WATER DIPLOMACY

A Negotiated Approach to Managing Complex Water Networks

Shafiqul Islam
and
Lawrence E. Susskind

RFF PRESS
RESOURCES FOR THE FUTURE

First published 2013
by RFF Press
Routledge, 711 Third Avenue, New York, NY 10017

Simultaneously published in the UK and ROW
by RFF Press
Routledge, 2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

RFF Press is an imprint of the Taylor & Francis Group, an informa business

Library of Congress Cataloging-in-Publication Data

Islam, Shafiqul, 1960-
Water diplomacy : a negotiated approach to managing complex water networks / Shafiqul Islam, Lawrence Susskind, and associates.
p. cm.
Includes bibliographical references and index.
1. Water-supply—Management. 2. Diplomacy. 3. Water-supply—Political aspects. 4. Water-supply—Government policy. 5. Water-supply—Environmental aspects. 6. Water resources development. I. Susskind, Lawrence. II. Title.
TD345.I84 2012
333.91—dc23
2011053475

ISBN: 978-1-61726-102-2 (hbk)
ISBN: 978-1-61726-103-9 (pbk)

Typeset in Bembo
by Cenveo Publisher Services

SFI Certified Sourcing
www.sfiprogram.org
SFI-00453

Printed and bound in the United States of America
by Edwards Brothers, Inc.

PREFACE

To address the emerging realities of our globalized world, we can no longer rely on the popular twentieth-century paradigm to which we have become so accustomed: scientists innovate; politicians make policy; and people respond, especially when they are unhappy. We offer a twenty-first-century approach to water management that acknowledges the complexity and uncertainty of natural and societal systems, accepts the increasing interconnectivity and consequences of important decisions, and rejects the unquestioned authority of hierarchical governance structures.

Our views have been shaped by a number of important books—*The Consolation of Philosophy* (Boethius, 525AD), *The Reflective Practitioner* (Schon, 1983), *Managing the Unknowable* (Stacey, 1992), *At Home in the Universe* (Kauffman, 1995), *The End of Certainty* (Prigogine, 1996), *The Science of the Artificial* (Simon, 1996), *The Third Side* (Ury, 1999), *The Black Swan* (Taleb, 2007), *Thinking in Systems* (Meadows, 2008), *Working Together* (Poteete, Janssen, and Ostrom, 2010), *Practical Wisdom* (Schwartz and Shapiro, 2010) and *Water Wisdom* (Tal and Rabbo, 2010).

Our approach to water diplomacy starts with a question: How can we ensure effective management of water as a common pool resource given that we can neither predict nor control many of the forces involved in its allocation and use? We think of diplomacy as the process of defining and resolving water issues at every level—from the design of a small-scale sanitation system in a village, to the development of a contested hydroelectric facility in one region of a country, to formal treaty negotiations among different nations.

Water problems are shaped by many natural, societal, and political interactions that create complex water networks. As population growth, economic development and climate change put increasing pressure on water resources, the management of these networks becomes increasingly important. Science cannot

provide all the answers. Policy-makers must take what scientists have to say into account, but beyond that, they also need to empower the relevant stakeholders to help formulate and implement solutions. To do this, we believe it will help to think of water as a flexible, even an expandable resource.

In our assessment, the most vexing water management problems are neither simple nor complicated. Simple problems are easily understood and manageable. Complicated problems, while not simple, involve interactions that are still knowable and predictable. Complex problems—and that is what most water management problems are—involve interactions that are both unknowable and unpredictable. Complex problems like these are not easily controlled. They involve too many variables, too many interactions and too much feedback.

For centuries we have taken nature apart and analyzed its components in ever-increasing detail. Now we realize that such "reductionism" can only provide limited insight. Water systems are more than the sum of their parts. "Systems engineering," which water managers have relied on for years, does not work well when natural, societal, and political boundaries are mismatched and cause–effect relationships are ambiguous.

We view water networks as an interconnected set of nodes representing natural, societal, and political variables. The flow of information among these nodes is what enables them to evolve and adjust. Our challenge is how best to manage the flow of information to formulate and achieve desired outcomes. It is in this context that we propose a new Water Diplomacy Framework (WDF) rooted in ideas from complexity theory and non-zero-sum negotiation. Water users and managers can use this Framework to link scientific objectivity and contextual understanding.

Throughout the development of this book, Shafik Islam has had the help of an extraordinary set of mentors, students, and friends. Several deserve special mention including A. Akanda, R. Bras, A. Chassot-Repella, E. Choudhury, Y. Gao, A. Jutla, P. Mollinga, I. Rodriguez-Iturbe, W. Moomaw, K. Portney, M. Reed, D. Small, and R. Vogel. Shafik also wants to acknowledge the love, support, and encouragement of his parents, his wife (Naaz), and their two wonderful daughters (Maia and Myisha). Without their unyielding support and their wise and diligent criticism during never-ending dinner-table conversations, this work would not exist.

Larry Susskind wants to thank Sossi Aroyan, Carri Hulet, Peter Kamminga, Paola Cecci-Dimeglio, Elizabeth Fierman, Todd Schenk, Noah Susskind and Nina Tamburello for their unstinting assistance in preparing this manuscript.

Shafik Islam
Larry Susskind
March 12, 2012

References

Boethius, A.M.S. (575 AD). *The Consolation of Philosophy*, English Translation by H.R. James, Signature Press Edition.

Kauffman, S. 1995. *At Home in the Universe: The Search for the Laws of Self Organization and Complexity*. Oxford: Oxford University Press.

Meadows, D.H. 2008. *Thinking in Systems: A Primer*, D. Wright (ed.), Chelsea Green Publishing.

Poteete, A.R., Janssen, M.A., and Ostrom, E. 2010. *Working Together: Collective Action, the Commons, and Multiple Methods in Practice*. Princeton, NJ: Princeton University Press.

Prigogine, I. 1996. *The End of Certainty: Time, Chaos, and the New Laws of Nature*. New York: The Free Press.

Schon, D.A. 1983. *The Reflective Practitioner: How Professionals Think in Action*. New York: Basic Books.

Schwartz, B. and Shapiro, K. 2010. *Practical Wisdom: The Right Way to do the Right Thing*. New York: Riverhead Books.

Simon, H.A. 1996. *The Science of the Artificial*. Cambridge, MA: The MIT Press.

Stacey, R.D. 1992. *Managing the Unknowable: Strategic Boundaries Between Order and Chaos in Organizations*. San Francisco, CA: The Jossey-Bass Management Series.

Tal, A. and Rabbo, A.A. 2010. *Water Wisdom: Preparing the Groundwork for Cooperation and Sustainable Water Management in the Middle East*. New Brunswick, NJ: Rutgers University Press.

Taleb, N.N. 2007. *The Black Swan: The Impact of the Highly Improbable*. New York: Random House.

Ury, W. 1999. *The Third Side: Why We Fight and How We Can Stop*. New York: Penguin Books.

1

A WATER MANAGEMENT FABLE FOR ALL TIME

(with Maia Majumder)

Once upon a time, many millennia ago, three hunter-gatherer tribes settled in different parts of a river water basin known as Indopotamia. People were few and resources were plenty. As the population grew, the tribes realized that they could no longer depend entirely on wild foods. Slowly, they learned to cultivate rice. The best land for agriculture, however, became increasingly scarce. Land was transformed into a symbol of power. To protect themselves, and to assert their authority, the tribes established geographic boundaries and organized governments. These eventually became the modern day states of Alpha, Beta, and Gamma.

Flash forward to the present. For centuries, there have been tensions among the three countries. Alpha is the largest of the three, and is economically and politically dominant. It has long monopolized access to the river, insisting that only after its water needs have been met will Beta and Gamma be allowed more water. Continued population growth and increasing crop productivity in Alpha, however, seem never to leave enough water for the smaller upstream countries. As it has continued to devote all of its resources to its own political and economic development, Alpha has earned a reputation as self-serving, cruel, and uncompromising.

Periodic droughts and forest fires plague Gamma. Lack of stored water undermines its ability to deal with these problems, and has slowed its economic development. Also, much of Gamma's groundwater is contaminated with arsenic, forcing it to rely almost entirely on the river for its drinking water. Beta, on the other hand, has lots of farmable land, but it does not have adequate labor supplies. In recent years, it has tried to shift to less labor-intensive energy-powered agriculture. This move has been difficult because Beta can't afford the required gasoline or coal. Unless Beta can import cheap labor or generate hydropower from the river, its crop development and economic growth will continue to suffer.

In desperation, Beta and Gamma have decided to join forces and build a dam. They are seeking funding from the Regional Lending Agency (RLA). They won't

qualify for loans and grants, though, unless they can reach a water usage agreement with Alpha.

Alpha is quite unhappy about the idea of the dam. But because the RLA will only give money to countries that have good relations with their neighbors—and because Alpha wants money from the RLA for its own purposes—Alpha has signed a statement saying it supports the dam. Simultaneously, Alpha has threatened Beta and Gamma through indirect channels, indicating that it won't be able to control local insurgents who may destroy the dam if it is built. This action has only increased the strain on Alpha's already poor relationships with Beta and Gamma.

Alpha has reason for alarm. If the dam is built, it won't have the water it needs to grow enough rice—the staple food of its population and economy. This concern has become increasingly acute in recent decades, as glacial melting and associated sea-level rise have caused saltwater intrusion in the Indopotamia basin. As a result, Alpha's coastal rice paddies are too salty to produce rice. Alpha used to be able to grow whatever it needed. It didn't have to rely on any of its neighbors, so friendly relationships with Beta or Gamma were not important. With the loss of coastal farmland, Alpha now needs help.

Alpha has such strained relationships with Beta and Gamma that it cannot ask for assistance. Instead, over the past few decades, Alpha has pumped more and more water from the basin to expand rice production. Beta and Gamma have not had the economic or military clout to stop this.

Alpha uses the additional water to irrigate dry land in Mu, its most populous state. Mu sits north of the coast at a relatively high elevation. It is one of the few parts of the country that has not been affected by saltwater intrusion. Its soil, though dry, is nutritious and can be made fertile for rice growing. But, as Alpha's population has continued to expand, irrigation of Mu's rice paddies has required many millions of gallons of water every season. Over the past few decades, Alpha's active pumping has resulted in the draining of lakes, ponds and streams in Beta and Gamma.

The residents of Mu feel that they have been robbed of their rights by the central government of Alpha. Wages have been cut drastically to pay for the ever-increasing energy costs associated with the active pumping scheme. Residential areas have been cleared to create more farmland. The central government has made it clear to the citizens of Mu that their purpose is to feed the country.

One faction in Mu has had enough. It is planning a rebellion, intending to cut off the nation's rice supply. Plans are afoot for organized military resistance. Mu is on the border with Beta, and has opened covert lines of communication with Beta's national government. Mu has offered to trade subsidized labor for arms and military support.

During diplomatic discussions about the dam, the relationship between Beta and Mu was revealed. The discovery undermined trust between Beta and Gamma. Gamma worries that Alpha's attempts to settle its dispute with Mu will make Beta's need for additional workers clear. Gamma believes that when Alpha realizes this, it will offer Beta the subsidized labor it needs in exchange for discontinuing its support for the dam project. Because the RLA intends to split the money for the dam

between the two countries, Gamma won't be able to finish construction of the dam if Beta abandons the project.

Beta could, in fact, get by without the dam. It wants the dam primarily to support water-powered energy production as it attempts to convert its rice paddy fields to machine-operated farms. In the long term, these will be much more economically efficient. If, however, Beta can find additional workers whose wages are paid by Alpha, the conversion to energy-powered farming will not be necessary. By contrast, the only way for Gamma to deal with its recurring droughts, forest fires, and widespread dehydration is to increase its access to the river. Otherwise, Gamma will remain agriculturally and socioeconomically backward, falling further behind its neighbors.

In an ideal world, Alpha would allow Beta and Gamma to build the dam—free of insurgent attacks—in exchange for rice. This would allow Gamma to deal with dehydration, drought and wildfires. It would also allow Beta to pursue its conversion to machine-operated farming. By exporting rice to Alpha, Beta and Gamma would gain diplomatic clout, creating a stronger web of interdependencies among the three countries that would be more durable in the face of external adversity. Alpha's relationship with Mu, which would no longer be responsible for producing food for the entire country, could heal. Finally, with peace in the region, the RLA and other international players would be more inclined to increase their investments.

Is Alpha too proud to agree to this solution? Can Gamma trust Beta to follow through on the dam construction? Or, will Beta turn on Gamma if Alpha offers subsidized labor? Will Mu be able to reconcile with Alpha's central government, or will there be civil war?

The answers to these questions are contingent upon the three countries being able to turn an age-old conflict into a problem-solving opportunity.

Welcome to our world of water diplomacy!

6

THE PRACTICE OF WATER DIPLOMACY IN A NUTSHELL

(with Elizabeth Fierman)

There are six key tasks central to the practice of water diplomacy. Each has been described briefly in one of the previous chapters. In this chapter, we take a more hands-on look at what it will take to implement these ideas in various parts of the world.

The first task is to ensure that the appropriate stakeholders and network interests are identified and adequately represented in water management efforts, so that the full range of perspectives and all available local knowledge can be tapped. Second, these parties need to engage in joint fact-finding to generate a shared understanding of how the key variables in the NSPD interact in their particular settings. Factual disagreements, particularly those caused by uncertainty and complexity, need to be discussed, but not necessarily resolved. Third, parties need to create as much value as possible. This usually involves seeking ways to expand the useable quantity of water or the range of water uses through the introduction of new water management techniques or technologies, consideration of how virtual or embedded water can alter the current situation, and trades of various kinds. Value creation tends to be most successful when a mutual gains approach to negotiation is used and a professional mediator or facilitator organizes the conversation. Fourth, informal problem-solving should be used to ensure that the product of informal deliberations is connected to formal decision-making. The product of water negotiations should take the form of proposals (as agreed to by almost all of the parties) that are forwarded to the appropriate political officials for action once the representatives who have produced them have had a chance to review them with their constituents. Fifth, the parties need to suggest how follow-up efforts ought to be organized to ensure that whatever actions are taken can be modified or enhanced as preliminary results become clear. We call this collaborative adaptive management. Finally, the individuals, groups,

and organizations involved in the search for negotiated water agreements should spend some time together reflecting on what they learned, so that further capacity-building is possible.

This chapter analyzes each of these tasks from a prescriptive standpoint, considering "best practices" in water diplomacy. Our analysis is followed by a final set of readings that illustrate how each of these tasks has worked in practice.

Stakeholder Representation

The first task in the management of water networks, representation, was discussed in Chapters 2 and 5. The aim should be to ensure that all network interests are identified and invited to select someone to speak on their behalf. Stakeholders, or nodes in the water management network, should include individuals and groups who are, or expect to be, affected by water allocations, water management, or water policy decisions. Having a full range of stakeholder interests represented is vital to the credibility of every water diplomacy effort. For one thing, excluded individuals or groups, as we noted in earlier chapters, may have important local knowledge that will be left out if they are not involved. Moreover, implementation of whatever agreements the groups reach will be a lot easier if everyone affected has a chance to make their interests known. Groups that are excluded may feel obliged to block implementation of the results of negotiations, arguing that the outcomes are illegitimate because they were not allowed to participate.

To ensure adequate stakeholder representation, a stakeholder assessment, of the sort described in Chapter 5, should be conducted by a professional neutral. Such assessments can help not only clarify who should be involved, but also provide a means of engaging stakeholder groups in the design of whatever informal problem-solving process follows. A stakeholder assessment typically requires a neutral party to undertake confidential interviews with a widening circle of potentially interested parties. The assessor needs to summarize his or her findings in a draft document that goes to everyone interviewed for their review. While they will not see their names mentioned, since all interviews are confidential, they should be satisfied that the concerns they raised and the priority they attached to various issues are incorporated into the design of the problem-solving process proposed by the assessor. Once all the relevant network interests have been identified, hard-to-fill categories—which may require the identification of proxies or surrogates—can then be added (Susskind et al 1999).

After the relevant stakeholder groups have been identified and have had an opportunity to review the proposed agenda, timetable, ground rules, and budget suggested by the assessor, the convening agency must decide whether or not it wants to proceed. If it does, it can follow the process the participants helped to design with confidence that all of the key players have agreed to come to the table. The facilitator may need to caucus groups in a broad stakeholder category, like

environmental activists, to let them choose a representative to speak for them in the problem-solving process that follows. It is always best if the parties in a stakeholder category choose their own representative, rather than waiting for the convening agency to handpick the people it prefers.

Some groups may require technical assistance before the negotiations begin. That is, they may need help canvassing their members, getting their representative up-to-speed on technical matters, or thinking through their priority interests and the trade-offs they will be willing to make. Such help can come from the facilitator as long as every group has the option of asking for similar assistance (Susskind and Cruikshank 2006).

Joint Fact-Finding and Scenario Planning

Once the relevant parties have been identified and brought to the table, the negotiators will need to consider the scientific and technical information required to address the water management decisions they face. Such information is usually quite complex, and multiple interpretations are almost always possible. As a result, allowing parties to generate their own forecasts or analyses is likely to generate further disagreement. Instead, computer-assisted modeling and/or other group decision analysis software should be used to make it easier for the group to reach informed agreement (van den Belt 2004).

The most difficult aspects of joint fact-finding are described in Chapter 5. As we noted, it is important to blend local or indigenous knowledge with expert scientific advice. This can be difficult, especially if technical experts do not respect local sources of expertise. The group also needs to confront the fact that its "findings" are likely to be sensitive to a range of non-objective judgments. For example, since there is no "correct" way to value all possible damage to local water resources, the group should consider how alternative methods of monetizing environmental or cultural impacts might lead to very different decisions. Even slight changes in the way visual landscapes or threats to human safety might be affected by water management plans deserve consideration. Also, as we noted in several earlier chapters, the complexity of water networks makes forecasting difficult. We suggest using scenario planning or some other technique that enables the parties to deal with uncertainty and complexity in a contingent fashion. (Wright and Cairns 2011)

Joint fact-finding can be used to blend differing interpretations of policy or management options. Engineers trained to produce integrated water resources management (IWRM) plans will have their own ideas about how to frame the choices that a water network ought to be considering. They tend to think in terms of bounded systems and optimization, as we discussed in Chapter 2. Indeed, funding agencies may insist that the principles of IWRM be included as part of any new water-related investment project (World Bank 2007). Other stakeholders, however, may have different perceptions about the most desirable options and the best way forward.

Once believable forecasts have been generated, the group will have to decide how it wants to handle data gaps and differences in interpretation. Joint fact-finding does not eliminate disagreement, it only makes clearer what the parties are likely to accept as common information and where and why they disagree about interpreting this material. Agency participants often explain that their legal or administrative mandates force them to give priority to certain kinds of analyses and to reject others. Some agency representatives will say that their hands are tied, requiring them to use a particular discount rate or to ignore impacts that might happen far into the future. For example, U.S. Army Corps of Engineers' guidance on hydropower dams limits cost and benefit analysis to "a period not to exceed 50-years except for major multiple purpose reservoir projects," meaning that any costs or benefits beyond 50 years should be set at zero (U.S. Army Corps of Engineers 2004). It is up to the mediator to draw attention to such sources of disagreement and to help the group look for contingent agreements that allow them to proceed even in the face of different assumptions about the future (Susskind et al 1999).

Value Creation

A central task of water diplomacy is value creation. This means searching for more efficient uses of water to meet multiple, often conflicting, interests as best as possible. In other words, value creation involves both understanding each stakeholder's core concerns—or interests—and thinking as creatively as possible about how to expand the available water supply so that non-zero-sum outcomes are possible. This is likely to involve the introduction of new technologies or new patterns of development. As discussed in Chapters 2 and 5, when we think of water as a flexible resource, value can be created by imagining new agricultural or industrial practices that release embedded water for other uses. Once locational trades or trades over time are considered, as discussed in Chapters 3 and 5, the prospect of sharing virtual water becomes possible. Creating value, therefore, implies not just a shift from an adversarial to a collaborative style of deliberation, but also a shift from viewing water as a fixed resource to viewing it as flexible and expandable.

Value creation is most likely to be accomplished if the parties consider ways of meeting their own interests while simultaneously meeting the interests of others. Brainstorming along these lines works if the parties agree that ground rules—including suspending criticism of all proposals until as many as possible have been noted—should be enforced by a mediator (Susskind and Cruikshank 2006). In general, value creation is more successful when efforts are made to build trust among the parties, encourage option generation, and aim for conversations that are respectful of cultural, educational, and political differences.

A mutual gains approach to negotiation helps with these tasks by emphasizing and clarifying the interests of the parties and generating multiple ways of

meeting them before committing to particular solutions. It is common to use a professional mediator to support such efforts. This approach allows stakeholders in complex water management networks to generate results that are better than what they would be likely to achieve through solutions imposed by authorities at any level. The goal of the mutual gains approach to negotiation is not an agreement in which everyone "wins" everything they want, but rather an agreement that meets all parties' interests better than if there were no agreement at all.

Value creation is usually the product of trades. If B's support is the key to A getting something it wants very much, and B would gladly give that support as long as A promises something that is equally valuable to B, then neither side is being asked to compromise. Rather, they are creating value through a trade that exploits differences in their priorities, interests or values. It is hard to do this without an extended list of items to trade. That's why value creation is so difficult when parties break their agenda into pieces and deal with issues one at a time. Instead, they need to rely on brainstorming to enrich their agenda. And then, nothing should be decided until everything is decided. This is the way to encourage exploration of possible packages without anyone locking into something they might be hesitant to support. New technologies that permit multiple uses (or reuse) of the same water make mutually beneficial trades possible. This is what we mean when we say that it helps to think about water as a flexible rather than a scarce resource.

Convening

Problem solving in the water domain is most likely to be successful if informal efforts to generate mutually beneficial proposals are clearly linked, from the outset, to formal decision-making by government agencies or officials. Otherwise, parties might not be willing to invest time or energy in ad hoc efforts to search for solutions to cross-boundary disagreements or conflicts. To manage what might be called the "governance connection," informal negotiations ought to be convened by one or more agencies or organizations with formal decision-making authority. It helps if the convening agency is prepared to make an explicit commitment to support proposals that emerge from informal problem-solving as long as representation is handled properly. The agencies or legislative bodies should designate staff to participate in or at least monitor the efforts to produce an informed consensus.

In addition to clarifying the link between ad hoc and formal governance, conveners should play other roles as well. First, they should familiarize themselves with the interests of the key stakeholders. Commissioning and paying attention to the results of a stakeholder assessment will make this relatively easy. Second, conveners should be prepared to contribute or help locate financial and other resources needed to support the involvement of independent experts in joint fact-finding. Third, they should be willing to identify and work with a professional mediator and

not try to control all aspects of the process themselves. Joint convening, by agencies at multiple levels, is not uncommon.

Collaborative Adaptive Management

We assume that even the best-intentioned and most carefully structured informal problem-solving efforts will run up against the complexity and uncertainty that challenge almost all water management efforts. Even if the right parties are at the table with an effective mediator, and even if the convener has provided the support the group needs to engage in joint fact-finding, what they do not know about the dynamics of a particular water network will probably exceed what they do know. This is especially true with regard to interactions among the societal and natural variables that comprise NSPD.

By taking a collaborative adaptive management (CAM) approach to each battle over water allocation, water resource development, or water policy, parties in water management networks will have a better chance of implementing the decisions made by the agencies with the formal authority to act. In other words, CAM offers an opportunity for parties to participate in implementing decisions. Accordingly, decision-making agencies should view stakeholders who advise them as allies, not adversaries. They also ought to view the relationships among these parties, which are enhanced when the water diplomacy framework is followed, as a kind of social capital that can support implementation of negotiated agreements (Putnam 2002).

CAM assumes that water network managers will never get everything right on the first try. So, whatever they decide to do (informed by the proposals they receive from the stakeholders) is likely to fall short. If such efforts are viewed as "experiments," however, they can provide information and insights that will allow recalibration of policies, programs, and plans. They might also lead to reconsideration of longer-term goals and objectives. For such adjustments to be successful, network managers need to invest in careful monitoring. Stakeholders can help with this: for example, water users may be in the best position to gather data on whether intended efforts are working. If, as part of negotiated agreements, participants in informal problem-solving specify what they think needs to be measured and how proposed efforts will be assessed, there is a good chance that mid-course corrections will be successful. In sum, collaborative adaptive management offers an approach to implementation that leaves room for ongoing adjustments or reconsideration of earlier decisions (Camacho et al 2010).

Societal Learning

Water diplomacy is not just about resolving specific boundary-crossing conflicts. It also seeks to improve the management of water networks more generally through capacity building and societal learning. This implies enhancing the knowledge and

capability of individuals, organizations, and networks over time. Whenever a water management network succeeds in generating a way to resolve a particular conflict (or, even if it fails in its efforts to do that), reflection on that experience should be used to strengthen the underlying capacity of the agencies and actors involved. Even a modest effort along these lines can make it easier to handle similar problems more effectively in the future. Making lessons learned explicit will help inform actors in other water networks and other contexts as well. Water management networks should make an explicit commitment to knowledge transfer and capacity building.

Water management networks should also take advantage of whatever assistance they can get from adjacent agencies and organizations. For example, the Social Learning Group, which includes scholars from nine countries representing multiple disciplines, offers helpful resources for water managers interested in societal learning and capacity building. This group has analyzed theories of social learning and applied them to research on how social learning relates to management of global environmental risks (Social Learning Group 2001). Much of this work reinforces our prescriptions around collaborative adaptive management.

The Social Learning Group is also an example of how a support network can be created to further scholarship, while simultaneously allowing colleagues to strengthen each other's capacities and produce resources that others can easily access. If knowledge transfer and capacity building are explicit network goals, then resources and research, along with lessons learned from practice, should be made as widely available as possible.

Conclusion

These "best practices" of water network management reflect our three core challenges to the conventional wisdom presented in Chapter 1: water systems are not bounded, rather they operate more as open networks; they are constantly changing in unpredictable ways; and water is a flexible, not a fixed, resource. They also reflect our analysis of what others around the world have actually been doing to manage water networks, beyond just what the conventional wisdom would have them do when tough decisions need to be made. On the basis of these propositions and real life inputs, we offer a water diplomacy framework that stresses the need to: account for and engage diverse and multi-sectoral interests; use joint fact-finding and collaborative adaptive management to take decisions in the face of uncertainty and flux, and adjust those decisions as necessary; and take advantage of the potential to create value through a mutual gains approach to multi-party negotiation. We have tried to be analytical and prescriptive, explaining what we think is required to resolve water management disputes and why. We have also tried to be practical, giving guidance on how to proceed in actual network management situations (see Figure 6.1).

The next chapter offers a set of teaching materials to help water managers and stakeholders practice using the water diplomacy framework.

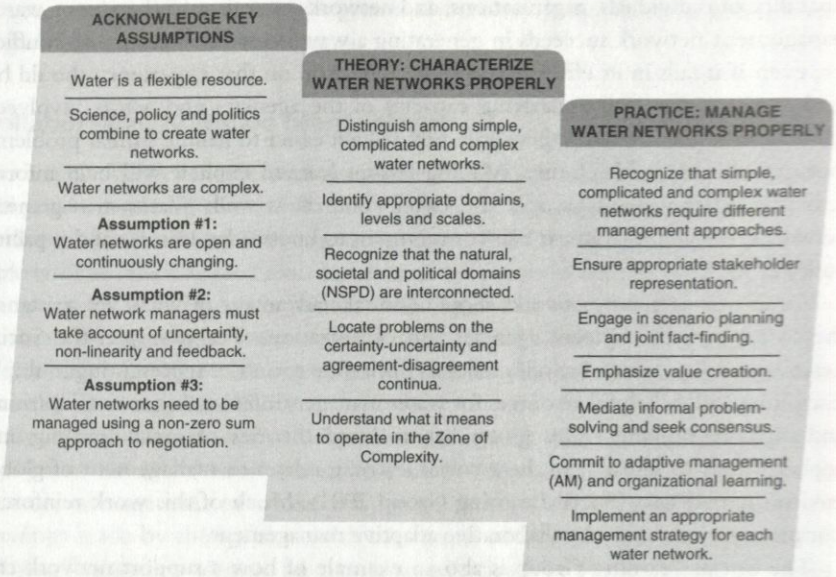

FIGURE 6.1 The Water Diplomacy Framework (WDF)

Selected Readings with Commentaries

B.N. Tapela "Stakeholder Participation in the Transboundary Management of the Pungwe River Basin," (2006)

Introduction

Barara Tapela's article discusses stakeholder engagement in the Pungwe River Basin Joint Integrated Water Resources Management Strategy, an initiative launched by Mozambique and Zimbabwe in 2002, with funding from the Swedish International Development Cooperation Agency, to facilitate joint management, development, and water conservation in the river basin.

The Pungwe River originates in Zimbabwe's Eastern Highlands, flows across the international border with Mozambique, and ultimately empties into the Indian Ocean on Mozambique's coast. Only 5 percent of the river's area is in Zimbabwe, but this region contributes significantly to the river's flow. Water scarcity in areas within and adjacent to the basin, as well as anticipated increases in water demand in both countries, are the primary challenges for water managers. To help address these challenges, and in response to international efforts to promote participatory water management, both countries formed multi-stakeholder committees. These committees included representatives of major water users and local government

source" ethos in which those with knowledge promote access to their ideas and products.

References

Asian Development Bank. 2007. "Information on networks and partnerships." From: http://www.adb.org/water/operations/partnerships.

Biggs, H. and Rogers, K.H. 2003. An adaptive system to link science, monitoring and management in practice, in J.T. du Toit, K.H. Rogers, and H.C. Biggs (eds.) *The Kruger Experience: Ecology and management of savanna heterogeneity*. Washington, DC: Island Press.

Biggs, H.C., Breen, C.M., and Palmer, C.G. 2008. Engaging a window of opportunity: Synchronicity between a regional river conservation initiative and broader water law reform in South Africa, *International Journal of Water Resources Development, 24*(3): 329–343.

Biggs, H.C., Westley, F.R., and Carpenter, S.R. 2010. Navigating the back loop: fostering social innovation and transformation in ecosystem management. *Ecology and Society, 15*(2): 9.

Boom, D. 2007.Unpublished draft paper on knowledge economies in Asia for a seminar at the ADB Institute. Asian Development Bank, Manila, Philippines.

Braack, L. 1997a. *A revision of parts of the management plan for the Kruger National Park, Vol. VII: An objectives hierarchy for the Kruger National Park*. Skukuza: South African National Parks.

Braack, L. 1997b. *A revision of parts of the management plan for the Kruger National Park. Vol. VIII: Policy proposals regarding issues relating to biodiversity maintenance, maintenance of wilderness qualities, and provision of human benefits*. Skukuza: South African National Parks.

Breen, C., Dent, M., Jaganyi, J., Madikizela, B., Maganbeharie, J., Ndlovu, J., et al. 2000. "*The Kruger National Park Rivers Research Programme*," Final Report, Water Research Commission, Pretoria.

Breen, C., Quinn, N., and Deacon, A. 1994. "A description of the Kruger Park Rivers Research Programme," Second Phase: Programme description: pp. 43.

Camacho, A.E., Susskind, L., and Schenk, T. 2010. Collaborative planning and adaptive management in Glen Canyon: A cautionary tale, *Columbia Journal of Environmental Law, 35*:1

Courcier, R., Venot, J.P., and Molle, F. 2005. *Historical transformations of the lower Jordan River basin (in Jordan): changes in water use and projections (1950–2025) (comprehensive assessment research report 9)*. Colombo, Sri Lanka: IWMI Comprehensive Assessment.

Davies, B.R., O'Keeffe, J.H., and Snaddon, C.D. 1995. River and stream ecosystems in Southern Africa. Predictably unpredictable, in C.E. Cushing, K.W. Cummins, and G.W. Minshall *River and Stream Ecosystems*. New York: Elsevier Press.

Doz, Y. and Hamel, G. 1998. *Alliance Advantage: The art of creating value through partnering*. Boston: Harvard Business School Press.

Dube, D. and Swatuk, L. 2002. Stakeholder participation in the new water management approach: A case study of the Save Catchment, Zimbabwe, *Physics and Chemistry of the Earth, 27*: 867–874.

Du Toit, J.T., Rogers, K.H., and Biggs, H.C. (eds.) 2003. *The Kruger Experience. Ecology and Management of Savanna Heterogeneity*. Washington DC: Island Press

Fisher, R. and Ury, W. 1991. *Getting to Yes: Negotiating Agreement Without Giving In*. New York, NY: Penguin Books.

Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Holling, C.S., Walker, B., et al. 2002. Resilience and sustainable development building adaptive capacity in a world of transformations, *Ambio*, *31*(5): 437–440.

Freitag, S., Biggs, H., and Breen, C.M. In review. Fifteen years of the spread and maturation of adaptive management in South African National Parks: Organisational learning in systems perspective, in W. Freimund, S. McCool, and C.M. Breen (eds.) *Engaging Complexity in Protected Area Management: Challenging Occam's Razor*. Pietermaritzburg, South Africa: University of KwaZulu-Natal Press.

Fuller, B. 2006. "Trading zones: cooperating for water resource and ecosystem management when stakeholders have apparently irreconcilable differences." *Dissertation, Massachusetts Institute of Technology, Department of Urban Studies and Planning.*

Gloor, P. 2006. *Swarm Creativity: Competitive Advantage through Collaborative Innovation Networks*. Oxford: Oxford University Press.

GTZ. 2000a. *History and Lessons Learned from the Formation of the Mazowe Catchment Council*. Zimbabwe: Harare.

GTZ. 2000b. *Project Appraisal Report: Irrigation Water Management in Jordan*. Amman, Jordan: GTZ/JVA.

GTZ. 2001. *Water Resources Management for Irrigated Agriculture – Annual progress report June 2001 and May 2002*. Amman, Jordan: GTZ/JVA.

GTZ. 2002. *Water Resources Management for Irrigated Agriculture: Annual progress report June 2001 and May 2002*. Amman, Jordan: GTZ/JVA.

GTZ, 2006a. *Work the Net – A Management Guide for Formal Networks*. New Delhi: GTZ/JVA.

GTZ. 2006b. *Water Resources Management for Irrigated Agriculture Presentation – Optimizing Water Management*. Amman, Jordan: GTZ/JVA.

GTZ. 2006c. *Economic Impacts of the Introduction of Participative Irrigation Management in the Jordan Rift Valley*. Amman, Jordan: GTZ/JVA.

GTZ. 2008. *GTZ in Jordan*. Retrieved October 1, 2008, from http://www.gtz.de/en/weltweit/maghreb-naher-osten/675.htm

Holling, C.S. 2001. Understanding the complexity of economic, ecological, and social systems, *Ecosystems*, *4*(5): 390–405.

Holling, C.S. and Gunderson, L.H. 2002, Resilience and adaptive cycles, in L.H. Gunderson and C.S. Holling (eds.) *Panarchy: Understanding Transformations in Human and Natural Systems* (pp. 25–62). Washington DC: Island Press.

Jezewski, J. and Roberts C.P.R. 1986, *Estuarine and Lake Freshwater Requirements*, Technical Report TR129, Department of Water Affairs.

JVA. 2007. *Data from JVA control center in Deir Allah*. Deir Allah, Jordan: JVA.

King, J.M., Tharme, R.E., and De Villers, M.S. 2000. "Environmental flow assessments for rivers: manual for the Building Block Methodology," Water Resources Commission Report TT 131/100, Pretoria, South Africa.

Kingsford, R.T., Biggs, H.C., and Pollard, S.R. 2011. Strategic adaptive management in freshwater protected areas and their rivers, *Biological Conservation*, *144*(4), 1194–1203.

Kujinga, K. and Manzungu, E. 2004. Enduring contestations: Stakeholder Strategic action in water resource management in the save catchment area, Eastern Zimbabwe, *Eastern Africa Social Science Research Review*, *20*(1): 67–91.

Lank, E. 2006. *Collaborative Advantage: How Organizations Win by Working Together*. New York: Palgrave Macmillan.

Latham, C.J.K. 2001. Manyame Catchment Council: A review of the reform of the water sector in Zimbabwe, 2nd WARFSA – WaterNet Symposium, October 2001, Cape Town.

Lave, J. and Wenger, E. 1991. *Situated Learning. Legitimate Peripheral Participation*. Cambridge: University of Cambridge Press.

LEMA OPS. 2007. *LEMA Operations database 2000–2007*. Amman, Jordan: LEMA OPS.

Luijendijk, J. and Arriëns, W.L. 2007. *Water Knowledge Networking: Partnering for Better Results*. The Netherlands: UNESCO-IHE.

McLoughlin, C.A., Deacon, D., Sithole, H., and Gyedu-Ababio, T. 2011. History, rationale, and lessons learned: Thresholds of potential concern in Kruger National Park river adaptive management, *Koedoe*, *53*(2), Art. #996.

Movius, H. and Susskind, L. 2009. *Built to Win: Creating a World-Class Negotiating Organization*. Boston, MA: Harvard Business School Publishing.

Noss, R.F. 1990. Indicators of monitoring biodiversity: a hierarchical approach, *Conservation Biology*, *4*: 355–364.

Odeh, N. 2009. "Towards improved partnerships in the water sector in the Middle East: A case study of partnerships in Jordan's water sector." *Dissertation, Department of Urban Studies and Planning, Massachusetts Institute of Technology*.

O'Keeffe, J. and Coetzee, Y. 1996. Status report of the Kruger National Park Rivers Research Programme: A synthesis of results and assessment of progress to January 1996, *Pretoria, Water Research Commission*: 63.

Plumb, D., Fierman, E., and Schenk, T. 2011. "Role Play Simulations: A Useful Roadmap for Decision Makers." *Consensus Building Institute*. (available from http://cbuilding.org/publication/article/2011/roleplay-simulations-useful-roadmap-decision-makers accessed March 16, 2012).

Pollard, S. and Du Toit, D. 2005. Achieving integrated water resource management: The mismatch in boundaries between water resources management and water supply. *Association for Water and Rural Development*. (available from http://www.nri.org/projects/waterlaw/AWLworkshop/POLLARD-S.pdf accessed March 16, 2012).

Pollard, S. and Du Toit, D., 2006. "Recognizing heterogeneity and variability as key characteristics of savannah systems: The use of Strategic Adaptive Management as an approach to river management within the Kruger National Park, South Africa," Report for UNEP/GEF Project No. GF/2713–03–4679, Ecosystems, Protected Areas and People Project.

Pollard, S. and Du Toit, D. 2007. "Guidelines for Strategic Adaptive Management: Experiences from managing the rivers of the Kruger National Park, South Africa." IUCN/UNEP/GEF Project No. GF/2713–03–4679, Ecosystems, Protected Areas and People Project, Planning and managing protected areas for global change.

Pollard, S. and Du Toit, D. 2008. "The Letaba Catchment: Contextual profile on factors that constrain or enable compliance with environmental flows," Shared River Programme, DRAFT Report, Project K5/1711.

Pollard, S.R., Biggs, H., and Du Toit, D. 2008, "Towards a Socio-Ecological Systems View of the Sand River Catchment, South Africa: An exploratory Resilience Analysis," Report to the Water Research Commission, Project K8/591, Pretoria.

Pollard, S., du Toit, D., and Biggs, H. 2011. River management under transformation: The emergence of strategic adaptive management of river systems in the Kruger National Park, *Koedoe*, 53(2). (available from http://www.koedoe.co.za/index.php/koedoe/article/view/1011/1260 accessed August 13, 2011).

Pollard, S.R. and Cousins, T. 2008. "Towards integrating community-based governance of water resources with the statutory frameworks for Integrated Water Resources Management: A review of community–based governance of freshwater resources in four southern African countries to inform governance arrangements of communal wetlands," Water Research Commission Report TT.328/08, Pretoria, Water Research Commission.

Pollard, S.R., Weeks, D.C., et al. 1994. Effects of the 1992 drought on the aquatic biota of the Sabie and Sand rivers, in *A pre-impoundment study of the Sabie-Sand River System, Eastern Transvaal, with special reference to predicted impacts on the Kruger national Park, vol. 2* (p. 122). Pretoria: Water Research Commission Report.

Pollard, S., Riddell, E., et al. 2010. "Compliance with the Reserve: How do the Lowveld Rivers measure up?", Report prepared for the Water Research Commission: Reserve assessment of lowveld rivers (Del. 1), n.p.

Putnam, R.D. 2002. *Democracies in Flux: The Evolution of Social Capital in Contemporary Society*. New York: Oxford University Press.

Radosevich, George. 2011. "Mekong River Basin, agreement & commission." *IUCN Water Program Negotiate Toolkit: Case Studies*. (available from http://www.iucn.org/about/work/programmes/water/resources/toolkits/negotiate/, accessed August 13, 2011).

Regner, H. J. 2005. *Improvement of water distribution in the Jordan Valley through participation of water user communities and their contribution to on-farm irrigation efficiency*. Paper presented at the ESCWA seminar on enhancing agricultural productivity through on-farm water use efficiency (23–25 November 2005), Beirut, Lebanon.

Regner, H.J., Salman, A.Z., Wolff, H.-P., and Al-Karablieh, E. 2006. *Approaches and impacts of participatory irrigation management in complex, centralized irrigation systems. Experiences and results from the Jordan Valley*. Paper presented at the Conference on International Agricultural Research for Development, University of Bonn, Germany.

Roberts, C.P.R. 1983. Environmental constraints of water resources developments, *Proceedings of the South African Institution of Civil Engineers*, n.p.

Rogers, K.H. 2005. The real river management challenge: Integrating scientists, stakeholders and service agencies, *River Research and Applications*, *22*(2): 269–280.

Rogers, K.M. and Bestbier, R. 1997. *Development of a Protocol for the Definition of the Desired State of Riverine Systems in South Africa*. Pretoria: Department of Environmental Affairs and Tourism.

Sithole, B. 2000. "Telling it like it is! Devolution in the water reform process in Zimbabwe." Paper presented at the biannual meeting of the International Association for the Study of "Common Property," Wisconsin.

Social Learning Group. 2011. *Learning to Manage Global Environmental Risks, Volumes 1 and 2*. Cambridge, MA: The MIT Press.

Susskind, L. and Cruikshank, J. 1987. *Breaking the Impasse. Consensual Approaches to Resolving Public Disputes*. New York: Basic Books, Inc.

Susskind, L.E. and Cruikshank, J.L. 2006. *Breaking Robert's Rules: The New Way to Run Your Meeting, Build Consensus, and Get Results*. New York: Oxford University Press.

Susskind, L., McKearnan, S., and Thomas-Larmer, J. (eds.) 1999. *Consensus Building Handbook: a comprehensive guide to reaching agreement*. Thousand Oaks, CA: Sage.

Tapela, B.N. 2002. "Institutional challenges in integrated water resources management in Zimbabwe: a case study of Pungwe sub-catchment area." Thesis (M. Phil. (Centre for Southern African Studies-School of Government))—University of the Western Cape.

Tapela, B.N. 2006. Stakeholder participation in the transboundary management of the Pungwe river basin, in A. Earle and D. Malzbender (eds.) *Stakeholder Participation in Transboundary Water Management* (pp. 10–34). South Africa: African Centre for Water Research.

U.S. Army Corps of Engineers. "Engineer Regulation 1105–2-100: Appendix D – Amendment #1, Economic and Social Considerations." *USACE Planning Guidance: Hydropower*, June 30, 2004 (available from: http://planning.usace.army.mil/toolbox/guidance.cfm?Option=BL&BL=Hydropower&Type=None&Sort=Default, accessed October 31, 2011).

Van Aarde, R., Whyte, I., and Pimm, S. 1999. Culling and the dynamics of the Kruger National Park African elephant population, *Animal Conservation*, *2*(4): 287–294.

Van Aken, M., Courcier, R., Venot Jean-Philippe., and Molle, F. 2007. *Historical Trajectory of a River Basin in the Middle East: The Lower Jordan River Basin (in Jordan)*. Amman, Jordan: International Water Management Institute.

Van den Belt, M. 2004. *Mediated Modeling: A System Dynamics Approach to Environmental Consensus*. Washington, DC: Island Press.

Van Wilgen, B.W. and Biggs, H. 2010. A critical assessment of adaptive ecosystem management in a large savanna protected area in South Africa, *Biological Conservation*, n.p.

Venot, J.P. 2004. *Reclamation's History of the Jordan River Basin in Jordan, A Focus on Agriculture: Past Trends, Actual Farming Systems and Future Prospective*. Amman, Jordan: Mission Regionale Eau et Agriculture.

Venter, F.J. and Deacon, A.R. 1995. Managing rivers for conservation and ecotourism in the Kruger National Park, *Water Science and Technology*, *32*: 227–233.

Venter, F.J., Gerber, F., Deacon, A.R., Viljoen, P.C., and Zambatis, N. 1995. 'Ekologiese Impakverslag: An ondersoek na die voorgestelde Maroelastuwal in die Krokodilrivier' [Ecological Impact Report: An investigation of the proposed Maroela weir in the Crocodile river], Report Nr 1/95 Scientific services, Skukuza.

Venter F.J., Naiman, R.J., Biggs, H.C., and Pienaar, D.J. 2008. The evolution of conservation management philosophy: Science, environmental change and social adjustments in Kruger National Park, *Ecosystems*, *11*: 173–192.

Weeks, D.C., Pollard, S.R., et al. 1992. "Downstream effects on the aquatic biota of the Sand River following the collapse of Zoeknog dam," Report submitted to Water Research Commission.

Wenger, E., McDermott, R., and Snyder W. 2002. *Cultivating Communities of Practice: A Guide to Managing Knowledge*. Boston, MA: Harvard Business School Publishing.

Werick, B. 2007. Changing the rules for regulating Lake Ontario levels, in *Computer Aided Dispute Resolution, Proceedings from the CADRe Workshop*, Institute for Water Resources, September 2007: 119–128.

World Bank Environment Department. 2007. "Strategic Environmental Assessment and Integrated Water Resources Management and Development." *World Bank* http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0CDYQFjAC&url=http%3A%2F%2Fsiteresources.worldbank.org%2FINTRANETENVIRONMENT%2FResources%2FESW_SEA_for_IWRM.doc&ei=h5-uTufyJ8fX0QHSxuTNDw&usg=AFQjCNF1G68HlzYI2PGgU8fnRkhDlfHhOw&sig2=tDCaZ-O6mWHAd6LSC35qRw(accessed October 31, 2011).

Wright, G. and Cairns, G. 2011. *Scenario Thinking: Practical Approaches to the Future*. New York: Palgrave/McMillan.