Water Security, Fear Mitigation and International Water Law (Symposium)

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WATER SECURITY, FEAR MITIGATION AND INTERNATIONAL WATER LAW

A. Dan Tarlock

I. INTRODUCTION: IS WATER FOR FIGHTING OR BARGAINING?

A. Why We Worry About Shortage-Driven Water Conflicts

Water lawyers, courts, and others in the water community are fond of quoting the quip attributed to Mark Twain, "whiskey is for drinking and water is for fighting over." Not only is there no evidence that Twain ever uttered these words, but the quote has taken on a life of its own which grossly distorts the nature of water competition disputes, especially state to state competition. Both whiskey and water are for human benefit and exist in sufficient quantities throughout the world to satisfy present and future demand. Meeting these demands will be challenging because water must be managed to counter the problems of mal-distribution in certain places. Nonetheless, the idea that water conflict can and will lead to violence is so powerful that the term "war" is often applied to intense but nonviolent conflicts over the use of water. The war metaphor implies that water conflicts are irresolvable unless one party totally prevails over the other. In reality, water violence happens; when it does, it is generally localized, although water facilities have been military targets. This said, many water disputes, especially international ones, simmer unresolved for decades.

Festering disputes are cause for concern because the ultimate driver in many water conflicts, both peaceful and potentially violent, is the fear of

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drought. One reads in the Old Testament, “I will make your heavens like iron and your earth like brass; and your strength shall be spent in vain, for your land shall not yield its increase, and the trees of the land shall not yield their fruit.” This famous curse, which was hurled at the Israelites as they are about to enter the Promised Land, exemplifies the ever contingent relationship between rainfall and the survival of civilization. In the biblical creation story, water was created on the second day and its abundance remained a sign of divine approval throughout the Old Testament, just as its absence, as illustrated by Leviticus, was a sign of God’s anger at humanity. Fear of its absence is almost universal. For example, it is deeply rooted in the development of civilization in the twin arid areas of Mesopotamia as well as in northern China.6

Water shortage fears were carried to the arid Mediterranean and then the New World.7 However, this fear receded with increased faith in the ability of science and technology to adapt to harsh climates. Human adaptation to climate constraints gradually pushed any idea of respect for nature from “civilization as it expanded from the relatively benign climate of the Mediterranean to northern Europe.”8 In the last two centuries, awe and respect for nature were completely replaced by the hubris that humans can improve upon it at no cost. In the United States, the Puritans rejected the view that natural disasters were a divine retribution for humankind’s sins. Just as one could not gain God’s grace, one could not lose it by one’s own efforts. The road to the modern view that nature should impose no constraints on human development is long and twisting. Tort law’s subsequent sharp distinction between fault and non-fault was an important step toward the modern philosophy that government has a duty to prevent and mitigate disasters for conditions that an individual did not cause.9 The move to ground liability in fault rather than the earlier simple theory that the tortfeasor caused an injury contributed to the expectation that adaptation to “acts of God” was not an individual responsibility. The large multipurpose reservoirs and dams constructed in the United States and throughout the world are testimony to the triumph of this idea.

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5 Leviticus 26:19-20.
6 In the Chinese creation story, after 45,600 years of rule by mythical human-beast emperors, the legendary monarch Fu Xi and his sister-consort Nu Wu appeared between 2852 and 2734 B.C. on the North China Plain. MILTON W. MEYER, CHINA: A CONCISE HISTORY 116 (2d ed. 1994). They are credited with the invention of writing, music, marriage and the worship of a supreme being as well as with water management and flood control, which is “crucial to the well-being of the Chinese state.” Id.
7 See PETER BURKE, THE ITALIAN RENAISSANCE 125 (rev. ed. 1986) (“[The] image of the Virgin Mary in the church of Impruneta, near Florence . . . was carried in procession to produce rain in times of drought or to stop the rain when there was too much . . . .”).
Despite the use of the science of technology to overcome the fear of shortage, the fear that supplies may not be secure remains and is growing in many parts of the world due to a combination of enduring and new factors. The two enduring fears among nations are use opportunity preemption and normal supply variability. The first reflects the risk that wealthier or more rapidly growing states will preempt future development opportunities by building incompatible projects. This is a typical fear of upstream states, but upstream states can equally preempt downstream opportunities. Capture can ripen into a vested right because once the project is built, the clock starts ticking on a vested rights claim, a subject discussed in the next section. The second fear has always been a factor in water planning and management due to inevitable climate cycles. Global warming magnifies this traditional fear because some of the most severe impacts will be felt by weak states with limited economic and political capacity to adapt to projected water stresses. Thus, the third fear raises the specter that the problem may be beyond the management capability of many countries and will produce various forms of instability, including violence and civil unrest, which spill across borders. There is growing speculation by serious military and foreign policy experts about the relationships among climate change, political stability, resource scarcity, hot war and widespread social unrest such as large-scale population migration. There is considerable concern that water scarcity could be a source of costly and inhumane regional instability, especially in weak “transition” states with an expanding population and an already stressed food supply due to dependence on domestic agriculture. The net result is that today water security is a more complex matter than it was when the term meant only a firm entitlement to a fixed allocation protected by courts, other tribunals or diplomatic pressure.

**B. The Argument: Worry But Manage Stressed Water Resources**

This article first summarizes the available evidence linking armed conflict and water scarcity, which concludes that violent, water-related conflicts are unlikely to occur even in the identified Middle Eastern and African “hot spots.” It nonetheless cautions that the possibility of larger-scale conflicts over water, especially in light of global warming scenarios, cannot be entirely discounted. Second, it examines the different definitions of water

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security or insecurity now on the table that arise from traditional and modern fears. Third, it compares the case for conflict with the case for cooperation. Fourth, it discusses the role that international water might play in encouraging or discouraging either conflict or cooperation.

The basic argument is that the power of fear to exacerbate tensions must be factored into the analysis on many regional water conflicts, but the fear of inadequate future supplies does not inevitably lead to violence and social disruption. Nations have cooperated to share common supplies or lived with high levels of uncertainty. Thus, cooperation rather than conflict is the likely future result because a monetary cost of conflict resolution is often reasonable and the joint benefits of cooperation outweigh the costs of alternatives. The law can play a positive role in mitigating fear by defining water security, as international water traditionally has, as a fairly apportioned common source of supply. However, to generate the trust necessary to alleviate fears, a fair allocation must be augmented by adaptive, integrated management institutions.

II. OFF TO WAR OVER WATER?

A. The Rise and Fall and Rebirth of Geographical Determinism and Water Conflict

There is a long intellectual tradition of speculation by historians and geographers about the relationships among a civilization – its sustainability, climate, the civilization’s use of its natural endowments, environment and conflict or social disruption. Many scholars have linked the decline of ancient civilizations to various types of human and natural environmental degradation. Droughts and unsustainable irrigation practices have been


15 See, e.g., NORMAN POUNDS, AN HISTORICAL AND POLITICAL GEOGRAPHY OF EUROPE (1947).

16 See, e.g., J. DONALD HUGHES, PAN'S TRAVAIL: ENVIRONMENTAL PROBLEMS OF THE ANCIENT GREEKS AND ROMANS 194 (1994) (concluding that “[e]nvironmental changes as a result of human activities must be judged to be one of the causes of the decline of ancient Greek and Roman civilization”). However, one must be cautious of single factor explanations. For example, the reason for the disappearance of the Anasazi civilization on the Colorado Plateau is now being supplemented by a more nuanced explanation that includes a religious reformation. See George Johnson, Vanished: A Pueblo Mystery, N.Y. TIMES, Apr. 8, 2008 § F, at 1.
blamed for the decline of the Sumerian civilization and others. This led to the theory of geographical determinism, which in its most extreme form posits that geography and climate determine a country’s fate.17 However, geographical determinism fell out of favor among geographers and historians in the United States, due in part to the Nazis’ use of the theory to justify the need for a greater German Reich at the expense of her eastern neighbors,18 and the rise of more sophisticated economic and cultural explanations for the way in which different countries develop. However, the theory never completely died. For example, in the midst of the 1945 Potsdam Conference, which carved up Germany and legitimated the Iron Curtain, President Truman startled Generalissimo Stalin and Prime Minister Churchill by announcing that his study of history led him to include that “water . . . straits and canals and rivers” were the source of 200 years of European wars.19

The current concern over global climate change-induced resource scarcity and degradation is producing a renewed interest in the links among climate, geography and society, especially war or dangerous social disruption, and thus a new neo-graphical determinism.20 In the 1990’s, proponents of international action to address environmental degradation expanded the traditional notion of national security as a defined territory defended by military might and began to link the “health” or “ill health” of a nation’s environment to its national security.21 A deteriorating environment

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17 The idea, as were most intellectual ideas in late nineteenth and early twentieth century America, was brought to the United States from Germany by the geographer Ellen Churchill Semple. See generally ELLEN CHURCHILL SEMPLE, INFLUENCES OF THE GEOGRAPHIC ENVIRONMENT (1911).

18 See Richard Peet, The Social Origins of Environmental Determinism, 75 ANNALS AM. ASS’N GEOGRAPHERS 309 (1985) (discussing the social underpinnings of the ideology of environmental determinism). Geographical determinism allowed historians to explain the distinctive cultural and economic patterns which developed in particular regions. Id. at 319-22. Environmental determinism paid particular attention to the role of climate on culture and society. Id. However, this simplistic cause and effect relationship was rejected in the United States in the 1920s and died after World War II, after Nazi Germany used earlier works by German scholars to support racial explanations for alleged superiority of northern European culture and the need for “lebensraum.” Id. at 316. As a result of this misuse of science, the emphasis on human adaptation to climate and the landscape gradually receded from the story of civilization. SIMMONS, supra note 8, at 178-79.

19 CHARLES M. LEE, JR., MEETING AT POTSDAM 197 (1975). President Truman was quite peeved when Stalin ultimately refused to include a proposal for an international waterways authority on the conference agenda. Id. at 275-76.

20 See generally, W. GORDON EAST, THE GEOGRAPHY BEHIND HISTORY: HOW PHYSICAL ENVIRONMENT AFFECTS HISTORICAL EVENTS (1965); David D. Zhang et al., Global Climate Change, War and Population Decline in Human History, 104 PROC. NAT’L ACAD. SCI. 19214 (2007) (showing that cooling is associated with reduced food production, famine, and war in China and Europe between 1400 and 1900; similar disruptions might result from the adverse impacts of global warming). The leading proponent of the new determinism is Professor Jared Diamond, whose books GUNS, GERMS, AND STEEL: THE FATES OF HUMAN SOCIETIES (1997) and COLLAPSE: HOW SOCIETIES FAIL OR SUCCEED (2005), have triggered a lively debate about the relationship between a nation’s natural resources and its culture.

21 See GERMAN ADVISORY COUNCIL ON GLOBAL CHANGE, supra note 11, at 29-23.
can be a source of internal conflict which can spill across borders. The more serious risks are linked to insufficient food supplies or mineral wealth competition. This argument was taken up by Warren Christopher, Secretary of State during the Clinton Administration. The widely accepted view that global warming is here has accelerated this speculation with regard to water and ecosystem change. From the Intergovernmental Panel on Climate Change (IPCC) down, scientists generally agree that warming may result in less net available water in areas that are already water-stressed. Regional instability in Africa and Asia, which includes the Middle East, is increasing as the "major" powers have less ability to dampen it and is a special area of concern because population growth bumps up against limited, often degraded, natural resources, including water.

**B. How Serious is the Risk of Real Water Wars or Serious Social Disruption?**

How serious is the future risk of large-scale water-driven violence? To date, the lesson of history is not much, but this is not a definitive answer. There are documented instances of violence connected to water disputes, but most violence, especially that related to water shortage, is localized and short-lived. For example, the head gates of a federal irrigation project in Oregon were dynamited after the Bureau of Reclamation closed them, in the summer of 2001, to leave sufficient water in an upstream lake for listed endangered species. The isolated and small-scale nature of water conflicts is confirmed by the major data base, the Water Conflict Chronology maintained by the Pacific Institute. The latest version starts with the

In 2007, Senators Chuck Hagel and Richard Durbin introduced legislation which would require the U.S. military to play war games to determine how climate change might affect national security. Global Climate Change Security Oversight Act, S. 1018, 110th Cong. (2007) (as referred to the Senate Select Committee on Intelligence); see also Bryan Bender, Bill Ties Climate to National Security, BOSTON GLOBE, Apr. 9, 2007.


23 Water management problems arise from either a lack or an excess of water. This article focuses on problems of inadequate supply but it recognizes that widespread flooding can be a serious social problem and a source of insecurity.

24 Don Phelps, Water and Conflict: Historical Perspective, 133 J. WATER RESOURCES PLAN. & MGMT. 382 (2007) (arguing that countries rarely go to battle over water and fights over water have generally "been initiated between individuals or small enclaves of individuals and not between sovereign bodies").

25 See DOREMUS & TARLOCK, supra note 4, at 4. The conflict is unresolved, but the violence was not repeated. A combination of wet years and government intervention has kept the head gates open in the summer.

Sumerian account of a flood to punish the sinful abuse of the earth and ends with a Hezbollah attack on an Israeli waste water treatment plant. But, most of the modern serious incidents are either the selection of water facility targets during a war or small village disputes in Asia and Africa. Thus, it is too broad to draw serious policy conclusions. This is not the end of the inquiry; there is a case for not following that adage that the past is prologue. The main message of modern environmentalism is that intensifying human use of the planet is causing unprecedented levels of change, much of which can legitimately be classified as environmental degradation. When change occurs in areas already stressed by climate and political instability, the risk of resource related violence can increase. This is not to say that violence is inevitable; it only says, as the studies discussed in this section show, that the warning signs are there and cannot be easily discounted.

To assess more accurately the threats to domestic and international security, it is necessary to distinguish among three potentially intertwined concepts of water conflicts. Conflicts can arise from water stress, "serious" water use competition, and the fear of permanently denied access to water. The three form a continuum of shortage risks as well as the likely response of a country. Water stress refers to the possibility (or fear) that available future supplies, especially in areas vulnerable to global warming, will not be available to satisfy all future demands, especially for irrigated agriculture. Serious water stress refers to the possibility that supplies will exceed demand in the foreseeable future because the available supply cannot satisfy all uses. This problem arises frequently when different uses demand different water levels and flows at different times of the year. The fear of permanent denial arises when one party seeks to control the source to the detriment of other users. This problem can occur between nations or within a nation. All levels of stress are a common condition in arid and semiarid developed and developing countries, and modern domestic water management systems can be understood as responses to these stresses. There is increasing concern that stress may invade humid regions as droughts become more frequent and evaporation increases, canceling any increased precipitation in higher latitudes. In brief, the consensus is that rainfall will decrease in the arid sub-

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27 See Daniel Hillel, Rivers of Eden: The Struggle for Water and the Quest for Peace in the Middle East 266 (1994) ("During the Persian Gulf War of 1991, both sides targeted waterworks such as dams, desalinization plants, and water conveyance systems. Most of Kuwait's desalinization capacity was destroyed by the retreating Iraqis.").
29 See generally L. Ohlsson, Water Conflicts and Social Resources Scarcity, 25 Physics & Chemistry Earth 213 (2000) (classifying scarcity as demand-driven, supply-driven or the result of structural inequities among different groups of water users).
Competition: Chronic But Containable?

Competition, of course, is characteristic of all water disputes when there is fear of future shortage. Stress and serious competition can be magnified on international river systems because the interstate rights are often uncertain and dispute resolution mechanisms are limited. International and interregional competition is often associated with geographical destiny. Geographically or socially disadvantaged nations fear that future options will be pressured or preempted by the actions of other nations. Lower riparian state competition with headwater states is a classic example of the fears and tensions that geography can produce. The endless disputes between the tropics and increased in high latitudes. However, in these areas, the net amount of water may be less because evaporation rates will rise as temperatures rise and there may be drought-flood cycles. Climate change is the gorilla in the water room because it increases anxiety by raising the possibility that many stressed areas, which continue to function on available supplies, may be bumped into the second and third categories. The problems that warming scenarios may pose for the Nile Basin are illustrative. Global warming threatens to make the yearly flows of Africa’s rivers even less reliable for large hydro projects than they are now, as well as more precarious for other uses. Over half of Basin states get more than 90% of their electricity from hydropower, while another three are 70% dependent on hydropower. Experts believe that dry parts of Africa will see further reductions in precipitation. In the Nile Basin, according to the Intergovernmental Panel on Climate Change, there has already been “a reduction in runoff of 20% between 1972 and 1987” and “significant interruptions in hydropower generation as a result of severe droughts.” A 1995 study of climate impacts on several major rivers worldwide noted that the Nile experienced the most severe change of the rivers studied. Central Asia faces similar problems. Melting glaciers in the Pamir Mountains, headwaters of the Amy Darya River will increase winter runoff but decrease summer runoff, furthering threatening irrigation in the region.

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mountain countries of Kyrgyzstan and Tajikistan with their Central Asian cotton growing downstream neighbors, Kazakhstan, Uzbekistan and Turkmenistan, is a classic example of potential incompatible different uses. The headwaters states want to hold back water for winter hydropower production when it is needed downstream for summer irrigation. The long simmering tension among Turkey, Syria and Iraq is a classic example of the power of upstream states to preempt downstream opportunities. Long before the United States-led invasion of Iraq, the vibrant agricultural economy of the lower Tigris and Euphrates Basin was jeopardized by Turkey’s aggressive, more recent upstream development. China is another example of a headwaters state with the capacity for rapid, preemptive development. It is not a party to the Lower Mekong River Treaty but now has the capacity to substantially influence Lower Basin river flows and the ecology of the basin by its construction of a cascade of hydroelectric reservoirs on headwaters tributaries.

Competition and conflict do not mean that the parties will resort to violence. There is no simple relationship between the degree of stress and the likelihood of violence, and there is ample precedent that competition and conflict will produce cooperation. The more than 200 water-related treaties in force testify to the fact that it is possible to settle or at least confine water disputes to manageable proportions. Modern technology provides water managers and users with much accurate real-time information which can help to reduce some of the uncertainty inherent in water use. European countries have provided a great deal of aid to support cooperative solutions in Asia and Africa. The next section examines the hypothesis that cooperation rather than violence is the likely outcome of water conflicts.

Patricia Wouters & Dr. Serguei Vinogradov eds., 2001). One of the leading forces in the development of the doctrine of equitable and utilization reports that upstream/downstream conflicts were the impetus for the International Law Association’s development of rules and that there were sharp differences of opinion among up and downstream states. Id. 


39 Id. at 870 (discussing the Turkish water project that “could cause Syria to lose up to 40 percent of its water from the Euphrates and Iraq as much as 90 percent”). In response to Syria and Iraq’s concerns over the loss, “Turkish officials have denied any obligation to provide water to downstream countries.” Id. at 871.


41 See Elizabeth Soderstrom et al., Int’l Water Mgmt. Inst., Transboundary Collaborative Learning: Case Study in the Okavango Basin (draft report), http://www.iwmi.cgiar.org/Assessment/FILES/word/ProjectDocuments/Okavango/Okavango_Draft%20Report.pdf (describing the creation of a database to help guide future management decisions among Angola, Botswana, and Namibia over the use of this vital African river). See text accompanying infra notes 91 to 95 for a brief discussion of the Okavango issues and management initiatives.
III. THE CASE AGAINST THE VIOLENCE THEORY

A. Money Conquers All

The case against the hypothesis that water conflict will lead to violence rests on the power of money to produce sufficient incentives to reduce uncertainty by creating the legal and management regimes to adapt to existing and new stresses. Economists reject the inevitable conflict hypothesis because to them water is simply another commodity with a price which factors fear out of the equation. Thus, water is for trading, not fighting. Those who control water but "irrationally" fail to share it face a high opportunity cost or loss of value and must inevitably come to their senses. To foster cooperation, they invoke the Coase theorem, which posits that rational actors will bargain toward the efficient allocation of a scarce resource regardless of the initial distribution of ownership rights. A 2005 study of the longest running contemporary water conflict, the dispute among Israel, the Palestinian Authority, Jordan and Syria over the area’s limited surface and groundwater supplies, found that all parties would achieve substantial gains from water trades. The division of the Mountain Aquifer is 76% to Israel and 24% Palestine. According to the study, water trades could result in “total joint gains [of] about $84 million to $95 million per year.”

B. From Allocation to Benefit Sharing

Economics does play a powerful role in conflict resolution by exposing the monetary benefits of cooperation. It is often said that “water runs uphill towards money,” and international water law is embracing an economic-based approach to supplement the traditional declaration of rights, which can lead to a winner takes all approach. The alternative is the shared benefit model derived from welfare economics. The model posits that water is valuable only as a scarce resource with alternative values. Thus, the transcendental objective of efficiency requires that the resource be allocated to the most valuable suit of uses. This means that some nations will have to forego the actual use of wet water but are entitled to monetary compensation for making it possible for other states to put the water to its most efficient use.

44 Id. at 205.
45 Id. at 206.
46 See DAVID J.H. PHILLIPS ET AL., STOCKHOLM INTERNATIONAL WATER INSTITUTE, THE TWO ANALYSIS – INTRODUCING A METHODOLOGY FOR THE TRANSBOUNDARY
Shared benefits emerged from the 1961 Canada-United States Columbia River Treaty, and have become a general principle of international water law and environmental law generally. The United States and Canada wanted to dam the mighty Columbia primarily for power generation and flood control. Downstream dams in Washington state and Oregon would have deprived Canada of opportunities for power generation; Canada’s planned dams would have provided substantial flood control benefits to the United States. The parties agreed to allow the major development in the United States but Canada was compensated. The idea has been applied in other basins where upstream states can store but divert water and downstream states consume the flow. In recent years, there have been increasing calls to shift the focus of international disputes from the allocation to benefit sharing.

The force of this idea can be seen in the evolving efforts to resolve a decades-long dispute between Egypt and her co-upstream riparians on the Nile. Shared benefits are at the heart of the much heralded Nile Basin Initiative, which is designed to try and preserve decades of legal and political gridlock that Egypt has been able to sustain, blocking all upstream development. The Initiative is based on the sustainable development of the entire basin and the equitable utilization of, and benefit from, the common Nile Basin water resources. Elsewhere, I have argued that shared benefits have a legitimate role to play in the allocation of transboundary waters as long as they are seen only as one among a broad menu of policy instruments able to promote the fair and efficient allocation of scarce waters. In addition, the record of large dams to promote the optimum use of water and social equity is increasingly being questioned. The global record of large dams, as documented by the World Commission on Dams, reveals that poorly planned large dams can exacerbate problems of poverty, water inequity, regional tensions and environmental degradation. Thus, the hope of the advocates of the shared benefit approach is that the monetization of


49 See STOCKHOLM INT’L WATER INST., TRANSBOUNDARY WATER MANAGEMENT AS A REGIONAL PUBLIC GOOD: FINANCING DEVELOPMENT: AN EXAMPLE FROM THE NILE BASIN 6 (2007) (“The NBI seeks to develop the river in a cooperative manner, while sharing the substantial socioeconomic benefits it provides, and promoting regional peace and security.”).

50 Id.


52 WORLD COMM’N ON DAMS, DAMS AND DEVELOPMENT 15-17 (2000).
river waters will reduce fears and promote increased long-term international cooperation that produces positive results for those living in the river basin.

IV. WHAT IS WATER SECURITY?

A. The Traditional Meaning

Water security has traditionally had two meanings which apply both to the rights of an individual or to the claims of a state on behalf of its citizens. Historically, there was little expectation that the lack of security would translate into widespread social unrest or even violence. The first meaning is a firm water right which can be judicially or diplomatically enforced against those who interfere with it. Domestic water law is structured to channel and minimize conflict and competition because the object of all water law is to allow the acquisition of firm, quasi-exclusive rights to the use of water. It does this by minimizing but not eliminating the risks inherent in the use of water. All water law is premised on the assumption that the water is a scarce resource that must be rationally and fairly allocated among competing claimants. Although water rights are inherently correlative, given the fugitive and variable nature of water bodies, quasi-exclusive entitlements can be fixed. Once these entitlements are fixed, the costs of inference are also set and competitors should be discouraged from interfering with existing rights. A fixed allocation has two benefits. First, conflict is channeled into litigation rather than violence, if a competitor wishes to contest the legality of a use. And, if a competitor cannot displace a use through the courts, negotiation is always an alternative. Second, a fixed allocation forces a nation to adapt to new demands. For example, markets can be used to shift water from lower to higher valued uses and imports can be substituted for local production.

The second traditional meaning of security is a physically dependable supply. This can be tied to a legal allocation or it can be simply based on capture and a low risk that any other party can interfere with the capture. In both arid and humid areas, water rights are provided by a right backed up by carry-over storage, dams and reservoirs. On international rivers, the practice has often been reversed. Many nations have dammed and diverted and then forced other states to negotiate an allocation from this new reality. This option is becoming more problematic for two reasons. First, there are growing criticisms of the performance of large multiple purpose projects and calls to pay more attention to the social and environmental consequences of its poorly planned dams, although China, India and Turkey have largely ignored this call. The second is the specter of many global

53 This characterization of a water right was adopted by the New Mexico Supreme Court in Walker v. United States, 162 P.3d 882, 888 (N.M. 2007) (quoting Charles Du Mars & A. Dan Tarlock, Symposium Introduction: New Challenges to State Water Allocation Supremacy, 29 NAT. RES. J. 331, 332 (1989)).
warming scenarios suggesting that reservoir systems will not be able to deliver their projected amounts of water and hydroelectric power as evaporation rates increase so that the costs of unilateral capture may exceed the benefits.

**B. The New Definition of Water Security: Water Insecurity an Unacceptable Risk**

As a result of increasing uncertainty about future supplies, the concept of water security today is being expanded beyond these traditional definitions to include the guarantee of sufficient water for a nation’s sustainable food production. The assumption is that unless sufficient water exists for this and related health purposes, the lack of water will become a source of social insecurity or violence. This risk is especially high for poor nations in Africa and Asia which cannot easily substitute imports for lost production from diminished water supplies in relation to its population and have limited political and financial adaptive capacity. A nation must have a sufficient confidence level in its continued territorial integrity, social stability and sustainability, but the common thread running through both definitions is the heightened fear of the drastic consequences of an inadequate supply. A drought (or flood) induced food crisis can trigger migration which can change the ethnic balance of the host country and spill across borders in a catchment basin.

**V. THE ROLE OF INTERNATIONAL WATER LAW IN PROMOTING WATER SECURITY**

**A. International Water Law’s Functions**

This section examines the possible roles that international water law can have in promoting water security. Law must perform two roles to achieve this objective, but it alone cannot alleviate the fears, real incompatible demands, inequitable distributions and supply uncertainties that create the risk of water insecurity and the disruptive and unnecessary consequences that could follow. First, the law must fairly define the rights of respective states to set the outer limits of the use of the resource. Second, to respond to many challenges posed by global climate change, increasing water consumption and population growth, adaptive management institutions must be developed to sustain interstate cooperation. After that it depends on

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55 See GERMAN ADVISORY COUNCIL ON GLOBAL CHANGE, supra note 11, at 93-102.

56 Id. at 159.

57 See Joseph W. Dellapena, Adapting to the Law Water Management to Global
political will to manage a resource over the long run, trust among all classes of users, and the marshaling of the necessary financial resources to support cooperation. International water law shares the same conflict reduction incentive. International law recognizes that each state has an inchoate right to a fair share of the resource. It seeks to provide all nations which share a common watercourse a permanent, fair, and dependable share of a common supply and thus prevent rival, unresolved claims from festering over time. The problem is the gap between principle and practice.

B. International Water Law: Principle Versus Practice

International law has made some progress toward the first objective but less toward the second. It remains strong in principle but weak in practice. The law is derived from United States Supreme Court jurisprudence, ironically itself based on international law, and grandly posits that all riparian states must share the use of a common river. The law developed in the United States because the Supreme Court has the power, under its original jurisdiction, to hear water disputes among riparian states. The basic principle that the Court has articulated is that all states are entitled to an equitable apportionment of an interstate river since they can neither go to war against the other nor enter into treaties.

Unfortunately, too often the practice of many riparian states, especially upstream ones, is to unilaterally divert, degrade and defend or to stall agreeing to a sharing arrangement. This reality was affirmed in the Lake Lanoux Arbitration, which rejected the principle that a nation must seek the consent of a co-riparian before undertaking a major water development project. The practice of damming and diverting is reinforced by the general legal bias of rewarding the first person—so it individual or state—to put the water to productive use. Priority protection can take many forms, but the net result is that the principle, or the fear that it will be applied, can chill or foreclose development by slower growing or less wealthy states. To counter

Climate Change and Other Hydropolitical Stresses, 35 J. Am. Water Resources Ass'n 1301 (1999).

58 See Attila Tanzi & Maurizio Arcari, The United Nations Convention on the Law of International Watercourses 15 (Dr. Patricia Wouters & Dr. Serguei Vinogradov eds., 2001) ("[A]ll co-riparians enjoy within their territory equal rights in the use of a shared watercourse, so that the right to utilisation of each riparian must respect (and be co-ordinated with) the correlative rights of other riparians.").

59 Kansas v. Colorado, 206 U.S. 46, 97 (1906). The Court applied federal, state and international law for the proposition that "underlying all the relations of the [federal] States to each other, is that of quality of right." Id. at 97.

60 U.S. Const. art. III, § 2.


the practice of states taking unilateral action and the inevitable argument that they have perfected vested rights that cannot be disturbed, international water law borrowed United States jurisprudence. The core principle articulated in codifications and conventions is that all riparian states have a right to the equitable utilization of the watercourse. 63

There is now a strong consensus among international lawyers that riparian states should agree to share fairly the waters of international rivers among their co-riparian states to counter unilateralism. Nations, with some exceptions, have accepted the principle that no one state can monopolize a resource. 64 Fairness has now been expanded to include protection of environmental interests which have very little footing within the traditional calculus of entitlements. 65 All formulations of equitable apportionment standards stem from the 1967 Helsinki Rules adopted by the International Association. 66 Geography, hydrology, climate and vital national needs are relevant factors. The latest and most widely used formulation is contained in the July 8, 1997 United Nations Convention on the Law of the Non-Navigational Uses of International Water Courses which is now open for signature. 67 The Convention is unlikely to enter into force given the slow pace of ratifications but it remains authoritative as a statement of customary international water law. 68 Article V enjoins states to use watercourses in an "equitable and reasonable manner." Article V is followed by Article VI which lists seven non-weighted factors relevant to the determination of what is equitable and reasonable. The International Law Association has replaced the Helsinki Rules with the Berlin Rules 69 which reflect the recent

63 This principle is consistent with the modern characterization of international law as a system to promote distributive justice of scarce resources among the international community. See THOMAS M. FRANCK, FAIRNESS IN INTERNATIONAL LAW AND INSTITUTIONS 74 (1995) (describing the Draft Convention on the Non-Navigational Uses of Watercourses as an effort "to provide for distribution of a scarce resource through the application of broadly conceived equity").


65 See generally OWEN McINTYRE, ENVIRONMENTAL PROTECTION OF INTERNATIONAL WATER COURSES UNDER INTERNATIONAL LAW (2007) (explaining the law’s evolution).


68 McINTYRE, supra note 65, at 71-75 (discussing the various provisions of the Convention and noting that the Convention is based on the draft article of the International Law Commission, "[t]he most important body with regard to the codification of international law").

recognition of environmental interests and the need for cooperative basin management, but the equitable apportionment standards remain the same.

The Convention's multi-factor test encompasses the full range of uses of a watercourse but gives nations little guidance about what their fair share is and whether it will be available in the future. International water law is more insecure than domestic water law. Given the sovereign interests at stake, more weight must be given, at least in theory, to the displacement of existing uses by subsequent ones.\textsuperscript{70} International water law broadened the concept to equitable apportionment, equitable utilization and the protection of prior uses as important but not decisive factors. In contrast, United States equitable apportionment law is heavily weighted toward the protection of existing vested interests.\textsuperscript{71} States must negotiate interstate compacts to obtain a right to unused waters.\textsuperscript{72}

\section*{C. Does Fairness Equal Water Security?}

The question that must be posed is: Does the recognition of fairness, combined with the increasingly rigorous procedural rules that apply to a state's decision to claim its equitable share of an international watercourse, substitute cooperation for conflict? To answer this question one must ask, what is international water law? There are three possible answers. The first is that it is an aspirational illusion which functions only to chastise state practices which run counter to its norms. The second is that international water law is best seen as a set of framework principles that invite nations to reach a negotiated solution that puts in place an institution for future cooperation. The problem is that all three are accurate to a point, but none fully capture the varieties of practices among nations. The law's uncertainty and vagueness makes it "soft" and aspirational. At its worst, international water law serves as justification for practices that run counter to the underlying message of a fair, long-term sharing among nations. Balanced against this is the general consensus that most accept and practice the idea that common supplies must be apportioned

\begin{itemize}
\item \textsuperscript{70} See James C. McMurray \& A. Dan Tarlock, \textit{The Law of Later-Developing Riparian States: The Case of Afghanistan}, 12 N.Y.U. ENVTL. L.J. 711 (2005) (exploring the argument that Afghanistan is a classic example of a (very) slow developing headwaters state and the possibility that its riparian claims might displace those of its other Central Asian neighbors).
\item \textsuperscript{71} The Court announced a flexible formula in \textit{Wyoming v. Nebraska}, 325 U.S. 589, 618 (1945), but priority remains the most important factor in determining what is equitable.
\item \textsuperscript{72} See \textit{Colorado v. New Mexico}, 467 U.S. 310, 323-24 (1984) (requiring that the State requesting access to interstate water present the harms and benefits of the accession to both states affected).
\end{itemize}
equitably among co-riparian states.\textsuperscript{73} There is no definite answer to the question whether fairness promotes security because authoritative applications of equitable apportionment do not exist. The most important recent international water law precedent is the International Court of Justice decision in \textit{Case Concerning the Gabčíkovo-Nagymaros Project (Republic of Hungary v. Slovak Federal Republic)}.\textsuperscript{74} All three characterizations of international water law can be found in it. In 1977, the two Soviet Block countries signed a joint river basin investment treaty for the construction of the multiple-purposed Gabčíkovo-Nagymaros hydroelectric, navigation improvement and flood control lock and dam project on the Danube between Bratislava and Budapest.\textsuperscript{75} During the 1980s, the project became controversial in Hungary for economic and environmental reasons, but Czechoslovakia continued to build at a faster rate than Hungary. By the spring of 1989, the Gabčíkovo dam was 85\% complete and the bypass canal was between 60\% and 95\% complete; Hungary, however, had only construed the coffer dam for its promised downstream Nagymaros dam in the Danube bend.\textsuperscript{76}

Hungary unilaterally suspended work on the project in 1989 for fiscal and environmental reasons and one year later suspended the treaty as a "mistake" after she broke away from the then Soviet Union. The ICJ only decided the respective states' rights under the 1977 treaty and rejected Hungary's invitation to develop new customary water law principles. The Court acknowledged the potential applicability of the doctrine of equitable apportionment, but it did not directly apportion the Danube's flow or apply the new emerging principles of international environmental law to this water dispute. For example, it rejected some of the broader proposed readings of the precautionary principle and narrowly interpreted Article Thirty-Three of the Draft Articles of International Responsibility to States, which provides that a state may invoke the doctrine of necessity only in limited circumstances to justify a wrongful state act.\textsuperscript{77} The Court found that Hungary failed to establish "that a real "grave" and "imminent" "peril" existed in 1989 and that the state's response was "the only possible response."\textsuperscript{78} Instead,

\textsuperscript{73} See McIntyre, supra note 65, at 23-28 (discussing the "principle of equitable utilization . . . in the development of customary international law").


\textsuperscript{76} Gabčíkovo-Nagymaros Project, 1997 I.C.J. at 31.

\textsuperscript{77} Id. at 39-40.

\textsuperscript{78} Id. at 45; see also Afshin A-Khavari and Donald R. Rothwell, \textit{The IJC and Danube Dam Case: A Missed Opportunity for International Environmental Law?}, 22 MELB.
Hungary had other means of responding to the threats to the River’s ecology other than suspension and abandonment.

By a fourteen to one vote, the Court concluded that the treaty created a territorial regime on the reach of the River that was unaffected by the break up of the former Czechoslovakia. Hungary’s environmentally changed conditions defense was rejected because the possibility that subsequent environmental information would require a modification of the project was not completely unforeseen in 1977 and did not preclude a mutual adjustment by the two countries. Hungary only got some legal crumbs by way of dicta. The Court acknowledged that changed environmental conditions may affect the operation of a project. New knowledge of ecological risk may impose a duty on parties to a complex river basin development treaty to take the information into consideration in the ongoing implementation of the treaty and management of the river. In the end, the Court voted thirteen to two that the two states must undertake good faith negotiations consistent with both international environmental norms such as sustainable development and the law of international water courses. The two countries have signed agreements to develop a new management scheme in the context of the already constructed projects in Slovakia, but the dispute and the status of the dam, for which construction as not yet begun,

U. L. Rev. 507, 515 (1998) (arguing that required level of scientific certainty will defeat the operation of the precautionary principle). Article Thirty-Three of the Draft Articles on the International Responsibility of States adopted by the International Law Commission embodies a limited precautionary principle. Gabčíkovo-Nagymaros Project, 1997 I.C.J. at 39-42. To invoke this article, a state must demonstrate by credible scientific evidence that a real risk will materialize in the near future and is thus more than a possibility. Id. The Court found that Hungary’s evidence of risk and the possible range of alternatives did not meet these standards. Id.

79 United States law supports this principle. Initially, courts held that the National Environmental Policy Act did not apply to the operations of dams constructed before the passage of NEPA. See Upper Snake River Chapter of Trout Unlimited v. Hodel, 921 F.2d 232, 233 (9th Cir. 1990). However, a subsequent federal district court decision has applied the statute to on-going management activities of a dam. See Or. Desert Ass’n v. Green, 953 F. Supp. 1133, 1149 (D. Or. 1997) (dealing with questions of grazing in a wild and scenic river corridor). Further, in 1992, the Secretary of the Interior reversed a prior departmental position and agreed to prepare an EIS when the turbines of Glen Canyon dam, completed before NEPA was enacted, were upgraded. The decision was made as Congress was in the process of enacting legislation. See Grand Canyon Protection Act of 1992, Pub. L. No. 102-575, 106 Stat. 4600 (1992) (mandating an EIS).

80 The majority opinion downgraded sustainable development to a “concept” rather than a principle.

remains unsettled.  

Vice President Weeramantry of Sri Lanka was willing to go further and articulate general principles. His separate opinion adopts the interrelated principles of environmentally sustainable development and cautionary environmental assessment and management as *erga omnes* customary rules. After an extensive survey of the emergence of international environmental law and the Asian history of balancing resource use and nature protection, he concluded that:

Among [the principles] which may be extracted from the systems already referred to are such far-reaching principles as the principle of trusteeship of earth resources, the principle of intergenerational rights and the principle that development and environmental conservation must go hand in hand. Land is to be respected as having a vitality of its own and being integrally linked to the welfare of the community . . . . Sustainable development is thus not merely a principle of modern international law. It is one of the most ancient ideas in the human heritage. Fortified from the insights that can be gained from millennia of human experience, it has an important role to play in the service of international law.  

The crucial question remains whether international water is sufficiently robust to address the new security fears. The question is important because ultimately the reduction of fear among riparian states will require the cooperative planning and management processes described in the next section. However, these processes function best when there is a default rule which is perceived by all parties as inferior to the results produced by the process. To function as a default rule, international water law must be clear enough to indicate the likely allocation, should the matter proceed to the ICJ or another tribunal. Three possible hypotheses about the relationship between international water law and the new meaning of water security exist. The first asserts that law magnifies conflict because it is too uncertain and weak to deter unilateral, preemptive action. For example, the law provides very little protection of downstream states who want to preserve some portion of the natural flow for either environmental reasons or future development.  

Despite efforts to incorporate environmental values into

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82 See generally Fürst, supra note 81.
international water law, there is little protection of the natural flow rule in practice. Strictures against causing pollution could be source of flow protection, but rivers are protected only from serious episodes of pollution. The material injury rule, which is at the heart of equitable apportionment, allows upstream states to progressively use water which creates the risk of environmental damage but not legally cognizable damage. For example, upstream diversions may generally increase the salinity of rivers by allowing salt water to migrate upstream. In addition, pollution is often limited to serious, identifiable pollution rather than less visible, cumulative impacts from environmentally destructive watershed land use practices. The presumed remedy is post hoc mitigation rather than prevention.

The second hypothesis asserts the opposite: law reduces these conflicts because it is clear enough to inject substantive and procedural fairness into allocation controversies. The object of the allocation and management of international basins is to promote development, social equity and environmental protection in a fair and sustainable manner, not simply to shift monetary resources within the basin. The United Nations Convention and the Berlin rules make it clear that no one state can monopolize a supply. These rules require making credible projections about what an equitable apportionment might be. The third hypothesis asserts that uncertain and weak law is positive because it provides an incentive for states to forego unilateral action and negotiate cooperative management institutions that reduce uncertainty and fear of shortage.

D. Toward Integrated Water Management

Traditionally, nations solved water disputes by a treaty or softer document but did not create institutions to deal with changing conditions in the basin. Treaties can either divide the waters among riparian nations or merely promise future cooperation. Fixed allocations are relatively rare and
many existing fixed allocations are increasingly criticized as inequitable, lacking in environmental protection provisions and out of date in light of advances in hydrology and global climate change. The general consensus in the international water community is that the majority of treaties, especially in the developing world, are not robust, especially because they provide inadequate dispute resolution and long-term management procedures. More permanent, functioning basin management institutions are needed with the capacity to build sufficient trust among the parties to permit adaptation to new conditions and demands for water use.

The management of the pristine Okavango River in southern Africa is a case in point. The river is shared between three countries each with different views of its use. Angola, the headwaters state, is emerging from decades of civil war and is just now considering her use options. Namibia and Botswana are among the driest countries in the world. Namibia views the River as the only dependable source of water for the central part of the country where her population is concentrated, and has proposed a diversion to the head of the Eastern National Water Carrier. Arid Botswana depends on the flow both for existing and planned agriculture and to sustain a vibrant ecotourism industry in the wildlife rich Okavango Delta, the largest Ramsar Convention wetlands in the world. In 1994, the three countries signed a general agreement creating a commission to develop criteria for the equitable utilization and sustainable development of the River, and this has evolved in a more ambitious, broad-based, long term cooperative effort to collect and share the data necessary to develop a coherent management for this aquatic treasure.

Resource Treaties: The Transboundary Freshwater Dispute Database, 9 COLO. J. INT’L. ENVTL. L. & POL’Y 157, 162 (1998). The United Nations Food and Agricultural Organization lists some 3,600 water-related treaties beginning in A.D. 805. Id. at 158. However, modern scholars use a database of about 145 treaties, and only fifty-four of those have a fixed allocation. Id. at 162.


See Establishment of a Permanent Okavango River Basin Commission (OKACOM), supra note 64, art. 4.3.

See Soderstrom et al., supra note 41, at 17.
The evolving Okavango management regime is an example of the current thinking in the world water community that the best hope for the adoption of sustainable water management both within and among nations is the adoption of Integrated Water Resource Management (IWRM). The basic thrust of IWRM is the permanent management of water resources on a sustainable, basin-wide basis. IWRM is not a totally new concept. It is not a substitute for making hard political choices about alternative water use options and the necessity for agreement among riparian states about their respective shares of a common river. For example, IWRM counsels that new demands for water must be recognized as potential constraints on traditional, often inefficient uses to accommodate new environmental and social equity uses.

There is a long history of treating river basins systems as single units and trying to plan and execute comprehensive management regimes characterized by integrated dams and irrigation and canal systems. IWRM builds on this long tradition of river basin planning, with deep roots in the United States and the former Soviet Union, but tries to correct the environmental and social myopia of previous planning and water resources development models. The concept introduces greater public involvement and economic discipline into water management and allocation practice, and it extends it across political boundaries. IWRM equally focuses much more on developing a wider range of alternatives to achieve long-term environmentally and socially sustainable water uses compared to previous planning models and practices and on creating permanent institutions that can adapt to changing conditions. Because it is river basin or catchment area-focused, it can either be confined to the national level or expanded across national boundaries.

IWRM is now the world standard for water management, if only because its formal adoption is a condition for European water resources development and planning funding. It was endorsed in Agenda 21, the environmental action plan for the twenty-first century agreed to at the 1992 United Nations Rio de Janeiro Conference on Environment and Development (UNCED). It is also one of the six principles adopted at the 1992 Dublin Conference on Water and the Environment. Between UNCED in 1992 and the 2002 World Summit on Sustainable Development (WSSD) or Rio Plus 10 in Johannesburg, South Africa, IWRM was endorsed by the Commission on Sustainable Development, the General Assembly of the United Nations, and the Ministerial Declaration of the International Conference on

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96 This section is adapted from Lakshman Guriswamy and A. Dan Tarlock, Sustainability and the Future of Western Water Law, in In Search of Sustainable Water Management, supra note 90, at 155.
Freshwater.\textsuperscript{99} It was reaffirmed as an international norm at the WSSD in Johannesburg. The WSSD re-articulated that environmentally sustainable development consists of three mutually reinforcing principles: economic development, social development and environmental protection.\textsuperscript{100} WSSD’s primary contribution is to add social development as a separate and coequal principle. Previously, it was only a component of economic development. In developing IWRM, the WSSD emphasizes the extent to which human needs are fulfilled by environmental protection as an integral part of economic and social development. In short, IWRM has always been based upon the foundational premises of environmentally sustainable development, but the WSSD reemphasized the need to integrate economic and social development with environmental protection.

IWRM calls for the holistic management of freshwater as a finite and vulnerable resource, and the integration of sectoral water plans and programs within the framework of economic and social policy.\textsuperscript{101} The objectives of integrated water resources management, as articulated in Agenda 21, are:

1. The promotion of a dynamic, interactive, iterative and multisectional approach to water resource management, including the identification and protection of potential sources of freshwater supply, that integrates technological, socioeconomic, environmental and human health considerations;

2. The planning of strategies for the sustainable and rational utilization, protection, conservation and management of water resources based on community needs and priorities within the framework of national economic development policy;

3. To design, implement and evaluate projects and programmes that are both economically efficient and socially appropriate within clearly defined strategies, based on an approach of full public participation, including that of women, youth,


indigenous people and local communities in water management policymaking and decision-making;

4. The identification strengthening, or development, as required, in particular in developing countries, the appropriate institutional, legal and financial mechanisms to ensure that water policy and its implementation are catalysts for sustainable social progress and economic growth.

Many countries of the world have adopted IWRM in principle. This is not surprising. Very few countries formally want to endorse unsustainable water use and ad hoc, uncoordinated water planning, although both are widely practiced. IWRM is also often a way to legitimate new, controversial, objectives. For example, Brazil adopted IWRM in its most recent water policy, although she did so, in part, to justify bulk water tariffs to support watershed and basin planning and to finance the administration of water permits. In other cases, the adoption of IWRM is part of the project of entrance into the world (western) community of nations. The 2000 European Union Water Framework Directive adopts IWRM to improve the water quality of the Union’s heavily used rivers. The Directive requires a river basin management plan that prioritizes risks and establishes cost effective measures to reduce pollution loads and flood damage. This Directive will influence almost all developing countries that want EU funds or World Bank or other financing.

IWRM must be supplemented by Adaptive Management, a management strategy developed in the late 1970s as a remedy to the defects in static or deterministic environmental assessment. Its proponents argued that “a fixed review of an independently designed policy” was inconsistent with the experience of resource managers worldwide and with what has come to be called non-equilibrium ecology. Adaptive management is a rigorous, continuous process of acquiring and evaluating scientific information. The hope is that the technique will permit decision makers to...

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102 See, e.g., Viktor A. Dukhovni, Prospects for Central Asia Development - Integrated Water Resources Management as Regional Issues Solution, in IMPLEMENTING INTEGRATED WATER RESOURCES MANAGEMENT IN CENTRAL ASIA 127 (Patricia Wouters et al. eds., 2007).


105 INT’L INST. FOR APPLIED SYS. ANALYSIS, ADAPTIVE ENVIRONMENTAL ASSESSMENT AND MANAGEMENT 1 (C.S. Hollings ed., 1980) (arguing that “this reactive approach will inhibit laudable economic enterprises as well as violate critical environmental constraints”).


107 NAT’L RESEARCH COUNCIL, DOWNSTREAM: ADAPTIVE MANAGEMENT OF GLEN
avoid the paralysis that scientific uncertainty creates by viewing management as an experiment that can progressively reduce scientific uncertainty over time. Adaptive management can introduce flexibility into water allocation regimes by supporting new allocations with mitigation plans or by the short-term alteration of fixed allocations.

VI. CONCLUSION

We have made some progress toward the recognition that international waters are resources that must be fairly shared among riparian nations. We have made less progress toward the implementation of real IWRM. It is never easy to implement a concept such as IWRM across national boundaries. It requires a firm, fair, but not rigid, allocation of a watercourse supported by strong management institutions, a high level of cooperation among all interests and continuous adaptation to new conditions. It also carries an important legal implication. The more nations cooperate to manage a water resource, the more they will be forced to move from the narrow notion that equitable apportionment gives them a share of the river to do with as they please to the idea that all riparian states share a community of interest in an international watercourse. This shifts the emphasis from the declaration of permanent rights divorced from management, to the duty to cooperatively manage international courses for a variety of uses from hydropower generation, consumption to the conservation of heritage ecosystems. Law alone cannot carry the burden of reducing the rising fears that all water allocation is a zero sum game. It can, however, help build trust among users and thus strengthen management institutions. This is the long run route to making sure that the projected violent conflicts over water never materialize.


109 For example, the amount of water to support an aquatic ecosystem is relatively small compared to the basin’s water balance and need not be supplied every year. This is the case with respect to the restoration of the Colorado River Delta in Mexico. A. Dan Tarlock, Possible Lessons From a Comparison of the Restoration of the Danube and Colorado Deltas, 19 PAC. McGEORGE GLOBAL BUS. & DEV. L.J. 61, 64-65 (2006).

110 I will leave to another time the question of whether riparian nations have a duty to share their resources with non-riparian nations. See FRESH WATER AND INTERNATIONAL ECONOMIC LAW (Edith Brown Weiss et al. eds., 2005).

111 See McIntyre, supra note 65, at 28-40 (using various illustrations to demonstrate common management and community interests in water resources).

112 For an example of a legal regime that is evolving to the conservation of a world heritage ecosystem, see A. Dan Tarlock, The Great Lakes as an Environmental Heritage of Humankind: An International Law Perspective, 40 U. MICH. J.L. REFORM 995 (2007).