opposing East Timor independence killed pro-independence followers and threw their bodies into a well.[52] Unmistakably, water's value as a powerful lever is commonly exploited to further both military and political objectives.

Recognizing its strategic value, securing adequate water resources has been a key task of governments. The early rise of Egypt and China is closely linked to the development of transportation canals and irrigation. In modern times, national prestige is symbolized through major capital water projects; in Egypt, the construction of the Aswan

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[48]Peter H. Gleick, "Water, War & Peace in the Middle East," *Environment* 36, no. 3 (April, 1994), 11, http://search.ebscohost.com/login.aspx?direct=true&db=eih&AN=9405037922&site=ehost-live (accessed 1 February 2008).

[49]Peter H. Gleick, *The World's Water 2000-2001: The Biennial Report on Freshwater Resources* (Washington, DC: Island Press, 2000), 184.

[50]*Ibid.,* 189.

[51]Steve C. Lonergan, "Water and Conflict: Rhetoric and Reality" In *Environmental Conflict*, eds. Paul F. Diehl and Nils P. Gleditsch (Boulder, CO: Westview Press, 2001), 118.

[52]Gleick, *The World's Water 2000-2001: The Biennial Report on Freshwater Resources*, 183.

High Dam on the Nile was the nation's highest priority.[53] Beyond mere prestige, Israeli Prime Minister Yitzhak Rabin observed that "[i]f we solve every problem in the Middle East but do not satisfactorily resolve the water problem, our region will explode."[54] In regions where states must compete for essential water supplies, most notably if the population is rising and/or the supply is decreasing, water becomes increasingly coveted with the potential to unleash conflicts.

Water Conflict

Crises through freshwater conflicts entail serious political consequences. To further understand the nature of water conflicts, it is useful to examine them through four causal categories – usage, pollution/degradation, relative distribution and absolute distribution:

> Conflict through use. Among the oldest usages of waterways is shipping. However, because of the well established legal structures, this activity rarely leads to conflict. More frequently, water usage conflicts involve activities such as dam construction or the channelling of a river flow.[55] A usage conflict occurred in 1967 when Israel destroyed an 'all-Arab' diversion works on the Jordan River

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[53]Michael T. Klare, *Resource Wars: The New Landscape of Global Conflict* (New York: Metropolitan Books, 2001), 141.

[54]*Ibid*., 142.

[55]Helga Haftendorn, "Water and International Conflict," *Third World Quarterly* 21, no. 1 (Feb., 2000), 53, http://links.jstor.org/sici?sici=0143-6597%28200002%2921%3A1%3C51%3AWAIC%3E2.0.CO%3B2-Y (accessed 7 February 2008).

headwaters.[56] In 2000, it was estimated worldwide that capital water infrastructure projects forced the dislocation of up to 80 million people – many without compensation or a voice in the process thereby sparking instances of violent protest.[57] Furthermore, environmental refugees are not always well-received in new locations, thereby sparking violence as a second order effect.

Pollution/Degradation. Water pollution is caused by industry, urbanization, and the use of fertilizer and pesticides in agriculture. Although first manifested in industrialized nations, these countries possess the financial, technological and regulatory capability to mitigate pollution's effects. However, different circumstances exist in the former Soviet Union and the growing mega-cities of the third world.[58] An example of pollution conflict is the violent protests by farmers in China's Zhejiang's province over government dispensations to local industrial pollution of the land and water, causing illness and poor crops.[59]

Relative Distribution. A relative conflict presents itself where a disparity over the use of water exists between upper and lower lying riparian states. Water manipulation may be made for the purposes of energy generation, navigation or

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[56]Gleick, *The World's Water 2000-2001: The Biennial Report on Freshwater Resources*, 186.

[57]Ken Conca, "The New Face of Water Conflict," *Navigating Peace* 3 (2006), http://www.wilsoncenter.org/topics/pubs/NavigatingPeaceIssue3.pdf (accessed 11 February 2006).

[58]Stephan Libiszewski, "International Conflicts Over Freshwater Resources" In *Ecology, Politics & Violent Conflict*, ed. Mohamed Suliman (London, UK: Zed Books, 1998), 125.

[59]Centre for Strategic and International Studies and Sandia National Laboratories, *Global Water Futures: Addressing our Global Water Future*, 40.

flood protection. For downstream countries, these actions may produce sizable socio-economic and ecological changes.[60] Nowhere is relative distribution conflict more evident than the Euphrates and Tigris rivers, which originate in Turkey. Turkey utilizes only a small portion of these waters, yet Iraq is nearly dependant upon both rivers and Syria depends upon the Euphrates. Iraq and Syria need the Euphrates for human consumption, irrigation and electricity generation, for which all three have constructed multiple dams. Political tension over freshwater came to a climax in the 1970s with the threat of military conflict between Syria and Iraq over the Assad Dam. Nestled in there is the Kurdish problem, a long standing source of tension.[61]

Absolute Distribution. An absolute conflict of distribution exists when there is insufficient water to meet a nation's needs. This situation is most acute in arid regions where the utilization of freshwater exceeds its renewable quantity and is intensified where different levels of development or military power lead to varying consumption levels. [62] Perhaps the most striking example is Israel's military advantage relative to the Jordan Basin that covers only 50% of the region's water needs and is further complicated by the Palestinian struggle for independence.[63]

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[60]Libiszewski, *International Conflicts Over Freshwater Resources*, 123.

[61]Haftendorn, *Water and International Conflict*, 56.

[62]Libiszewski, *International Conflicts Over Freshwater Resources*, 121.

[63]Haftendorn, *Water and International Conflict*, 59.

Understanding the root causes of conflicts yields clues to evaluating a country's vulnerabilities to water-resource problems or reliance on contested supplies with a view to their ultimate resolution.

Indicators of Water Resource Vulnerability

A nation's vulnerability to water resources is dependent upon many interrelated variables such as the economic development of the waterway, water availability and the degree to which it is reliant upon external water sources. These factors suggest indicators of potential risk for conflict, as well as where cooperation and intervention would be worthwhile.

The first measure is the percentage of annual water demand to the renewable water supply, as shown in Table 1. A percentage that exceeds 100 suggests a need to import freshwater, pump ground water at a non-renewable rate or desalinate brackish water.[64] Whether the shortage results from high demand or limited supply, this circumstance may threaten neighbouring countries. Countries that fall into this category include Libya, Jordan, Israel, Egypt, and Yemen; Middle East countries where political tensions are high. The growing percentage in this region signals concern. It is noteworthy that Israel and Jordan's ratio has decreased, likely the effects of the 1994 peace treaty, where Article 6 stipulates cooperation in water resources.

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[64] Peter H. Gleick, "Water and Conflict: Fresh Water Resources and International Security," *International Security* 18, no. 1 (Summer, 1993), 99, http://search.ebscohost.com/login.aspx?direct=true&db=tsh&AN=9309292431&site=ehost-live (accessed 6 February 2008).

Table 1 – Ratio of Water Demand to Supply

Country	Withdrawal m^3	Renewable Supply m^3	Late 1980s Withdrawal/Supply [a] %	2005 Withdrawal/Supply %
Libya	4,811	~1000	374	481
Yemen	6,631	~4,000	135	165
Egypt	68,653	~58,000	97	111
Israel	2041	~2000	110	102
Jordan	1016	~1000	110	102
Afghanistan	23,261	~65,000	n/a	35
Canada	45,974	~2,902,000	n/a	1

Note
a. This data shows the percentage of water annually used consumed compared to the annual renewable supply.
Sources: Gleick, *Water and Conflict: Fresh Water Resources and International Security*, 100 and Earth Trend, "Freshwater Resources 2005" http://earthtrends.wri.org/pdf_library/data_tables/wat2_2005.pdf.

A second indicator that accounts for both a growing population and diminishing water supply is the annual per capita water availability. As described earlier, 1,000 cubic metres is considered the minimum per capita water requirement for an industrialized nation. Globally, the aggregate number facing water stress is growing; from 2.4 billion today to a forecast of 4 billion in 2025. Most acute is tension riddled Africa and the Middle East (for example Libya, Jordan, Yemen, Rwanda). Those countries facing significant water stress and unable to increase water-use efficiency or invest in desalination technology will risk severe economic dislocation,[65] thus exacerbating the disparity in a globalized economy.

[65] *Ibid*., 100.

A third measure is a dependency ratio. Water's transboundary characteristics reveal its vulnerability to competing interests. This vulnerability is most acute for nations where a large proportion of their freshwater sources originate from outside their borders and is under the control of other nations.[66] Egypt is a prime example. Located at the end of the Nile, 97% of its water first flows through nine other countries. Another country is Bangladesh, with a 91% dependency ratio, where it took over 30 years to establish a satisfactory water-sharing agreement with India.[67] This vulnerability is further compounded with the nation's relative dependence on hydroelectricity as a portion of its total electrical supply. This points to a nation's energy source as a vulnerable military target. As such, frictions over water use may arise where water is controlled by neighbouring countries. [68]

Water Cooperation

In 1995, Ismail Serageldin, Vice-President of the World Bank, stated that "the wars of the next century will be about water."[69] At first, the linkages between water scarcity and conflict appear intuitively direct. However, that linkage is indirect as water

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[66]*Ibid*., 101.

[67]Meredith Giordano, Mark Giordano and Aaron Wolf, "The Geography of Water Conflict and Cooperation: Internal Pressures and International Manifestations," *The Geographical Journal* 168, no. 4 (December, 2002), 298, http://links.jstor.org/sici?sici=0016-7398%28200212%29168%3A4%3C293%3ATGOWCA%3E2.0.CO%3B2-S (accessed 6 February 2008).

[68]Gleick, *Water and Conflict: Fresh Water Resources and International Security*, 102-103.

[69]Aaron T. Wolf, A. Krammer and A. Carius, "State of the World 2005 Global Security Brief #5: Water can be a Pathway to Peace, Not War," Worldwatch Institute, http://www.worldwatch.org/node/79 (accessed 5 February, 2008).

scarcity is nested among a combination of other political factors that could escalate to conflict.[70] As one Israeli hydrologist/peace-negotiator stated: "[i]f there is a political will for peace, water will not be a hindrance. If you want reasons to fight, water will give you ample opportunities."[71] Consequently, it is asserted that nations rarely battle exclusively over water, instead shared water basins foster cooperation rather than instigate conflict.

There are 263 international water basins that account for 60% of the global river flows and host 40% of the world's population in 145 nations.[72] Because of its integrated economic importance, nations cannot afford to fight over water because the risk of conflict results in lost markets; instead, cooperation increases trade flows between impacted nations.[73] Politically and economically, the opportunity cost of conflict is convincingly articulated by an Israeli defence analyst:

> "Why go to war over water? For the pricts in llll 3507 fighcin, (you ca buiuldl)Tj-0.0002 Tc -0.
>
> youdonl 35t havte todel

Research favours diplomatic solutions as modern history identifies only seven severe disputes involving violence, compared to 150 treaties signed in the 20th century. This impressive history of water dispute resolution dates back to 805 A.D. and includes more than 3,600 treaties.[75]

International Law

International law is an essential element in structuring trustful cooperation. Early development of international law on water focussed primarily on navigation. To prevent conflict and settle existing disputes in the last 100 years, the international community has developed principles for freshwater management. In 1997, they were adopted by the United Nations as the Convention on the Law of the Non-Navigational Uses of International Watercourse.[76] The Convention embodies a number of customary principles regarding the shared use of water resources:

Equitable share and reasonable utilization;[77]

Obligation not to cause significant harm;[78]

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[75]Aaron T. Wolf, "Conflict and Cooperation Along International Waterways," Oregon State University, Transboundary Freshwater Dispute Database, http://www.transboundarywaters.orst.edu/publications/conflict_coop (accessed 12 February, 2008).

[76]Meredith Giordano and Aaron T. Wolf, "The World's International Freshwater Agreements," Oregon State University Transboundary Freshwater Dispute Database, http://www.transboundarywaters.orst.edu/publications/atlas/atlas_html/foreword/internationalAgreements.html (accessed 23 February, 2008).

[77]*Ibid*.

[78]*Ibid*.

Obligation of prior consultation; and[79]

Obligation to cooperate and negotiate with the intention of reaching an agreement.[80]

The term 'equitable share' remains elusive. Rather than meaning 'equal', contributing to its vagueness is the consideration of a variety of factors: geography, societal and economic needs of riparians, existing and potential uses of the water way, and the availability of alternates. Lacking a universal definition on equitable use, specific treaty based agreements are best suited to reflect regional realities of need and power in augmenting the Convention's broad principles.[81]

Institutions and Joint Basin Management

With a legal foundation that encourages greater collaboration, it is at the basin-level that progress in cooperative water management is realized. Effective treaties incorporate flexibility to adapt to changing requirements and consider representation of all co-riparian sectors. As allocations are central to most water disputes, successful treaties further establish usage priorities and water quality thresholds. Moreover, the distribution of benefits must be equitable and allow for a positive-sum outcome for all participants. To that end, a number of precedents exist for linking water negotiations to

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[79]Jacques Sironneau, "Is there an International Law on Water? Progress and Prospects for the Resolution of Conflicts Over Water Use" In *Water and War: Symposium on Water in Armed Conflict*, ed. International Committee of the Red Cross (Geneva: ICRC Publications, 1995), 55.

[80]*Ibid*., 54.

[81]Water Encyclopedia, *Law, International Water.*

other issues, thereby enlarging the basket of benefits.[82] Water cooperation is often a gateway to "shared regional identities and institutionalized cooperation on issues larger than water, as exemplified by the creation of the SADC [South African Development Community] in post-apartheid southern Africa."[83]

Water management is highly complex and extremely political. Good governance makes for good treaties when administered by strong institutions. "[T]he presence or absence of institutions has proven to be one of the most important factors influencing co-riparian water relations."[84] Institutional efficacy incorporates forums for discussion, joint management, rules, data gathering and management, technical committees, and dispute settlement arrangements.[85] Such features create transparency, facilitate trust, and overcome the fear of cheating.[86] These regimes "turn out to be tremendously resilient over time, between otherwise hostile riparians, even as conflict is waged over other issues."[87] Since 1960, the Indus Water Commission has operated effectively despite three wars and several border clashes between India and Pakistan.[88] Also, the Mekong Committee of six nations persevered despite the Vietnam War.[89]

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[82]Giordano and Wolf, *The World's International Freshwater Agreements.*

[83]Wolf, Krammer and Carius, *State of the World 2005 Global Security Brief #5: Water can be a Pathway to Peace, Not War.*

[84]Giordano and Wolf, *The World's International Freshwater Agreements.*

[85]Powers, *International Economic Institutions: Formal Mechanisms for Dealing with Resource Conflict*, 321.

[86]Zawahri, *The Water Weapon: Havoc and Harmony Over International Rivers*, 4.

[87]Wolf, *Conflict and Cooperation Along International Waterways.*

[88]Zawahri, *The Water Weapon: Havoc and Harmony Over International Rivers*, 88-89.

The involvement of a financially powerful and trustworthy third party is an essential element to institutional progress and treaty success.[90] Such actors, such as the World Bank, the United Nations or an unaligned developed nation, bring international credibility and often provide financial incentives. They must be willing to support the process over the long-term where results may not be easily measurable. However, in the end, it will be the riparians themselves who drive the process.

Recurring disputes over shared basins coincide with an absence of institutional structures, as in the case between Iran and Iraq with tensions over the Shatt Al-Arab.[91] The recent progress in international law through the U.N., adaptive treaties and resilient water institutions promote better basin management and development of the resource itself; they advance economic integration and promote regional security.

CONCLUSION

Freshwater is a primary resource, integral to all ecological and societal activities. Yet its distribution is uneven and irregular, leaving some regions extremely water-short. As human populations grow and living standards increase, so will the demand for

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[89]Alan Dupont, *The Environmental and Security in Pacific Asia* (New York: International Institute for Strategic Studies, Oxford University Press Inc, 1998), 69-73.

[90]Wolf, Krammer and Carius, *State of the World 2005 Global Security Brief #5: Water can be a Pathway to Peace, Not War.*

[91]Sironneau, *Is there an International Law on Water? Progress and Prospects for the Resolution of Conflicts Over Water Use*, 59.

freshwater. However, on-going global climate change contributes to water scarcity making the supply problematic and uncertain.

Competition for this dwindling resource gives rise to freshwater as a security concern, most notably when its scarcity leads to political or economic disadvantage. These conditions only exacerbate existing high levels of political conflict omnipresent in some regions of the Middle East, Persian Gulf, Africa and Asia, which are water stressed. History reveals a legacy where water has been both an instrument of conflict and a source of conflict due to usage, pollution, and distribution. However, there are a number of quantitative indicators that assess the vulnerability of states to water-related disputes. These disputes will more likely lead to political confrontations and negotiation rather than armed conflict provided there is a political will for cooperation. This willingness can be promoted through the association of a trusted, powerful third party. Yet, sustained basin water joint-management is a function of institutional resiliency, which remains the best insurance for collaboration. As such, this paper has argued that in water disputes the propensity for resolution is through cooperation rather than conflict.

We have seen that water's geopolitics is a function of the interaction of political, socio-economic and cultural factors. Perhaps Mark Twain was premature in his observation that water was worth fighting over, because understanding water's ever-evolving geopolitics gives reason for policymakers to head-off conflict and to support sustainable cooperation.

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