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Jerome Delli Priscoli and Aaron T. Wolf
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1 Background, trends, and concepts

The sage's transformation of the World arises from solving the problem of water. If water is united, the human heart will be corrected. If water is pure and clean, the heart of the people will readily be unified and desirous of cleanliness. Even when the citizenry's heart is changed, their conduct will not be depraved. So the sage's government. . . . consists of talking to people and persuading them, family by family. The pivot (of work) is water.

– Lao Tze, ca. sixth century BCE

1.1 CONFLICT MANAGEMENT, PUBLIC PARTICIPATION, AND WATER MANAGEMENT

Water is likely to be the most pressing environmental concern of this century. As global populations continue to grow exponentially, and as environmental change shifts the location of the flow, timing, quality, and quantity of water, the ability of nations and states to peacefully manage and resolve conflicts over distributed water resources will increasingly be at the heart of both stable and secure international relations and of political stability within many countries. There are 263 watersheds and untold aquifers that cross or underlie the political boundaries of two or more countries (Figure 1.1). These international surface basins cover 45.3 percent of the land surface of the Earth, affect about 40 percent of the world's population, and account for approximately 60 percent of global river flow (Wolf et al., 1999). Water has been a cause of political tensions and occasional exchanges of fire between Arabs and Israelis, Indians and Pakistanis, and Americans and Mexicans and among all ten riparian states of the Nile River. Water is one of the few scarce resources for which there is no substitute, over which there is poorly developed international law, and the need for which is overwhelming, constant, and immediate (Bingham, Wolf, and Wohlgenant, 1994).

Within nations, too, there are many examples of internal water conflicts, ranging from inter-State violence and death along the Cauvery River in India (Baviskar, 1995; Anand, 2004) to the United States, where California farmers blew up a pipeline meant for Los Angeles (Reisner, 1986) to intertribal bloodshed between Maasai herdsmen and Kikuyu farmers in Kenya (*News24.com*, 2005; *BBC*, 2005). The inland, desert U.S. state of Arizona even commissioned a navy (made up of one ferryboat) and sent its state militia to stop a dam and diversion on the Colorado River in 1934 (Miller, 2001). Recent research on internal disputes suggests that as geographical scale drops, the likelihood, and the intensity, of violence rises (see, e.g., Giordano, Giordano, and Wolf, 2002).

These resource conflicts will gain in frequency and intensity as water resources become relatively scarcer and their use within jurisdictions can no longer be insulated from having an impact on neighboring jurisdictions. A clear understanding of the details of how water conflicts have been resolved historically will be vital to those responsible for bringing together the parties to resolve or to prevent these future conflicts.

Humans have been managing and resolving disputes for thousands of years (Biswas, 1970). Recently, the formal fields of dispute resolution and conflict management have emerged from attempts to find alternatives to expensive litigation, an adversarial and highly expensive means for resolving disputes or, bluntly, to avoid violence or war. Conflict management has been driven by traditional fields of labor management negotiations, contract settlements, community mediation, and, most recently, environmental and resource conflicts.

At the same time there is growing concern for public participation. This concern was highly visible in the western United States during debates on water and natural resources management in the 1970s and early 1980s. This was due primarily to a spate of legislation on resources, starting with the 1969 National Environmental Policy Act (NEPA) and the 1972 Clean Water Act. The salience of participation to technical water managers seemed to lapse during the 1980s and early 1990s, to the detriment of many U.S. water agencies. Recently, however, public participation is once again being seen as a useful tool in the industrial countries and throughout

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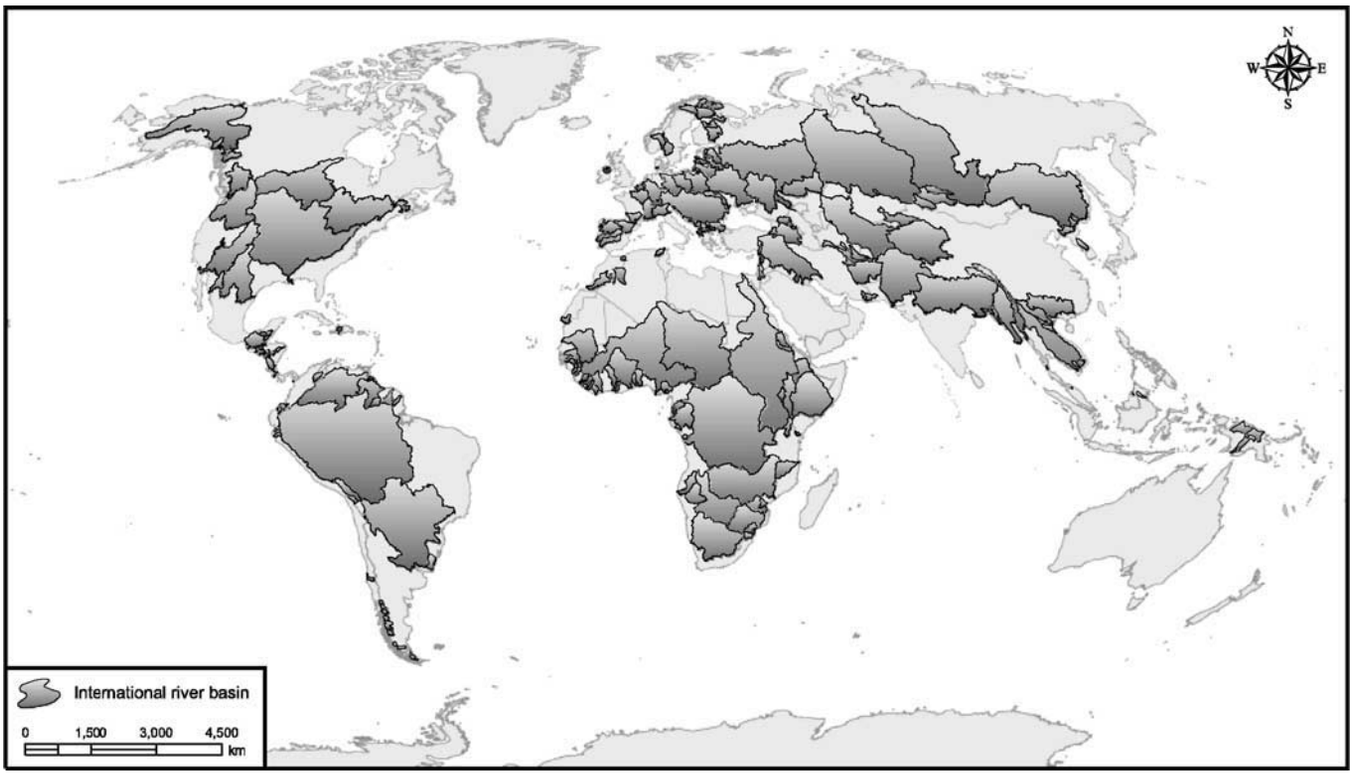

Figure 1.1 Map of the international river basins of the world (Transboundary Freshwater Dispute Database, 2006).

poorer countries. Traditionally, public participation emerged from concerns about open access to government, empowerment of people, and building democratic culture (Bruch et al., 2005). Both participation and conflict management advocate similar process procedures and thus can be included under the general rubric of integrative bargaining or collaboration. But although conflict management and alternative dispute resolution (ADR) speak of dealing with, anticipating, and avoiding conflict, they have much less to say about long-term institution building and structural change based on fundamental value change driving the behavior of water resources managers. Much can be gained by mixing the lessons from these fields, and all are central to efficient governance of water.

Social scientists tell us that institutions are routinized patterns of behavior creating stable expectations over time (Lasswell, 1971). These patterns are driven by values that, over time, are often latent and unexamined. Water resources institutions are being transformed by profound changes in the values of those societies they support. For example, the wealthy West has come to see pollution as critical; however, those who are poor, although they understand the problems of pollution, are more concerned with water's utilitarian value as an engine for growth. The institutions designed to deal with water in turn reflect these different values in their priorities. Bringing new values and their attendant claims to bear on water institutions means a long-term shift in water resources managers' patterns of behavior. However, by focusing on the nation-state, the rich experience of building water institutions is often missed because much of it has fallen within and not among nation-states. What were once regional intrastate issues can become international. We have only to look at Central Asia and the Aral Sea for such an example. We choose to use the word *interjurisdictional* to cast a broad net to capture such water resources institution-building experiences.

The 1997 UN Convention on Non-Navigational Uses of International Watercourses (see Appendix A; United Nations, 2005) builds on the 1966 Helsinki rules (International Law Association, 1966), various UN deliberations, and the 20-year process of the International Law Association's deliberations. They have produced some sound principles for nonnavigational uses of international waters. In summary, they call for

- equitable and reasonable use
- obligations not to cause significant harm
- general obligation to cooperate
- regular exchange of data and information
- examination of relations between users

These are good principles. They could be useful in all transboundary water management, whether within a federal

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state with competing jurisdictions or among sovereign nations. However, they present operational questions: Which principle prevails when equitable use conflicts with the obligation not to cause appreciable harm? What is appreciable harm? What are the standards of responsibility for a breach of principles? What should we do when there is no internationally recognized legislation and no compulsory enforcement jurisdiction?

Water resources management requires collaboration across jurisdictions and sectors, whether within or among states. Indeed, much of the history of water institutions is about the conflict between geographic dictates of the resource versus the realities of political jurisdictions. Water resource institutions go to the heart of our changing notions of subsidiarity. *Subsidiarity* generally means the principle that none of the polity's tasks should be assigned to a body larger than the smallest that can satisfactorily perform it. For example, water resources management and administration in the United States must be seen as a result of the Federalist system of government, where the states within the United States have first sovereignty over the water.

Building water resources institutions for collaboration depends on how we see the principle of subsidiarity at work in water resources management. Building water resources institutions is also directly related to capacity building and governance. The most important factors in building cross-jurisdictional and sectoral institutions are creating the will and incentives to cooperate and the processes to do so.

Before we examine trends pushing for cooperation and reasons for process techniques and procedures, we should acknowledge two important points. First, that contrary to common thinking, dispute management is neither modern nor Western. Traditions of dispute resolution date back millennia. "*Acequia*," for example, is the term used in the United States' desert southwest and other Spanish-speaking parts of the world to denote both an irrigation ditch and the informal institution that manages it. *Acequias* have their roots in Spain. According to tradition, the Tribunal de las Aguas (Water Court) has been meeting to resolve the disputes over the *acequias* around Valencia in the same church-front square since medieval times, if not before (Glick, 1970). But the root of *acequia* is *al-saqia*, Arabic for a gear-driven waterwheel, the technology that made early irrigation possible along many of the rivers of the ancient Middle East (Oleson, 1984). From the Middle East to Spain to the New World – the roots of collaborative approaches run deep. This system teaches us much about the subsidiarity principle of dealing with conflicts and of cooperating for planning and operations at the lowest possible levels.

Second, the water resources field is rich with experiences and illustrations of collaboration approaches. Indeed, the water resources field is at the nexus of one of the oldest and most contemporary of public policy questions: How should specialized knowledge relate to power in a society? We can learn much from our water resources experience that can inform our current search for answers to this question in the water resources and other related areas.

1.2 SOME TRENDS PUSHING TOWARD COOPERATION

Like all trends, whether they are positive or negative is in the eyes of the beholder. We choose to be optimistic about what follows:

1. Water compels us to think regionally. Because it ignores legal delineations, and because technical information has and continues to play a crucial role in water resources decision making, the need for regional management and data-gathering bonds water professionals across jurisdictions.
2. There is growing realization that the price for having some control over agreements is sharing ownership and cooperating in both the process and outcome of those agreements.
3. As constraints on the resource grow, especially in an era of fiscal austerity, the opportunity costs for not cooperating become clearer. Indeed, negotiations can be seen as a social-learning process, and the need for cooperation is one of its lessons.
4. The movement for environmental justice will bring new environmental value claims directly to social claims and link them to per capita measurements.
5. Influential new actors are emerging that represent new claims on water resources that cross jurisdictional boundaries.
6. The politics of water is moving from that of distributing benefits of an expanding pie to the perception of redistributing a decreasing pie, now and in the future.
7. The transaction costs in time, dollars, resources, lost revenues, and even violence are escalating beyond traditional management methods and/or capacity to keep up. This is forcing the adoption of alternative approaches.
8. Available money relative to identified needs is contracting. Therefore, more must be done with less. A qualitative multiplier is needed for our management procedures. Cooperation built on a new ethic of informed consent, rather than an old ethic of paternalism, can provide such a multiplier, especially in terms of increased program effectiveness and enhanced implementation.
9. There is a growing moral imperative for more accountability, responsiveness, and intergenerational equity in water resources decisions.

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10. There is a shift from a deterministic prediction of the future to the notion of jointly creating the future.
11. Traditional legal systems everywhere are seen as unable to cope with change. The reliance on precedent is insufficient if the problem is that current legal obligations are locked into allocation formulas that diverge dangerously from current demographic realities.
12. International lenders and donors are beginning to perceive their role as that of a facilitator to agreements rather than an expert dictator of agreements. These actors have resources that can be incentives for cooperation, even in a world with weak legal systems and sanctions.
13. New treaties and agreements that are multipurpose are growing. Old, single-purpose treaties and agreements are under pressure to expand.
14. There is a renewed interest in functional diplomacy and what is now called "second-track" diplomacy.
15. Technologies that are accessible to ordinary people and technologies that help rather than hinder dialogue, alternative generation, and sensitivity testing are rapidly emerging.
16. There is a growing and changing public awareness of water resources.
17. There is evidence from divergent fields of science that cooperation is and has been the key to growth and evolution. Such evidence can be found in computer science and game theory, evolutionary biology, social psychology, and hard and soft technology. Lewis Thomas (1992) notes, "The driving force in nature, on this planet and biosphere is cooperation . . . and that our bacterial ancestors learned, early on, to live in communities." Speaking about trench warfare in World War I, anthropologist Ashworth (1968, 1980) notes "how a kill or be killed strategy turned into something like live and let live." Computer scientist Axelrod (1984) finds the "Roots of Cooperation" in playing millions of prisoners' dilemma games. The result is that a tit-for-tat strategy – a strategy that starts with cooperation and repeats whatever moves the other player makes – works best.

1.2.1 Trends of cooperation at the institutional level

CHANGING CONTEXT OF GOVERNANCE

The world is changing. A renewed democratic spirit and a new ecological awareness are two of the principal forces driving change. This democratic spirit is calling us to new notions of individual freedom, transparency, and accountability in public decisions. The new ecological awareness reminds us of a collective responsibility and leads us to notions of holistic and comprehensive systems. With its long-term focus and its calls to include stakeholders in decision making, sustainability has become a venue for this dialogue (United Nations, 2002a). Building the physical water infrastructure in a collaborative and participatory way is now an important means of "governance environment." Water resource management, with its current debates over markets, pricing, planning, participation, and environmental assessment, is a meeting ground for these forces.

Indeed there is growing recognition that the experience of solving and managing water conflicts can greatly influence the political structures of nations. Contrary to the old Wittfogel (1956) thesis that development begets large water infrastructure, which begets large bureaucracy, which begets control, which begets authoritarianism, the opposite is also true. For example, many have recognized how the experience of the Dutch water boards, over several hundred years, greatly influenced the current structure of Dutch government. Those boards, through the experience of being elected and making decisions on essential matters, helped to build a culture of democracy. The experience of managing water, which is close to and vital to people's lives, is an enormous opportunity for social learning on how to live together, as well as how to manage water.

EXPANDING OF ISSUES AND OF STAKEHOLDER NUMBER AND ASYMMETRY

Water management must now integrate new ecological values and criteria of sustainability. Both require more information, which, in turn, highlights additional new risk and uncertainty. Both require professionals to compare among incommensurable values and other values that are difficult to quantify. More explicit understanding of risk requires an active choosing of, rather than passive reacting to, risk by beneficiaries. All of this will push water resource professionals beyond traditional methodologies and into new process considerations.

More voices with competing views of the future must be involved in water development. Although the distribution of power among these parties is asymmetrical, the power to stop or delay is diffusing faster than incentives to create and cooperate. New ways to prioritize investments and manage conflicts among competing interests will be needed. Inertia toward negative and reactive attitudes must be countered with incentives for positive and creative development and with new ways to foster ownership in both the plans and the process of generating those plans among interested and affected parties. Impact assessments are crucial for both informed technical and good moral decision making because, to the best of our ability, we must know the consequences of our actions. However, we must move beyond being paralyzed by our understanding of consequences

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by simply looking at costs. Process techniques and procedures offer a route out of paralysis toward action.

GROWING GAP BETWEEN DEVELOPMENT NEEDS AND AVAILABLE CAPITAL

While the industrialized world debates reallocation and reapportionment within existing water systems, many in the world have little or nothing to reapportion and need new systems. At the same time capital is short. So doing more with less means, in part, being more efficient. But being more efficient confronts us with issues of distributive equity and fairness. In recent years, water managers have moved beyond the traditional structural interventions into natural systems to management of social systems and now biological systems as means for water management. Thus, cost recovery and project performance will become even more important to decision makers. For several years World Bank evaluations at the project level show how participatory processes can be effective in meeting these challenges (Nagle and Ghose, 1990).

Creative alternatives and new public/private partnerships must be found to develop and allocate water use. Without the strategic management of allocation, the transaction costs of managing water can escalate to unacceptable levels. Indeed, resource scarcity, when seen by some parties as a relative deprivation, whether perceived or real, can lead to violence and political authoritarianism (Gurr, 1985) and corruption (Rinaudo, 2002). Without operating agreements between and within nations and among users, the opportunity costs in lost economic benefits, poverty reduction, and public health could escalate to the point of social stagnation. We must begin to reinterpret our awareness of water interdependence as an opportunity to create cooperation rather than as inevitable zero-sum competition.

A key to such reinterpretation is in the way – or the processes – by which we anticipate and manage the competing and conflicting demands for the resource. Water resource development is becoming more dependent on integrative bargaining, agreement building, participation, collaborating, and using fair processes for managing conflict. To this extent, the international agencies have a stake in integrative bargaining, especially in the international system, where incentives for proactive collaboration are often weak.

GROWING WATER INTERDEPENDENCE WITH WEAK COMPLIANCE AND INCENTIVE SYSTEMS

Water policy reviews in the international development agencies have been documenting how water use and its allocation and reallocation are likely to drive development strategies. Water is central to poverty alleviation through food production and infrastructure development (Sullivan et al., 2003). A report on international environmental conflict resolution (IECR) notes that "Most current IEC's are related to international rivers" (Trolldalen, 1992). Stern and Druckman (2000) identify numerous conceptual, methodological, and inferential challenges of using a scientific approach to evaluate the effects of past conflict-resolution interventions.

As population and urbanization accentuate conflicting demands for the same resource – water – our interdependence becomes more evident. Everywhere the call for better water pricing and readjustment of agricultural subsidies is heard. But the question is "how?" The reality is that agreements on agricultural prices, as shown in the World Trade Organization (WTO) process and in the European Community (EC), are difficult if not impossible to reach. Thus, it is hard to see how food security interests, to say nothing of national ideological interest, will be met.

Most of the world's largest rivers are international, and more are becoming so because of political changes, such as the breakup of the Soviet Union and the Balkan states, as well as access to today's better mapping sources and technology, which can better trace a watershed. There were 214 international basins listed in 1978 (United Nations, 1978), the last time any official body attempted to delineate them, and there are 263 today.

Even more striking than the total number of basins is the percentage of each nation's land surface that falls within these watersheds. A total of 145 nations include territory within international basins. Twenty-one nations lie in their entirety within international basins; including these, a total of thirty-three countries have more than 95 percent of their territory within these basins. These nations are not limited to smaller countries, such as Lichtenstein and Andorra, but include such sizable countries as Hungary, Bangladesh, Belarus, and Zambia (Wolf et al., 1999; UNEP and OSU, 2002).

A final way to visualize the dilemmas posed by international water resources is to look at the number of countries that share each international basin: nineteen basins are shared by five or more riparian countries; the Danube has seventeen riparian nations; the Congo, Niger, Nile, Rhine, and Zambezi are each shared by between nine and eleven countries; and thirteen basins – the Amazon, Ganges-Brahmaputra-Meghna, Lake Chad, Tarim, Aral Sea, Jordan, Kura-Araks, Mekong, Tigris-Euphrates, Volga, La Plata, Neman, and Vistula (Wisla) – have between five and eight riparian countries. Likewise, the large countries of the world, such as the United States, Canada, India, Mexico, China, Nigeria, Russia, and Brazil, have states or provinces within them across whose boundaries water flows.

In the Middle East, two-thirds of Arabic-speaking people depend on transboundary waters that flow from non-Arabic

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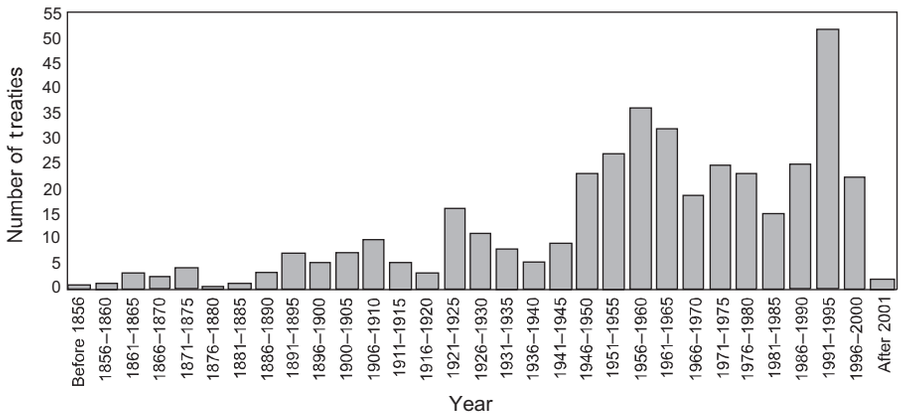

Figure 1.2 Number of international water treaties by year (Transboundary Freshwater Dispute Database, 2006).

areas (Kolars, 1992). Because the structure of international compliance to water quality, the environment, and other supply issues is weak, interdependence will have to be served through incentives. As the Oslo report states, international financial institutions with financial leverage will become critical to encouraging and leading new incentives (Trolldalen, 1992).

Cai and Rosegrant (2002) and Rosegrant and Cai (2002) modeled global water demand and supply projections and determined that water demand will grow rapidly for domestic and industrial uses with slowing growth for agricultural uses. Current water use in several of the shared basins is generating demands that either already exceed available supply or soon will. Some of the most pronounced deficits are likely to occur in regions already ripe for high-intensity conflict and with rivers of high flow variations, such as in the Middle East (Amery and Wolf, 2000; Allan, 2001). Other projected deficits are likely to occur in areas already prone to famine. Projected deficits in arid regions of the United States, despite their comparative wealth, are already causing significant political realignments (Miller, 2001).

GROWING DISCONTINUITY BETWEEN TRADITIONAL INSTITUTIONS AND NEW REALITIES

In recognition of growing interdependence, 286 international treaties concerning water were signed by 1970. By 1986 there were 324, and there are currently more than 400 (Figure 1.2 shows the continued growth in the rate of treaty development). Although the rate of agreements increases, only two-thirds of these treaties relate to river basins in Europe and North America (Nagy, 1987). Few exist in the developing world, where the need is rapidly growing (Nagy, 1987). For example, Europe, with 48 river basins, has 175 water-related treaties, whereas Africa, with 34 river basins, has 34 treaties (Linnerooth-Bayer, 1986). More important, almost 85 percent are bilateral rather than multilateral, even on multilateral basins, and single purpose rather than multipurpose (Hamner and Wolf, 1998). For example, of eighteen agreements on the Danube since 1948, all but one has been bilateral (Linnerooth-Bayer, 1986).

The most frequent purposes of earlier treaties were navigation and hydropower production, which gave way to water allocation. Multipurpose use, water quality, and environmental aspects have now become more prominent. Flood control management is a major objective in about 10 percent of existing treaties. Most treaties relate to planning or preliminary surveys, whereas those relating to construction and joint operation are far fewer. Few relate to groundwater or water quality – about 25 percent mention water quality, but only four treaties are explicit in their requirements (Giordano, 2002). Also, few treaties use a basinwide approach, and most relate to specific sections of the rivers (Nagy, 1987). However, current agreements are beginning to reflect an interest in a comprehensive view of uses: basinwide management, multisectoral development, and water-quality control (Vlachos, 1991).

Changing demographics are demanding new priorities and flexibility in water use and are straining the capacity of traditional water institutions. Almost 15 percent of the World Bank's portfolio is water related, leading to overlapping sectoral jurisdictions within the Bank and overlapping geographic jurisdictions outside. Beyond the Bank, institutional means to achieve environmental health and development seem inadequate. In the end, no matter what organization is created, discontinuities will require more managed flexibility and planning.

DEVELOPMENT OF WATER RESOURCES MANAGEMENT AS A MEANS TO BROAD AGREEMENTS

Because many of the world's rivers are regional, not global, because their related social interdependencies are so tangible

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and so clearly shared, and because they have such a rich history of interdependence, management of these rivers offers opportunities for cooperation built on technical needs, which could produce further positive political, social, and economic cooperation (Conca and Dabelko, 2002). Although it is perhaps open to criticism as either geographical determinism or naive neofunctionalism, water resources management has helped and continues to help integrate social and political groups. The earliest U.S. Supreme Court decisions establishing federal power concerned water navigation. European rivers, such as Rhine, Rhône, and Danube, have been steadily moving from functional agreements around water to more administrative integration. In the midst of land grabs and war, some southern African nations, through mediation, discovered shared interest in irrigation and hydroelectric power. They signed a joint nonaggression pact and teamed up to gain international financing for a water development project (Hickey, 1992). Although commentators like to focus on water potential to ignite Middle East conflict, it is currently one of the few areas serving as a means for parties to talk. Senior technical/administrative water officials share a technical language that can be a powerful base for communication. In addition, at some level almost all cultures recognize the sanctity of water. Water as cleanser and healer is one of the paramount metaphors of human experience. Water has a deep, almost primordial significance and immense potential symbolic power to move people.

CHANGING ETHICAL BASIS OF PROFESSIONALISM

The ethical basis of professionalism is moving from a traditional paternalism to a newer notion of informed consent. Throughout societies, the very meaning of professionalism is changing. Some patients no longer say "cure me"; they participate with doctors in their own diagnosis and treatment. Clergy may no longer maintain strict distinctions between the "lay" and "religious" and may no longer consider themselves the sole salvation mediators between heaven and earth. Lawyers may no longer neglect alternatives to litigation or avoid linking their individual actions to the overall state of social justice. Water professionals should not be surprised when affected groups and beneficiaries of their works demand rights in influencing project design and locations.

Professionalism includes not only the final goods and services provided but also the means employed to deliver those goods and services. The means by which the goods and services are delivered establish a relationship with client and partners. Process procedures are means to help professional engineers cope with these changing demands emanating from a new understanding of professionalism throughout society.

GROWING NEED FOR BALANCE AMONG DEVELOPMENT, GROWTH, DEMAND MANAGEMENT, AND STRUCTURAL INVESTMENTS

After a period of unfettered development, followed by a period of sometimes indulgent introspection and assessment, the world is entering a new period of balancing management and structures. Once a certain level of wealth was attained in the West, the environmental and other costs became more evident. During periods of early growth or during a depression, the focus was on generating income, wealth, and social well-being. Once these issues were settled, the costs, often hidden, became evident. This understanding eventually led to new policies on growth and various forms of impact assessments. These requirements have spilled over to lending and granting to the Third World from the external support agencies (ESAs). These requirements for impact assessment have engendered great debate and have often looked like cultural imperialism from the developed world. Today, as witnessed by the new sector strategies of the World Bank, the call is for both management and development. This call essentially means negotiated approaches, which are more open and inclusive of both the people benefiting as well as those impacted and also of the distribution of risk sharing. In short, there is growing recognition that integrated water management or poverty reduction cannot be attained if either structures or management are taken off the table. The question is how to attain the appropriate mix – and this requires more process sensitivity and skills on the part of the water managers.

Nowhere is this clearer than in today's dialogue between the rich and the poor about water. Figure 1.3 illustrates the dilemma. As countries and societies develop, they must first invest in water infrastructure. At this point, investment in management is usually lower. Over time, as a country prospers, the investment in management increases as that in infrastructure decreases. Well-intended prescriptions from those in

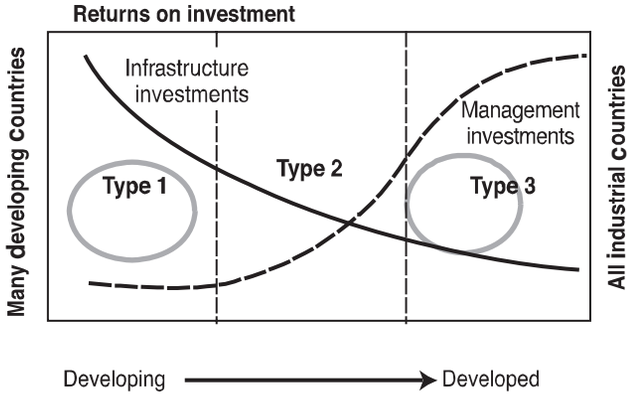

Figure 1.3 Need for new rich–poor dialogue (World Bank, 2006).

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the rich countries to increase funding for water management schemes may not be appropriate for developing countries that have little or no water infrastructure. For example, Sidebar 1.1 shows some approximate investment data for water in recent U.S. history. No one really knows the extent of that investment, but it is huge when one adds the state and local investment and water-services investment. The Water Environment Federation estimates that the United States must spend about US$23 billion a year to meet its environmental standards. There are more than 100 countries in the world with little infrastructure and with GDPs less than US$23 billion. Water prescriptions for poor areas of the world based on the assumptions gained from the U.S. experience can lead to fundamental misunderstandings. In fact, it can often appear that rich nations are admonishing the poor not to use the resources in the same way the rich did during development. Such prescriptions can come across as a new form of imperialism. Instead, rich nations should reexamine how they used their water resources during development and at what costs – then, based on those costs, help currently developing countries design mitigative measures to help them avoid similar costs as they grow. But this dialogue is not prevalent.

Sidebar 1.1 History: U.S. Investment in Water Supply

- New Deal: Works Progress Administration (WPA) 2,600 water projects = US$312 million (in 1930s dollars).
- Federal Power Commission (FPC) [later the Federal Energy Regulatory Commission (FERC)]; Civil Works Administration (CWA); WPA US$112 million for municipal water (in 1930s dollars).
- 1972–1990 more than US$650 billion in federal grants for sewage treatment and US$20+ billion from states.
- World Economic Forum (WEF) estimates that US$23 billion per year is needed for 20 years to meet the U.S. Environmental Protection Agency (EPA) standards.
- *More than 100 countries that lack adequate sanitation have an annual budget less than US$23 billion.*

1.2.2 The world of the professional water manger is changing

The world has changed for water resources managers, planners, and decision makers. Today, especially in the context of new demands for integrated water resources management (IWRM), water managers and planners often work in teams involving multiple disciplines rather than just engineering and associated technical fields (e.g., see Diplas, 2002). Increasingly they also work in multiagency teams that include a variety of public, nongovernmental organization (NGO), and private sponsors. Today's water managers and decision makers must consult with a broader range of stakeholders, publics, and NGOs locally, regionally, and often internationally. And, they must do all this while operating in a world of increasing demands on water.

Technical expertise remains necessary for creating sustainable water management decisions – perhaps even more necessary than ever – however, that alone is not enough. People all over the world need technical engineering competence, but the ability to put that competence in service of those who need it depends, in many cases, on changing the relationship between the experts and those whom they are serving. This book aims at helping to build, modify, or create such new functional relationships.

This new water resources decision-making environment requires at least two sets of skills. First, it requires broad, interdisciplinary technical skills, which reach across disciplines to allow consideration of alternatives that in the past were often not evaluated. Many water decisions rest on a scientific basis that is itself incomplete. This means that water decision makers may first need to get agreement on what studies should be conducted and what data collected to ensure that decisions are based on science, not rhetoric. As a result, water planners and managers need a breadth of technical knowledge that goes beyond traditional engineering.

Second, water planners and managers need another set of skills: the skills to design and conduct processes that draw together partners, stakeholders, and publics, resulting in decisions that enjoy broad cross-sectoral, and often transboundary, public support. The era where water planners and managers employ the "decide-announce-defend" approach is rapidly disappearing. In this new era, water management is "done with" (as opposed to being done "for" or "to") potentially affected agencies, public and private organizations, and individuals.

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2 Water wars, water reality: Reframing the debate on transboundary water disputes, hydropolitics, and preventive hydrodiplomacy[1]

Fierce competition for fresh water may well become a source of conflict and wars in the future.

– Kofi Annan, March 2001

But the water problems of our world need not be only a cause of tension; they can also be a catalyst for cooperation. . . . If we work together, a secure and sustainable water future can be ours.

– Kofi Annan, January 2002

Before delineating appropriate measures for water conflict prevention and management, we first need to address the larger issues between people and their environment – that is, who affects whom? It is quite clear that people affect their environment, but to what extent is the opposite true: just how deep is the causal relationship between environmental stresses and the structure of human politics? This relationship is at the heart of understanding the processes of environmental conflict prevention and resolution. If, as the large and growing "water wars" literature would have it (see, for example, Cooley, 1984; Starr, 1991; Bulloch and Darwish, 1993; Remans, 1995; Amery, 2002), the greatest threat for water conflicts is that water scarcity can and will lead directly to warfare between nations. This lends itself to diversion of a potentially huge amount of resources, in attempts to arrest these processes at the highest levels. If the processes are actually both more subtle and more local in nature (as suggested by, among others, Elhance, 1999; Marty, 2001; Chatterji, Arlosoroff, and Guha, 2002; Wolf, Yoffe, and Giordano, 2003b; Carius, Dabelko, and Wolf, 2004) then so too are the potential solutions.

Throughout this book, we will note that shared water does lead to tensions, threats, and even to some localized violence – and we will offer strategies for preventing and mitigating these tensions – but not to war. Moreover, these tense "flash points" generally induce the parties to enter negotiations, often resulting in dialogue and, occasionally, to especially creative and resilient working arrangements. We will note also that shared water provides compelling inducements to dialogue and cooperation, even while hosilities rage over other issues.

But let's look at the evolution of the "water leads to war" thesis. Although the extreme "water wars" literature mostly began to fade in the late 1990s, a number of articles dating back decades argue quite persuasively for some degree of causality between environmental stress – reaching up against relative resource limits – and political decision making. One cannot discuss water institutions, for example, without invoking Wittfogel (1956) and his classic argument that the drive to manage water in semiarid environments led both to the dawn of institutional civilization – described by Delli Priscoli (1998a) as the "training ground for civilization" – and to particularly autocratic, despotic forms of government. This latter argument, and the generally enthusiastic reception he received, needs to be understood in the Cold War setting from which it sprang and was quite effectively challenged by Toynbee (1958), among others. Toynbee's vehemence (in his review he calls Wittfogel's book a "menace") is particularly interesting because many of Wittfogel's theories can be seen as extensions of a sort of Toynbee's (1946) "challenge-response" thesis in which he argues that the impetus toward civilization becomes stronger with greater environmental stress. Toynbee's objections are primarily with Wittfogel's "tribalistic" lens to history, aimed, as Toynbee charges, at demonizing the Soviet Union. Wittfogel (1956) in turn, distinguishing himself from Toynbee, writes of his own position, "causality yes, determinism no" (p. 504). However, the premise that there is a critical link between how society manages water and its social structure/political culture remains as an important and valid insight.

This thread of causality between the environment and politics has been taken up regularly over the years. When Sprout and Sprout (1957) describe the environmental factors inherent in international politics, it becomes the direct intellectual precursor to today's blossoming "environmental security" literature, as spearheaded by Homer-Dixon (1991). Homer-Dixon,

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Jerome Delli Priscoli and Aaron T. Wolf
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like Wittfogel, was initially greeted enthusiastically by the defense establishment, this time in the setting of the post–Cold War redefinition of relevance and, again like Wittfogel, has been taken to task for the degree of causality in his arguments. (A summary of Homer-Dixon's findings, along with a debate on the topic is presented in Wolf, 2002b.) In his defense, Homer-Dixon's arguments, along with those of much of the "water wars" crowd, have become more muted over the past few years – in 1994, he wrote: "the renewable resource most likely to stimulate interstate resource war is river water," which he repeats in his 1996 article. He modifies the claim, elaborated in his 1999 book: "In reality, wars over river water between upstream and downstream neighbors are likely only in a narrow set of circumstances . . . [and] . . . there are, in fact very few river basins around the world where all these conditions hold now or might hold in the future."

In water systems, the dichotomy of causality is manifested as whether the stress on water resources lends itself more readily to conflict or cooperation. Both arguments are powerful and have been supported by a rich, if mostly anecdotal, history. Postel (1999) describes the roots of the problem at the subnational level. Water, unlike other scarce, consumable resources, is used to fuel *all* facets of society, from biologies to economies to aesthetics and religious practice. As such, there is no such thing as managing water for a single purpose – *all* water management is multiobjective and is therefore, by definition, based on conflicting interests. Within a nation, these interests include domestic use, agriculture, hydropower generation, recreation, and environment – any two of which are regularly at odds – and the chances of finding mutually acceptable solutions drop precipitously as more actors are involved.

Conceptually, and as described in case studies by Trolldalen (1992), these conflicting interests within a nation represent both a microcosm of the international setting and a direct influence on it. Trolldalen's work is particularly useful in that he sidesteps the common trap of treating nations as homogeneous, rational entities, and explicitly links internal with external interests. Bangladesh is not just the national government of Bangladesh when it negotiates a treaty with India over Ganges flow: it is its coastal population, inundated with saltwater intrusion; its farmers, dealing with decreasing quantities of water and increasing fluctuations; and its fishermen, competing for dwindling stocks.

This link between the internal and external is critical when we look at violent international conflicts (Conca, 2006). Gleick (1993) is widely cited as providing what appears to be a history replete with violence over water resources. But a close read of his article reveals greater subtlety and depth to the argument. Wolf (1998) points out that what Gleick and others have actually provided is a history rife with tensions, exacerbated relations, and conflicting interests over water but *not* State-level violence, at least not between nations or over water as a scarce resource. It is worth noting Gleick's careful categorization because the violence he describes actually turns out to be water as a tool, target, or victim of warfare – *not* the cause of the violence. Wolf (1998) contrasts the results of a systematic search for interstate violence – one true water war in history, 4,500 years ago – with the much richer record of explicit, legal cooperation – 3,600 water-related treaties. In fact, a scan of the most vociferous enmities around the world reveals that almost all the sets of nations with the greatest degree of animosity between them, whether Arabs and Israelis, Indians and Pakistanis, or Azeris and Armenians, either have a water-related agreement in place or are in the process of negotiating one.

2.1 WHY IS THE WATER WAR ARGUMENT SO COMPELLING?[2]

If water is at the heart of most human activity, if it is shared between often hostile users, and if it is becoming relatively scarcer year by year, it is difficult to think of *alternatives* to inevitable warfare. Recent articles in the academic literature (Cooley, 1984; Starr, 1991; Remans, 1995; Amery, 2002) and popular press (Bulloch and Darwish, 1993; *World Press Review*, 1995) point to water not only as a cause of historic armed conflict but also as *the* resource that will bring combatants to the battlefield in the twenty-first century. Invariably, these writings on "water wars" point to the arid and hostile Middle East as an example of a worst-case scenario, where armies have in fact been mobilized and shots fired over this scarce and precious resource. Elaborate, if misnamed, "hydraulic imperative" theories have been developed for the region, particularly between Arabs and Israelis, citing water as the prime motivator for military strategy and territorial conquest.

Westing (1986), for example, suggests that, "competition for limited . . . freshwater . . . leads to severe political tensions and even to war"; Gleick (1993) describes water resources as military and political goals, using the Jordan and Nile as examples; Remans (1995) uses case studies from the Middle East, South Asia, and South America as "well-known examples" of water as a cause of armed conflict; Samson and Charrier (1997) write that "a number of conflicts linked to freshwater are already apparent" and suggest that "growing conflict looms ahead"; and Butts (1997) suggests that "history is replete with

[2] This section draws from Wolf (1997). International water conflict resolution: Lessons from comparative analysis. *International Journal of Water Resources Development*, **13**(3, September), 333–356.

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