

## 2. OVERVIEW OF LITERATURE ON CONFLICT NEGOTIATION AND COOPERATION OVER SHARED WATERS\*

### Objectives

While the literature on transboundary water is relatively young, the depth and scope of issues it has been covering has grown over the years. The chapter covers the main disciplines involved in analyses of transboundary water, namely legal, geography, economics, negotiation. After reading this chapter you will have (1) a good understanding of the approaches used by each discipline, (2) a recognition of the issues that are central to transboundary water, and also some good grasp of the various hot spot basins around the world.

Various works on conflict, negotiation, and cooperation over shared international fresh waters (shared waters) have been published over the years. However, the end of the Cold War and renewed interest in water and environment, around the Dublin and Rio conferences,<sup>1</sup> in 1992, also had much influence in fostering interest in shared water issues, specifically as it pertained to the spheres of politics, security, and international relations. The past 15 years have seen much more work on international water and this will be reflected in this chapter as well.

While studies regarding conflict and cooperation over water have varied in scope, work on shared waters can nonetheless be distinguished by three unique categories — theoretical, empirical, and case studies.<sup>2</sup> The literature has also both embodied and benefited from the tools, lessons and underpinnings provided by different academic disciplines. Four such fields have been most instrumental: economics, international law, international relations, and negotiation theory. Other disciplinary approaches, such as geography and hydrology, have made significant contributions and will be incorporated as well.

\*A revised and updated version of Dinar and Dinar (2003).

<sup>1</sup>The conferences highlighted the importance of water as an “economic good” with “basic human need” in national and international arenas.

<sup>2</sup>We intentionally do not report on the rich literature that focuses on individual basin case studies. These can be found in Dinar and Dinar (2003). An additional source of updated work can be found in the Water and Conflict Bibliography website (<http://biblio.pacinst.org/conflict/>) by the Pacific Institute.

## DISCIPLINARY APPROACHES

The different fields introduced above have all been invaluable in contributing to the work done on shared waters. Economics has brought to bear such concepts as regional cooperation, game theory, and institutional economics. International Water Law, rich in its history but relatively juvenile in its codification status as of 1997, has introduced particular important legal principles such as *equitable utilization* and the *obligation not to cause significant harm*, paramount in contributing to future resolution of conflicts over shared waters. The field of international relations has likewise sharpened ideas on conflict and cooperation over water, employing variables and concepts such as state power, interdependence, and domestic politics. This discipline has also been instrumental in guiding discussion on water and international security issues and institutional and organizational approaches. Negotiation studies have introduced concepts such as party motivation, third party mediation, linkage, culture, and other important tools to understand different bargaining outcomes.

### **Economic Aspects of International Water Conflict Negotiation and Cooperation**

Although economics is one of the building blocks of cooperation over shared waters, it is surprising that the economic literature is not sufficiently endowed with works related to international water. Since the seminal work by Krutilla (1967) on the economics of the agreement between the USA and Canada over the Columbia River, there have not been many works of this magnitude.

Economic studies of cooperation over shared water usually take either the central planning approach or the market approach. The first approach assumes the existence of a central planner that makes decisions regarding the allocation of water and other factors of production, and resulting benefits among the riparian states (e.g., Giannias and Lekakis, 1996; Kally and Fishelson, 1993). The second approach, driven by market considerations, assumes that riparian states behave as agents in the market, responding to price and value signals and driven by profit maximization (e.g., Dinar and Wolf, 1994; Zeitouni *et al.*, 1994; Becker *et al.*, 1996). Such approaches assume politically neutral considerations. However, as is well acknowledged (see the section on international relations), this assumption is not well suited with reality of international water. As with many other scarce common pool resources (Ostrom *et al.*, 1994), strategic behavior is more common among parties sharing common water resources. Incorporation of strategic behavior into water-sharing approaches brings us to game theory.

Game theory has been applied to international water conflicts only sporadically. Rogers (1969) applied a game theoretic approach to the disputed Ganges–Brahmaputra sub-basin that involved different uses of the water by India and Pakistan. The results suggest a range of strategies for cooperation between the two riparian nations, which will result in significant benefits to each. In a more recent paper, Rogers (1991) further discussed cooperative game theory approaches applied

to water sharing between the USA and Canada in the Columbia Basin, among Nepal, India, and Bangladesh in the Ganges–Brahmaputra Basin, and among Ethiopia, Sudan, and Egypt in the Nile Basin. In-depth analysis is conducted for the Ganges–Brahmaputra case, where a joint solution improves each nation’s welfare more than any noncooperative solution (Rogers, 1993). Dufournaud (1982) applies game theory to both the Columbia and the Lower Mekong to show that “mutual benefit” is not always the most efficient criterion to measure cooperation in river basins.

While game theory has been very useful in explaining water allocation among international basin riparian states, lately, pollution and water quality aspects of transboundary water sharing have become increasingly important. Here too, game theory may help in understanding potential for cooperation among basin riparians. Fernandez (2002) developed and applied a differential game using data of abatement costs, environmental damages, trade flows, and pollution dynamics to transboundary water pollution problems along the border between the USA and Mexico. The framework offers a way to compare pollution control when the USA and Mexico coordinate efforts and when they act independently. In another recent work, Umanskaya *et al.* (2006) develop a differential game to examine the effects of international lobbying on the solutions for transboundary pollution stock control involving two trading countries. The model explores (at the theoretical level) optimal pollution regulation strategies and the evolution and equilibrium levels of pollution stock in both countries under two different scenarios: in the presence and in the absence of international lobbying. Comparison of the outcomes of these scenarios shows that international lobbying may lead to a laxer regulation of the transboundary pollution externality and degradation of environmental quality.

Application of metagame theory, which is a nonnumeric method to analyze political conflicts, has been applied to water resources problems by Hipel *et al.* (1976) and Hipel and Fraser (1980). The resulting outcome of a conflict is a set of strategies most likely to occur and their payoffs to each participant. Becker and Easter (1995) analyze water management problems in the Great Lakes region among different US states and between the United States and Canada. A central planning solution is compared to a game theory solution with the results favoring the solution found through game theory.

Using a game theory approach, Dinar and Wolf (1994) evaluate the idea of trading hydrotechnology for interbasin water transfers among neighboring nations. They attempt to develop a broader, more realistic conceptual framework that addresses both the economic and political problems of the process. A game theoretic model is then applied to trade in the Middle East involving Egypt, Israel, the West Bank, and the Gaza Strip. The model allocates potential benefits from trade among the cooperators. The main findings are that economic merit exists for water transfer in the region, but political considerations may harm the process, if not block it entirely. Part of the objection to regional water transfer might be due to unbalanced allocations of the regional gains and, in part, to regional considerations not directly related to water transfer.

Incorporation of economics of conflict and cooperation into international shared-water problems has become more used in recent years (Dinar and Wolf, 1997; Just and Netanyahu, 1998a). Just and Netanyahu (1998a) for example, include various works that apply game theory and other economic concepts (e.g., regime theory, contract theory, water markets, bargaining theory). Other examples include Netanyahu *et al.* (1998) that apply game theoretical approaches to the dispute over the Mountain Aquifer between the Israelis and the Palestinians.

Additionally, Bennett *et al.* (1998) demonstrate the application of interconnected games (addressing issue linkage) to the Aral Sea Basin and to the Euphrates River Basin. They conclude that issue linkages — such as trade and air pollution (for the Aral Sea Basin) and the Kurdish ethnic dispute and the Orontes River conflict (for the conflict over the Euphrates) — may be a more efficient approach than using side-payments — which are subject to instability due to the Victim Pays principle<sup>3</sup> — in the formation of cooperative agreements. But Just and Netanyahu (2004) suggest that the linkage between negotiated issues other than water will actually eliminate a solution in the case of the Mountain Aquifer between the Israelis and Palestinians. Still with the Israeli–Palestinian conflict, Yaron (2002) applies game theory models to assess the economic value of cooperation and non-cooperation between Israelis and Palestinians over their shared-water resources. He concludes that whether or not a solution to the regional water problem will be of a cooperative or noncooperative nature will depend on several political, institutional, and economic considerations that may or may not be in place.

Finally, Just and Netanyahu (1998b) discuss cooperation in the context of a multiriparian river basin. According to the authors, coalitions are more sustainable when they incorporate a smaller number of players rather than a larger number. This may be relevant in cases where cooperation is lacking in a river basin, yet a large number of riparians may make treaty formation difficult. The authors argue that multilateral coordination in river basins with a large number of riparians may have to be preceded by bilateral agreements first — since they are easier to sustain.

This approach is also advocated by Swain (2003), who argues for a sub-basin approach to cooperation in the context of the Nile Basin. Swain contends that while the basin is composed of 10 states, Egypt, Sudan, and Ethiopia hold within their territory the largest portion of the river flow and have the largest stakes in the conflict. Since a multilateral initiative addressing the concerns of all 10 riparians will most likely not transpire, solid cooperation at the sub-basin level should take priority. The arguments of Swain and Just and Netanyahu are still to be tested in light of the on-going regional Nile initiative, led by the World Bank.

Taking a basin-wide approach, Rogers (1997) argued that externalities can either create conflicts or hamper cooperation. According to Rogers, however, if there is a way to internalize such externalities, a basis for cooperation may exist. Several

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<sup>3</sup>The Victim Pays principle suggests that the party that suffers from externalities created by the other party pays to mitigate or to adapt for its suffer or damage. The Victim Pays principle can be compared with the Polluter Pays principle, which argues that the creator of the externality pays for the cost imposed by it.

principles are of specific interest such as pareto-admissibility (compensation possible) and superfairness (for all parties), both of which are a basis for cooperation. Using three cases, the Columbia, the Ganges–Brahmaputra, and the Nile Rivers, Rogers applies a game theoretic approach to demonstrate the use of such concepts. Another game theoretic approach is applied to the Great Lakes Basin by Becker and Easter (1999). Alternative diversion restrictions and coalition structures are applied to evaluate potential for basin-wide cooperation and noncooperation among the federal governments of Canada and the United States and the relevant provinces.

An interesting linkage between domestic water pricing policies and basin economy is addressed by Roe and Diao (1997). They argue that depending on the relative size of the water sector, different water pricing policies of the river riparians may either have negative or positive effects on the domestic economy as well as the international economy of the basin. The authors show that the economies of the two riparians are interlinked and affected by the price policies of the other.

Another angle through which one can learn about efforts to assess economic benefits and costs that are associated with a basin wide utilization of water is via the optimization models and cooperative game theory models. Our book addresses to some extent the optimization and modeling approaches in Chapter 10 and the principles of cooperation in Chapters 4–6.

**For Further Discussion.** Surprisingly, both the number and the scope of economic studies (including game theory) of transboundary water are quite small. One can attribute it to various factors, such as complication of the problems that provided disincentives to economists, or the case-study nature of such problems that might be of less interest to economists. What would you suggest as new paradigm for economic work on transboundary water that could be of interest to economists in this field?

### *Regional Optimization Models*

Optimization models provide solutions that, economically, are preferable to the entire basin. They are usually seen as if a social planner took responsibility for the preferences of the parties in the basin and suggested solutions that they “could not resist.” A class of optimization models applied to resource allocation problems can be found in the literature.

Chaube (1992) applies a multilevel, hierarchical modeling approach to international river basins in order to evaluate possible resolution arrangements of the India–Bangladesh–Nepal–Bhutan conflict over the Ganges–Brahmaputra river basin water. That modeling approach allows the utilization of existing models and institutional frameworks for the analysis of large-scale, real-life problems. By breaking the overall problem into hierarchical stages, it can carry a robust analysis of physical, political, economic, and institutional systems. As opposed to Chaube (1992), who used a static framework, Deshan (1995) presents a large-system, hierarchical dynamic programming model, which is applied to the Yellow River in China.

By incorporating intertemporal effects, this approach allows for the testing of likely future impacts of water availability scenarios on the urban, storage, and hydropower sectors that compete over the scarce water of the river. Having the intertemporal effects built into the regional framework allows a careful evaluation of potential cooperation arrangements as well.

Another tool is the multiple objective planning approach. North (1993) applies a multiple objective model (MOM) to water resource planning and management. MOMs are particularly important in water-related conflicts, since water conflicts may arise because each party has a different set of objectives (that may conflict with other parties' objectives) in using the scarce resource. MOMs can compare the results of various optimization problems in terms of incommensurate values for economic, environmental, and social indicators.

Kassem (1992) develops a river basin model driven by water demand at each of the nodes (stakeholders, users, countries, etc.) in the river basin. This comprehensive approach takes into account both the available water resources and the characteristics of water use by each of the use sectors. In addition, the model allows for policy interventions directed at each of the river basin parties, in order to affect water use efficiency. Pricing, storage, and administrative quota restrictions are among such interventions.

The similarity among these planning models is that they provide a wide set of alternatives for consideration by the parties, but they do not create a mechanism flexible enough to respond to changing local and global situations (e.g., relative power, economic conditions) affecting the parties involved.

LeMarquand (1989) suggested a framework for developing river basins that are economically and socially sustainable. At the core of the approach is a river basin authority to coordinate basin-wide planning and execution of multipurpose projects, including water and other regional development. In the case of developing countries, the approach also includes a component to coordinate donor activities. Especially in international rivers. LeMarquand suggests the following conditions for successful water sharing agreements: (1) similar perceptions of the problem, (2) similar characteristics of the welfare functions of the parties, (3) similar water production functions, (4) existence of some level of dialogue, (5) a small number of parties involved, and (6) at least one party having the desire to resolve the conflict.

Sprinz (1995) investigated the relationships between local (state) production and pollution and international pollution-related conflicts. Although very specific to international environmental pollution conflicts, there are some features in this work that can be adapted to international water conflicts. The move from closed economies to a situation that allows international trade, international pollution regulation, and global environmental problems produces a more stable and acceptable solution.

While the economics game theory and planning approaches provide an overall framework for basin-wide arrangements for regulating flows, pollution, and benefit allocations, it is quite obvious that without amending such allocation solutions with a sound legal and institutional framework, they will not be practical under many

real-world situations. Therefore, one should immediately address the vast literature on international water laws and its applications.

## International Water Law<sup>4</sup>

The evolution of International Water Law provides a useful insight into the context of the legal aspects of water conflicts and their resolution. The literature includes not only a general assessment of international legal clauses but also application to particular river basins' conflicts and their resolution. In the context of both these approaches, it is especially interesting to note the controversy between upstream and downstream countries. In addition to reviewing key works on surface water, we will also address issues related to groundwater.

### *International Law for Surface Water*

In 1997, the *UN Convention on the Non-Navigational Uses of International Water Courses* was adopted by the United Nations — considered to be an international framework agreement for use by states in negotiating water disputes (for more in-depth discussion, see Chapter 3). Perhaps most notably the Convention has officially put to rest the historic conflict between the two extreme principles of *absolute territorial sovereignty* (the right of an upstream state to do as it wishes with the waters in its territory regardless of the adverse affect on downstream states) and *absolute territorial integrity* (the right of a downstream state to an uninterrupted flow of a fixed quantity of usable water from upstream states). Instead, it adopted the *limited territorial sovereignty* principle, which introduces *equitable utilization* and *the obligation not to cause significant harm*. The Convention was adopted by a vote of 103 for and 3 against, with 27 abstentions and 33 members absent. However, the Convention has yet to be ratified by a sufficient number of countries to enter into force — the ratification deadline (May 20, 2000) has passed. The 1997 Convention is seen as the modern international law, replacing several attempts to arrive at rules and laws in the past 200 years (Salman and Uprety, 2002; McCaffrey, 2001).

Much work on International Water Law has, of course, preceded the 1997 Convention, comparing it with previous frameworks. Two comprehensive studies (Salman *et al.*, 2002; McCaffrey, 2001) provide a comprehensive review of the process leading to an analysis of the content of the 1997 Convention. A more in-depth analysis of the Convention and its various clauses can be found in Chapter 3. In this context, let us only mention two other recent works. One recent publication (Subedi, 2005) provides a comprehensive view of the existing challenges facing the International Water Law, with a special focus on the Ganges Basin in comparison with the Rhine and Mekong Basins. The works in Subedi (2005) challenge international law applications in basins with high scarcity, high risk of environmental pollution,

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<sup>4</sup>A more detailed and focused review of international law literature is provided in Chapters 3 and 9.

and sustainable development. In addition, the interaction between national laws and international law is used to demonstrate potential difficulties. The work by Nolkaemper (2005) is very representative of challenges brought about in the 21st century that have to be addressed by the international law. Issues such as industrial chemical pollution, salinization, and rehabilitation of ecosystems in the Rhine, and the regional EU Water Framework Directive that was imposed on European countries after the International Water Course Law was adopted, may affect its implementation, indicating that states may not be ready yet for its full implementation.

A major work reviewing the 1997 UN Convention by Tanzi and Arcari (2001) not only takes the reader through a historical context of how International Water Law has developed and evolved but also reviews the entire Convention, its principles and articles. Their survey reveals and emphasizes several important points: (1) The *equitable utilization* principle and the *no harm* rule, rather than competing with each other, are part of the same normative setting. This applies to both water allocation and pollution. One does not prevail over the other. (2) While the Convention is primarily interested in the economic exploitation of water, its reference to general rules and standards of environmental law constrains the freedom of co-riparinas. While the no harm principle does not necessarily refer to pollution issues, pollution is one of the mainstays of the principle. Thus the “subjectivism inherent in the unilateral or agreed assessment of the equitable character of a use finds a limit in the objective requirements of protection and preservation of the watercourse” (Tanzi and Arcari, 2001). (3) The authors also argue that it is this balance inherent in the Convention that makes it a suitable reference in actual or potential negotiations. And while the Convention has not entered into force, its authority is not subject to codification. Rather the authors argue that its relevance is demonstrated in the way it is used in other international agreements as a catalyst and impetus for ending disputes.

We turn now to a quick mention of works that were published prior to the adoption of the 1997 Watercourses Law. McCaffrey (1993) reviews an array of rules of international law that concern shared water resources. Focusing on the two main principles — *equitable utilization* and the *obligation not to cause significant harm* — he compares draft resolutions of three highly authoritative international legal organizations, which reflect evidence for state practice and customary law. McCaffrey clearly shows that interpretation of the concepts of *equitable utilization* and *prevention of harm* put different degrees of weight on both principles. Despite the differences, McCaffrey argues that the work of such organizations is most welcome and will, without question, contribute to the resolution of international water controversies (McCaffrey, 1993:99).

Kliot (1994) attempts to apply the 1991 Draft Rules of the International Law Commission (ILC)<sup>5</sup> and the 1966 Helsinki Rules to three Middle Eastern river basins. Kliot chose perhaps some of the most politically-charged river basins in the

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<sup>5</sup>The ILC is the body associated with the United Nations, which was responsible for drafting the Articles that culminated in the 1997 Convention.

world for applying a still growing and evolving International Water Law. Her analysis not only demonstrates how particular rules apply to particular positions and realities in each river basin, but also speaks about some of the deficiencies in the Draft Articles and the Helsinki Rules, making recommendations of how they can be improved upon when applied to actual river basins. Another account of international law in the context of the Middle East is provided by Ahmed (1994). Perhaps most interesting about Ahmed's analysis is his stipulation that the 1929 and 1959 Agreements signed between Egypt and Sudan, and ignoring the other Nile River riparians, continue to be valid despite the changing geopolitics in the region. These two agreements have been quite controversial among the other Nile river riparians but Ahmed bases his contention on international law, in general, and Articles 11 and 12 of the 1978 Vienna Convention on Succession of States in respect of Treaties and the 1969 Vienna Convention on the Law of Treaties, in particular, which recognize the legality of such treaties. Ahmed also applies the 1966 Helsinki Rules to the Nile Basin. Waterbury (1994) reviews the Nile River, Tigris–Euphrates, and Jordan River Basins. Like Kliot, Waterbury analyzes the hydrogeopolitics of each basin and the positions of each state in the context of International Water Law. Waterbury provides a descriptive and brief overview from various reports and newspaper articles of the interests and principles advanced by Middle Eastern riparians to defend their claims of transboundary waters. These are based on principles such as equity, reason, and appreciable harm.

Dellapenna (1996) also reviews the hydrogeopolitics of the Jordan and Nile River Basins in the context of International Water Law. He demonstrates how the positions and subsequent favored legal principles of the riparians have evolved over the years. Despite their evolution, Dellapenna describes how the principles have been opposed at their core, depending on the geographical location of the states, and argues that the tension between opposing principles can only be managed if the water is cooperatively managed by the respective states in such a way as to assure equitable participation in the benefits derived from the water from all communities sharing the basin. Like Kliot and Waterbury, Hillel (1994) considers the Nile, the Jordan, and the Euphrates–Tigris. Hillel's work includes a deep historical and religious analysis transcending the link between the basins' ancient civilizations and subsequent modern state system with water. Most interesting is the analysis on legal criteria (Hillel, 1994:269) for sharing international waters and a small section describing how antecedents to rules regulating water allocation can be found in the Middle East itself. Islamic law and edicts issued by medieval Jewish sages, Hillel argues, had also evolved a sophisticated set of principles to regulate water management in order to minimize conflict. These traditions, however, have not been extended to international rivalries over water rights.

In another work touching upon the connection between individual treaties and the 1997 Convention, Ramoeli (2002) reviewed the South African Development Community (SADC) Protocol on Shared Water Courses. While the SADC Protocol was originally signed in 1995, it was recently (in 2000) modified and expanded to align itself with the UN Convention on the Law of Non-Navigational Uses of Shared Watercourses. Ramoeli explains how the harmonization process between a

general international convention and a regional protocol took place. Interestingly, harmonization is discussed and encouraged in Article 3 of the UN Convention. The modified SADC Protocol can provide an appropriate lesson for other river basins considering the same procedure.

Perhaps the most comprehensive, not to mention a convenient compilation, of pre-Convention writings can be found in two, Spring and Summer, 1996 special issues of *Natural Resources Journal*.<sup>6</sup> The two volumes include some of the key thinkers on International Water Law. The writings reveal some of the developments and evolution of International Water Law in the 1990s — specifically the clash between Articles 5 and 7 in the context of the ILC alluded to above by McCaffrey. Again, we offer much more details on international law in Chapter 3.

### *International Law for Groundwater*

Groundwater, the “unexplored resource,” has received cursory attention and has often been considered the “poor cousin” to surface water. The issue of groundwater and international law is reviewed by Biswas (1999). An out-of-sight, out-of-mind mentality has resulted in its contamination and overuse, both in domestic and international aquifers. Increasingly, however, it is realized that the issue is of high priority. Both McCaffrey (1999) and Freestone (1999) discuss the issue of groundwater in the context of International Water Law and International Environmental Law. McCaffrey reviews the relevance of the 1997 Convention to groundwater issues and international agreements and finally looks at the work of international legal non-governmental organizations and expert groups in the field of groundwater. Both McCaffrey and Freestone indicate that surface water and groundwater are not alike, and thus international groundwater law has to be developed. The law of international groundwater is still in its embryonic stages.

In an effort to apply International Water Law to a specific groundwater aquifer, Eckstein and Eckstein (2003) discuss the Mountain Aquifer shared between the Israelis and Palestinians. After reviewing some of the entailed hydrogeological and hydropolitical issues, the authors consider the 1966 Helsinki Rules and 1986 Seoul Rules as they apply to groundwater. Most interesting about the authors’ analysis, however, is their discussion of the 1997 UN Convention. The authors argue that under the definition of a “watercourse” and “groundwater” set forth by the Convention, the Mountain Aquifer cannot be accounted for and the authors provide specific examples. Given that the Convention does not account for the Mountain Aquifer, Eckstein and Eckstein discuss other legal principles that may be relevant for the management of the Mountain Aquifer.

Kemper *et al.* (2003) also discuss the applicability of International Water Law to groundwater and review the case of the Guarani Aquifer system, shared by Argentina, Brazil, Paraguay, and Uruguay. The authors review the legal principles

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<sup>6</sup> *Natural Resources Journal*, 36(2), Spring 1996, Part 1; *Natural Resources Journal*, 36(3), Summer 1996, Part 2.

required for appropriate use of the aquifer, considering different legal clauses and texts assessed by international organizations and legal societies, culminating their discussion of International Water Law with the 1997 UN Convention. Like Eckstein and Eckstein, Kemper *et al.* consider the definition of “watercourse” and “groundwater” and argue that applying the 1997 UN Convention to the Guarani Aquifer may be problematic. The authors also point to the Bellagio Draft Treaty as a possible outline for aquifer management in the Guarani case but realize that, given groundwater law’s embryonic development, the riparian states will have a challenging task ahead.

We will conclude with a recent work by Daibes-Murad (2005), which offers a new legal framework for managing international groundwater, with an application to the Mountain Aquifer conflict. Using a wealth of existing treaties, including the Ballagio Draft Treaty Framework (all are provided in Appendix 1 to that work), and extrapolating from existing international treaties, Daibes-Murad suggests a “Progressive Framework” to take into account (1) the asymmetry among the parties, (2) the opposed riparian priorities over rights vs. needs, and (3) the lack of cooperation and coordination, and existing water institutions and practices. We should indicate here that many of the components proposed in the “Progressive Approach” are very similar to the principles of the Joint Management institution proposed by Feitelson and Haddad (2001), and the suggested framework to address the “Victim Pays” principle by Just and Netanyahu (2004), using a game theory model to assess various solutions to that conflict.

## **International Relations**

Although an array of disciplines have influenced the study of conflict and cooperation over water, the international relations discipline has had much bearing. Topics such as scarcity, interdependence, domestic politics, geography, and state power have set the context for analyzing river basin hydrogeopolitics. Other important issues and approaches, under the guises of the international relations discipline, have also shaped the hydrogeopolitics field. These include: the security-water nexus and the water-war debate, institutional and organizational approaches for analyzing conflict, and cooperation over shared international waters. While a detailed and focused analysis of hydrogeopolitics and international relations can be found in Chapter 6, the following section summarizes and categorizes some of the important literature as it is related to the above topical issues.

### ***Topical Issues***

There is no better place to start this literature review, pertaining to the international components of hydrogeopolitics, than with Elhance (1999), who provides one of the most recent and comprehensive analyses of conflict and cooperation over water in the context of six river basins. He considers elements such as geography, hydrology, and

politics, and argues that the geographic and hydrological nature of an international river basin creates a complex network of environmental, economic, political, and security interdependencies between its riparian states. These interdependencies, however, may lead to either conflict or cooperation over shared waters. Understanding how conflict ensues and abates and how cooperation comes about has been the main focus of the nexus between hydropolitics and international relations.

What are some of the factors and variables that either facilitate cooperation or prolong conflict? Gleick (1998) argued that the intensity of the conflict and the need for cooperation over freshwater is determined by several factors: (1) the degree of scarcity, mismanagement, or misallocation of water in various regions; (2) the interdependence of states regarding common water resources, which respect no political boundaries; (3) the geographic and historic criteria of water ownership vis-à-vis states; (4) whether a protracted conflict underlies the water dispute; (5) the existence of alternative sources of water or options for a negotiated agreement and the desperation of the parties to an agreement; and (6) the relative power of the parties. Some of these factors are considered below.

On the one hand, scarcity, and the interdependent character of environmental issues such as water, has been argued by some scholars to contribute to conflict, and possible violent conflict, between states (Mathew, 1999; Falkenmark, 1992; Gleick, 1993; Homer-Dixon, 1999). On the other hand, other scholars have argued that those same variables are just as likely to contribute to cooperation (Deudney, 1991; Brock, 1992; Wolf and Hamner, 2000a). Thus while the variables under consideration have been uniform, the assumptions about their propensity for conflict or cooperation have been opposing.

Domestic politics and the overall relationship between the respective countries have also been argued to contribute to either conflict or cooperation. If domestic political sentiments reject cooperation and the overall relationship between the riparians is poor, conflict is likely to arise. However, if domestic political sentiments favor cooperation and the overall relationship between the riparians is warm, cooperation is likely to ensue. Lowi (1993), Elhance (1999), and Giordano *et al.* (2002), to name a few, have provided examples of domestic sentiments that have explained the conflictive scenario while LeMarquand (1977) has provided examples of domestic political workings that have facilitated the cooperative scenario.

Power and geographic location have also been touted as important variables in understanding conflict and cooperation over international rivers. Depending on whether the river basin's hegemon is upstream, and thus occupying the geographically superior position, or downstream, and thus occupying the geographically inferior position, scholars have come to different conclusions on whether conflict or cooperation shall ensue (Frey, 1984, 1993; Lowi, 1993; Naff, 1994; Homer-Dixon, 1999; Amery and Wolf, 2000). Others have considered only the relative power capabilities, as the key variable, among the river basin's riparians to analyze the propensity for conflict and cooperation (Hillel, 1994; Allan, 2000).

### *Issues and Approaches*

The above topics and debates have also helped shape the environmental security field as it pertains to freshwater issues. The water-war debate has taken center stage in this water-security nexus. The core argument of the water-war school has been that wars have been fought over water in the past and will be fought even more intensely in the future (Cooley, 1984; Starr 1991; Bulloch and Darwish, 1993; Soffer 1999; Myers, 1993). Critics argue that while water installations have been a target of military attack, the water-war prediction has been alarmist at best. The reasons include lack of evidence of past wars over water, the ability of states to contend with scarcity through trade and technology, armed interstate conflicts being caused by a multitude of political and economic factors, and water being an element of cooperation and not armed conflict (Allan 1996; Ohlsson 1999; Wolf 1999; Dolatyar and Gray 2000; Wolf and Hamner 2000a, 2000b; Wolf, 2000; Turton, 2000; Lowi, 2000; Allan, 2001; Lonergan, 2001; Uitto and Wolf, 2002).

There are some conclusions that can be made regarding this fascinating debate. Conflict over water — in some cases political and in some cases prone to armed exchanges — may indeed take place. In many cases, water is used as a military tool or target in a war over unrelated issues. Most of the time, however, either the status quo of stalemate and conflict ensues or the parties realize that cooperation is more rational and cost-effective and engage in negotiations over the resource. Similarly, the rich history of cooperation over water, demonstrated in thousands of documented treaties, not only outweighs the few examples of water-wars and military skirmishes over water, but also demonstrates that shared-water resources may ultimately induce cooperation rather than conflict. Finally, the security and scarcity dimension of water, as a whole, may require some scrutiny. Countries may employ different strategies to cope with water scarcity or may over time develop room in their national discourse for economic and environmentally conscious solutions to their domestic and regional water problems. Until then, they will choose to make it a security matter.

**For Further Discussion.** The literature on international relations applications in transboundary water seems to miss a significant volume of work that is not related to water, but is very relevant at the basin level. What can we presumably add from other known conflicts, and how can that be used in the case of water conflict and cooperation?

### **Institutional and Organizational Aspects**

The aforementioned remarks about cooperation provide a good transition for discussing institutional and organizational approaches to hydropolitics. Indeed, disputes over water may require a basin-wide solution whereby institutional and other organizational mechanisms are employed to foster collaboration among the respective riparians.

Two works, Nishat and Faisal (2000) and Kibaroglu and Unver (2000), emphasize the importance of institutional mechanisms for cooperation over shared waters in the context of the Ganges–Brahmaputra–Meghna and Euphrates–Tigris River Basins, respectively. Nishat and Faisal (2000) discuss the role of the Joint Rivers Commission (JRC) in the context of the agreements and memorandums of understanding signed between India and Bangladesh, primarily for sharing the Ganges. According to the statutes of the JRC, the parties are to discuss mutual water issues within the auspices of the Commission and find effective solutions to these problems in its institutional capacity. But the authors argue that while the JRC has been instrumental in the cooperative framework between the two countries, it requires more authority in identifying and implementing effective solutions. It should therefore engage in regular collection and sharing of data and should be extended in scope to include other water issues that have emerged over time. Kibaroglu and Unver (2000) analyze the history and implications for future negotiations and cooperation over the Euphrates–Tigris within the boundaries of the Joint Technical Committee (JTC). The authors suggest particular principles, rules, norms, and decision-making procedures for a more effective JTC. The two works admit or imply, however, that despite the utility of the institutions created, political constraints such as lack of political will on the part of one of the parties and the relative power discrepancies among the countries combined with their distinct underlying interests may scuttle the effectiveness of the institution.

Duda and La Roche (1997) discuss the importance of basin-wide institutions and international organizations in the management of transboundary water conflicts and the facilitation of cooperation. Using the case of the Danube River Basin, the authors argue that states that experience bigger political conflicts should cooperate over issues such as water and environment. Such cooperation may help ameliorate the political conflict. Another important point is that nations should try to develop and test out joint management mechanisms of shared freshwater resources rather than employ compensation or allocation mechanisms. International institutions such as the Global Environmental Facility (GEF) have the capacity to facilitate both of these recommendations. Similarly, Uitto and Duda (2002) consider the role of the GEF in promoting cooperation in the Aral Sea Basin, Bermejo River, and Lake Tanganyika.

Jagerskog (2002) also discusses the role of regimes and institutions, such as the 1955 Johnston negotiations, which culminated in a water-sharing scheme that was never recognized by the states. He argues, however, that this unrecognized agreement actually helped regulate the relations between Israel and Jordan and has facilitated more friendly relations. The author recognizes the limitation of regime theory, arguing that water is sometimes subordinate to other more contentious areas of dispute. The author also discusses the 1994 Agreement between Jordan and Israel, which included an agreement on the disputed water. He then assesses the quality of the regime by looking at its effectiveness, robustness, and resilience in relation to actual events. He applies similar tools to the Joint Water Committee established between Israel and the Palestinian Authority.

Also praising the role of institutions and rules, Henwood and Funke (2002) address the importance of institutions in managing Southern Africa's transboundary water. According to the authors, if water-related problems are perceived to develop into a threat, the water issue will become "securitized." The chances of this taking place increase if a water dispute or regional water issue is part of the foreign policy paradigm of the countries rather than the international relations paradigm. Foreign policy is much more limited. It is more about the national interest of the state. International relations, on the other hand, are more inclusive and broader in scope referring to all forms of interactions, including interactions between governments and nongovernmental organizations over trade, values, ethics and communication — issues that will not create undue tensions. The situation unique to Southern Africa vis-à-vis water places the issue in the foreign policy sphere, which is not good for regional development and stability in Southern Africa. Cooperation rather than conflict must be the basis for the states' interaction and the "desecuritization" of water can only be achieved through provisions that create and institutionalize the capacity to manage shared watercourse systems effectively.

Turton and Henwood (2002) extend the notion of hydropolitics, arguing that Arun Elhance's definition of hydropolitics as "the systematic analysis of interstate conflict and cooperation regarding international water resources" does not take into account the rich literature on water, the environment, society, and culture. Instead, Turton (2002) argued that hydropolitics should cover all political interactions over water and thus it should be defined as: "the authoritative allocation of values in society with respect to water." This is similar to the proposals made above by Dolatyar and Gray (2000). Turton and Henwood (2002) also include works that suggest moving away from the river basin as a unit of reference and instead allow for interbasin analysis. To a certain extent, the notion of interbasin could be considered as a unit of analysis assuming that cooperation is possible and that externalities from such expansion are internalized. A compelling example of interbasin transfers of water between SADC countries is provided by Heyns (2002). The work outlines, in our view, all the necessary items for consideration for policy-makers in evaluating the feasibility of interbasin transfers. Since interbasin transfers within the jurisdiction of one country have recently become rather "popular," the suggested framework could be applied to assist in the analysis of transboundary interbasin transfers. Still, international transfers are more complicated and more is needed in the suggested framework to address it.

Giordano and Wolf (2003) provide another assessment of the importance of institutions. The authors argue that the difference between conflict over water and cooperation over water is attributed to the degree of institutions embodied in a river basin. Specifically, evidence of how institutions can serve to defuse tensions is seen in basins with large numbers of water infrastructure projects. In fact, co-riparian relations are more cooperative in basins with established water treaties — by extension higher levels of institutional development. In addition to reviewing international legal principles and conventions that have refined principles of shared water management, the authors cite the actual treaties states have negotiated over

shared waters. The authors' broad approach to treaty analysis allows them to make specific recommendations for fostering higher levels of institutionalism in different river basins via several key factors such as equitable distribution of benefits, flexible criteria for water allocation, and water quality and conflict resolution mechanisms.

A new framework based on network analysis is of interest in shared water as it allows comparison of various management systems across states and cultures. Blatter and Ingram (2001) employ new approaches for the study of water such as network analysis, discourse analysis, historical and ethnographic analysis, and social ecology analysis. According to the authors, the meaning of water and other water policy issues are not fully captured in the context of the nation state or other modern approaches, which is "beyond human control and rational calculation" (p. 4). Blatter (2001) explores the notions of network analysis and discourse analysis — phenomena also associated with the notion of epistemic communities in the international relations lingo of the constructivist persuasion — in the context of Lake Constance. Blatter considers the influence of ideas, institutions, and cross-border networks in transboundary water policies. Accordingly, this is a new political landscape where political actors, communities, and organizations are embroiled in the process of change and reconstruction — symbolic meaning and shared issue framing become extremely important. These nontraditional influences led to the development and success of cross-border cooperation in regulating boating and pollution on Lake Constance (p. 94).

In the context of the Black Sea, DiMento (2001) argues that even in a watercourse where riparians are divided by nationalist fervor, ethnic conflict, exclusionary ideologies — elements that divide actors — cross-boundary networks, discourses on cooperation, institutions, and legal regimes can emerge. This example provides additional tools for the analysis and management of water bodies. In fact, DiMento concludes that despite the claims of many of the Black Sea riparians that they cannot be environmentally sensitive given their difficult economic state and needs, efforts have emerged pointing to a new understanding of transboundary interaction and institutionalizing procedures essential for international cooperation to combat the Sea's degradation. DiMento specifically points to the role of the Black Sea Environmental Program (BSEP), developed under the auspices of the United Nations Environment Program and the Global Environmental Facility, in bringing together international legal principles and technical and financial instruments to support efforts by the riparian countries in their ongoing efforts at rehabilitation and protection of the Black Sea. The challenges are plenty, DiMento admits, but the institutionalization of particular principles and values makes the process more amenable to success.

Meijerink (1999) also developed a unique approach — a framework for decision-making on international river issues. The basin for which this framework is applied is the Scheldt Basin that lies within France, Belgium, and The Netherlands. Meijerink focuses on the process of the negotiations among the riparians and attempts at predicting the direction at which the negotiation process will develop. The analysis covers the period 1967–1993 that includes 14 rounds of negotiations and the final agreement that has been reached.

Another new approach to cooperation over water is offered by Kuffner (1998) who advocates a concept of sharing international rivers by jointly managing them to the maximum mutual benefit through an international agency, instead of dividing the waters and managing them separately. Kuffner criticizes the traditional solutions to water division among parties that are often stipulated in agreements on the account that they are based on a rather rigid allocation formula and do not provide for adjustments to changing conditions. Kuffner suggests the interconnection of water systems between states, with the aim of buying and selling water when the need arises, or allowing the transfer of water surplus in one system to an adjacent system. The solution would require a physical conveyance system and agreements regarding water trade, specifying the price and quality of water. He cites the example of the Lesotho Highlands Project as a possible case to emulate in the Jordan River Basin. Implied in Kuffner's analysis is a challenge to the notion of state sovereignty, and a neglect of the fact that rights to the water will still have to be assigned to companies by, most likely, governments, which means that water quantities will still have to be divided among countries. A similar approach — joint management of the resource — is suggested by Fitelson and Haddad (2001), who developed a joint management scheme for the Mountain Aquifer shared by the Israelis and the Palestinians. However, while Kuffner suggested an international agency to manage the shared resource, Fitelson and Haddad's (2001) management scheme consists of a committee that is based on experts from the two riparians.

## Negotiation

In this section, we discuss the relationship between hydropolitics and negotiation theory. In addition to Chapter 7, Chapter 9 will also consider these elements in a more detailed fashion. Nonetheless, in this section we review and categorize some of the main literature pertaining to such concepts as prenegotiation, third-party intervention, culture and negotiation, the position of states along a river as a form of power in a negotiation process, asymmetrical negotiations, and economic discrepancies among the parties.

Faure and Rubin (1993) introduce perhaps one of the less analyzed concepts in the process of negotiations over water — culture. The work includes river basins from across the globe. Specifically, Deng (1993) analyzes the conflict over the construction of the Jonglei Canal between North and South Sudan; Slim (1993) considers how the clash of political cultures between Turkey, Syria, and Iraq and between Iraq and Syria has contributed to the conflict over the Euphrates; Lowi and Rothman (1993) argue that given the intractable conflict between the Arabs and Israelis, it is only when the larger political issues (e.g., identity, recognition, and security) are discussed seriously that cooperation on water can advance in a more meaningful manner and at the same time help the negotiation on the larger issues gain more momentum.

Another element of the negotiations process is power, which was discussed in the context of conflict and cooperation in the previous international relations section.

According to Zartman and Rubin (2000), however, the conventional definition of power, where the state with the mightiest military and the strongest economy will have its way in negotiations, or will have overwhelming influence, should be scrutinized. In the negotiation process, power is better understood as being issue-specific rather than static and aggregate. The example of the Indo-Nepali water relations is analyzed by Gyawali (2000) who considers the overwhelming aggregate power of India (military and economic might) versus the issue-specific power of Nepal (owning the sites where hydroelectric plants can be built). Relying on negotiation concepts and tactics developed by Habeeb (1988), Gyawali argues that while India and Nepal have negotiated agreements that have been perceived by Nepal to have overwhelmingly benefited India, the issue of hydroelectric generation has not been permanently settled. Only a fraction of the benefits that can accrue, if large storage dams are built deeper in Nepal, have so far been attained. Gyawali reviews some of the inner political workings of the India–Nepal water relationship, arguing that Nepal has been able to increase its bargaining power.

Kremenjuk and Winfried (1995:8–9) also discuss location and geography as an element of power in environmental negotiations. The authors argue that a downstream nation is more likely to ask for strict controls of water pollution than an upstream nation. In that context, Faure and Rubin (1995:22–23) argue that when it comes to pollution issues, for example, the upstream interest may be far less inclined to take the problem seriously, let alone to bear responsibility for devising an appropriate solution, than the downstream interest. To support it, Matthew (1999:171) contends that downstream states are more likely to be concerned about the future and more willing to participate in a collective management scheme than upstream states. In such a scenario, parties differ in their dependence on an agreement as well as their motivation to negotiate one.

Economic discrepancies among states are also a factor in negotiations over water. The literature deals with the limited resources and assets that a poor nation can bring to bear relative to a richer nation. As a negotiating tactic, a bargaining strategy held by the weaker party is to deprive the stronger actor of what it desires. According to Sjostedt and Spector (1993:311–312), cooperation from the poorer country will ensue if the richer country provides economic and financial incentives. Weak states may use their incapacity, relative to stronger states, to comply with certain provisions desired in a cooperative management, as a leverage to receive benefits.

Barrett (2002) developed a theory for interstate cooperation over shared resources and considered the notion of asymmetries as an element of international environmental agreements. The theory is applied to global shared resources such as the ozone layer and to regional water resources such as the Aral Sea and the Rhine in Europe. In the context of asymmetrical negotiations, Barrett argues that to encourage participation in and enforcement of a treaty, concessions can be extracted and financial and technological aid can be guaranteed in return for compliance. Similarly, according to Young (1994:134–135) and Underdal (2002), those states which believe that they have been treated fairly and that their core demands have been

addressed will be more inclined to make agreements work and will stand by their commitments.

Economic differences among the parties reflect their attitudes toward the environment. Richer nations and poorer nations may value the same resource in completely different ways. Poor countries may have more of a propensity to pollute to the detriment of wealthier countries with higher pollution standards. According to Compte and Jehiel (1997:64), mutually beneficial agreements between states with heterogeneous preferences may require side payments. Similarly, Martin (1995:73) argues that heterogeneities in capabilities and preferences create possibilities for tradeoffs among international actors. For example, states that have intense interests in environmental protection are willing to make economic sacrifices. In essence, this is a kind of *exchange* whereby a state may agree to forgo benefits on some issues in return for concessions on others (pp. 81–82).

The literature, therefore, provides us interesting insight into water and negotiations. To induce cooperation, in general, or pollution abatement, in particular, in asymmetric situations — whether it is positional or economic asymmetry — side-payments may have to be employed or issue linkage will have to be the strategy. The geographical upper hand of upstream states may thus give it an advantage in negotiations with downstream states. At the same time, the relative economic disparity of one country and its propensity to pollute, relative to another country, may win it some concessions in negotiations over pollution abatement. This is investigated in Dinar (2007) and to some degree in Lemarquand (1977).

## GLOBAL STUDIES

A recent trend in transboundary water research includes efforts by geographers, economists, and international relations scholars to focus on global analysis of water treaties, and other aspects of cooperation among basin riparians. This trend follows a similar branch in international economics that addresses peace–war relationships among states and determinants of cooperation (e.g., Polachek, 1980, 1997; Reuveny and Kang, 1996).

Giordano *et al.* (2002) suggest that the international level of water conflict among riparian states and domestic water and nonwater events in each of these states are linked. Using three case studies in the Middle East, South Asia, and Southern Africa, the authors apply both cooperation/conflict indexes and contextual analysis to make their point. A similar proposition but using a wider set of observations and a more comprehensive set of variables can be seen by Hensel *et al.* (2006). They add an interesting angle to the cooperation theory, arguing that cooperation is more likely where basin level institutions exist, and also, where riparian-level institutions are supporting cooperation. A similar argumentation has been made by Giordano and Wolf (2003), but the work by Hensel *et al.* (2006) is also supported by empirical analysis of treaty data.

Both Giordano *et al.* (2002) and Hensel *et al.* (2006) do not use the global river basin data set. Several studies utilize the treaty data set of Oregon State University (OSU). Song and Whittington (2004) and Espey and Towfique (2004) explain differences in treaty making among riparians of transboundary river basins, using geographical, economic, political, cultural, and trade variables. It is also interesting to point to the work by Sigman (2004), who assessed econometrically the role of trade among riparian states in achieving better pollution control arrangements. We also note an article by Toset *et al.* (2000), which attempts to explain conflict over water among basin riparians and across a large number of river basins based on similar variables.

The literature also provides some antagonistic theories as to the linkage between scarcity (of resources) and conflict/cooperation. Giordano *et al.* (2005) suggest that at highly scarce and highly abundant situations, the likelihood of conflict is relatively low, but at medium level of abundant/scarcity levels, the likelihood of conflict is higher. The authors amend their argument of resource scarcity with the role of scarcity, of proper institutions, and the role of trade. No empirical support to their propositions is provided. A somewhat different theory is suggested by Hensel *et al.* (2006). They claim that resource-poor basins form environments that are highly competitive, leading to inability to create institutions or ineffective institutions to handle conflict over these scarce resources. In resource abundant basins, the opposite is the case. Therefore, their theory suggests that more cooperation will be more evident in resource-abundant locations. Using a subset of 57 transboundary basins, the authors attempt to demonstrate that as the level of scarcity increases, conflicts are more likely. In a third theoretical development, Dinar (2006a) suggests the term “Scarperation” to argue that at low levels of scarcity (abundance) and at high levels of scarcity, riparians are less likely to cooperate, for different reasons. In the case of the low scarcity, they have no reason to cooperate as each has sufficient amount of the resource. At high scarcity levels, there is so little or nothing to share that their cooperation may not be effective. Cooperation will be most effective and thus most likely in the moderate scarcity zone. Thus the cooperation curve displays a hill-shaped behavior with regard to scarcity level. Dinar *et al.* (2007) apply this theory to a dataset of 226 bilateral basins, as is reported below.

Dinar *et al.* (2007) investigate the determinants of cooperation between riparians of bilateral rivers. They prove the hill-shaped behavior of scarcity-cooperation interaction. In addition, international trade and governance in the basin affect the likelihood of cooperation. Geography was found less important in explaining levels of cooperation, but the authors suggest that geography explains treaty arrangements rather than likelihood of treaty formation or level of cooperation. Addressing the structure of bilateral rivers’ treaties, Dinar (2005; 2006b; 2007) shows the interaction between the geography of the transboundary river and the nature of agreement over scarce resources. In particular, the author assesses the impact of geography and economic variables on side-payment and cost-sharing patterns in 271 recorded bilateral treaties.

A very useful study has been conducted by Wolf *et al.* (2003) who assemble a Geographical Information System database in order to identify basins at risk of eruptible conflicts. Using GIS technology, a data set that includes historic events of biophysical, socio-economic, and geopolitical events are compiled and used to identify basins at risk for the future.

**For Further Discussion.** So far, this chapter has reviewed works from quite a number of disciplines. If you are a manager of a consulting firm that was awarded a contract to study a water conflict in a river basin and to suggest solutions, how would you recruit your consultants and how would you prioritize the sequence of the work?

## CONCLUSION

Shared water resources are subject to conflict and, at the same time, are also a source for cooperation. Our much-focused review in this chapter does not cover the entire list of works in the field, but it provides the necessary mix of the disciplines we include in the book: law, international relations, economics, and planning.

While we focus in our review on a subset of disciplines, we are aware that the field of conflict and cooperation over shared waters has come a long way in the last decade. In addition to the sources referred to in footnotes 1 and 3, various publications that represent these different disciplines can be found in Beach *et al.* (2000), which includes both earlier publications and an extended list of journal publications in an annotated format.

We also note an extensive compilation of international water treaties found in the Atlas of International Freshwater Agreements (UNEP and OSU, 2002) and the Transboundary Freshwater Dispute Database of Oregon State University (OSU).<sup>7</sup> One can also refer to the Food and Agriculture Organization for earlier treaties and other depositories, such as the United Nations Treaty Collection and the International Water Law Institute of the University of Dundee, to locate treaty texts.<sup>8</sup>

The literature on international law is very rich, but also focused. Only recently, with the adoption of the 1997 UN Convention on the Non-Navigational Uses of International Water Courses did work in international law take a step toward a

<sup>7</sup><http://www.transboundarywaters.orsu.edu>

<sup>8</sup>Systematic index of international water resources treaties, declarations, acts and cases by basin, *Food and Agriculture Organization*, Legislative Studies, V I N 15, 1978, Systematic index of international water resources treaties, declarations, acts and cases by basin, *Food and Agriculture Organization*, Legislative Studies, V II, N 34, 1984; Food and Agriculture Organization, WATER-LEX, <http://faolex.fao.org/waterlex/>; United Nations Treaty Collection, <http://untreaty.un.org> (subscription required); International Materials, International Water Law Research Institute, University of Dundee, [http://www.dundee.ac.uk/law/iwlri/Research\\_Documents\\_International.php](http://www.dundee.ac.uk/law/iwlri/Research_Documents_International.php)

more comparative analysis of international disputes and agreements. This is a trend that we tried to capture in the review and will further address in Chapter 3.

International relations literature is not rich in work that is comprehensive, but focused more on cases rather than on explaining sources of differences among cases. A synthesis work is needed to facilitate better understanding of processes and trends. The emerging globalization is surely a field that should be more investigated by international relation experts to explain opportunities for better cooperation over shared water.

The field of economics is underrepresented in the literature reviewed in this book. This is not to say that economics is not important or that economists are not interested in international water issues. It is probably a combination of several factors, including difficulty in obtaining accurate data and information, and the ability to communicate the results to the decision-makers in the respective river basins. Therefore, economists should develop models that do not rely on sophisticated approaches, which necessitate accurate data that is probably as scarce as the water in the basin they are investigating. Regardless, economic analysis for identifying conditions for cooperation in various basins is greatly needed. Economic justification of cooperative arrangements and development options is the first step toward the initiation of a negotiation process that hopefully will lead to an agreement.

And finally, while each of the disciplines we reviewed has a legacy and potential, it is clear from the review that each discipline by itself cannot provide sufficient explanation to the spectrum of issues and cases in the field of shared water. What we hope we were able to show is that the various approaches are actually complementary and jointly provide better explanations and more useful solutions to shared water problems. This observation or belief is reflected in the rest of the book.

### Practice Questions

1. Provide a critical evaluation of the strong and weak aspects of International Water Law, addressing fairness, efficiency, and sustainability of the resource allocation.
2. Review and discuss at least two approaches that have been suggested in the literature for managing transboundary water.
3. In their papers, Giordano *et al.* (2005), Hensel *et al.* (2006), and Dinar *et al.* (2007) suggest a certain relationship between level of resource abundance/scarcity and conflict/cooperation. (a) Draw the suggested relationships and discuss the theory used in each paper to explain the proposed relationship. (b) What in your opinion are the strong and weak parts in each theory?

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