Managing and Transforming Water Conflicts

All living things need water. . . . Where water crosses boundaries – be they economic, legal, political, or cultural – the stage is set for disputes among different users trying to safeguard access to a vital resource, while protecting the natural environment. Without strategies to anticipate, address, and mediate among competing users, intractable water conflicts are likely to become more frequent, more intense, and more disruptive around the world. In this book, Jerome Delli Priscoli and Aaron T. Wolf investigate the dynamics of water conflict and conflict resolution, from the local to the international. They explore the inexorable links among three facets of conflict management and transformation: alternative dispute resolution (ADR), public participation, and institutional capacity. This practical guide will be invaluable to water management professionals, as well as to researchers and students in engineering, economics, geography, geology, and political science who are involved in any aspect of water management.

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Jerome Delli Priscoli dedicates this book to the memory of Pierre Teilhard de Chardin, S. J., whose writings and spirit have been so helpful in trying to integrate thirty-five years of multidisciplinary research and practical work in water resources around the world.

Aaron T. Wolf dedicates this book to Professor John Ross, advisor and friend, who taught a generation of students how to see watersheds without boundaries.

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Foreword

With the dramatically increasing number of users and the potential impact of climatic change, human systems and the hydrological system might be on an unsustainable path. Indeed, population rises, the climate seems to change, and water demands grow to quench the thirst of cities, suburbs, industry, and agriculture, often leaving ecosystem needs on the wayside. All of these factors might lead to potential conflicts among uses and users. However, water scarcity is not the only concern, as we are reminded by recent flooding events that have spelled disaster for the human communities living in affected areas. In the past decade, water-related pressures have resulted in media headlines foreboding a future wrought with "water wars." With 263 rivers and countless aquifers transversing national boundaries, the cultivation of such a somber image is not surprising. Indeed, water cuts across the boundaries of countries, cultures, and economic sectors, meaning that water planning and decision making in one jurisdiction has the potential to spill over to into others. The risk of disruption, conflict, and violence exists around transboundary waters. However, earlier work by the authors points to a lengthy history of cooperative interactions, rather than conflicts, over this precious resource.

Sparked by the concern over water security, in particular, the challenges of sharing water resources across political boundaries and of responding to the needs of many Member States, UNESCO initiated the project From Potential Conflict to Co-operation Potential (PCCP) in 2000. PCCP endeavors to increase the capacity of stakeholders to find conciliatory ways to reach mutually accepted solutions for the management of their shared water resources. Since its inception, PCCP has produced many relevant publications, training courses, and educational materials, increasing the knowledge base of issues pertaining to transboundary waters, conflict, and cooperation. In response to requests of Member States, the project has also focused on providing technical assistance. In spite of these advancements, further work is needed to broaden and deepen our understanding of how to manage shared water resources in an equitable manner that enables social and economic development, contributes to poverty eradication, and protects environmental systems.

In light of the growing complexity of water resources management, UNESCO is grateful for the outstanding contributions of Dr. Wolf and Dr. Delli Priscoli to the field of transboundary waters. In this comprehensive book, *Managing and Transforming Water Conflicts*, Wolf and Delli Priscoli, each a preeminent expert in the field, bring together their incisive and visionary thinking, providing a resource for achieving constructive interactions around water resources. The authors pose and dissect questions of stakeholder involvement and interest-based negotiations and provide tools to affect each phase of a conflict resolution process. They also build on earlier research, which underscores the importance of institutional capacity in preventing and resolving water-related conflicts.

Eloquently written, Wolf and Delli Priscoli's book is instructive and hopeful, taking us closer to realizing a more optimistic vision of water as a tool for promoting cooperation and peace. UNESCO, through PCCP, has cautiously embraced a positive view of managing shared water resources. Reading this book, one remains hopeful that even in these times of unprecedented ecological, social, and political change, the possibility exists to transform potential water conflicts into avenues for cooperation.

Water connects us and forces us to build bridges.

András Szöllösi-Nagy
Deputy Assistant Director General of UNESCO
Secretary of the International Hydrological Programme

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Subsequently, we have drawn on a host of expertise from around the world to present the ideas in this book. The "Four Stages in Water Conflict Transformation" presented in Chapter 6 was drawn from a skills-building course developed over years within the World Bank on which Wolf had the honor to work. We are grateful to our co-instructors, Undala Alam, Inger Andersen, Terry Barnett, David Grey, Bo Kjellen, Stephen McCaffrey, Claudia Sadoff, Salman Salman, and Dale Whittington, for the discussions and experiences that led to this thinking, and to Len Abrams, who crafted the world (and maps) of the Sandus Basin.[1]

[1] A course workbook was published as Wolf (2008), which an interested instructor might use in a classroom to supplement this text.

Many people have added substantively to the text or approach of the book. The case studies in Appendix C were substantially updated and expanded by Joshua T. Newton, currently at Tufts University, who also wrote the Guaraní, Kura–Araks, Senegal, and Lake Titicaca case studies. Appendix E, on groundwater, and Appendix F, on quality-related treaties, come from the excellent theses by Kyoko Matsumoto and Meredith Giordano, respectively. Appendix D, on international water pricing, was researched and authored by Kristin M. Anderson and Lisa J. Gaines of Oregon State University. Jakub Landovsky and Olga Zarubova-Pfeffermannova contributed to the research on the Kosi and Ganduk for Chapter 4. Some of the text draws from articles coauthored with Ariel Dinar, at the World Bank; Meredith Giordano, now at International Water Management Institute (IWMI); Sandra Postel, of the Global Water Policy Project; and Shira Yoffe, currently with the U.S. Department of State. Todd Jarvis and Marloes Bakker, both of Oregon State University, read the entire document critically and carried out a thorough update of relevant literature. The bibliography and some text were augmented and finalized thanks to Nathan Eidem, Eva Lieberherr, Michele Lizon, Patrick MacQuarrie, Olivia Odom, and Kate Zahnle-Hostetler, of Oregon State University, and Jamie Frey-Frankenfield of the University of Oregon. The maps and figures owe their appeal to the cartographic expertise of Sara Ashley Watterson, currently of Earthjustice, and Gretchen Bracher and Nathan Eidem, of Oregon State University. The transboundary waters team at Oregon State University has learned long ago never to allow any document to leave the building without the thorough crafting and enhancing of Caryn M. Davis of Cascadia Editing. Caryn's energy, attention to detail, grasp of the document as a whole, and passion for the work provide so much more than one has a right to expect from a "technical edit." If this book has any coherence and appeal, it is due in no small part to Caryn and her magic.

Wolf benefited profoundly from his relationship with his colleagues at the Universities Partnership for Transboundary

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Appendix C. Case studies of transboundary dispute resolution

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Appendix D. International water pricing: An overview and historic and modern case studies

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Appendix F. Treaties with water quality provisions

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Introduction

Till taught by pain, men really know not what good water's worth.
– Lord Byron, "Don Juan"

In 1978 the Dead Sea turned over for the first time in centuries. For millennia, this terminal lake at the lowest point on the Earth's surface had been receiving the sweet waters of the Jordan River, losing only pure water to relentless evaporation and collecting the salts left behind. The result had been an inhospitably briny lake eight times saltier than the sea, topped by a thin layer of the Jordan's relatively less-dense fresh water. The two salinity levels of the river and the lake kept the Dead Sea in a perpetually layered state even while the lake level remained fairly constant – evaporation from the lake surface occurs at roughly the rate of the natural flow of the Jordan and other tributaries and springs.

These delicate balances were disrupted as modern nations – with all of their human and economic needs tied inexorably to the local supply of fresh water – built up along the shores of the Jordan. In the past century, as both Jewish and Arab nationalism focused on this historic strip of land, the two peoples locked in a demographic race for numerical superiority. As more and more of the Jordan was diverted for the needs of these new nations, the lake began to drop, most recently by about one-half meter per year. As it dropped, greater shoreline was exposed, the lake was cut in half by the Lisan Straits, the shallow southern half all but dried up, and the potash works and health spas built to take advantage of the lake's unique waters found themselves ever farther from the shore.

Along with the drop in lake level came a relative rise in the pycnocline – the dividing line between the less-saline surface water and its hypersaline fossil base. The division between the two layers was finally eradicated briefly in the winter of 1978–1979, and the Dead Sea turned over, effectively rolling in its grave – a hydrologic protest against the loss of the Jordan. The turnover brought water to the surface that had not seen light of day for three hundred years. Although it sterilized the lake, this turnover was not counted as an ecological disaster – except for bacteria, fungi, and one type of algae, the Dead Sea is appropriately named – but the event was a symptom of a wider crisis of history-influencing proportions.

The fact is that the populated world is running out of "easy" water. Although the total quantity of water in the world is immense, the vast majority is either saltwater (97.5 percent) or locked in ice caps (1.75 percent). The amount economically available for human use is only 0.007 percent of the total, or about 13,500 km^3 (about 2,300 m^3 per a person – a 37 percent drop since 1970; United Nations, 2005). This number continues to fall as populations grow and as existing supplies become more polluted (Figure I.1).

Most of the world's population lives in areas where the majority of the rainfall comes in only a few short months of the year. The same poor who are continually flooded also suffer recurrent drought. Our variability in climate is indicating changing patterns and timing of runoffs. Hydrologists suggest that intensity of hydrological events could increase. No one can predict the regional variability of these projected changes. Thus the sources of potential water stress are varied and uncertain. Human responses will require use of mixed infrastructures and changes in our behavior.

In conjunction with these hydrological stresses, though, come the political stresses, which result as the people who have built their lives and livelihoods on a reliable source of fresh water are seeing the shortage of this vital resource impinge on all aspects of the tenuous relations that have developed over the years – among nations, among economic sectors, and among individuals and their environment. This book speaks to how people have, and have not, dealt with hydropolitics and its impact on people and the environment. It seeks to help us to better understand and deal with these stresses and their uncertainties (Sidebar I.1).

United Nations data of a decade ago showed that 25 percent of the world's human population lived in areas at high risk of drought and floods. The number of victims affected by droughts and floods is growing rapidly. Average annual losses

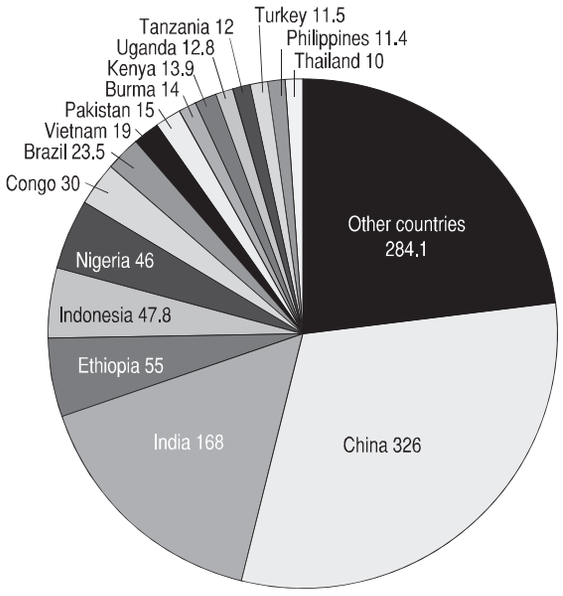

Figure I.1 Seventy-five percent of people without access to safe water reside in sixteen countries (United Nations, State of the World Population, 2004).

are now over US$40 billion, with economic losses that are ten times greater than in the 1950s (Munich Re Group, 2000). More recent data indicates that this trend is continuing (United Nations International Strategy for Disaster Reduction, 2004). Cheap and accessible electricity has traditionally been the key to economic development. However, two billion people lack access to electricity, and the demand is growing. Throughout the world, developed countries (occasionally defined by membership in the Organisation for Economic Co-operation and Development) have used about 70 percent of their hydropower potential, but in Africa, with its huge potential for hydropower, only 6 percent has been used. In Asia, 20 percent has been used, and in Latin America, about 35 percent (Sadoff and Grey, 2005). The poor pay a far higher percentage of their income or available wealth for water: an average of about US$1.00 to US$2.50 per cubic meter. This is in contrast to the United States, where citizens pay about US$0.30 to US$0.80 per cubic meter. The connected poor pay about US$1.00 per cubic meter, and the unconnected poor pay US$5.50 to US$16.50 per cubic meter on average. These are numbers no rich country would tolerate.

Sidebar I.1 Some of the Gloomy Arithmetic of Water

- 1.4 billion people lack safe water
- 80 percent of diseases are carried by water: One child dies every 8 seconds and 5 to 7 million people die annually; $125 billion in workday losses per year
- 50 percent of people lack adequate sanitation
- 20 percent of freshwater species are near extinction
- 76 percent of people live in water-stressed areas (less than 1,000 centimeters of rainfall per year), most in politically unstable regions
- We will lose irrigated land by 30 percent in 2025 and 50 percent by 2050
- 50 percent of people will depend on world markets for food
- Asia: More than two-thirds of the population live in areas where 80 percent of rainfall occurs in 20 percent of the year

There has been a spectacular increase in groundwater development for irrigation in most arid and semiarid countries. This is a "silent revolution." Probably, about half of the value of irrigated agriculture is obtained with groundwater, but the volume of groundwater used is only a small fraction of the corresponding volume of surface water used for irrigation (Delli Priscoli, 2005a). A huge and growing literature speaks to the human and ecological disasters attendant on the global water crisis – essentially an ongoing deployment of a hydrological weapon of mass destruction (see especially the works of Peter Gleick [e.g., his biennial World's Water Series, 2003], Sandra Postel (1992, 1999), United Nations Environment Programme (UNEP) [UNEP and OSU, 2002; UNEP and the Woodrow Wilson Center, 2004; Wolf, 2006; Carius, Feil, and Taenzler, 2003], United Nations Educational, Scientific and Cultural Organization (UNESCO) [which has produced dozens of papers under the auspices of its PCCP Programme], and others).

We investigate the dynamics of water conflict stemming from such stresses, as well as the processes that are integral to capacity and institution building for managing waters that cross jurisdictional boundaries. We explore the intertwined nature of three facets of capacity and institution building processes: conflict management processes, public participation processes, and institutional capacity-building processes, as they are embedded in disputes over water resources around the world.

For many reasons documented in these pages and in many other reports, water is becoming the critical resource of the twenty-first century. The more we realize its importance, the more we also realize a fundamental reality of water management: water, which is created by nature, often crosses jurisdictional boundaries, which are created by humans, and this generates conflicts. Water behaves in an integrated way, whereas the institutions through which we manage it are fragmented. Fragmented institutional management seems to be the rule for water that crosses national boundaries and boundaries of states and provinces within national boundaries.

Water management, by nature, becomes a process of anticipating disputes and managing conflict so as to build new ways

and means to deal with stresses. The industrialized world has prospered and grown because of its ability to do so, and societies around the world have developed in part through their successes in managing water resources. Indeed, we can argue that creating capacity and institutions to manage water across federal jurisdictional boundaries has been a major element in creating the United States as one nation on the North American continent. It is no accident that the European Union, in looking toward more integration, has put management for river basins that cross State boundaries in the center of its directives. In the past, countries such as Holland have integrated and evolved politically in ways heavily influenced by the experiences of local water boards (Reuss, 2002). Indeed, needs arising from cross-boundary water uses, such as navigation or pollution control, have consistently led the way to increased joint planning, diagnosing, and managing of Continental Europe's waters, often leading to cooperation in other areas.

The terms *transboundary* and *international waters* can be the sources of endless debate. Clearly, sovereign States must play out debates over water within relevant diplomatic and international rules. However, even when water crosses jurisdictional boundaries within nations, conflicts arise between entities, some of whom have legal status and sovereignty concerns close to those of international States, including, for example, Canadian or German provinces or Indian tribes within the United States. The institutional experience of such management can often provide models or at least concepts that are relevant to those in international waters. For our purposes, we use the term *international waters* to refer to those water resources that cross the boundaries of two or more countries, and *transboundary waters* as a more inclusive term to refer to water that crosses *any* jurisdictional or sectoral boundaries, including those within a nation. It is important that the experiences in managing transboundary disputes within nation-states and those that occur internationally across States better inform each other (Sidebar I.2).

Boundaries change. Sovereign States have emerged from regions, thus creating international waters, which were once better thought of as regional waters. So, too, international waters can become regional if incorporated into other states. Jurisdictional boundaries are more fluid than nature's watercourses, especially if we look over a time period of 50 to 100 years. The fact that the waters continually conflict with jurisdictional boundaries, however, does not change.

We couch the lessons of this book within this broad perspective. We do this to help expand the possibilities for the capacity of individuals, organizations and institutions, and society to manage water. Doing so opens up new possibilities for all of us who are struggling with the number-one need recognized by the World Water Forums and many other regional forums – the need for institution and capacity building for water management.

Sidebar I.2 Some Useful Definitions

Basin: We use *basin* synonymously with what is referred to in the United States as a *watershed* and in the United Kingdom as a *catchment*, or all waters, whether surface water or groundwater, that flow into a common terminus. The 1997 UN Convention on the Law of Non-Navigational Uses of International Watercourses (Appendix A; United Nations, 2005) similarly defines a *watercourse* as "a system of surface and underground waters constituting by virtue of their physical relationship a unitary whole and flowing into a common terminus." By definition, basins can include lakes, wetlands, and aquifer systems in addition to rivers. Colloquially, some use watersheds as smaller units, whereby many watersheds make up a river basin.

Conflict: "[T]wo or more entities, one or more of which perceives a goal as being blocked by another entity, and power [of some sort] being exerted to overcome the perceived blockage" (Frey, 1993). *Acute conflict* is defined as conflict that results in military or violent actions among competing parties.

Dispute: Conflicts that result in nonviolent tensions among parties, including political, legal, or economic actions.

Hydropolitical Resilience: The complex human-environmental system's ability to adapt to permutations and change within these systems; *hydropolitical vulnerability* is defined by the risk of political dispute over shared water systems.

International Waters: Following the 1997 Convention, we use "international waters" as a watercourse, parts of which are situated in different States (nations).

Transboundary Waters: Water that crosses *any* boundaries – be they economic sectors, legal or political jurisdictions, cultural divides, or international borders. This also includes water crossing boundaries of sovereign entities, whether these boundaries are within a federalist nation-state or among nation-states.

Institutions/Organizations: Keohane defines *institutions* as "persistent and connected sets of rules (formal and informal) that prescribe behavioral rules, constrain activity, and shape expectations" (Keohane, 1989, p. 3), whereas Lasswell (1971) uses "routinized patterns of behavior creating stable expectations over time." *Organizations* are generally the formal bodies that implement institutional arrangements. Although the authors recognize the distinctions between *institutions* and *organizations*, these terms are used interchangeably in many places in this book.

War: Including both formal and informal declarations of war; extensive acts of violence between two nations, or among more nations, causing deaths, dislocation, and high strategic costs (Azar, 1980).

We also examine issues that tend to recur in water conflicts: questions of equity in water allocations and characteristics of water that tend both to encourage cooperative management and to rend apart negotiations. The question we seek to answer is, in short: what aspects about water disputes are unique in the realm of conflict resolution, and how can these attributes be harnessed to help encourage cooperation?

Following this introduction, Chapter 1 describes background and trends that lead to and prescribe the need for more explicit managing of water conflicts. Chapter 2 revisits the thesis of "water wars" and reframes the issue of water conflict and war by looking at water realities in history and cooperation around water.

Chapter 3 reviews some theories of conflict management and what has been called "alternative dispute resolution" (ADR), as they might be applied to water conflicts. The principles of conflict management are described and applied to water issues, in both the unassisted and assisted settings. Some background is then provided on diagnosing the causes of conflict, and on generating creative value- and interest-based alternatives in water disputes. Chapter 4 looks at the means for conflict management and includes some discussion on participation processes. Although the two often use similar tools, they do not always hold the same purposes and ends. Both conflict management and participation do strive to enhance the institutional capacity for managing water conflicts. Possibilities for public participation in water resources are then explored, followed by a description of capacity for water institutions to resolve disputes.

Chapter 5 looks at some ends of negotiating over water conflicts to build transboundary arrangements or organizations to manage water conflicts. It moves into the realm of how conflict management is actually practiced in the world of water resources by using these theories as a context. The chapter begins with a general description of water conflict resolution in the interjurisdictional setting.

Chapter 5 also discusses ends or purposes of negotiating around water issues. Frequently we think of each negotiation as an event unto itself rather than a longer-term process. Transboundary and international water arrangements evolve and grow over long periods of time, however, with some of the best known – such as on the Delaware River in the United States – taking almost 50 years to create. Negotiations in areas with difficult problems are therefore usually a start. This chapter presents the idea that these ends are really institution and capacity building. It presents successful conflict management of water issues around transboundary waters as a longer-term process rather than simply a series of short-term events.

Chapter 6 discusses some means for negotiating transboundary water disputes. This chapter uses the theories presented in earlier chapters to frame discussions of how actual processes can evolve. It also emphasizes new views of interest-based negotiations and the use of outside or third parties.

Chapter 6 also includes one construct for understanding the process of water conflict transformation. Although there are no blueprints for resolving water disputes, some patterns do tend to emerge, particularly an organic evolution from thinking of water in terms of rights, to needs, to benefits, to equity.

Chapter 7 describes the lessons learned through an examination of patterns and issues in both national and international case studies and asks: what issues of the future may look nothing at all like the past?

Much of the popular debate around water issues is couched in apocalyptic and doomsday view of crisis. But what is crisis? *Crisis*, from its Greek roots *krisis*, refers to decision and not necessarily disaster – to a time of decisive action, to a turning point that may make things worse or better. Crisis also signifies opportunity as much as, or more than, disaster. Crisis is like a wake-up call for decision and action. Today, water crises are carrying wake-up calls but also a hope for creativity and opportunities for community building.

The debate about water and conflict is frequently heavy on problems and light on solutions. For example, we hear much about conservation, population control, and vaguely defined "better ways." More frequently we find critiques of what has been done or what exists, with little discussion of what would have happened without various projects or programs. In other words, the retrospective balance of benefits and costs is rarely clear. It is unclear where such retrospective balance would lead us, but what is clear is that this is a new level of discussion in which we must engage.

One way or another, humans are going to change societal and individual behavior around water – even under the best assumptions of population growth, conservation, and better pricing. We hope this book will help decision makers concerned with water, water professionals, nongovernmental organizations, and other users adapt to these changes. We can be reactive or choose to be proactive. To do nothing is likely to be an invitation for bad socioeconomic and environmental projects. To proactively codesign and coengineer our ecology with God and/or nature carries awesome responsibilities – and can be frightening. Pessimism and fear will not get us there. We need to tap our rich history of water resources experience. Such is the spirit guiding this book.

A Note on the OSU Transboundary Freshwater Dispute Database

To facilitate the comprehensive study of issues related to conflict and cooperation over shared water resources, researchers at the Oregon State University Department of Geosciences have collaborated with the Northwest Alliance for Computational Science and Engineering over the years to develop what has become known as the Transboundary Freshwater Dispute Database (see Wolf, 1999b; Yoffe et al., 2004).

The database currently includes digital mapping of the world's 263 international watersheds, along with geographic information system (GIS) mapping of many spatial parameters; a searchable compilation of all 400 water-related treaties and 39 U.S. interstate compacts, along with the full text of each; an annotated bibliography of the state-of-the-art of water conflict resolution, including approximately 1,000 entries; negotiating notes (primary or secondary) from the detailed case studies of water conflict resolution (see Appendix C); a "Water Event Dataset," which includes comprehensive news files of all reported cases of international water-related disputes and dispute resolution (1950–2000), along with similar datasets for Oregon and for the U.S. West; and descriptions of indigenous/traditional methods of water dispute resolution.

Work on the database has resulted in dozens of published articles (most available online at the database's Web site), and several master's theses and Ph.D. dissertations (including those by Kyoko Matsumoto and Meredith Giordano, from which we derive Appendices E and F). In this book, when we describe "our collection," "the treaties surveyed," or "our survey of events," we are referring either to the database itself (available at: http://www.transboundarywaters.orst.edu) or to resulting research.