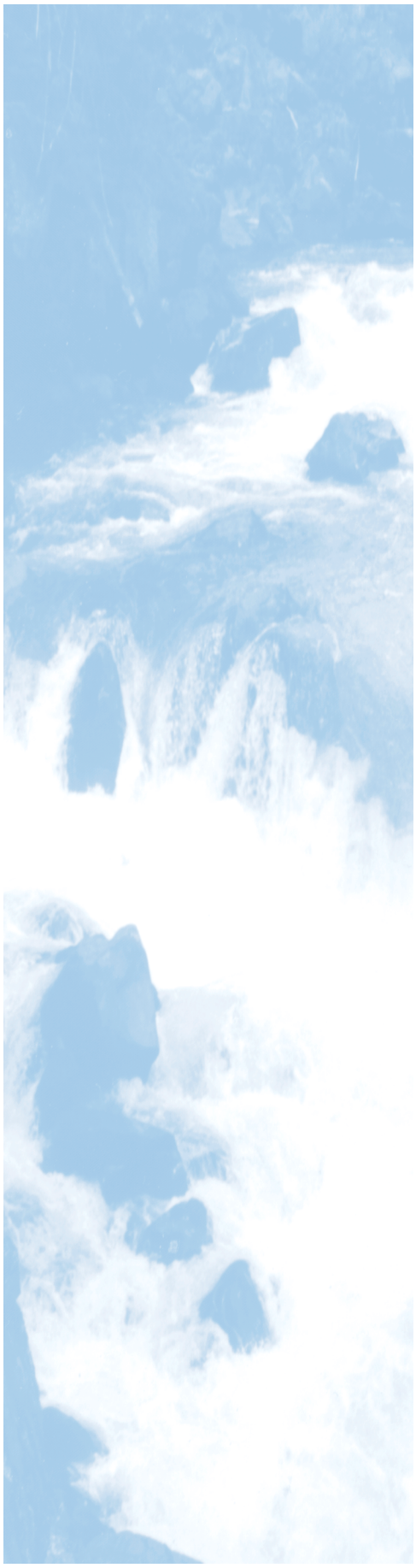


The World's International Freshwater Agreements: Historical Developments and Future Opportunities

Population growth, economic development, and changing regional values have intensified competition over water resources worldwide, leading to predictions of increasing future conflicts over shared water supplies. Of particular concern to the international community is the potential for conflict within the world's 263 international basins. To mitigate the likelihood of conflict as well as to resolve existing disputes, the international community has devised principles for international watercourse management. Over the past century, these principles have been refined and, most recently, codified in the 1997 United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses. Likewise, basin communities, building on their own rich treaty history, have accelerated the development of cooperative institutions to manage internationally shared river systems.

This Atlas serves to document the developments in the management of international river basins over the past century. Utilizing historical documents, statistical analyses, and state-of-the-art mapping technology, the Atlas presents both a graphic and textual analysis of the world's international basins and related agreements. The Atlas begins with a discussion of the complexities of transboundary water management and the factors that influence co-riparian relations over water resources. Historical developments in international water institutions are then discussed at both the global and basin scale along with an analysis of future institution-building opportunities.

The World's International Basins

As illustrated in Figure 1, there are currently 263 rivers that either cross or demarcate international political boundaries. Geographically, Europe has the largest number of international basins (69), followed by Africa (59), Asia (57), North America (40), and South America (38). The absolute numbers of international basins, as well as the nations through which they traverse, change over time in response to alterations in the world political map. In the 1990s, for example, the break-up of the Soviet Union and of Yugoslavia led to

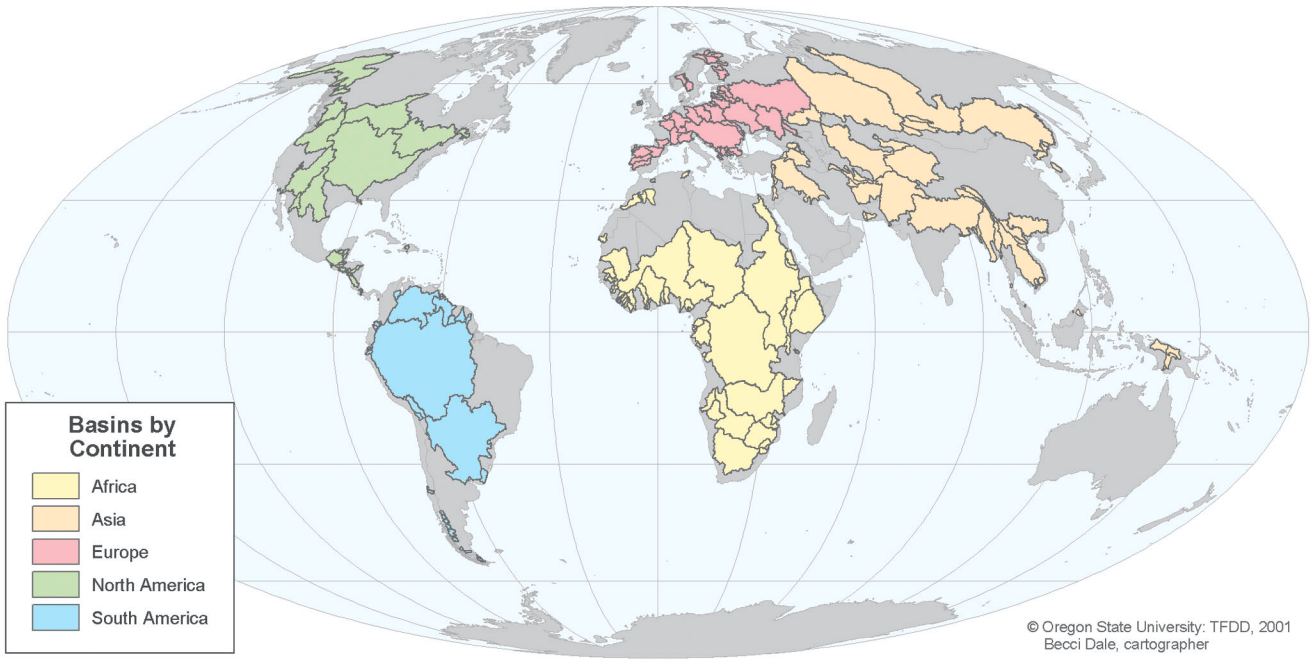


Figure 1. International river basins as delineated by the Transboundary Freshwater Dispute Database project, Oregon State University, 2000. Data source: International River Basins, Wolf et al. (1999), updated 2001.

the "internationalization" of several basins (e.g., the Dnieper, Don, and Volga basins) as well as to changes in the political composition of existing international basins (e.g., the Danube, Ob, and Aral Sea basins) (see Figure 2). In contrast, the unification of both Germany and Yemen in 1990 resulted in the "nationalization" of two formerly international basins — the Weser and Tiban.

Beyond the sheer number of basins involved, the significance of the world's international waterways is further reflected in their physical extent and abundant resources. The world's 263 international river basins account for nearly one-half of the earth's land surface, generate roughly 60% of global freshwater flow and are home to approximately 40% of the world's population. It is the political composition of these shared water systems, however, that highlights their vulnerabilities. A total of 145 countries contribute territory to international basins. Thirty-three nations, including such sizeable countries as Bolivia, Chad, the Democratic Republic of the Congo, Niger, and Zambia, have more than 95% of their territory within the hydrologic boundaries of one or more international basins. Perhaps even more significant is the number of countries that share certain individual basins. The Danube, for example, has seventeen riparian states. The Congo, Niger, Nile, Rhine, and Zambezi are each shared by more than nine countries while the Amazon, Aral Sea, Ganges-Brahmaputra-Meghna, Jordan, Kura-Araks, La Plata, Lake Chad, Mekong, Neman, Tarim, Tigris-Euphrates-Shatt al Arab, Vistula, and Volga basins each contain territory of at least five sovereign nations (Wolf et al., 1999).

Dynamics of International River Basin Management

The complex physical, political, and human interactions within international river basins can make the management of these shared water systems especially difficult. Issues of increasing water scarcity, degrading water quality, rapid population growth, unilateral water development, and uneven levels of economic development are commonly cited as potentially disruptive factors in co-riparian water relations. The combination of these factors has led academics and policy-makers alike to warn of impending conflict over shared water resources.

Despite these seemingly formidable obstacles, however, co-riparian states have demonstrated a remarkable ability to cooperate over their shared water supplies. In the largest quantitative study of water conflict and cooperation, researchers at Oregon State University found that cooperative interactions between riparian states over the past fifty

years have outnumbered conflictive interactions by more than two-to-one. Since 1948, the historical record documents only 37 incidents of acute conflicts (i.e., those involving violence) over water (30 of *these* events were between Israel and one or another of its neighbors, the last of which occurred in 1970), while during that same period, approximately 295 international water agreements were negotiated and signed. Furthermore, extreme conflicts over water were confined to two issues — water supply and infrastructure — whereas basin states signed water treaties concerning a range of issues, including water quantity, quality, economic development, and hydropower.

Confluence of Iguazu and Paraná Rivers. Photo credit: Rolando León.

At the sub-acute level, which defines most water interactions, cooperative relations again dominate the history of international water relations. This does not imply that water cannot act as a source of discord, for disagreements over water can make good relations bad and bad relations worse. Water, for instance, was the last and most contentious issue resolved in negotiations over the 1994 Treaty of Peace between Israel and Jordan and, in the Israeli-Palestinian context, discussions concerning the resource were relegated to "final status" negotiations along with such other controversial issues as the status of Jerusalem and the right of return for Palestinian refugees. Far more prevalent, however, are examples where water has served as a unifying agent, particularly where relatively strong institutions

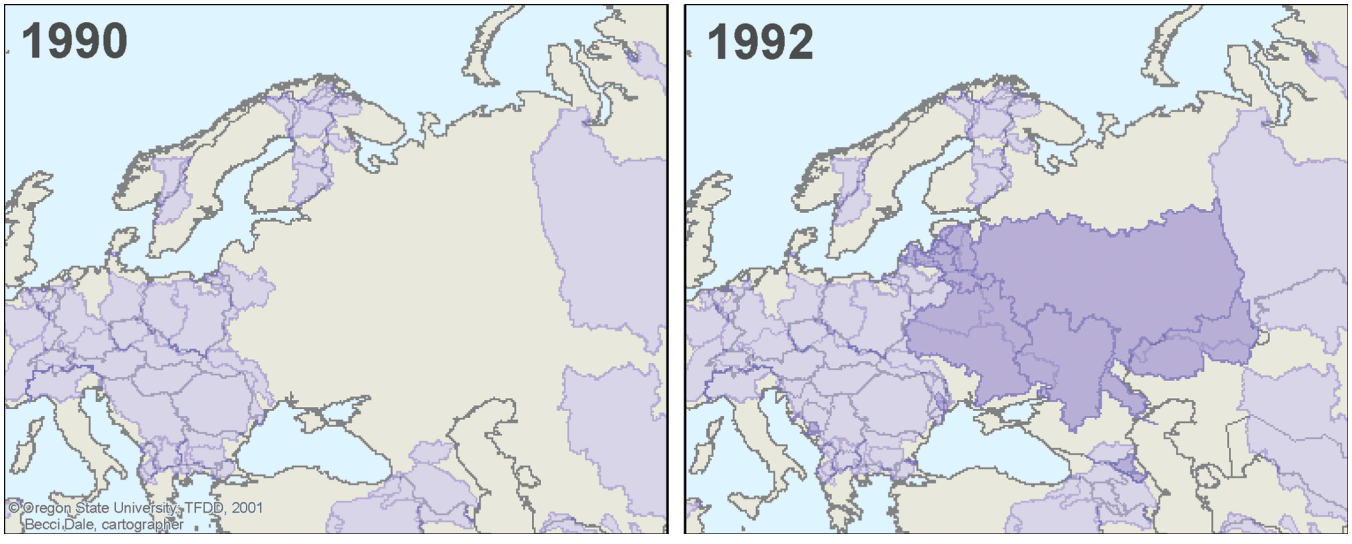
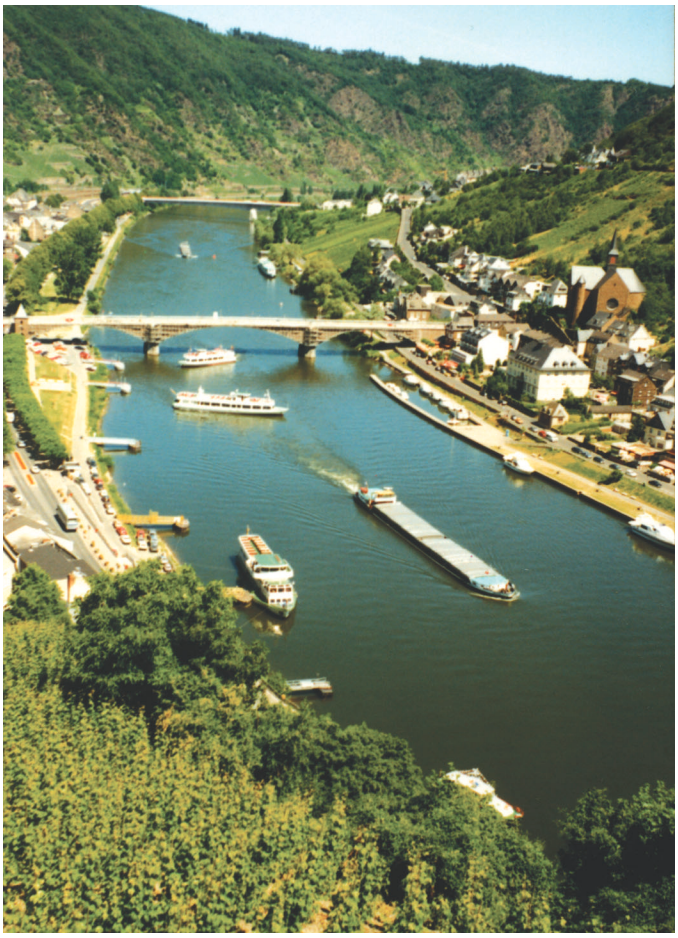


Figure 2. When changes in political boundaries take place, there may be the creation or dissolution of international river basins. The break up of the Soviet Union in 1991, for example, led not only to the "internationalization" of several basins (e.g., the Dnieper, Don, and Volga rivers) but also to a change in the political composition of existing international basins (e.g., the Ob and Aral Sea basins). Data source: Historical International River Basins, Fiske and Yoffe (2001).



Moselle River. Photo credit: Michael Freitag.

such as treaties are present. The establishment of the Indus Water Commission in 1960 between India and Pakistan, for example, fostered remarkably resilient bilateral cooperation over water, despite two wars and continued political turmoil between the two states. The Mekong River Committee, established in 1957 among the four lower riparian states of Thailand, Cambodia, Vietnam, and Laos, also weathered extreme political conditions and resulted in continued water-related data exchange by the member states, even during the Vietnam War. (See the *General References* section for a listing of literature concerning both conflict and cooperation over shared water resources.)

Thus, the creation and maintenance of international water institutions can play a vital role in conflict mitigation efforts. In fact, the presence or absence of institutions has proven to be one of the most important factors influencing co-riparian water relations, exceeding such traditionally cited variables as climate, water availability, population density, political orientation, and levels of economic development. In addition, the historical record indicates an increased likelihood of conflict in basins lacking institutions that can accommodate changing political, hydrologic, or other basin conditions. Where international water institutions exist, however, relations among riparian states are generally more cooperative than in basins without treaties or other cooperative management mechanisms. This situation holds true even in basins with high levels of infrastructural development, an otherwise conflict-prone setting (Wolf, Yoffe, and Giordano, forthcoming, 2003).

Institutional Developments in International Freshwater Management

Acknowledging the benefits of cooperative water management frameworks, policy makers have been involved in institution-building efforts over the past century at a range of geographic scales. Globally, the international community has developed guiding principles and laws for international freshwater management. At a finer scale, regional bodies and individual governments have developed protocols and treaties governing the management and protection of specific international water bodies. Together, these developments have encouraged greater understanding and advanced a goal of coordinated management within the world's international basins.

Principles of International Freshwater Management

To preempt potential conflict and resolve existing disputes, the international community has focused considerable attention in the 20th century on developing and refining principles of international freshwater management. The Institute of International Law (IIL) published a set of basic recommendations in its 1911 Madrid Declaration on the International Regulation regarding the Use of International Watercourses for Purposes other than Navigation. Included in these recommendations, the IIL discouraged unilateral basin alterations and harmful modifications of international rivers, while advocating the creation of joint water commissions. Expanding on these guidelines, the International Law Association developed the Helsinki Rules of 1966 on the Uses of the Waters of International Rivers. The Helsinki Rules outlined principles related to the "equitable utilization" of shared watercourses and the commitment not

to cause "substantial injury" to co-riparian states (Caponera, 1985).

Four years later, in 1970, the United Nations commissioned its own legal advisory body, the International Law Commission (ILC) to codify the law on the non-navigational uses of international watercourses. In 1997, the ILC's task was completed with the United Nations General Assembly's adoption of the Convention on the Law of the Non-Navigational Uses of International Watercourses (UN Convention), which regularized principles of "equitable and reasonable utilization" and the "obligation not to cause significant harm" and established a framework for the exchange of data and information, the protection and preservation of shared water bodies, the creation of joint management mechanisms, and the settlement of disputes (Wouters, 2000).

Despite the fact that 103 countries approved the United Nations' resolution adopting the document, the UN Convention's ultimate practicality has been called into question due to its vague and sometimes contradictory language and the slow progress that has been made towards its ratification (see Figure 3). However, while explicit approval of the UN Convention may prove difficult, implicit support of the international water management principles it contains is clearly evident through such international statements as the 1972 Declarations of the United Nations Conference on the Human Environment, the 1977 Declarations and Resolutions of the United Nations Water Conference, the 1992 Dublin Statement from the International Conference on Water and the Environment, and the 2000 Second World Water Forum's Ministerial Declaration.

Regional Accords

Initiatives of regional organizations have further served to encourage co-riparian cooperation. Through the creation of region-specific guidelines, multinational bodies such as the Organization for Economic Cooperation and Development (OECD), the European Union, and the Southern African Development Community (SADC) have formulated agreements and protocols supporting collaborative water resource initiatives. In the 1970s, the OECD Council, for example, issued a series of recommendations concerning the management and protection of transboundary resources relevant to international rivers. European governments have addressed regional water issues through such agreements as the Convention on Environmental Impact Assessment in a Transboundary Context (1991) and the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (1992). Similarly, in the southern African context, the SADC member states, drawing heavily from the language contained in the UN Convention, have established the Protocol on Shared Watercourses in the Southern African Development Community (2000).

Basin Treaties

While global- and regional-scale efforts have indeed served to encourage greater collaboration among basin states, it is at the basin-scale where the greatest developments in cooperative water management are found. The history of international water treaties dates as far back as 2500 BC, when the two Sumerian city-states of Lagash and Umma crafted an agreement ending a water dispute along the Tigris River (Wolf, 1998). Since then, a rich body of water

Grand Canyon of Colorado River. Photo credit: Terrence E. Davis.

Figure 3. On 21 May 1997, the United Nations General Assembly adopted the United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses by 103 votes in favor, 3 against and 27 abstentions. To bring the document into force, 35 instruments of ratification, acceptance, approval, or accession are necessary. To date, only 12 countries have ratified or consented to be bound (acceptance, approval or accession) by the agreement. Data sources: UN General Assembly Vote, United Nations (1997). Current Status of Convention, United Nations (2002).

treaties has evolved. The Food and Agricultural Organization of the United Nations has documented more than 3600 international water treaties dating from AD 805 to 1984. Although the vast majority of these agreements concern navigational issues, a growing number address water as a limited and consumable resource apart from navigation, boundary delineation, or fisheries related matters. Included in this latter category are more than 400 water agreements signed since 1820, as detailed in the *Treaties and Related Agreements* section of this Atlas. A review of the provisions contained in these agreements highlights a number of positive trends in international river basin management over the past century. First, the hydrologic linkages formed by the world's international basins create shared interests among each basin's co-riparian states. Agriculture, industry, recreation, hydropower, flood control, environmental integrity, and human health are all connected to some degree within an international basin. While individual sectors and countries may have exploited their riparian position or dominance at times throughout history, basin states have likewise demonstrated a remarkable ability to cooperatively capitalize upon their shared interests and to focus not only on the division of shared water resources themselves, but on the broader benefits from their use or control. As part of the 1957 Mekong River Agreement, for example, Thailand agreed to provide financial support for a hydroelectric project in Laos in exchange for a proportion of the resultant power generation. Through the 1986 Lesotho Highlands Water Project Agreement, South Africa supports the financing of a hydroelectric/water diversion facility and in turn receives the rights to drinking water for its industrial heartland in Gauteng province. Similarly, under the 1998 Agreement on the Use of Water and Energy Resources of the Syr Darya Basin, Uzbekistan and Kazakhstan make in-kind compensation to the Kyrgyz Republic for the transfer of excess power generated during the growing season.

Second, basin states have illustrated a great deal of creativity in formulating treaty provisions that meet the unique hydrological, political, and cultural

settings of their individual basins. A 1969 agreement between South Africa and Portugal on the Kunene River, for instance, allows for "humanitarian" diversions solely for human and animal requirements in Southwest Africa, as part of a larger project for hydropower. As part of the 1994 Treaty of Peace, Jordan stores water in an Israeli lake while Israel leases Jordanian land and wells. India, under a 1966 agreement with Nepal, plants trees upstream in Nepal to protect its own, downstream, water supplies. In a 1964 agreement Iraq "gives" water to Kuwait, "in brotherhood," without compensation. In an example with particularly local implications, a 1957 agreement between Iran and the USSR includes a clause that allows for cooperation in identifying corpses found in their shared rivers (Wolf, 1999a).

Third, conditions and priorities within a basin can change considerably over time, necessitating some degree of flexibility in the institutions created to manage shared water systems. While further progress is needed in this area, precedents exist for incorporating provisions into basin accords to accommodate changing needs and values. The 1987 Agreement on the Action Plan for the Environmentally Sound Management of the Common Zambezi River System, for example, allows for the future accession of additional riparian states to the treaty. Other examples of treaties with built-in flexibility include water allocation formulas that account for hydrologic fluctuations or changing needs and values, such as in the 1996 Treaty between India and Bangladesh on Sharing of the Ganga/Ganges Waters at Farakka, the 1986 Lesotho Highlands Water Project Agreement, and the 1992 Komati River Basin Treaty between South Africa and Swaziland.

A final notable development in the 20th century treaty record has been a use, albeit limited, of multi-resource linkages, effectively broadening the "basket of benefits" considered in international water agreements and expanding the possibility for positive-sum solutions to resource problems. While countries have traditionally treated water separately from other transboundary issues, a number of precedents exist in which water negotiations were explicitly linked to other issues. In treaties concluded in 1959 and 1966, India and Nepal, for example, bundled projects related to irrigation, hydropower, navigation, fishing, and afforestation. More far-reaching examples can be found in the Middle East, where the 1994 and 1995 agreements between Israel and Jordan and Israel and the Palestinian Authority, respectively, incorporate water within a broader framework for peace in the region.

Mahabad River. Photo credit: Babak Sedighi.

Future Institution Building Opportunities

While a review of the past century's water agreements highlights a number of positive developments, institutional vulnerabilities remain. Notably, 158 of the world's 263 international basins lack any type of cooperative management framework. Furthermore, of the 106 basins with water institutions, approximately two-thirds have three or more riparian states, yet less than 20 percent of the accompanying agreements are multilateral. Moreover, despite the recent progress noted above, treaties with *substantive*

Blue Nile dam. Photo credit: Badege Bishaw.

references to water quality management, monitoring and evaluation, conflict resolution, public participation, and flexible allocation methods, remain in the minority. As a result, most existing international water agreements continue to lack the tools necessary to promote long-term, holistic water management.

Drawing from the past century's treaty-writing experience, the following lessons may assist the international, regional, and basin communities as they expand and refine their cooperative water management structures.

1. *Adaptable management structure.* Effective institutional management structures incorporate a certain level of flexibility, allowing for public input, changing basin priorities, and new information and monitoring technologies. The adaptability of management structures must also extend to non-signatory riparians by incorporating provisions addressing their needs, rights, and potential accession.

2. *Clear and flexible criteria for water allocations and quality.* Allocations, which are at the heart of most water disputes, are a function of water quantity and quality, as well as political fiat. Thus, effective institutions must identify clear allocation schedules and water quality standards that simultaneously provide for extreme hydrological events, new understanding of basin dynamics, and changing societal values. Additionally, riparian states may consider prioritizing uses throughout the basin. Establishing catchment-wide water precedents may not only help to avert inter-riparian conflicts over water use, but also protect the environmental health of the basin as a whole.

3. *Equitable distribution of benefits.* This concept, subtly yet powerfully different from equitable use or allocation, is at the root of some of the world's most successful institutions. The idea concerns the distribution of benefits from water use — whether from hydropower, agriculture, economic development, aesthetics, or the preservation of healthy aquatic ecosystems — not the benefits from water itself. Distributing water use benefits allows for positive-sum agreements, whereas dividing the water itself only allows for winners and losers.

4. *Detailed conflict resolution mechanisms.* Many basins continue to experience disputes even after a treaty is negotiated and signed. Thus, incorporating clear mechanisms for resolving conflicts is a prerequisite for effective, long-term basin management.