

Chapter 5

Transboundary Water Conflicts and Cooperation

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Introduction

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

International transboundary water issues are increasingly being viewed through the lens of security studies, which are guided by an appreciation of the mutually destabilizing forces of poverty and political instability. The process of poverty alleviation is often hampered in regions where human security is at risk. As a consequence, much of the thinking about the concept of “environmental security” has moved beyond a presumed causal relationship between environmental stress and violent conflict to a broader notion of “human security” – a more inclusive concept focusing on the intricate sets of relationships between environment and society.

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

From the Klamath to the Jordan, transboundary water issues are a priority at state, national, and international levels. Although full-fledged wars over water have not occurred in modern history, there is ample evidence showing that the lack of clean freshwater has been linked to poverty and has led to intense political instability, and that acute violence has occasionally been the result at this scale. While these disputes also occur at the sub-national level, the human security issue is more subtle and more pervasive. As water quality degrades – or quantity diminishes - over time, the effect on

the stability of a region can be unsettling, nowhere more so than in basins which cross political boundaries.

There are 261 watersheds which cross the political boundaries of two or more countries. These international basins cover 45.3% of the land surface of the earth, affect about 40% of the world's population, and account for approximately 60% of global river flow (Wolf et. al 1999). [See Figure 1: International Rivers.] Disparities between riparian nations – whether in economic development, infrastructural capacity, or political orientation – add further complications to water resources development, institutions, and management. As a consequence, development, treaties, and institutions are regularly seen as, at best, inefficient; often ineffective; and, occasionally, as a new source of tensions themselves. Despite the tensions inherent in the international setting, riparians have shown tremendous creativity in approaching regional development, often through preventive diplomacy, and the creation of “baskets of benefits” which allow for positive-sum, integrative allocations of joint gains. Some of these approaches may be “scalable,” and relevant to the problems of the American West.

Part 1: Transboundary Waters of the West

International Waters

There are two sets of international rivers in the American West: those shared between the US and Canada, primarily the Columbia, and those shared between the US and Mexico, especially the Colorado and the Rio Grande/Rio Bravo. Each is administered through different institutional structures—the International Joint Commission in the case of US-Canada, and the International Boundary and Waters

Commission for US-Mexico—and thus are described and assessed separately. A relatively new body of trinational law also exists in the region associated with the promotion of free trade.

U.S./Canada Waters

Canada and the United States share one of the longest boundaries in the world, at approximately 4,000 miles. Industrial development in both countries, which in the humid eastern border region relied on water resources primarily for waste disposal, had led to decreasing water quality along their shared border to the point where, by the early years of the twentieth century, it was in the interest of both countries to seriously address the matter. Prior to 1905, only *ad hoc* commissions had been established to deal with issues relating to shared water resources as they arose. Both countries considered it within their interests to establish a more-permanent body for the joint management of their shared water resources.

As Canada and the United States entered into negotiations to establish a permanent body, the tone was informed by the concerns of each nation. For the United States, the overriding issue was sovereignty. While it was interested in the practical necessity of an agreement to manage transboundary waters, it did not want to relinquish political independence in the process. This concern was expressed by United States position that absolute territorial sovereignty be retained by each nation for the waters within its territory—tributaries should not be included in the Commission's authority. The new body might retain some of the *ad hoc* nature of prior bodies, so as not to acquire undue authority. Canada was interested in establishing an egalitarian relationship with

the United States. This goal was hampered not only because of the relative size and level of development of the two nations at the time, but also because Canadian foreign policy was still the purview of the United Kingdom—negotiations had to be carried out between Ottawa, Washington, and London. Canada wanted a comprehensive agreement, which would include tributaries, and a Commission with greater authority than the bodies of the past.

The "Treaty Relating to Boundary Waters between the United States and Canada," signed between the United Kingdom and the United States in 1909, reflects the interests of each negotiating body. The Treaty establishes the International Joint Commission (IJC) with six commissioners, three each appointed by the governments of Canada and the United States. Canada accepted US sovereignty concerns to some extent—e.g., tributary waters are excluded. The United States in turn accepted the arbitration function of the Commission and allowed it greater authority than it would have liked. The Treaty calls for open and free navigation along boundary waters, allowing Canadian transportation also on Lake Michigan, the only one of the Great Lakes not defined as boundary water. Although it allows each nation unilateral control over all of the waters within its territory, the Treaty does provide for redress by anyone affected downstream. Furthermore, the Commission has "quasi-judicial" authority: any project which would affect the "natural" flow of boundary waters has to be approved by both governments. Although the Commission has the mandate to arbitrate agreements, it has never been called to do so. The Commission also has investigative authority: it may have development projects submitted for approval, or be asked to investigate an issue by one

or another of the governments. Commissioners act independently, not as representatives of their respective governments.

In 1944, the US and Canada both asked the IJC to study the feasibility of cooperative development in the Columbia Basin, a process which lasted 20 years, until the signing of the of the Columbia River Treaty and Protocol in 1964. The focus of the treaty is a series of dams subsequently built for hydropower generation and flood control along the main stem and tributaries. The length of the negotiations reflect disagreements both within nations—notably in the US between upstream states of Idaho and Montana, where the most inundation would have occurred, and downstream in Washington and Oregon where the bulk of the benefits would be realized—as well as between the US and Canada. A budding environmental movement, concerned with loss of salmon runs, winter elk habitat, and the inundation of national parks, also played a role. Many of these concerns remain today (Muckleston, in Nakayama et. al).

According to Muckleston (in Nakayama et. al), the Treaty stipulates: 1) the equal sharing of downstream benefits from hydropower and flood control in the US that result from upstream storage in Canada; 2) the three storage sites in Canada, including the total volume for Treaty implementation (15.5 MAF); 3) an option for the US to build the Libby storage project; 4) the method, amount, and timing of US payments to Canada; 5) the permissibility to transfer water from the Kootenay to the Columbia, including the timing and the maximum volumes to be transferred; 6) the option to transfer water out of the Columbia Drainage Basin; 7) the sequence of steps to be taken for conflict resolution if difficulties arise during Treaty operations, and 8) the creation of new and/or designation of existing institutions to supervise and operate the Treaty.

The US Entity is composed of the Bonneville Power Administration (BPA) and the North Pacific Division, Corps of Engineers (COE), while the Canadian Entity is the British Columbia Hydro and Power Authority (BCH). The Entities work through committees equally represented by members from each Entity. The Operating Committee is instrumental in the planning and execution of treaty reservoir operations covered under the Treaty.

While the treaty has been effective in managing water and power according to the priorities set during initial negotiations, many concerns of the day, as well as a host of new issues brought on by changing needs, growing populations, and increasing environmental awareness, remain.

U.S./Mexico Waters¹

The border region between the United States and Mexico has fostered its share of surface-water conflict, from the Colorado to the Rio Grande/Rio Bravo. It has also been a model for peaceful conflict resolution, notably the work of the International Boundary and Water Commission (IBWC), the supra-legal body established to manage shared water resources as a consequence of the 1944 US-Mexico Water Treaty.

The International Boundary and Water Commission has its roots in the 1848 Treaty of Guadalupe Hidalgo which established a temporary joint boundary commission to mark and map the new boundary between the two countries. An 1889 convention established the International Boundary Commission, charging it with resolving "...differences or questions that may arise on that portion of the frontier between the United States of America and the United States of Mexico where the Rio Grande and the

¹ This section draws from Nakayama et al., (forthcoming).

Colorado Rivers form the boundary line..." The Commission's status was permanently extended in 1900.

The 1944 Treaty between the United States and Mexico, "Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande," firmly established the international character of waters on the border between the United States and Mexico. It specified in considerable detail the amount of water allocable to each country from the boundary rivers and their tributaries, with detailed delivery schedules and procedures for water accounting. Additionally, the treaty established the framework for construction of international storage reservoirs, diversion dams, and flood control works. This treaty also clearly established the role of the International Boundary and Water Commission, United States and Mexico, (IBWC) as the international organization that the two countries would rely on in addressing these transboundary water issues.

The IBWC consists of a Mexican Section, headquartered in Ciudad Juarez, Chihuahua and a United States Section, headquartered just across the Rio Grande in El Paso, Texas, the midpoint along the international border. Each section is headed by an engineer commissioner appointed by the president of his country and operates under the guidance of each country's respective foreign affairs department.

The first water distribution treaty between the two countries, the Convention of March 1, 1906, established an agreed-upon amount of Rio Grande water allotted to Mexico at Ciudad Juarez, Chihuahua. This international agreement determined the national ownership of waters for the upper 145 kilometers of the Rio Grande's international segment. Decades later, in 1944, the national ownership for the remaining 1874 kilometers of the Rio Grande downstream to the Gulf of Mexico was established

along with the authority to jointly construct impoundment and other engineering works for each country to make the greatest beneficial use of its apportioned waters.

Achieving these treaty allocations was a difficult process, marred by an incident responsible for adding the “Harmon Doctrine” to the lexicon of international waters. Named for the US attorney-general who suggested this stance in 1895 regarding a dispute with Mexico over the Rio Grande, the doctrine argues that a nation has absolute rights to water flowing through its territory (LeMarquand 1993; McCaffrey 1996).² Considering this doctrine was immediately rejected by Harmon's successor and later officially repudiated by the US (McCaffrey 1996), was never implemented in any water treaty (with the rare exception of some internal tributaries of international waters), was not invoked as a source for judgment in any international water legal ruling, and was explicitly rejected by the international tribunal over the Lac Lanoux case in 1957, the Harmon Doctrine is wildly over-emphasized as a principle of international law.³ Nevertheless, upstream nations, states, territories, and even individual landowners to this day regularly call on some variation of the Harmon Doctrine in the opening stages of negotiations.

The treaty provisions related to the Colorado River and the practical effects of their implementation remain an ongoing source of discussion between the two countries. Over the past half century, various differences have arisen which required substantial attention from the IBWC in order to reach a satisfactory conclusion. The Treaty

² "The fundamental principle of international law is the absolute sovereignty of every nation, as against all others, within its own Territory" (cited in LeMarquand 1993, 63). Harmon was making the hydrologically preposterous argument that upstream water diversions within the territorial US would not legally affect downstream navigation on international stretches of the Rio Grande since the diversions were to be carried out by individuals, not States (McCaffrey 1997).

³ As far back as 1911, the Institut de Droit International had asserted that the dependence of riparian states on each other precludes the idea of absolute autonomy over shared waters (Laylin and Bianchi 1959, 46).

provides a special annual allotment to Mexico and obligates the United States to provide that water under annual schedules provided by Mexico. There are provisions for times of excess flows and for times of shortages. In addition the treaty provides for works for the control of flood waters and for diversion structures by Mexico.

During the 1950's, the United States regularly made surplus declarations. However, as river conditions changed in the 1960s, the United States determined that no surplus existed. Mexico, having become accustomed to the surplus deliveries, expressed an interest in continuing to receive the larger deliveries. Mexico was also accustomed to receiving water with salinity adequate for their irrigation uses. The lower flows matter was complicated with the introduction from an irrigation district in Arizona of pumped saline drainage, which nearly tripled the salinity in waters delivered to Mexico. The salinity problem was dealt with through five-year arrangements of the IBWC supported by expertise from United States and Mexican federal agencies. The problem arose again in 1972, leading to special Presidential task force, the efforts of which resulted in a new IBWC agreement in 1973 for a solution of the salinity problem.

In the 1980s, questions arose over surplus waters and their impacts in Mexico, a matter that was dealt with through a new technical information exchange program of the IBWC. Similarly, questions arose in the 1990s over silt deposition and flood water conveyance and salinity peaks in the waters delivered to Mexico. The IBWC turned its information exchange program into proactive international task forces to deal with the salinity problem, the immediate silt problem, and the longer term conveyance questions. More recently, the IBWC has extended their information development task forces to a fourth group dealing with the Colorado River Delta.

Another more recent complication is the difficulties encountered in managing shared groundwater, which can pale in comparison to trying to allocate surface water resources. Each aquifer system is generally so poorly understood that years of study may be necessary before one even knows what the bargaining parameters are. Mumme (1988) has identified 23 sites in contention in six different hydrogeologic regions along the 3,300 kilometers of shared boundary. While the 1944 Treaty mentions the importance of resolving the allocations of groundwater between the two states, it does not do so. In fact, shared surface-water resources were the sole focus of the IBWC until the early 1960's, when a US irrigation district began draining saline groundwater into the Colorado River and deducting the quantity of saline water from Mexico's share of freshwater. In response, Mexico began a "crash program" of groundwater development in the border region, to make up the losses. These tensions have resulted in renewed interest in resolving these topics.

An interesting aspect of the various IBWC agreements is the way in which binational projects are funded. In the case of the system to deliver Colorado River water to Mexico, the treaty required Mexico to pay for some works *in the United States* to protect U.S. interests from flooding. In addressing salinity issues, the United States agreed to pay for works *in Mexico*. Flexibility in allocating costs based on the benefits accrued to each country and the cost each country would incur if a project were domestic rather than binational are among the factors considered by the IBWC in determining a fair and equitable cost distribution that may or may not result in a 50-50 cost share. This has allowed the IBWC to deal with significant questions *in a cooperative manner*.

Tri-National Arrangements

As North America increasingly embraces free trade, a variety of trinational agreements and organizations are emerging that, theoretically, can have some influence on transboundary water resources. Of particular note is the North American Free Trade Agreement, a regional extension of General Agreement on Tariffs and Trade established in 1947. While considerable ambiguities exist, these agreements likely do not provide for private trade in bulk water among the three nations, and thus respect existing treaty arrangements. Nonetheless, the influence of expanded trade on water resources is acknowledged, as evidenced by the establishment in 1994 of the trinational Commission on Environmental Cooperation, charged with finding long-term solutions to border environmental problems. The scope of this organization does not typically extend beyond border pollution issues, as larger scale natural resource management concerns were “formally and deliberately” omitted from its mandate (Mumme, 1999: 166).

Interstate Rivers

In addition to the rivers extending into Canada and Mexico, the United States is also home to many interstate rivers and, thus, interstate conflicts. In the American West, questions of allocation typically dominate interstate water disputes. The Constitution provides two strategies for resolving these conflicts (Getches, 1990).⁴ First, as the holder of “original jurisdiction” in disputes among states, the U.S. Supreme Court is empowered

⁴ Arguably, a third strategy also exists: congressional apportionment. This approach is not included here because it has only been observed in one, highly unusual situation, and is generally not expected to emerge again as a means for interstate apportionment. The case in question involved allocation of the Lower Colorado River among Arizona, California, and Nevada, something that Congress effectively did (according to a later court decision) in the Boulder Canyon Project Act of 1928 (Getches, 1990).

to resolve interstate complaints. Traditionally, this has been done using the highly flexible doctrine of “equitable apportionment” in which issues of equity and need are used to craft allocations that can be later revisited by the Court should conditions change. The initial use of equitable apportionment was on the Arkansas River between Colorado and Kansas in 1907, although the most celebrated case in 1931 concerned the Delaware River (*Kansas v. Colorado*, 206 U.S. 46 (1907); *New Jersey v. New York*, 283 U.S. 336 (1931)).

The second and much more common approach for resolving interstate conflicts in the West has been the use of interstate compacts (McCormick, 1994). Compacts are legally binding agreements between states, as authorized by the compact clause of the Constitution. States generally prefer compacts over equitable apportionment proceedings since they can retain control over the dispute resolution process, the terms of the ultimate agreement, and the implementation arrangements. Compacts also allow allocations to occur long before needs materialize, which can greatly aid long-term planning and management programs. For these and other reasons, even the courts typically encourage compacts over judicial proceedings (e.g., see *Colorado v. Kansas*, 320 U.S. 383, at 392 (1943)).

Interstate compacts can be found throughout western river basins and the plains to the east receiving Rocky Mountain snowmelt. Examples include the Arkansas (Colorado-Kansas, 1949; Kansas-Oklahoma, 1965; and Arkansas-Oklahoma, 1970), Bear (Idaho-Utah-Wyoming, 1955), Belle Fourche (Wyoming-South Dakota, 1943), Big Blue (Nebraska-Kansas, 1971), Canadian (New Mexico-Texas-Oklahoma, 1950), Colorado (Wyoming-Colorado-Utah-New Mexico-Nevada-Arizona-California, 1922), Costilla

Creek (Colorado-New Mexico, 1944), Klamath (Oregon-California, 1956), La Plata (Colorado-New Mexico, 1922), Pecos (New Mexico-Texas, 1949), Red (Texas-Oklahoma-Arkansas-Louisiana, 1978), Republican (Colorado-Nebraska-Kansas, 1943), Rio Grande (Colorado-New Mexico-Texas, 1938), Sabine (Texas-Louisiana, 1953), Snake (Wyoming-Idaho, 1949), South Platte (Colorado-Nebraska, 1923), Upper Colorado (Wyoming-Colorado-Utah-New Mexico, 1948), Upper Niobrara (Wyoming-Nebraska, 1962), and Yellowstone Rivers (Wyoming-Montana-Idaho, 1950). Colorado is a party to nine interstate compacts!⁵

Typically, the negotiation and approval of interstate compacts has followed a 5-step process: (1) Congress authorizes the states to negotiate a compact, (2) state legislatures appoint commissioners, (3) the commissioners meet, usually aided by a federal chairman, to negotiate and sign the agreement, (4) the state legislatures ratify the compact, and (5) Congress ratifies the compact. Omitted from this description is the role of the federal water development in stimulating agreements, as the Department of the Interior typically required states to resolve interstate water allocation disputes prior to commencing federally funded river basin developments. The best example of this phenomenon occurred in the Upper Colorado River Basin, where a Bureau of Reclamation study identifying 134 potential projects prompted the basin states within four months to begin compact negotiations (Terrell, 1965).

⁵ Interstate water allocation compacts are becoming fashionable in the East, as found in the Delaware, Susquehanna, Apalachicola-Chattahoochee-Flint (ACF), and Alabama-Coosa-Tallapoosa (ACT) River Basins. The Delaware and Susquehanna compacts are unique in that they involve the federal government as a signatory and partner (so-called federal-interstate compacts) (GAO, 1981). The agreements in the ACT/ACF basins are unique in that they do not include allocation formulas, but rather establish commissions empowered to later devise allocation compacts.

The key element in interstate water allocation compacts—and for that matter, many international treaties—is the mathematical formula used to apportion flows. Four different allocation strategies are typically seen: (1) systems based on maintaining minimum flow levels at state lines (or other useful gauging stations), (2) approaches based on reservoir storage, (3) formulas allocating fixed or percentage-based rights to consumption or diversion, and (4) a requirement—seen only in the Colorado River basin—for upstream states to deliver downstream a minimum *volume* (rather than a constant *flow* rate) over a lengthy time period. Several formulas have been problematic, largely due to incorrect assumptions about precipitation and runoff levels, a failure to consider surface water/groundwater connections, and due to the growth of water demands in some areas beyond compact apportionments (Kenney, 1996).

Administering compact allocations and resolving conflicts are duties frequently delegated to compact commissions formed by the interstate agreements. Most compacts feature a compact commission, often with a federal (usually non-voting) member. In many cases, however, disputes escalate to the judiciary. Among the most problematic compacts have been those for the La Plata, Pecos, Canadian, Arkansas, Rio Grande, and Colorado Rivers.

Water allocation compacts often provide an element of certainty, stability, and civility in interstate water issues. Ironically, this certainty can be somewhat counterproductive, in that it can eliminate the need and opportunity for continued interaction among the basin states. With the very limited exception of periodic meetings of compact commissioners, so-called “successful” compacts generally do not require interstate coordination or ongoing cooperation, and provide little reason for one state to

be concerned with the water needs of the other. Unlike an equitable apportionment, compacts cannot be modified unilaterally except, perhaps, by congressional action—and no congress has demonstrated an interest in testing that power.

Compacts also do not effectively reconcile hydrologic and political regions. While the signatories to a compact may collectively encompass the entire drainage basin of a particular river, the boundaries of those states do not follow the actual contours of the river basin. Consequently, within states, issues arise about whether to use compact apportionments within the basin itself, or in areas outside the basin. Many of the largest users of the Colorado River, for example, lie outside the topographic bounds of the river basin, but are within the states recognized in the compacts. Similarly, most compacts fail to recognize water rights associated with tribal lands and other federally reserved lands within the signatory states.

Also of concern in most compacts is the limited attention given to competing water uses and sectors, and in the case of environmental protection, competing water values. With few exceptions, these issues are dealt with in the context of state water law, often with the use of markets.⁶ One of the few exceptions is the Northwest Planning Power Council, which is charged with balancing hydropower generation and salmonid management in the U.S. section of the Columbia River system.⁷ This sort of multi-faceted mandate is rarely seen in western compacts and compact commissions; however, in the Midwest and East, interstate arrangements addressing pollution control, flood control and planning, and project development are relatively common (Muys, 1971).

⁶ Interstate water markets have not materialized, and may not be legally viable under many compacts.

⁷ The Northwest Power Planning Council is, admittedly, an odd arrangement led by appointees from the four basin states, formed by a combination of interstate compact and federal legislation, and charged primarily with regulating federal activities—New Federalism in the extreme (Volkman and Lee, 1988).

Local Context

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

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

One highlight of these new approaches is that the results of conflict analysis are very different depending on the scale being investigated. To clearly understand the

dynamics of water management and conflict potential, then, thorough assessments would investigate dynamics at multi-scales simultaneously. María Rosa García-Acevedo (2001), for example, puts nominally a “US-Mexico” dispute over the Colorado into its specific historic context, and tracks water’s changing meanings to the local populations involved, primarily indigenous groups and US and Mexican farm communities, throughout the 20th century. The local setting strongly influences international dynamics and vice versa.

Similarly, it can be equally useful to follow the dynamics of an issue as it grows in scope and political geography. For example, water resources issues in the Columbia River basin transitioned from intranational to international in 1944 as Canadian and US planners recognized that cooperative development might well be superior to individual actions, and both countries requested the International Joint Commission (IJC) to study the feasibility of cooperative development in the Columbia Basin. By 1964, the Columbia River Treaty and Protocol were ratified by the governments of Canada and the USA. The treaty is one of the most sophisticated in the world, particularly because it circumvents the zero-sum approach to allocating fixed quantities of water by instead allocating to each country an equal share of benefits derived from the shared basin. Hydropower production, flood control, and other benefits are quantified and shared annually, and there is little dispute across international boundaries.

Many water issues in the Columbia basin and elsewhere, however, have defied a centralized approach. In response to the weaknesses of top-down legislation over locally generated issues such as non-point source pollution and salmon habitat restoration, management authority in the Columbia has been steadily diffusing to local watershed

councils. This trend is seen throughout the West and, more sporadically, in several other nations, with mixed success. This trend further reinforces the value of considering multiple scales in defining and addressing transboundary water issues.

Part 2: International Waters: Conflict and Cooperation

Threat of Conflict

Only 2.5% of the world's water is fresh water, and only a small fraction of that amount is readily available for human use. This renewable but not infinite resource is becoming increasingly scarce. The amount available to the world today is almost the same as it was when man last went to war over it in Mesopotamia some 4,500 years ago. At the same time, global demand has steadily increased. In the last fifty years, world population has swelled from 2.5 billion to 6 billion, while the renewable supply per person has fallen 58 percent. Moreover, unlike oil and most other strategic resources, fresh water has no substitute in most of its uses. It is essential for growing food, manufacturing goods, and safeguarding human and environmental health. And while history suggests that cooperation over water is the norm, it is not the rule.

United Nations Secretary-General Kofi Annan is on record as warning that "fierce competition for fresh water may well become a source of conflict and wars in the future" and a recent report of the U.S. National Intelligence Council concludes that the likelihood of international conflict will increase during the next 15 years "as countries press against the limits of available water." These conflicts are likely to go beyond traditional issues of surface water flows to include groundwater depletions and, increasingly, the long-neglected issue of water quality.

The greatest threat of the global water crisis comes from the fact that people and ecosystems around the globe lack access to sufficient quantities of water at sufficient quality for their well being. The concern over water is spreading as populations increase. By 2015, nearly 3 billion people—40 percent of the projected world population—are expected to live in countries that find it difficult or impossible to mobilize enough water to satisfy the food, industrial, and domestic needs of their citizens. This scarcity will translate into heightened competition for water—both within and between political regions.

The largest and most combustible imbalance between population and available water supplies will be in Asia, where crop production depends heavily on irrigation. Asia today has roughly 60 percent of the world's people but only 36 percent of the world's renewable fresh water. China, India, Iran, and Pakistan are among the countries where a significant share of the irrigated land is now jeopardized by groundwater depletion, scarce river water, a fertility-sapping buildup of salts in the soil, or some combination of these factors. Groundwater depletion alone places 10 to 20 percent of grain production in both China and India at risk. Water tables are falling steadily in the North China Plain, which yields more than half of China's wheat and one third of its corn, as well as in northwest India's Punjab, another major breadbasket.

As farmers lose access to irrigation water and see their livelihoods deteriorate, they may not only resort to violent protest but migrate across borders and to restive and already overcrowded cities. Such has been the case in Pakistan, where falling agricultural output has prompted a massive rural migration to large urban centers, leading to renewed outbreaks of ethnic violence.

Mechanism of Conflict⁸

The scarcity of water leads to intense political pressures, often referred to as “water stress.” Water shortages have contributed to tensions between competing uses around the globe, pitting town against country, environment against industry, and upstream users against downstream interests. One-fourth of water-related interactions during the last half-century were hostile. Although the vast majority of these hostilities were confined to verbal antagonism, rival countries took to arms on 37 recorded occasions (see Figure 2).

Most transboundary water conflicts share a common trajectory. A three-year study of conflict and cooperation within international river basins by researchers at Oregon State University found that the likelihood of conflict increases significantly whenever two factors come into play (Wolf et al. 2003). First, some large or rapid change occurs in the basin’s physical setting (typically the construction of a dam or other development project) or in its political setting, especially the breakup of a nation that results in new international rivers. Second, existing institutions are unable to absorb and effectively manage that change, due to the lack of a treaty spelling out each nation’s rights and responsibilities with regard to the shared river or implicit agreements or cooperative arrangements. Even technical working groups can go some way to managing contentious issues, as they have in the Middle East.

Over the next 10 years, 17 river basins appear ripe for tension or conflict, and at another four serious unresolved water disputes already exist or are being negotiated.

⁸ This section draws from Postel, S. and A. Wolf. “Dehydrating Conflict.” *Foreign Policy*. September/October 2001, pp. 60-67.

These basins encompass 51 nations on five continents in just about every climatic zone. Consider, for example, the Salween River, which rises in southern China, then flows into Myanmar (Burma) and Thailand. Each of these nations plans to construct dams and development projects along the Salween, and no two sets of plans are compatible. To compound matters, China was one of just three countries that voted against a 1997 UN convention that established basic guidelines and principles for the use of international rivers.

Other river basins are at risk of disputes due to rapid political changes. The breakup of the Soviet Union resulted in several new international river basins almost overnight, and, not surprisingly, institutional capacity for managing water disputes in them is weak. The watershed of Central Asia's Aral Sea, for instance, spanned five Soviet republics that are now independent countries. Tensions among the young nations quickly arose both over how to share the Amu Darya and Syr Darya, the two rivers that feed the Aral Sea, as well as how to ameliorate the human and environmental tragedy caused by the sea's dramatic shrinking—a result of 40 years of river diversions masterminded by Moscow to grow cotton in the Central Asian deserts. With assistance from international agencies, these young governments have taken tentative steps toward trying to resolve their water dilemmas.

Cooperation is Key

There is certainly room for optimism, though. Historically, cooperation typically prevails over conflict. The most vehement enemies around the world, whether Israelis and Arabs, Indians and Pakistanis, or Armenians and Azeris, either have negotiated

water-sharing agreements, or are striving to realize them. Violence over water seems neither strategically rational, hydrographically effective, nor economically viable. Shared interests consistently outweigh water's conflict-inducing characteristics.

Looming crises in food production may also stimulate new international alliances, as countries with increasingly deficient water supplies for food production seek new and expanded partnerships with grain exporters. For example, Asia, Africa, and the Middle East already account for 26 percent of global grain imports, and as these water-stressed regions add an additional billion people over the next 15 years, may be compelled to form stronger alliances with potential exporters in China, India, and Pakistan.

Of course, for those nations without sufficient foreign exchange to turn to imports, notably those in sub-Saharan Africa, higher world grain prices will likely mean greater hunger, political insecurity and conflict, and more calls for humanitarian aid. The challenge for the international community is to get ahead of the “crisis curve,” to help develop institutional capacity and a culture of cooperation in advance of costly, time-consuming crises, which threaten lives, regional stability, and ecosystem health.

Selected Case Studies⁹

Hundreds of examples of transboundary conflict and cooperation exist throughout the world. While several examples have already been referenced, some particularly salient cases are discussed below in greater detail, with the aim of further exploring themes already mentioned while identifying new findings and lessons that may have applicability to the American West.

⁹ Thanks to Kristin Anderson for helping to compile these summaries.

Mekong River of Southeast Asia

The Mekong Basin, which includes China, Myanmar, Thailand, Cambodia, Vietnam, and Laos is an example of an international basin that has been successfully managed through cooperation of a shifting set of riparians.¹⁰ Since 1957, coordinated water resources planning in this basin has been the goal of the international institution now named the Mekong River Commission (MRC). The MRC and its predecessors have used legal and organizational tactics to promote cooperation between riparian nations. Laws require unanimous consent for mainstem projects, maintaining focus on basinwide management. Although diversions from the Mekong are legal, the lack of apportionment between riparians has also contributed to a cooperative, basinwide planning approach. These laws, in turn, have upheld the resiliency of the institution.

The Mekong River Commission has focused on scientific investigations and data collection of basin hydrology, ecosystems, and human and legal aspects of water management. This science-based approach of the MRC has encouraged collaboration between otherwise rivaling parties. Additionally, the MRC has recently made a transition from a project-oriented approach to a program-oriented approach. Furthermore, the lack of large development on the Mekong River has allowed the MRC to keep its options for development broad. Large upstream dams could threaten this, however.

The Mekong River Basin serves as an example where an international water resource has helped to unite, rather than divide, riparians. Riparian nations foresaw more potential benefits through multilateral cooperation than through unilateral approaches to

¹⁰ This section is a summary of “Transboundary River Management in the Mekong River Basin: Key Issues and Lessons for Western U.S. Water Management” by Jeffrey Jacobs of the National Research Council.

development on the Mekong. Flexibility in river management and institutional capacity have been keys to cooperation, and the prospect of donor aid has provided a significant incentive for cooperation. The exemplary actions of the Mekong River Commission and its experience in conflict resolution and collaborative science programs could help inform interstate and interbasin dialogue in the American West. The shift of priority of the MRC from projects to programs resembles the U.S. Bureau of Reclamation's shift from water development to water management, and both institutions could learn from the other's shift.

Okavango River in Southern Africa

An examination of the Okavango River in southern Africa yields many valuable lessons for water management in the western United States.¹¹ A major international river, the Okavango provides important natural resources and ecological functions as well as ideological significance to the populations who live in the basin and use the resources within it. Knowledge of rights concerning riverine land and resources is passed on from one generation to the next. Historically, the socioeconomic values of riparian resources have been determined by the local population, and the people in turn have had the right to handle the resources however they so choose. However, changes have been occurring recently in the basin. Cattle owners and safari companies have been increasing in numbers, and a trend toward privatization of resources is evident. These changes are linked to rising populations, increasing development, environmental degradation, and conflicts over resource use. These issues are exacerbated by the increasingly undefined

¹¹ This section is a summary of "The Okavango River Basin in Southern Africa: A Case Study of Transboundary Resource Management Issues" by Robert K. Hitchcock of the University of Nebraska-Lincoln.

status of land and the lack of secure authority structures. This changing situation coupled with the dire shortages of water that are projected for the next few decades make the future tenuous.

Angola, Namibia, and Botswana, the major riparians of the Okavango, all have different national administrative structures at the national and district levels that handle water resources management, but they are held together with the regional institutional structure of the Permanent Okavango River Basin Commission, that was formed in 1994 by these riparian nations. The Trinational Permanent Water Commission, also formed by these three nations, provides advice on environmentally and socially sustainable development of the Okavango River waters. The establishment of this interbasin form of governance has helped to alleviate pressures that lead to periodic outbreaks of conflict regarding the Okavango.

Many lessons have come out of the experience of these institutions that can be applied to resource planning the Western US. The involvement of local populations in decision-making regarding natural resources can improve the planning process on all scales. The existence of international (or in the case of the western U.S., also interstate or interbasin) institutions can aid greatly in resolving conflicts over resources, harmonizing water resource policies, and monitoring compliance. A protocol established by such an institution can be valuable if members states are willing to respect the protocol and operate by its rules. Finally, the implementation of social and environmental justice principles into all policies and practices are critical to the resolution and prevention of conflicts.

The West Bank

A complex set of interactions over many scales from local to international influence water resources in the West Bank.¹² In the highly politicized Israeli-Palestinian conflict in the West Bank, Israel, the stronger negotiating party, hands down military orders regarding water allocations from aquifers. Palestinians in the West Bank are allocated less than one fourth the amount that Israelis receive, and pumping more water from Palestinian wells has come to be viewed as a nationalist act, threatening the resource. However, beyond this allocation, Israel interferes little with the management of water resources.

Although irrigation is not well developed in the West Bank, 65% of water goes toward irrigation practices. Irrigation communities often have communal property regimes for water management. Water for irrigation mostly comes from springs and wells, each of which has different regimes of management. Water from springs is often allocated based on nested local institutions that can include, for example, families, groups, and subgroups within a village, that are in turn connected to a reticulation network operated by the municipality. Wells, which have appeared in the last several decades in the West Bank, are managed through private bargaining of farmers and well owners. Water management for agriculture is handled informally and is independent of the Palestinian Authority. These institutions of water control are very resilient and are involved in many facets of water control.

The management of water for domestic use stands in contrast to that of agricultural use. The arrival of the Palestinian Authority brought about many changes in

¹² This section is a summary of “Case Study—The West Bank” by Julie Trottier of the Oxford Centre for Water Research at the University of Oxford.

domestic allocation from its traditional local management. The Palestinian Water Authority is involved in providing water for domestic use, although it faces challenges from local forces as well as the Ministry of Local Governments, which currently controls many reticulation networks. In addition, many communities are not yet connected to reticulation systems, but receive supplies from water tankers who have control over their own pricing structures.

The juxtaposition of the traditional view of water resources in terms of social control and security with the newer view of water being a public good plays a critical role in the difficulties of managing water in the West Bank and presents a challenge to Palestinians. In order for any approach towards sustainable management of water resources to be effective, both views have to be taken into account. All dimensions of interactions must be considered. This provides a valuable insight for water management in the American West. Although the power configurations regarding water in the Western US and the West Bank are different, multiscale analyses of the impact of various policies can prove valuable to both.

Part 3: Findings and Conclusions

This global review of transboundary water conflicts yields a variety of insights. Three findings are particularly prominent:

1. Water crossing international (and interstate) boundaries often causes tensions between nations (and states) that share the basin. Early coordination between riparian governments, however, can often help ameliorate conflict.

2. Once international institutions are in place for transboundary water resources, they prove tremendously resilient, even as conflict is waged over other issues.
3. As transboundary water disputes evolve, a gradual decrease in quantity or quality is a more likely outcome than violent conflict. Over time this can affect the internal stability of a nation or region. The resulting instability may have effects in the international arena.

Transferring Lessons: Key Considerations

Converting findings (observations) to transferrable lessons (practical advice) is a significant challenge. It should be clear from the cases presented in this study that both similarities and distinct differences are inherent between regions of the world, and between national (including interstate) and international water conflicts. This provides both opportunities and constraints to the transference of international findings to the transboundary conflicts of the American West. Four key issues to consider when evaluating the transferability of case study findings are listed below:

1. Institutions and Authority

National cases often are played out in relatively sophisticated institutional settings—such as found in the American West—while international conflicts can be hampered by the lack even of an institutional capacity for conflict resolution. Presumably this would make national (including interstate) conflicts more amenable to resolution, however, it can be argued that the presence of strong law-dominated approaches to resolving conflicts can impede creative problem-solving, effectively presenting the same challenges as the international setting.

2. Law and Enforcement

A similar dichotomy exists regarding issues of legal enforcement of agreements. The US and other countries have over the years established intricate and elaborate legal structures to provide both guidance in cases of domestic water disputes, and a setting for clarifying conflicting interpretations of that guidance. International disputes, in contrast, rely on poorly defined water law, a court system in which the disputants themselves have to decide on jurisdiction and frames of reference before a case can be heard, and little in the way of enforcement mechanisms. (One result is that international water conflicts are rarely heard in the International Court of Justice. Likewise, of the international cases presented in this volume, only the Mekong Committee has used the legal definition of "reasonable and equitable" use in its agreement.) Nonetheless, it has been argued that the differences between national and international disputes are more apparent than real, and that given the myriad of legal venues open to disputants (in national settings), and ambiguities of court jurisdiction, creative lawyers can effectively hamstring legal challenges for years, essentially creating a de facto lack of legal authority.

3. Presumption of Equal Power

"All are equal in the eyes of the law," is a common phrase describing national legal frameworks. Yet, no such presumption exists in international conflicts, where power inequities define regional relations. Each of the international watersheds presented here includes a hegemonic power which brings its power to bear in regional negotiations, and which often sees agreements tilt in its favor as a consequence. Yet, to attribute such inequities just to international settings is tenuous, as financial or political inequities in a national setting can also ensure that conflict resolution processes lead to distorted outcomes.

4. The Best Alternative to a Negotiated Agreement (BATNA)

A difference commonly pointed out between national and international disputes is that, in national water conflicts, war is not usually a realistic alternative to a negotiated agreement—what the dispute resolution profession terms a “BATNA” (Best Alternative to a Negotiated Agreement). While it may be true that intra-national "water wars" are not likely, the same is increasingly accepted as being true of the international setting. While shots have been fired, both nationally and internationally, and troops have been mobilized between countries, no all-out war has ever been caused by water resources alone. As one analyst familiar with both strategic issues and water resources has noted, "Why go to war over water? For the price of one week's fighting, you could build five desalination plants. No loss of life, no international pressure, and a reliable supply you don't have to defend in hostile territory."

Three Lessons for the American West

Effectively addressing the issues raised by transboundary resources will be a chronic problem in the American West. Nonetheless, three lessons gained from international experience appear to offer real hold for improved outcomes.

1. Seek Flexible Solutions Based on Needs, Not Rights

What one notices in the global record of water negotiations is that several of those surveyed begin where many Western US issues are now, with parties basing their initial positions in terms of rights—i.e., the sense that a riparian is entitled to a certain allocation based on hydrography or chronology of use. Irrigators in the Klamath basin invoke rights under the Reclamation Act while environmentalists refer to the Endangered Species Act.

Upstream riparians often invoke some variation of the Harmon Doctrine, claiming that water rights originate where the water falls. Downstream riparians, meanwhile, often claim absolute river integrity, claiming rights to an undisturbed system or, if on an exotic stream, historic rights based on their history of use.

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

Similarly, successful frameworks in the international experience are flexible; flexibility in agreements is almost more critical than the initial agreements themselves. Needs, interests, flow regimes, and values all change over time. But the record shows that human creativity, when applied with a modicum of goodwill, have overcome these obstacles in settings plenty more complex and hostile than the Western US, which should come as quite encouraging news for our area of interest.

2. Expand the Pie

Most of the treaties and interstate agreements reviewed deal exclusively with water (and typically just water allocation), separate from any other political or resource issues between countries—water qua water. By separating the two realms of "high" and "low" politics, or by ignoring other resources which might be included in an agreement, some have argued, the process is either likely to fail, as in the case of the 1955 Johnston accords on the Jordan, or more often to achieve a sub-optimum development

arrangement, as is currently the case for the Indus agreement, signed in 1960.

Increasingly, however, linkages are being made between water and politics, between water and other resources. These multi-resource linkages may offer more opportunities for creative solutions to be generated, allowing for greater economic efficiency through a "basket" of benefits. Some goods that have been included in water negotiations include financial resources, energy resources, political linkages, transportation infrastructure, and data.

Policymakers may want to consider a change in focus from the current water-specific concentration to an aggregate view of river basin resources. Co-riparians may find it beneficial, for example, to pool water allocation issues with other river basin projects. A bundling of river basin resources may not only provide additional bargaining options, but may also, by reducing duplicative efforts, result in a more efficient and mutually beneficial allocation of resources, both natural and monetary. For example, a downstream riparian might offer financial assistance for a hydroelectric project in exchange for some percentage of power, or an upstream riparian might support the construction of locks and dams in a downstream riparian state in exchange for navigation rights (Krutilla, 1969). Limited precedents for multi-purpose linkages currently exist in certain international water treaties. The 1964 US-Canada Columbia River treaty, for example, allocates water according to an equal distribution of benefits, defined by hydropower generation and flood control. (Incidentally, this results in the odd arrangement that power may be exported out of basin for gain, but the water itself may not.) Similarly, as part of the 1975 Mekong River Agreement, Thailand provided financial support for a hydropower project to Laos in exchange for a percentage of the

electricity generated. India and Nepal also bundled projects such as irrigation, hydropower, navigation, fishing, and afforestation into two treaties concluded in the 1950s and 1960s. Other resources that have been or could potentially be included in water negotiations include data, technology, and political capital (Wolf, 1998).

3. Devise Institutions for Ongoing Coordination

In managing transboundary water resources, strong institutions make a difference. The Indus Waters Treaty, for example, survived two wars between the signatories and allowed each to pursue its agricultural and economic plans without risking the ire of the other. Long-term programs of joint fact-finding, technical cooperation, and other initiatives that establish a climate of cooperation among countries can pave the way for resolving disputes when they do arise. The Global Alliance for Water Security aimed at coordinating assistance in priority regions may help countries get ahead of the crisis curve.

But what should a basin-wide institution look like? Despite the tendency of water managers to think in terms of total integration of watersheds, this often is not the most likely or practical outcome. Even friendly nations internationally often have difficulty relinquishing sovereignty to a supra-legal authority, and the obstacles only increase along with the level of suspicion and rancor. Consequently, one should strive for coordination over true integration. Once the appropriate benefits are negotiated, it then becomes an issue of “simply” agreeing on a set quantity, quality, and timing of water resources that will cross each border. Coordination, when done correctly, can offer the same benefits as

integration, and be far superior to unilateral development, but does not threaten the one issue all states hold dear: their sovereignty.

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