TRANS-BOUNDARY RIVER BASINS: A DISCOURSE ON WATER SCARCITY, CONFLICT, AND WATER RESOURCE MANAGEMENT

Timothy Riley, B.A.

Thesis Prepared for the Degree of

MASTER OF ARTS

UNIVERSITY OF NORTH TEXAS

December 2003

APPROVED:

Irene Klaver, Major Professor
Thomas La Point, Committee Member
Julie Smith, Committee Member
Eugene Hargrove, Committee Member and Chair of the Department of Philosophy & Religion Studies
Sandra L. Terrell, Interim Dean of the Robert B. Toulouse School of Graduate Studies

Riley, Timothy, Trans-boundary river basins: a discourse on water scarcity, conflict, and water resource management. Master of Arts (Philosophy), December 2003, 148 pp., 3 tables, 19 maps, references, 252 titles.

This thesis is an inquiry regarding the interconnections between water scarcity, geopolitics, resource management, and the strategies for developing effective ways to resolve conflict and encourage sustainable water resource use in developing countries. The ecological services of trans-boundary rivers are explored in conjunction with the potential impacts to freshwater availability due to economic modernization, water resource development, and decision making regimes that determine how water is allocated among competing users. Anthropogenic stressors that induce water scarcity and the geopolitical mechanisms of conflict are studied. A discourse on the creation and functional extent of global and localized water ethics is investigated, emphasizing the importance of perceptual dispositions of water users in understanding the value of trans-boundary river basins.

ACKNOWLEDGEMENTS

I would like to acknowledge Dr. Irene Klaver and the members of my committee for allowing me the opportunity to pursue such an interdisciplinary project. This thesis embarks beyond the horizons of philosophy, political science, or environmental studies. To truly understand water scarcity and trans-boundary rivers, one must work through the hermeneutics of each of these discourses simultaneously, which, in the end, created this hybrid work, derived from these disciplines, yet also distinctively different.

I also owe a tremendous debt of gratitude to Samantha Medlock for providing invaluable comments throughout the many drafts of this work.

Finally, I wish to recognize and thank my mentor, Dr. Richard Owsley (1923-2003), who shaped my vision of philosophy, tutored me in the art of phenomenology and life, and provided the encouragement to pursue *ἀλήθεια* wherever it may be found.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF MAPS

CHAPTER 1

WATER SCARCITY, VIOLENCE, AND SOCIAL POLICY

Introduction

Rivers must have been the guides which conducted the footsteps of the first travelers. They are the constant lure, when they flow by our doors, to distant enterprise and adventure; and, by a natural impulse, the dwellers on their banks will at length accompany their currents to the lowlands of the globe, or explore at their invitation the interior of continents.[1]

This thesis is an inquiry regarding the interconnections between water scarcity, geopolitics, resource management, and the strategies for developing effective ways to resolve conflict and encourage sustainable water resource use in the developing world (formerly labeled as the "Third World" during the cold war era). In the last three decades, various authors have forwarded theories relating to how the acquisition, diversion, and use of trans-boundary river flows affect regional political stability and potentially instigate conflict or even violence among developing riparian states. Drawing from literature in the fields of international relations theory, geography, environmental science, economics, and philosophy, the problems of equitable appropriation and effective water resource management are discussed through a discourse grounded upon the rethinking of institutional regimes as facilitators of an integrative and sustainable architecture for water consumption, public health, and environmental protection.

[1] Henry David Thoreau*,"* Week on the Concord and Merrimack Rivers," in *Walden and Other Writings of Henry David Thoreau*, ed. Brooks Atkinson (New York: The Modern Library, 1992), p. 321.

Understanding the interconnections among ethics, politics, environmental science, and economics requires a fundamental recognition that trans-boundary rivers are *perceived* contextually and defined in terms of use and value through various interpretative means. Therein, the very presence of trans-boundary rivers is simultaneously understood differently by multiple stakeholders. For instance, national water agencies may interpret the rivers as a complex system of flows that must be controlled to ensure adequate flood prevention and hydroelectric generation, while local farmers may see rivers as solely a water source for irrigation. Other interpretations and values may be operative and deduced through sociopolitical discourses or religious beliefs. In order to understand how conflict, or even violence, may emerge surrounding the use and allocation of trans-boundary river waters, one must first de-construct the myriad interpretations and assumptions made by competing water user groups. Deciphering predispositions and articulating different attitudes and demands placed upon trans-boundary rivers represents a critical step in efforts to resolve disputes. Technical and engineering stressors often turn on the demands of sociopolitical and economic interests; those interests are ultimately derived from chosen or adopted ethical value systems. Thus, a critical investigation of implicit or explicit value choices is a necessary function of any inquiry studying the interconnections between water management, conflict, and resource scarcity.

The method selected for this work is a phenomenological one. Phenomenology is a philosophical *practice*, rather than a system of ideas, where the emphasis is the study of truth through critically interpreting phenomena.[2] In essence, phenomenology is a methodological exercise in studying how one interprets the outside world without

[2] Dermot Moran, *Introduction to Phenomenology* (New York: Routledge, 2000), p. 4-6.

first prescribing a generalized system of explanations. The philosophical onus of inquiry is not on *what* a phenomenon is, but rather *how* it is we come to understand and ascribe meaning to the phenomena and the world around us. The very word phenomenon comes from the ancient Greek *phainomenon*, meaning the manifest or self-showing. Phenomenology is then the logical discourse of how an observer comes to recognize the presence of a phenomenon, or as Martin Heidegger states, "The term 'phenomenology' expresses a maxim that can be formulated: 'To the things themselves!' (*zu den Sachen selbst*)."[3] Additionally, phenomenology is a study always of interconnected events, situations, objects, or ideas, and rejects the notion that discrete phenomena can be separated from their contextual surroundings without losing or adopting new meanings. This contextual-focused study allows for the revealing of often hidden operative assumptions ensconced in competing management interests of natural resources.[4] The revealing of these value-laden assumptions allows for convergent and divergent issues to emerge and become open for discussion.

Particularly in the field of environmental studies, great attention must be paid to how we comport ourselves to objects and ideas in the world around us. In a certain sense, understanding the demands placed upon natural resources requires a epistemological realization that geopolitical and management discourses are derived from "situated knowledge," defined and bounded within the unique socio-historical, ethnic, and religious backgrounds that shape our worldviews.[5]

---

[3] Martin Heidegger, *Being and Time*, trans. Joan Stambaugh (Albany: State University of New York Press, 1996), p. 24. Text in parenthesis added by author.
[4] John van Buren, "Critical Environmental Hermeneutics," *Environmental Ethics* 17, no. 3 (Fall 1995): 259-276.
[5] Christopher J. Preston, "Conversing with Nature in a Postmodern Epistemological Framework," *Environmental Ethics* 22, no. 3 (Fall 2000): 227-240.

Heidegger argues that over time certain understandings of a particular phenomenon become the primary operative construct that defines the presence of that phenomenon. This defining interpretation dominates the observer's understanding, concealing other potential ways of comporting with the phenomenon.[6] In particular, external conditions, customs, and habitats can reinforce and solidify this single interpretive variation, making it difficult to perceive other ways of thinking about it or recognizing the legitimacy of others who may understand the phenomenon in a different way.[7] In essence, this can be considered the root cause for conflict surrounding any valuable resource. In a simple example, we tend to see a chair as an object for "sitting" before that of other possible uses, such as a place for holding books beside a computer desk or a raised platform used for standing while watering plants. In a more complex example, trans-boundary rivers are often understood first as conduits of flowing water, which are captured or diverted for human consumption, before seeing them as ecological systems or as socio-historical resources. The concept of *truth* through a phenomenological discourse is the effort to "open" the presence of phenomena to a variety of potential meanings, simultaneously revealing a contingent diversity of possible interpretive variations.[8]

Applied throughout this thesis, the above described phenomenological method is used through a series of examples of trans-boundary river basins in order to decipher the unique set of circumstances and forces that create a water scarcity condition or a conflict-prone geopolitical environment. As will be argued later, conflict over water

[6] Martin Heidegger, "A Question Concerning Technology," in *Martin Heidegger: Basic Writings*, ed. David Farrell Krell (San Francisco: HarperSanFrancisco Press, 1993), p. 307-342.
[7] Heidegger, *Being and Time*, p. 118-123.
[8] See generally, Martin Heidegger, *Contributions to Philosophy (From Enowning)*, trans. Parvis Emad and Kenneth Maly (Bloomington: Indiana University Press, 1999).

resources is primarily a function of anthropogenic stressors, induced by competing claims on the function and value of the services provided by trans-boundary rivers. Thus, to understand the nature of such conflict requires interpreting the dispositions of the engaged water user groups. Doing so, in turn, means revealing the operative theories of international relations, notions of state power and autonomy, and the grounding from which ethical systems are derived when placing value upon trans-boundary rivers. Ultimately, decisions on effective river management and equitable distribution of resources are bounded within an encompassing "water ethic." Argued throughout the thesis, such a water ethic is a function of the phenomenological dispositions unique to each water user and the interpretive meanings ascribed to the river that place and justify a sense of value or worth upon it. In a sense, a water ethic is merely the re-appropriation of existing value systems to the phenomenal presence of the river. These existing value systems may come from religious, ethnic, or local customs or traditions, or may be products of socio-historical paradigms, philosophical, or political and economic theories. Therein, the focus on developing a water ethic should emphasize the phenomenal presence of the river as a *locale* from which a multitude of interpretations may be derived. Conflicting interpretation is then an inevitable function of the rivers. Yet, an emphasis on truth seeking as keeping open these, at times, divergent interpretations can provide for the necessary ethical vantage point from which to begin understanding how the river is used and the effects those uses will have on all the potential water users at the local, regional, and international levels.

At present count, there are 261 trans-boundary rivers, covering almost one half of the total land surface of the Earth. Within these 261 river basins, lie the territories of 145 countries, each vying for control and capture of the river's precious flow, often to the detriment of downstream riparians. Given fresh water's distinctive preeminence as the world's only non-substitutable natural resource, and the legally ambiguous and limited ability to manage international flows, recent attention has been directed at understanding how these rivers can instigate or quell potentially dangerous competition, tension, or even violence among riparian water users. Some have even gone so far as to say the wars of the twenty-first century will be wars over water.

Recent literature in the field of international conflict explores linkages between resource scarcity, population growth, political instability, and conflict. A recurring scenario is that of "resource geopolitics," or the theory that scarce and non-substitutable resources that cross political boundaries are potential locales of political, economic, and social tensions. Furthermore, research alludes to the direct relationship between that of natural resource scarcity and potential for conflict.[9] These authors consistently refer to various precursor conditions that may exacerbate this potential for conflict in trans-boundary river basins. Aridity, rapid population growth, socioeconomic modernization or reform, and preexisting hostilities in the basin, can frustrate cooperative ventures, the enforcement of international treaties, or induce a general condition of distrust.

[9] Shira B. Yoffe and Aaron T. Wolf, "Water, Conflict and Cooperation: Geographical Perspectives," *Cambridge Review of International Affairs* 12, no. 3 (Spring-Summer 1999): 198, citing Tedd Robert Gurr, "On the Political Consequences of Scarcity and Economic Decline," *International Studies Quarterly* 29 (1985); Thomas F. Homer-Dixon, "On the Threshold: Environmental Changes as Causes of Acute Conflict," *International Security* 16, no. 2 (Fall 1991): 76-116; R.D. Lipschutz*, When Nations Clash: Raw Materials, Ideology and Foreign Policy* (Cambridge: Ballinger, 1989).

Traditional notions of resource *scarcity* have been questioned. Recent research explains that often a population's access to freshwater is more a function of social, political, or technological forces than the mere lack of water itself. In this sense, water scarcity is as much a problem in arid environments like those found along the Jordan River in the Middle East as in so called water-rich basins like the Lower Mekong River in South East Asia.

Additionally, many scholars and water managers argue that multilateral agreements and linkages of water management with other geopolitical issues should be encouraged to support watershed level development that is respective of the concerns and interests of all riparian states. Conversely, others argue that such strategies result in complicating solutions to water scarcity and create unenforceable and inefficient water management regimes that fail to meet intended expectations. They believe that appropriate water infrastructure, flood control, hydroelectric generation, and irrigation projects are best managed primarily through intra-state institutions that are accountable and empowered. With a combination of competitive market incentives, regulatory oversight, and effective use of technology, access to water for the majority of water users within a state is not only possible, but economically advantageous.

As developing countries seek greater self-reliance, many are rapidly industrializing or bringing into production greater tracks of arable land. This poses a greater strain on riparian environments, increasing the severity and types of water pollution, and significantly degrading the overall potential "natural capital" embedded within trans-boundary river flows. Once again, this new phenomenon is forcing water managers to rethink traditional notions of scarcity as not just a quantitative vector, but a

qualitative one as well. Upstream riparian states can pollute trans-boundary rivers, avoiding the external costs of pollution by sending it downstream. Toxic chemicals, salinity, or siltation, among other possible pollutants, render downstream waters useless, or worse, dangerous to public health and the natural environment.

This thesis investigates the use of regulatory practices to encourage appropriate use of competitive free market controls, and the protection of riparian and associated ecologies, which can facilitate the use of trans-boundary rivers as powerful political, economic, and social devices for protecting public health and preserving ecological integrity, while still balancing the needs of other riparian stakeholders. This philosophy of multi-objective water resource management requires a shift from multilateral water development to a more regional or local system of controls that are organized specifically around meeting the needs of water users. Arun P. Elhance writes:

> This multiple-use potential of freshwater, especially trans-boundary water resources, combined with the certainty of growing water scarcities in many arid and semi-arid regions of the Third World, makes hydropolitics between riparian states that share international river basins one of the most urgent, complex, and contentious issues that the developing countries and the international community will have to face and resolve in the next century.[10]

In many instances, such a refocusing will involve significantly reordering a state's or region's development—adding or removing land from agricultural production, the reallocation of water for industrial or commercial uses, or altering population densities to better match the carrying capacity of the land. Additionally, greater emphasis must be placed on protecting environmental flows. Some of these solutions are easily obtainable; others are extremely difficult. Various institutional options are proffered and

[10] Arun P. Elhance, *Hydropolitics in the 3rd World: Conflict and Cooperation in International River Basins* (Washington, D.C.: United States Institute of Peace Press, 1999), p. 4.

many examples are used to paint a picture of the complexity and diversity of managing trans-boundary rivers throughout the developing world.

Chapter 2, entitled “The Importance of Trans-Boundary Waters,” introduces the expansive scope of services trans-boundary river basins provide. Increasing population and service demands are straining existing water sources and radically reshaping how the international community and riparian states formalize and implement international agreements. Specifically addressed in the chapter is a discourse concerning how modern scholars and water managers define trans-boundary rivers. The hydrology and geomorphology of these basins are also studied. The questions of how much water is available for use and how much we really need are outlined.

Chapter 3, entitled “Water Scarcity and Violence,” introduces the geopolitics of trans-boundary rivers. This chapter explores how rivers as political and economic resources can destabilize the geopolitical environment. Specifically, the chapter reveals how water scarcity is often a human-induced process as opposed to a hydrological condition. Additionally, the chapter explores the claimed linkages between water scarcity and potential violence that may culminate into “water wars.” The chapter also looks at the management obstacles water managers and policymakers must face in using or reacting to the use of trans-boundary flows.

Chapter 4, entitled “Trans-Boundary Water Resource Management,” investigates the historical management regimes used in the last century by riparian states. Central government controls versus local level approaches are compared. Specifically, the connections between economic development and water use are addressed. Finally, the chapter concludes with a discourse defending the position that international treaties and

multilateral basin development in the developing world should not deter from the sociopolitical benefits of effective intra-state water development.

Chapter 5, entitled “A Water Ethic and Conclusions,” begins with a discourse on how several researchers have defined a water ethic. Instead of seeking to develop a new ethic, the argument is made that a water ethic already exists and is the manifestation of multiple influences, such as religion, philosophy, economics, science, or politics. A core element is the phenomenal presence of the river itself, which creates a common locale from which divergent perceptions, or ethics, can converge. An effective water ethic is one that allows for the shaping of individual ethics in such a manner as to allow the river to remain open to the perceptions and value systems of others.

Overview of Main Themes

Prior to reviewing literature specific to the topics enumerated in this thesis, it is important to clearly identify and define certain key thematics that will influence the analysis proffered. The following overview of several themes present in the thesis represent certain critical philosophies, historical practices, and management strategies associated with managing, allocating, and conserving trans-boundary rivers. Some are entirely philosophical in nature, meaning they represent fundamental attitudes or dispositions that contextually shape how trans-boundary rivers are perceived. Others are political, establishing a theoretical framework which decision makers use to identify and manage political, socioeconomic, and technological risks in acquiring, preserving, or utilizing trans-boundary rivers.

From the perspective of international foreign policy and geopolitics, the argument is made that trans-boundary rivers exist as sociopolitical phenomena, and that the conflicts, management strategies, and resource allocations of trans-boundary flows, are uniquely and ultimately determined by the *perception* of the value held by trans-boundary rivers. Harold and Margaret Sprout, political scientists from Princeton University, articulated a critical and often cited international relations theory based upon the perception of sociopolitical international "environments." They wrote:

> Environmental factors become related to the attitudes and decisions which comprise a state's foreign policy only by being perceived and taken into account in the policy-forming process. The statesman's *psychological* environment (that is, his image, or estimate, of the situation, setting, or milieu) may or may not correspond to the *operational* environment (in which his decisions are executed). But in policy-making, as we have stressed before, what matters is how the policy-maker imagines the milieu to be, not how it actually is.[11]

This argument is critical to developing a common ground between multiple competing discourses to converge into discursive and practical inquiries of trans-boundary rivers, allowing for an opening to critically compare and complement multiple dialogues simultaneously. Such discourses offer greater, more comprehensive insights into the complex interface of water scarcity, conflict, and social policy.

Second, a variety of political theories describe the behavior of states. The one predominately used throughout this thesis is known as "geopolitics." Geopolitics espouses the idea that power, prosperity, and prospects of a state are defined by geographical conditions and that national autonomy and control are highly valued

[11] Harold Sprout and Margaret Sprout, "Environmental Factors in the Study of International Policies," in *Conflict Prevention and Resolution in Water Systems*, ed. Aaron T. Wolf (Northampton: Elgar Reference Collection, 2003), p. 31.

functions of the state.[12] Geopolitics includes the synthesis of geography, anthropology, and politics, viewing the state as a "living organic unit" that is dynamic and subject to international and domestic forces.[13] Geopolitics also includes environmental factors as structural and nonstructural forces that can influence policy and governance of the state.

Third, the argument is made that trans-boundary rivers in reference to geopolitical conflict, the potentiality of violence, and discussions related to appropriate management strategies, are perceived as a *resource*. Many environmental philosophers have argued against merely perceiving "nature" as a resource designed for human consumption. Paul Taylor arguing for a "biocentric" theory of human society's *place* in the environment, develops a method for integrating policies and practices that can "transform what would otherwise be situations of confrontation between humans and nonhumans on the level of basic interests into various means of mutual accommodation."[14] Earlier, Aldo Leopold, considering the meaning of "ethics" as defining the relationship of one entity with other interdependent individuals or groups for the purpose of "co-operation," developed the idea of the "land ethic," which, "simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land."[15] Furthermore, Hugh McDonald argues for a deontological environmental ethic that establishes a non-anthropocentric and non-subjective theory of

[12] Ronnie D. Lipschutz, "Environmental Conflict and Environmental Determinism: The Relative Importance of Social and Natural Factors," in *Conflict and the Environment*, ed. Nils Petter Gleditsch (London: Kluwer Academic Publishers, 1997), p. 35-50.
[13] James E. Dougherty and Robert L. Pfaltzgraff, Jr., *Contending Theories of International Relations: A Comprehensive Survey, 4th Addition* (New York: Longman New York, 1997), p. 48-60.
[14] Paul W. Taylor, *Respect for Nature* (Princeton: Princeton University Press, 1986), p. 303.
[15] Aldo Leopold, *A Sand County Almanac: and Sketches Here and There* (New York: Oxford University Press, 1949), p. 202-204.

duties to species and habitats.[16] Ultimately, perceiving nature as merely a resource through the use of technology and the philosophy of utilization reduces, in this case, trans-boundary rivers, to a single perceptional dimension, standing in "reserve" for human consumption and waste, and, thus, denies us access to the river as a multi-faceted, complex presence.[17]

The intent of this thesis is not to challenge a biocentric philosophy. Rather, the focus is on the modes of interaction between riparian states, institutional organizations, and water users with how they perceive the values derived from the services provided by the rivers. As such, a great portion of this thesis focuses on resource questions and the mechanisms that create water scarcity and the potential for conflict in trans-boundary river basins. The potential for intra-basin and domestic geopolitical tension, or possible violence, is ultimately a function of management choices, or what actions or inactions are taken by a riparian state and how other states or stakeholders respond. From this assumption, conclusions reached in this thesis argue that key management strategies can be identified to facilitate the sustainable allocation and distribution of trans-boundary waters in an equitable and ecologically conscious way, while protecting the integrity of individual states and stakeholder values and perceptions.[18]

The final thematic is that water *scarcity* is intricately bound to both environmental and anthropogenic conditions. Scarcity is not merely the product of arid and semi-arid environments or the availability of annual flows. Management strategies also create

---

[16] Hugh McDonald, "Toward a Deontological Environmental Ethics," *Environmental Ethics* 23, no. 4 (Winter 2001): 411-430.
[17] Leslie Paul Thiele, "Nature and Freedom: A Heideggerian Critique of Biocentric and Sociocentric Environmentalism," *Environmental Ethics* 17, no 2 (Summer 1995): 171-190.
[18] For greater discussion of divergent philosophical values and convergent environmental policy views, see generally, Bryan G. Norton, *Toward Unity Among Environmentalists* (New York: Oxford University Press, 1991).

scarcity through misuse, inequitable distribution, and destruction of the ecological and hydrological integrity of these basins. Geopolitical factors and environmental conditions combine in a complex matrix of decisions that ultimately determine if the *perception of scarcity* is operationally present and how riparian states respond to that perception.

The Jordan River and Conflict: A Global Challenge

Before beginning an analysis of trans-boundary rivers, the next section provides a brief historical overview of water scarcity and conflict issues surrounding one of the most commonly cited trans-boundary rivers in the world, the Jordan River. Often considered an isolated, third world, arid-environment problem, the Jordan River basin experience, nevertheless, offers keen insights to the universal problem of using trans-boundary flows.

Particularly for Middle Eastern trans-boundary rivers (the Jordan, Nile, and Tigris-Euphrates basins), since the early 1980s, many have suggested that water-poor states would be willing to wage war over access rights to water resources.[19] Discussed in depth later, few experts agree that water alone will cause wars. Yet, as an integrated element in the overall complex matrix of ever entwining international politics, water resources, such as trans-boundary rivers, can and do function as destabilizing forces, especially in developing riparian states already ensconced in regional turmoil. In the case of the Jordan River and other trans-boundary river basins, on- and off-channel

[19] Peter Beaumont, "Water and Armed Conflict in the Middle East—Fantasy or Reality?" in Gleditsch, *Conflict and the Environment*, p. 355, citing Clive Agnew and Ewan W. Anderson, *Water Resources in the Arid Realm* (London: Routledge, 1992); Ewan W. Anderson, "Water: The Next Strategic Resource," in *The Politics of Scarcity – Water in the Middle East*, ed. Joyce R. Starr and Daniel C. Stoll, (Boulder: Westview, for Centre for Strategic and International Studies, 1988); Malin Falkenmark, "Middle East Hydropolitics: Water Scarcity and Conflicts in the Middle East," *Ambio*, vol.18, no. 6 (1989): 350-352; Joyce Starr, "Water Wars," *Foreign Policy*, no. 82 (Spring 1991): 17-36.

projects to develop water resources are often analyzed more in terms of geopolitical constraints versus engineering and technological obstacles.

Israel is one of the most water poor countries in the world.[20] Additionally, Israel has been consistently exceeding available water supplies since the 1970s by over-mining groundwater from three aquifers located primarily underneath the Palestinian populated West Bank. Israeli population densities are geographically disassociated from the region's freshwater resources and Israel is highly dependent upon upstream flows from beyond its political borders and upon aquifers located under the disputed West Bank.[21]

The Jordan River illustrates the complex interrelationship water holds within a region's cultural, political, and historical fabric. The conflict over water rights is not merely a technological or contemporary dilemma. Rather, the importance of the Jordan River is well-documented in the chronology of Jewish immigration and return to Israel dating back to the first part of the twentieth century Zionist movement.

Miriam Lowi argues that the root conflict over the Jordan River is a twofold convergence. Historically, Palestine is an area of few natural resources. Given its relatively small landmass, the margin for viable economic autonomy is quite narrow, especially when internal agricultural and energy production are considered to be necessary components of Israeli national security. Secondly, the early Zionist ideological movement sought to establish a Jewish national home in Palestine. The *idea* of Palestine was grounded not so much in the belief that land was a basic

[20] Kliot Nurit, *Water Resources and Conflict in the Middle East* (London: Routledge, 1994).
[21] Miriam R. Lowi, "Transboundary Resource Disputes and Their Resolution," in *Contested Grounds: Security and Conflict in the New Environmental Politics*, ed. Daniel H. Deudney and Richard A. Matthew (New York: State University of New York Press, 1999), p. 225.

requirement of settlement, but rather, that the need to "return" to Palestine, to work and "redeem" it would define the cultural return to Israel, or *Eretz Yisrael*, "land of Israel." [22] For the socialist Zionists, water was a dominant part of the ideology of agriculture, encouraging food production and self-sufficiency as a key achievement of *Eretz Yisrael*. By working the land, the Israeli people would become rooted to *this* place and thus become literally productive instead of being a people defined merely by trade and commerce.[23]

From an ideological aspiration to an historical necessity, unrestricted access and control of the Jordan's flow became a non-negotiable prerequisite for the survival of a Jewish national home in Palestine. At the Paris Peace Conference in February 1919, the World Zionist Organization declared:

> The economic life of Palestine, like that of every other semi-arid country depends on the available water supply. It is, therefore, of vital importance not only to secure all water resources already feeding the country, but also to be able to conserve and control them at their sources.[24]

Yet, despite such ardent efforts, Israelis would not acquire secure control of the Jordan headwaters. In one of the few instances where water played a key part in instigating a violent action, it would be war that redefined the geographical and hydrological maps of the Middle East.

---

[22] Miriam R. Lowi, *Water and Power: The Politics of a Scarce Resource in the Jordan River Basin* (New York: Cambridge University Press, 1995.), p. 40.
[23] See generally, Mostafa Dolatyar and Tim S. Gray, *Water Politics in the Middle East: a Context for Conflict or Co-operation* (New York: Macmillan Press, 2000), p. 96-98; Lowi, *Water and Power*, p. 51, citing Walter Laqueur, *A History of Zionism* (New York: Schocken Books, 1972).
[24] Lowi, *Water and Power*, p. 40, citing Jacob Hurewitz, "The Zionist Organization's Memorandum to the Supreme Council at the Peace Conference," in *Diplomacy in the Near and Middle East*, vol. 2 (Princeton: D. Van Nostrand Co., 1956), p. 48.

MAP 1-1: The Jordan River Basin

Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

On November 29, 1947, the United Nations General Assembly voted by resolution to partition Palestine into a Jewish state, an Arab state, and an internationally protected Jerusalem under United Nations (UN) control. One day before British forces withdrew from Palestine, Israel declared itself a sovereign, independent Jewish state on May 14, 1948. Neighboring Arab states attacked the following day, instigating the first contemporary Arab-Israeli War. By war's end, the Israel military had conquered and secured political and police control over an area 20 percent larger than what had been previously allocated under the 1947 Partition Plan. The Armistice Agreements of 1949 gave Israel several key waterbodies within its state boundaries. Most of the upper catchments of the Jordan, one of three headwater tributaries — the Dan, Lake Huleh, Lake Tiberias, including its southern outlet, and part of the western shoreline of the Dead Sea — all fell under Israeli control. By the Armistice Agreements, Israel has secured access to many of the key areas to fulfill the original Zionist vision of a self-sufficient irrigation state, capable of defending *and* feeding all returning Jewish immigrants.

Israel's newly acquired water resources placed a significant burden upon the Kingdom of Jordan, which had in the aftermath of the fighting, become the unwitting refuge for over 450,000 Palestinian Arabs. Additionally, another 400,000 Palestinians still living on the West Bank became dependent upon the Jordanian state for support. With the influx of Arab refugees, the Kingdom of Jordan's population tripled in less than two years. [25]

[25] Ibid., p. 46-47, citing Peter Gubser, *Jordan: Crossroads of Middle Eastern Events* (Boulder, Colo.: Westview Press, 1983).

Israel, too, faced a formidable population explosion. With sovereignty achieved and immigration barriers nullified, the Jewish state of approximately 700,000 doubled within the first four years of existence. As early as 1952, more than 684,000 new Jewish immigrants, arriving from Europe, the Middle East, and North Africa, returned to Palestine, each bringing different linguistic, cultural, and ethnic backgrounds. With such an influx of people, in an arid and semi-arid environment having limited natural resources, the Jordan River system began to play a crucial role in the strategic planning for the new state.[26]

The Six Days War of 1967 redrew the geopolitical map of the central Middle East. With the occupation of the Sinai Peninsula, Gaza Strip, West Bank, Golan Heights, and Eastern Jerusalem, Israel more than tripled its territory and provided an unprecedented improvement in the state's strategic military and resource assets. The new land demarcations ultimately reduced Israel's borders by 25 percent, while increasing its shoreline by half.[27] Israel also gained a new array of water resources. By occupying the Syrian Golan Heights, the headwaters of the Banias tributary were added to the state's water coffers. Only the Hasbani tributary, originating in southeastern Lebanon, lay beyond Israeli control.[28] Additionally, with the West Bank came strategic groundwater resources, such as the large Yarqon-Taninim aquifer and smaller aquifers that discharge into the Bet She'an and Jezre'el Valleys.[29]

---

[26] Ibid., p. 49.
[27] Ibid., p. 147, citing Gerald H. Blake and Alasdair Drysdale, *The Middle East and North Africa: a Political Geography* (New York: Oxford University Press, 1985), p. 289-291.
[28] Aaron T. Wolf, "'Hydrostrategic' Territory in the Jordan Basin: Water, War, and Arab-Israeli Peace Negotiations," in *Water in the Middle East: A Geography of Peace*, ed. Hussein A. Amery and Aaron T. Wolf (Austin: The University of Texas Press, 2000), p. 85.
[29] Sinaia Netanyahu, Richard E. Just, John K. Horowitz, "Bargaining Over Shared Aquifers: The Case of Israel and the Palestinians," in *Conflict and Cooperation on Trans-Boundary Water Resources*, ed. Richard E. Just and Sinaia Netanyahu (Boston: Kluwer Academic Publishers, 1998), p. 42.

Since 1967, Israel has continuously exploited the water resources under its jurisdiction. Diversion projects, inter-basin transfers, and aquifer withdrawals severely limit the quality and quantity of freshwater available to other stakeholders in the Jordan basin.[30] As Israel's population increases and greater efforts are made to industrialize and modernize its economy, greater demands are placed on the supplies within the basin and the multitude of communities that rely on the Jordan's flow for survival.

The Jordan River reveals that water scarcity is as much a product of anthropogenic causes—history, religion, and geopolitics—as it is an environmental constraint. Throughout the developing world, similar stories and struggles exist. Geographically flowing through states while politically severing international relationships, trans-boundary rivers carry with them a difficult and complex challenge for resource managers and the peoples and economies dependent upon their flows for survival.

[30] Arnon Soffer, *Rivers of Fire: The Conflict over Water in the Middle East*, trans. Murray Rosovsky and Nina Copaken (New York: Bowman & Littlefield Publishers, 1999), p. 161-189.

CHAPTER 2

THE IMPORTANCE OF TRANS-BOUNDARY RIVERS

Waters of International Concern

In the nineteenth century, international treaties and agreements concerning the development and protection of trans-boundary rivers were limited mainly to navigational issues.[31] Called "waters of international concern," trans-boundary rivers historically have been seen as navigational conduits for thriving market interests, particularly for imperial states like Great Britain, which controlled and relied heavily upon foreign trade with its colonial protectorates.

In the twentieth century, the scope of international management of trans-boundary rivers has evolved substantially in order to accommodate increasing conflicts of demand for trans-boundary flows.[32] Increasing competition from various classes of stakeholders (irrigation, hydroelectric, flood control, environmental and recreational uses, as well as traditional needs of navigation), have expanded the scope of international attention beyond navigation to include the more general "allocation of use." The 1966 Helsinki Rules expanded this scope further, introducing for the first time the term "drainage basin."[33] With the advent of the drainage basin, resource managers and policymakers began to think beyond the riverbank and into a broader understanding of a trans-boundary river's hydrological environment. A drainage basin could be associated

[31] For a comprehensive reading of historical multilateral water treaties, see James L. Wescoat Jr., "Main Currents in Early Multilateral Water Treaties: A Historical-Geographic Perspective, 1648-1948," *Colorado Journal of International Environmental Law and Policy* 7, no.1 (Winter 1996): 39-74.
[32] Gerald H. Blake, "International Transboundary Collaborative Ventures," in *Political Boundaries and Coexistence*, ed. Werner A. Gallusser (Berlin: Peter Lang, Proceedings of the IGU-Symposium, May 1994), p. 359-365.
[33] Gwyn Rowley, "Political Controls of River Waters and Abstractions between Various States within the Middle East: Laws and Operations, with Special Reference to the Jordan Basin," in Amery and Wolf, *Water in the Middle East: A Geography of Peace*, p. 229-31.

with a river, lake, drainage channel, groundwater, open and closed canals, perennial and ephemeral streams, estuaries, floodplains, erosional areas, and riparian flora and fauna. And, in the last several decades, with increased economic activity in developing nations, water quality has become an important component to water resource management. As a result, water pollution was integrated into the definition of a drainage basin as early as the late 1960s. [34]

As each trans-boundary river has different characteristics and resource management demands, it is important to consider all vectors that either benefit or reduce the optimal use and protection of the overall drainage basin. As such, geographical and hydrological boundaries, as well as, geopolitical demarcations play an important role in evaluating the potential value of trans-boundary flows. The services provided by a drainage basin are a function of geomorphologic conditions; yet the management of trans-boundary rivers is often dependent upon political boundaries. The nexus between these two types of boundaries define the sociopolitical and economic potential of trans-boundary water resources. Additionally, water quality and quantity are impacted by activities throughout the watershed, not just along the mainstem of the river. Upland activities, such as deforestation, urbanization, and pollutant discharges into smaller-order tributaries can directly and indirectly affect the overall service capacity of trans-boundary rivers.

From this discussion, one conclusion that riparian states may glean is that the management of trans-boundary rivers ought to be regulated and utilized at the drainage basin level. This scope of management would expansively include relevant

[34] Richard E. Just and Sinaia Netanyahu, "International Water Resource Conflicts: Experience and Potential," in Just and Netanyahu, *Conflict and Cooperation on Trans-Boundary Water Resources*, p. 4.

geographical, political, and economic interests and boundaries.[35] However, there is a problem with such an expansive scope. As the umbrella of management successively increases, so does the scale of management issues. Addressing single-interest, localized development issues, such as the management of navigational interests, only transportation flows are relevant. Yet, as appropriation and diversion become factors in the scope of management, more riparian states become part of the management problem, but all the riparian states may not necessarily need to participate. Historically, most international agreements have tended to be bilateral. As more stressors and resource demands are added, international treaties or agreements become increasingly more complex and difficult to establish and maintain. Additionally, when atmospheric conditions and land use in the basins are considered, non-riparian states become involved, making joint management even more difficult to achieve.[36] Discussed in greater depth later, evidence and historical practice indicate that less ambitious concepts of management below that of the basin level may have more practical relevance than multifaceted international agreements.

Defining Trans-boundary Rivers

As indicated above, political boundaries define how the world's trans-boundary flows are divided. In 1997, the United Nations General Assembly adopted the *Convention on the Law of the Non-Navigational Uses of International Watercourses*, which defined *watercourse* as a system of surface waters and groundwaters constituting by virtue of their physical relationship a unitary whole, which provided for broad reaching scope, inclusive of watersheds, and established a definitional grounding for

[35] See generally, Ludwik A. Teclaff, "Fiat or Custom: the Checkered Development of International Water Law," *Natural Resources Journal* 31, no. 45 (1991).
[36] Just and Netanyahu, "International Water Resource Conflicts," p. 6.

interpreting the impacts one riparian state's water diversion activities may have on another state within the river basin.[37] In 1958, the United Nations published the first comprehensive collection of trans-boundary rivers of the world. This early assessment identified 166 major trans-boundary basins. In 1978, the 1958 assessment was updated by the UN, which identified 214 basins. Until 1998, this assessment was the only comprehensive documentation of trans-boundary basins. Particularly by today's standards, the 1978 map was extremely crude and subject to large errors. [38]

The hydro-political map has changed significantly since 1978. Dramatic improvements in identifying geographical characteristics and topographical measurements have allowed for more precise watershed maps. Additionally, widespread geopolitical changes have redefined states and their borders. For instance, within the Indus River Basin, the 1947 creation of an independent Pakistan and India from the British Government, divided the river, and therein, a complex irrigation canal system. The upper portions of the canal's water flows from the Indus remained in India, rendering Pakistani farmers highly dependent upon Indians passing flows downstream. In some instances, India used this new upstream status against Pakistan, even stopping flows through dam headworks from reaching Pakistan's irrigation canals.[39]

---

[37] Stephen McCaffrey, "The UN Convention on the Law of the Non-Navigational Uses of International Watercourses: Prospects and Pitfalls," in *International Watercourses: Enhancing Cooperation and Managing Conflict*, ed. Laurence Boisson de Chazournes (Washington, D.C.: World Bank, Technical Paper No. 414), p. 18.

[38] Peter H. Gleick, *The World's Water 2000-2001: The Biennial Report on Freshwater Resources* (Island Press: Washington, D.C., 2000), p. 7, citing United Nations, *Integrated River Basin Development* (New York: UN Publications, 1958) and United Nations, *Registry of International Rivers* (Oxford: Pergamon Press, prepared by the Centre for Natural Resources, Energy and Transport of the Department of Economics and Social Affairs, 1978).

[39] Asit K. Biswas, "Indus Water Treaty: the Negotiating Process," *Water International* 17 (1992): 201-209, citing A. A. Michel, *The Indus Rivers* (New Haven: Yale University Press, 1967).

TABLE 2-1: Number of International River Basins, by Continent[40]		
Continent	United Nations (1978)	Wolf et al. (1999)
Africa	57	60
North and Central America	33	39
South America	36	38
Asia	40	53
Europe	48	71
TOTALS	**214**	**261**

In 1998, the World Resources and Worldwatch Institute prepared a new trans-boundary basins map for all major international watersheds using new digital elevation map sets.[41] In 1999, Aaron Wolf and colleagues released a new comprehensive drainage analysis based on the new maps. This new registry was compiled using digital elevation models crosschecked with existing topography maps. The new watersheds were created from superimposing this new data coverage over a completely updated political map. The new registry now identifies 261 major trans-boundary basins, covering over 45 percent of the land surface of the Earth (excluding Antarctica). 145 states include territory within these trans-boundary basins, with 33 states having more than 95 percent of their total land area in such basins.[42]

Ecosystem Services of Trans-Boundary River Basins

Researchers, politicians, water managers, and engineers often discuss trans-boundary rivers simply in terms of flow rates, volume, and maximum diversions and allocations, overlooking an important consideration that these river systems provide numerous ecological services. While geopolitics drives the perception of these systems as bounded or transected by political boundaries, the expansive watersheds of trans-

[40] Table derived from Peter H. Gleick, *The World's Water 2000-2001*, p. 33, citing United Nations, *Registry of International Rivers* and Aaron T. Wolf, et al., "International River Basins of the World," *International Journal of Water Resources Development* 15, no. 4 (December 1999).
[41] Ibid., p. 27, citing C. Revenga, et al., *Watersheds of the World: Ecological Value and Vulnerability* (Washington, D.C.: World Resources Institute, 1998).
[42] Ibid., p. 28, citing Aaron T. Wolf, "International River Basins."

boundary rivers encompass a vastly more complex set of ecological functions, ultimately essential to providing municipal, industrial, and agricultural water demands. Emergent domestic and foreign conflicts, resource scarcity, and water management demands require critical attention, but equally important to remember is that trans-boundary rivers are sensitive environmental phenomena that are more than merely a conveyance of surplus flows from uplands to the ocean.[43]

Rivers can be basically understood as an interconnected system of *flows*. Ultimately, the management of water for human consumption is the dynamic regulation of flows, ensuring enough water moves through rivers and into diversion structures and irrigation canals, or sequestered behind dams in large reservoirs to be used for drinking water or hydroelectric generation. The hydrological cycle of water is of critical importance to water managers. For sustainable development, the hydrological cycle creates the management imperative to consider the entire watershed of a river, from the uplands and tributaries, to the riparian corridor of the mainstem itself.[44] Stephen Merrett also discusses the "hydrosocial cycle" of water, or the interface of the hydrological cycle with the demands for human consumption. The river then is one element in a complex matrix of engineering, technological, economic, and political decisions and management strategies, whereby rivers are the conduits from which raw water is captured, stored, or diverted, and to which treated (and untreated) wastewater, brine, pollutants, and sediments are discharged.[45] In essence, the "natural" and "constructed" systems of the

[43] Jon Martin Trolldalen, "International River Systems," chap. 8 in *International Environmental Conflict Resolution: The Role of the United Nations* (Oslo: World Foundation for Environment and Development, 1992), p. 62.
[44] E. C. Pielou, *Fresh Water* (Chicago: The University of Chicago Press, 1998).
[45] Stephen Merrett, *Introduction to the Economics of Water Resources: An International Perspective* (Boulder: Rowman & Littlefield Publishers, 1997), p. 5-22.

river are intriguingly intertwined. Louke van Wensveen argues, in essence, that this hydrosocial cycle, along with other ecosystem processes, creates an ethical imperative to preserve an "ecosystem sustainability" virtue.[46] Such a virtue ethic implies that sustainability is interconnected with other spheres of influence, including economic and social demands, and that the needs of ecological functioning must be balanced in relationship to other service requirements. Additionally, Philip Cafaro argues that a similar virtue ethic supports the idea of "human excellence" and "flourishing" within the context of recognized and valued ecological limits.[47] Ontologically, identifying the "place" of trans-boundary rivers at the watershed level creates the opportunity for defining rivers in terms of their interactive and relational structures to surrounding environmental features and with anthropogenic activities.[48]

Forests, vegetation, fish, and wildlife are dependent upon trans-boundary rivers. Modifications to upland ecosystems due to urban encroachment, floodplain modification, and pollutant loading through inadequate wastewater treatment, agriculture, and industry can dramatically impact both the quality and quantity of available flows. Impoundments such as dams, canal diversions, and the creation of reservoirs along tributaries of trans-boundary rivers can also severely limit or shift peak flows to downstream riparian states. Additionally, hydrological and hydraulic shifts of upland, interior tributaries reveal the expanding complexity of managing trans-boundary

[46] Louke van Wensveen, "Ecosystem Sustainability as a Criterion for Genuine Virtue," *Environmental Ethics* 23, no. 3 (Fall 2001): 227-242.
[47] Philip Cafaro, "Thoreau, Leopold, and Carson: Toward an Environmental Virtue Ethics," *Environmental Ethics* 23, no. 1 (Spring 2001): 3-18.
[48] Daniel Berthold-Bond, "The Ethics of 'Place': Reflections on Bioregionalism," *Environmental Ethics* 22, no. 1 (Spring 2000): 5-24.

rivers because managers are concerned not merely with main on-channel diversions or flows, but the entirety of ecological impacts within the watershed.

MAP 2-1: Eastern Europe, Including Danube River
Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

For instance, twelve (12) riparian states are located along the Danube River; many like Hungary and Romania are rapidly developing alongside continued industrial activity from economically advanced countries such as Germany and Austria. As such, water quality along the Danube has suffered from a multitude of point and non-point source discharges from wastewater treatment and solid waste disposal, agri-businesses, chemicals, pulp industries, metal, mining, textile industries, and livestock production.[49] Nutrients and hazardous substances, such as pesticides, ammonia, polychlorinated biphenyls (PCB) and polyaromatic hydrocarbons (PAH), and metal contaminants along the mainstem and tributaries of the Danube, have had a significant impact on aquatic wildlife and drinking water quality for downstream riparian states.[50]

A combination of environmental and anthropogenic factors can also impact the ecological services in trans-boundary river basins. In Bangladesh, for example, situated at the bottom of the Ganges-Brahmaputra-Meghna drainage basin, multiple influences have had a significant negative impact on public safety, irrigation, agriculture, fishing, and water quality. The basin drains over 1.75 million km^2 of which only 7 percent is located within Bangladesh. Yet, over one-third of Bangladesh's population—40 million people—is dependent upon the Ganges River for fisheries, agriculture, municipal consumption, forestry, and salinity management near the delta, which support the Sundarbans, the largest mangrove forest in the world.[51] The physiological and hydrological features of the basin consist of the upland reaches in the Himalayan

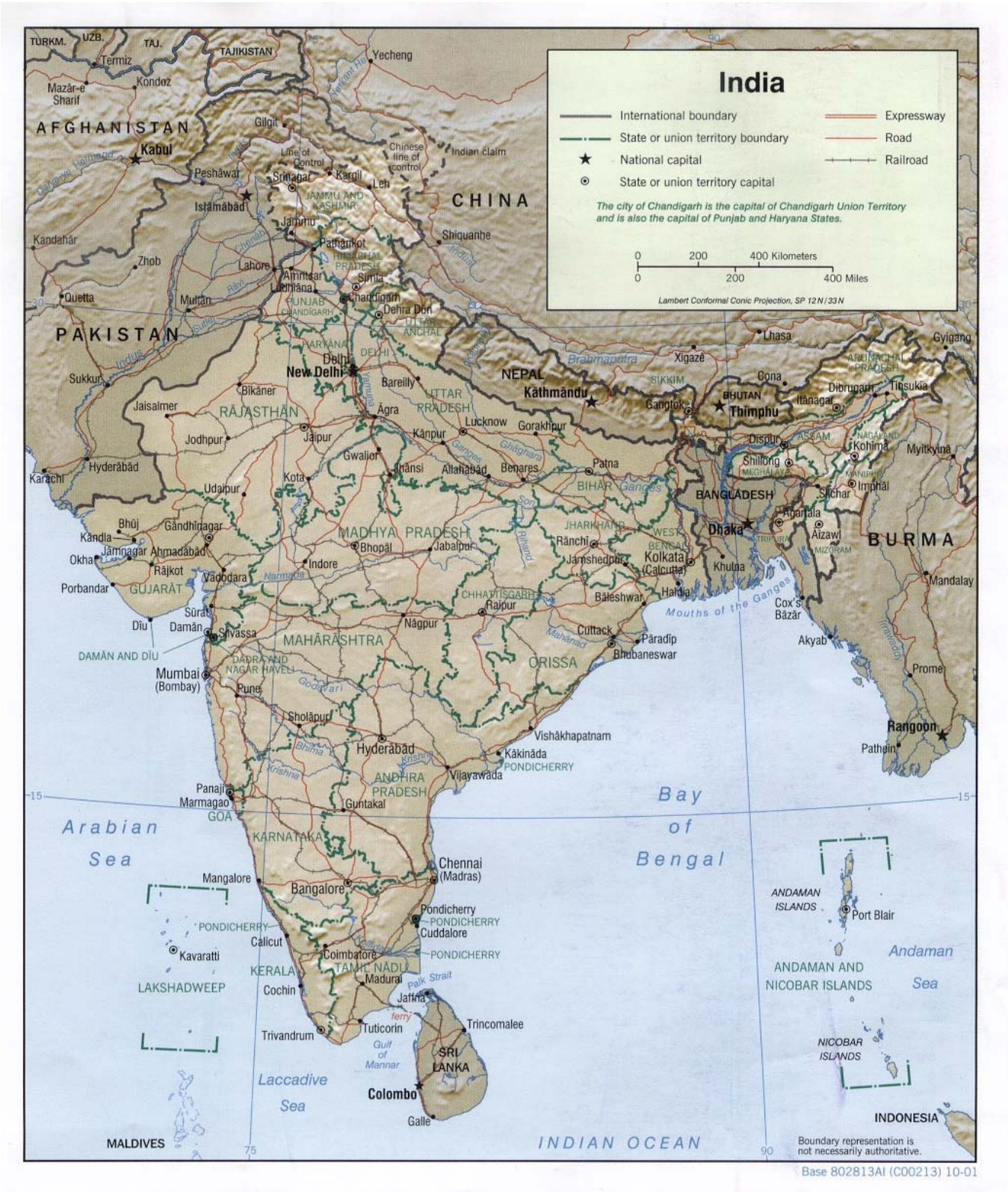
[49] Hans-Peter Nachtnebel, "The Danube River Basin Environmental Programme: Plans and Actions for a Basin Wide Approach," *Water Policy* 2, no. 1-2 (1999/2000): 116.
[50] Ibid., p. 116-118.
[51] M. Asafuddowlah, "Sharing of Transboundary Rivers: The Ganges Tragedy," in *The Peaceful Management of Transboundary Resources*, ed. Gerald H. Blake, et al. (London: Graham & Trotman/Martinus Nijhoff, 1995), p. 209-210.

Mountains. As the youngest mountain range in the world, tectonic effects create landslides and massive soil erosion that flows through the basin, depositing silt along the alluvial floodplains that dominate Bangladesh. Subject to dynamic course shifting, these rivers radically alter the landscape, making it difficult to farm along the banks. Most of southern Bangladesh, including the Ganges delta, is created by this affect, causing massive subsidence, endangering entire communities. Anthropogenic stressors, such as dam construction, upstream diversions, pollutant loading, poorly treated or untreated sewage, has increased flooding and desertification, decreased water quality, and negatively impacted estuary commercial fishing stocks. Both factors have limited the overall ability to effectively develop and manage natural resources dependent upon the rivers.[52]

A Question of Volume and Location

Given the complex variability of the Earth's atmosphere, land surface, and energy fluxes, freshwater is heterogeneously distributed temporally and geographically throughout the planet. In many instances, this uneven distribution of water generates problems related to water management and allocation. The question of scarcity is not one of volume but of geography and access. Here, location is both temporally and spatially distinguished and equally important in understanding the modern dilemma of the rising tide of water scarcity.

[52] M. Abdul Hafiz and Nahid Islam, "Environmental Degradation and Intra/Interstate Conflicts in Bangladesh," In *Environmental Degradation as A Cause of War, Volume III*, ed. Kurt R. Spillman and Günther Bächler (Zürich: Verlag Rüegger, 1996), p. 1-108.



MAP 2-2: India and Bangladesh

Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

It is estimated that the total volume of water on earth is approximately 1.4 billion cubic kilometers (km^3); of which, only 2.4 percent of it, or about 35 million km^3, is fresh water.[53] Most of this fresh water is trapped year-round as permanent ice or snow, primarily in Antarctica and Greenland, or contained in extremely deep groundwater aquifers.

For human consumption, lakes, rivers, soil moisture, and shallow groundwater aquifers constitute the vast majority of available irrigation and potable water supplies, and is estimated to be only 200,000 km^3 of water—less than 1 percent of all fresh water on earth and only one one-hundredth of a percent (0.01%) of all water on the planet.[54] Making the resource game even more difficult, most of this water is located too remotely for effective human consumption. Additionally, only approximately 40,000 km^3 of water from surface runoff and groundwater recharge constitute the primary source of human consumption.[55] Annually 500,000 km^3 of moisture evaporates—86 percent from the oceans and 14 percent from land—returning to earth as precipitation, this water constitutes the 40,000 km^3 for human consumption and is ultimately the total inflow of water into watersheds. As Leif Ohlsson argues, "A sustainable use of rivers, reservoirs and lakes, as well as aquifers, ultimately depends on keeping annual consumptive water withdrawal within the limits of the yearly precipitation a particular watershed receives from the oceans."[56] While only an estimated 3,800 km^3, roughly 10 percent, is used for human annual consumption, with the remainder returning to surface hydrologic

[53] Gleick, *The World's Water 2000-2001*, p. 21.
[54] Ibid., p. 22.
[55] I. A. Shiklomanov, "World Water Resources and Water Use: Present Assessment and Outlook for 2025," State Hydrological Institute, St. Petersburg, Russia, 1999.
[56] Leif Ohlsson, "The Role of Water and Origins of Conflict," in *Hydropolitics: Conflicts over Water as a Development Constraint*, ed. Leif Ohlsson (London: University Press, 1995), p. 5.

systems and aquifers, often these return flows are of reduced water quality.[57] The remaining flows remain beyond effective production. A large fraction of available water exists where water demands are low, such as in the Amazon basin, Canada, and Alaska where rainfall and river runoff due to periodic flooding emerges in very short durations and is generally not available for human consumption. Ultimately water once used becomes contaminated, limiting the potential benefits for down-stream and secondary uses. Most developing countries lack the necessary water treatment infrastructure to properly treat "grey" water for potable uses. Increased pollutant loading, such as brine, human and animal wastes, and herbicides and pesticides can significantly reduce available water for effective irrigated agriculture.

As such, water availability, often only discussed in terms of water spatially (volume) and temporally (flow), has a significant impact on water quality and public health. Dubbed the "International Drinking Water Supply and Sanitation Decade," the 1980s still witnessed 1.3 billion people without access to safe, clean drinking water, and over 1.7 billion without access to appropriate sanitation facilities.[58] Millions of these impacted peoples are heavily or entirely dependent upon trans-boundary river basins. Such conditions have been directly linked to the severe impact of water-borne diseases in developing countries, including outbreaks of dysentery, malaria, cholera, and the multiple parasitic diseases rampant throughout Asia and Africa. In 1996, a World Health Organization study revealed that one person in five does not have access to safe and affordable drinking water, with half of the world's population lacking appropriate

[57] William J. Cosgrove and Frank R. Rijsberman, *World Water Vision: Making Water Everybody's Business* (London: Earthscan Publications Ltd., 2000), p. 6.
[58] Joseph Christmas and Carel de Rooy, "The Decade and Beyond: At a Glance," *Water International* 16, no. 3 (1991): 127-134.

access to sanitation, leading to an estimated 3-4 million deaths dues to waterborne infection, including more than 2 million children dying from diarrhea alone.[59]

Additionally, water scarcity is not merely driven by geographic or temporal factors, but, and perhaps primarily, by political ones. The world's political map is not drawn according to watershed boundaries. In historical and current practice, tradition, economics, cultures, and wars have created nations and countries, most often with little regard to hydrological features. And theoretical water availability per capita of a given population represents a poor assessment of usable water. As discussed in chapter 4, actual water availability per capita depends almost entirely upon socioeconomic factors, such as legality, technology, politics, and the historical disposition of certain groups of peoples, irrespective of a nation's political boundaries.

In many trans-boundary river basins, as population growth and water demands increase, relative water availability is quickly exceeded by generally accepted minimum water requirements. Known as the "water barrier," Malin Falkenmark identifies a threshold level of between 1,000 and 2,000 people for every million cubic meters of water per year to meet minimum water quality requirements.[60] In certain instances, arid and semi-arid states dependent upon trans-boundary flows, such as Israel and Jordon, have already or will cross this water barrier in the near future. Improvements in water efficiency, conservation, and reuse can only forestall the crossing. David Schmidtz argues that immediate needs and economic considerations can force individuals to act contrary to their value systems in order to acquire the necessary resources to survive

[59] World Health Organization, *Water Supply and Sanitation Sector Monitoring Report* (Geneva, 1996).
[60] Malin Falkenmark, "Fresh Water-Time for a Modified Approach," *Ambio* 15, no. 4 (1986): 194-200.

on a daily basis.[61] Particularly in the developing world, where a riparian state is suffering from water scarcity, ethical values that normally respect the river and encourage sustainable consumption are forgotten in the daily tribulations of finding enough water for subsistence farming or domestic consumption.

Hence, while many argue that water resource management strategies are ultimately the end-product of the ethical decisions made by stakeholders, the converse is true as well. Environmental conditions and the accessibility of water resources can function as morally limiting conditions, re-attuning a local or regional attitude from cooperative and sustainable management to one of conflicting and competing demands. In such instances, value systems that project ethical decisions based on potential future impacts to the environment are outweighed by the immediate needs that often include management responses that are unsustainable and detrimental to the riparian ecosystem and downstream water user groups. In a sense, poverty and water scarcity, combined, have the potential to create a self-fulfilling prophecy, whereby resource limitations spur community responses that focus only on immediate needs, limiting the potential for sustainable development opportunities that may remove the instigating causes of the scarcity in the first place. Such efforts can help redress the critical motivational problems associated with establishing public policy decisions that attempt to restructure individual behaviors and actions.[62]

[61] David Schmidtz, "Natural Enemies: An Anatomy of Environmental Conflict," *Environmental Ethics* 22, no. 4 (Winter 2000): 397-408.
[62] Norman S. Care, "Future Generations, Public Policy, and the Motivation Problem," *Environmental Ethics* 4, no. 3 (Fall 1983): 195-214.

The Dilemma of Irrigation

In most trans-boundary river basins dominated primarily by developing riparian states, irrigated agriculture represents the largest consumer of water, generally making those flows unavailable for use by other water demand sectors or even agricultural reuse. Food is produced through a variety of water sources, including natural precipitation, groundwater from aquifers, and artificial irrigation from surface waters, often through inter-basin transfers. Agricultural irrigation accounts for over 85 percent of all water consumed.[63]

Without irrigation water, there would not be enough water to feed the world's current population. Sandra Postel's research reveals that nearly 500 million people live in countries with insufficient water to meet domestic food production requirements, and that a quarter of the entire international trade in food goes to meet those needs.[64]

In developing countries, over 885 million hectares of land are currently in crop production, with the additional possibility of over 2,600 million hectares of land worldwide that may offer productive crop yields with irrigation.[65] However, many argue that the best lands for crop production are already in use, with remaining uncultivated lands remotely located and under important environmentally sensitive zones, such as forests and wetlands, often with inadequate soil or general farming conditions.[66]

---

[63] I. A. Shiklomanov, *World Water Resources: A New Appraisal and Assessment for the 21st Century* (Paris: International Hydrological Programme Report, United Nations Educational, Scientific, and Cultural Organization, 1998).

[64] Sandra L. Postel, "Water for Food Production: Will There Be Enough in 2025?" *Bio-Sciences* 28 (1998): 629-637, and see generally, Sandra L. Postel, *Pillar of Sand: Can the Irrigation Miracle Last?* (New York: W.W. Norton, 1999).

[65] United Nations Food and Agriculture Organization, *World Agriculture: Toward 2010*, an FAO Study, N. Alexandratos, ed. (Rome: J. Wiley and Sons, 1995).

[66] See generally, H. W. Kendall and D. Pimetal, "Constraints on the Expansion of the Global Food Supply," *Ambio* 23, no. 3 (May 1994); I. Carruthers, "Going, Going, Gone! Tropical Agriculture as We Know It," *Tropical Agriculture Association Newsletter* 13, no. 3 (1993): 1-5; L. R. Brown and H. Kane, *Full*

The search for additional irrigable land often comes into direct conflict with increasing land acquisition pressures from urban and industrial development. Under poor management, particularly given marginally performing land conditions, irrigated agriculture can lead to erosion, loss of soil cover, and soil compaction, decreased nutrients and energy inputs, all of which requires greater use of fertilizers, pesticides, and irrigation. Inevitably over time, crop production dramatically decreases due to salinization and nutrient loss. According to Gardner, even with increasing acreages brought into agricultural production, the total cropland per capita has dropped from 0.31 hectares per person in 1983 to under 0.25 hectares in 2000.[67] Recent studies suggest that about 75 percent of agricultural lands in Central America, 20 percent in Africa, and 11 percent in Asia have suffered major degradation.[68]

Historically the scourge of irrigated crop production has been a problem of salinization. River and groundwater naturally contains dissolved salts. Under irrigation, plants take up the water, but leave the salts behind. Particularly in arid and semi-arid environments, large volumes of irrigation water can raise the groundwater table in low-lying valleys, increasing the deposition of salts, which if not corrected, can "poison" the soils for low salt tolerant crops.[69] Human-induced salinization has a distinguished history, paralleling the rise and fall of the first ancient civilizations. For instance, the cultures dwelling between the Tigris and Euphrates River Basins, around the later half of the fourth millennium, B.C.E., thrived off irrigated agriculture, growing primarily wheat.

House: Reassessing the Earth's Population Carrying Capacity (Washington, D.C.: Worldwatch Institute, 1994).

[67] G. Gardner, "Preserving Global Cropland," in *State of the World 1997*, ed. L. Brown (New York: W.W. Norton, 1997), p. 42-59.

[68] Gleick, *The World's Water 2000-2001*, 73, citing S. J. Sherr, "Soil Degradation: A Threat to Developing Country Food Security by 2020?" International Food Policy Research Institute (IFPRI), 2020 Brief 58, Washington, D.C, 1999.

[69] Postel, *Pillar of Sand*, p. 18-19.

After centuries of wheat harvests, dissolved solids in the irrigation water increased soil salinity. Barley, a more salt-tolerant substitute, replaced wheat. By 1700 B.C.E., much of the cultivated land was abandoned by these ancient cities. The near total soil decline was attributed to decreasing soil fertility from increased salinization.[70]

As of 1997, an estimated 267 million hectares of land were under irrigation, or approximately 18 percent of total worldwide cropland in production. There exists a radically uneven distribution of irrigated croplands. Approximately 60 percent of the world's irrigated land is found in Asia.[71] For south-east Asian nations along the Lower Mekong River, dependency on irrigated waters poses a unique geopolitical tension, often fraught with perilous consequences. Lacking an enforceable international treaty, water use and consumption on the lower Mekong River by riparian states is generally unregulated with no clear definition of water rights. Diversion and flood control projects jeopardize agricultural production downstream and commercial fishing, as is the case with Thailand and Vietnam.[72] Domestic unrest between farmers at the local level exacerbates tensions between the riparian states and function as a disruptive force in domestic politics. In Thailand, timber exports represent a major economic force, particularly in the northern portions of the country. Rapid deforestation has displaced indigenous populations, induced soil erosion and loss of biodiversity, and created water

[70] Ibid., p. 73, citing F. Ghassemi, J. A. Jakeman, and H. A. Nix, *Salinisation of Land and Water Resources: Human Causes, Extent, Management and Case Studies* (Sydney: University of New South Wales Press, Ltd, 1995).
[71] Ibid., p. 80.
[72] Prachoom Chomchai, "Management of Transboundary Water Resources: A Case Study of the Mekong," Blake, *The Peaceful Management of Transboundary Resources*, p. 245-259.

scarcity, particularly through the large, water-intensive monoculture plantations of Eucalyptus trees.[73]

MAP 2-3: South East Asia
Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

Complicating water scarcity concerns are the rising costs and decreasing returns on expanding ever more complex irrigated systems. Often the development of these high cost, large-scale irrigation systems means the continuing rapid depletion of aquifers, assimilation of marginally productive lands, and generally increasing conflicts over water priorities and needs. Additionally, water irrigation projects in developing countries are often the response to critical scarcity, where flows are desperately needed. Farmers cannot afford to divert resources and have an extremely short timeframe reference to water demand. Thus, irrigation projects, particularly involving the use of dams and extensive conveyance systems, mean top-end farmers close to the dam headwork will utilize flows first until the reservoir backfills. With an emphasis on using the water, regardless of efficiency, those farmers become locked into irrigation infrastructure that may preclude more efficient usages later and pose both water quantity and quality impacts to downstream users as more flows become available.[74] From the beginning, an environmental scarcity-driven situation may lead to an anthropogenic scarcity, devaluing the effectiveness of the original intent in creating the system in the first place.

[74] Elinor Ostrom, "Crafting Institutions," in *Crafting Institutions for Self-governing Irrigation Systems* (San Francisco: Institute for Contemporary Studies, 1992), p. 62.

CHAPTER 3

WATER SCARCITY AND VIOLENCE

The Destabilizing Force of Water Scarcity

Many researchers have argued that anthropogenic stressors on the environment could pose a destabilizing affect on national and international security.[75] Starting in the 1970s, a variety of scenarios, some more plausible than others, have been proposed. For instance, some believed that environmental stress might shift the balance of power either from or to states, regional security alliances, or globally, creating conflict that may induce violence. Also a topic of heated debate was the concern that environmental degradation could widen the economic divide between industrialized and developing worlds, potentially inciting poorer nations to unite militarily against wealthier nations for greater access to trade and resources. Rising temperatures due to global warming may lead to contention over newly created sea-lanes in the Artic Ocean or more accessible resources in the Antarctic. Increasing populations and loss of viable croplands might produce waves of environmental refugees. These refugees would migrate between borders, consuming what limited resources are available, provoking domestic political turmoil in adjacent countries. Countries may deploy military forces against each other to stave off domestic starvation and maintain crop production by securing dwindling trans-boundary water resources to protect water quantity and quality. Developing countries whose domestic and foreign economy is driven by agriculture

[75] See generally, Richard Ullman, "Redefining Security," *International Security* 8, no. 1 (1983): 133, 143; David Wirth, "Climate Chaos," *Foreign Policy*, no. 74 (Spring 1989): 10.; Robert Gilpin, *War and Change in World Politics* (Cambridge: Cambridge University Press, 1981); A. F. K. Organski and Jacek Kugler, *The War Ledger* (Chicago: University of Chicago Press, 1980); Jack Levy, "Research Note: Declining Power and the Preventive Motivation for War," *World Politics* 40, no. 1 (1987): 82-107.

confronted by increasing water demand stressors could provoke hostilities between urban and rural populations. In another argument, suppliers and exporters use foodstuffs as a socioeconomic weapon should environmental degradation tighten food supplies. Finally, some argue that environmental stress, due to gradual, increased impoverishment of communities, can create ethnic and class conflict, undermine political regimes, and encourage internal insurrection.[76]

In the 1990s, Homer-Dixon argued that in the coming decades, environmental scarcity could plausibly produce five general types of violent conflict. They are: (1) disputes caused directly by ecological degradation; (2) ethnic clashes due to environmental scarcity and population migration; (3) civil strife; (4) scarcity induced interstate war; (5) and global scale "north-south" conflicts (e.g., developed versus developing states). According to Homer-Dixon the first type is unlikely to cause more than sporadic, localized violence. There is a low probability that the fifth type (North-South hostilities) will occur. This also holds true with the fourth possibility—interstate war, particularly over water resources. Therefore, Homer-Dixon focuses on the interconnection between resource scarcity and potential intrastate conflicts involving ethnic and civil strife. Homer-Dixon writes:

> Many developing countries face increasingly complex, fast-moving, and interacting environmental scarcities. These scarcities can overwhelm efforts to produce constructive change and can actually reduce a country's ability to deliver reform. Consequently, environmental scarcity sometimes helps to drive societies into a self-reinforcing spiral of

[76] See generally, William Ophuls, *Ecology and Politics of Scarcity: A Prologue to a Political Theory of the Steady State* (San Francisco: Freeman, 1977); Fen Hampson, "The Climate for War," *Peace and Security* 3, no. 3 (1988): 9; Ian Cowan, "Security Implications of Global Climatic Changes," *Canadian Defence Quarterly* (October 1989); Jodi Jacobson, *Environmental Refugees: A Yardstick of Habitability*, Worldwatch Paper 86 (Washington, D.C.: Worldwatch Institute, 1988); Jessica Tuchman Mathews, "Redefining Security," *Foreign Affairs* 68, no. 2 (1989).

> violence, institutional dysfunction, and social fragmentation. The negative effects of severe environmental scarcity will often outweigh the positive.[77]

All told, such environmental scarcities pose a threat to developing countries, particularly given that the daily well-being of half the world's population of over six billion remains almost entirely bound to local natural resources. Concerning domestic consumption of freshwater, over 1.2 billion lack general access to clean drinking water, with many forced (usually women and children) to walk many miles to acquire the water they need for daily use. For instance, decades of ethnic violence and resource degradation by upstream Mauritania and downstream Senegal along the Senegal River, one of the few major surface water systems in the Western Sahara, have created severe domestic and international tension. Displacing populations and the lack of effective water infrastructure for irrigation and human consumption have limited the economic viability of the region and inflamed political and military tensions.[78] Often lost in the struggle to manage competing resource claims, particularly in developing states, is the preservation of the natural history or cultural heritage values associated with trans-boundary rivers. For instance, the Ganges River, considered a great goddess in riverine form, is an important spiritual and cultural locale for Hindu Indians, who use the Ganges waters in rituals. In fact, a common word for a sacred site is *tirtha*, which means both a place on a riverbank and a crossing point on a river. The Ganges waters are considered as one of the purest, sacred substances that can be offered to other

[77] Thomas F. Homer-Dixon, *Environment, Scarcity, and Violence* (Princeton: Princeton University Press, 1999), p. 5.
[78] Regina Wegemund, "Ethnic and Transborder Conflicts in the Senegambian Region Caused by Environmental Degradation," Spillman and Bächler, *Environmental Degradation as a Cause of War, Volume III*, p. 285-313.

deities.[79] Yet, highland deforestation and discharges of untreated sewage, along with other pollutants, have made the Ganges a heavily polluted and dangerous trans-boundary river and the site for considerable intra-state and international geopolitical disputes. Balanced against such competing claims, it is difficult to preserve the heritage values of these unique rivers throughout the developing world.[80]

TABLE 3-1: Trans-Boundary Rivers Shared by 5 or More States[81]

River Basin	Number of States	States Sharing the Basin
Danube	17	Romania, Hungary, Yugoslavia (Serbia and Montenegro), Austria, Germany, Bulgaria, Slovakia, Bosnia-Herzegovina, Croatia, Ukraine, Czech Republic, Slovenia, Moldova, Switzerland, Italy, Poland, Albania
Congo	11	Democratic Republic of Congo, Central African Republic, Angola, Republic of the Congo, Zambia, United Republic of Tanzania, Cameroon, Burundi, Rwanda, Gabon, Malawi
Niger	11	Nigeria, Mali, Niger, Algeria, Guinea, Cameroon, Burkina Faso, Benin, Ivory Coast, Chad, Sierra Leone
Nile	10	Sudan, Ethiopia, Egypt, Uganda, United Republic of Tanzania, Kenya, Democratic Republic of Congo, Rwanda, Burundi, Eritrea
Rhine	9	Germany, Switzerland, France, Netherlands, Belgium, Luxembourg, Austria, Liechtenstein, Italy
Zambezi	9	Zambia, Angola, Zimbabwe, Mozambique, Malawi, United Republic of Tanzania, Botswana, Namibia, Democratic Republic of Congo
Amazon	8	Brazil, Peru, Bolivia, Colombia, Ecuador, Venezuela, Guyana, Suriname
Lake Chad	8	Chad, Niger, Central African Republic, Nigeria, Algeria, Sudan, Cameroon, Libya
Tarim	7	China, Kyrgyzstan, Pakistan, Tajikistan, Kazakhstan, Afghanistan, India

[79] David Kinsley, *Ecology and Religion: Ecological Spirtuality in Cross-Cultural Perspective* (Englewood Cliffs: Prentice Hall, 1995), p. 59-60.
[80] See generally, Janna Thompson, "Environmental Heritage," *Environmental Ethics* 22, no. 3 (Fall 2000): 241-258.
[81] Table derived from Gleick, *The World's Water 2000-2001*, p. 34.

Volta	6	Burkina Faso, Ghana, Togo, Mali, Benin, Ivory Coast
Aral Sea	6	Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan, China
Ganges/Brahmaputra/ Meghna	6	India, China, Nepal, Bangladesh, Bhutan, Myanmar
Jordan	6	Jordan, Israel, Syria, Jordan, Saudi Arabia
Mekong	6	Laos, Thailand, China, Cambodia, Vietnam, Myanmar
Tigris-Euphrates	6	Iraq, Turkey, Iran, Syria, Jordan, Saudi Arabia
Kura-Araks	6	Azerbaijan, Georgia, Iran, Armenia, Turkey, Russia
Neman	5	Belarus, Lithuania, Poland, Russia, Latvia
Vistula/Wista	5	Poland, Ukraine, Belarus, Slovakia, Czech Republic
La Plata	5	Brazil, Argentina, Paraguay, Bolivia, Uruguay

Such environmental scarcity can lead to chronic, diffused, sub-national violence. In fact, Homer-Dixon goes on to state that depletion of natural resources, including water, will contribute more to social turmoil and the potential for conflict than climate change or ozone depletion in and of themselves.[82] Though environmental scarcity—particularly water scarcity—has not been the primary force behind existing hostilities, it nevertheless, in a complex matrix of sociopolitical, historical, and economic tensions, can exacerbate already difficult and hostile situations. And, as populations rise, coupled with a general trend toward higher per capita consumption of resources, the coming decades may very well see water scarcity dominating the politics of communities, countries, and international forums, such as the United Nations and World Bank.

[82] Thomas F. Homer-Dixon, "Thresholds of Turmoil: Environmental Scarcities and Violent Conflict," Deudney and Matthew, *Contested Grounds*, p. 63.

Mechanisms of Water Scarcity

As alluded to above, water scarcities usually have complex causes, often revealed in subtle and indirect ways. States that may appear to have a national per capita water availability to meet water demands may have severe water deficiencies at the local or regional level.[83] In general, one cause of water scarcity is a function of depleting and degrading a resource, the vulnerability of which is determined by several factors, including the size of the resource versus the size of the consuming-population, and the technologies and practices the population uses in its consumptive behavior. Finally, the size of the population, its technologies, and practices, are the end-product of a diverse array of variables, ranging from women's status to the availability of human resources, and financial capital.[84] Effective conservation and joint-use structures are requirements for sustainable management of trans-boundary flows. However, attaining such goals is extremely difficult with international water bodies because of the extensive inter-dependency required, and thus, many trans-boundary basins remain under-utilized or unilaterally over-exploited due to riparian conflict.[85]

At the sub-national level, incompatible goals related to access, control, and water consumption through diversions, dams, and reservoirs can generate the initial forces of conflict that can translate into larger regional, national, and international conflicts.[86] Thus, local water management issues, while not perceived as interconnected with other potentially international concerns, can individually or collectively, exacerbate interstate

[83] Hussein A. Amery and Aaron T. Wolf, "Water, Geography, and Peace in the Middle East," in Amery and Wolf, *Water in the Middle East*, p. 6.
[84] Homer-Dixon, *Environment, Scarcity, and* Violence, p. 14.
[85] Mikiyasu Nakayama, "Successes and Failures of International Organizations in Dealing with International Waters," *Water Resources Development* 13, no. 2 (1997): 367, citing S. Kirmani and G. Le Moigne, *Fostering Riparian Cooperation in International River Basins,* World Bank Technical Paper No. 239 (Washington, DC: World Bank, 1997).
[86] Jonathan Wilkenfield, ed., *Conflict Behavior and Linkage Politics* (New York: David McKay, 1973).

political relations. Externalities from the use of trans-boundary rivers, such as salinity, modified flow dynamics, pollution, or sewage, can also create fertile grounds for potential interstate conflicts. Even externalities resultant from activities not associated with the physical use or diversion of trans-boundary rivers, such as deforestation, soil erosion, eutrophication, and pollution generated from industries not dependent upon water, can impact water availability domestically and for downstream riparian states.[87]

The *perception* of water scarcity by political elites can induce management responses to secure water resources, often under the banner of national security.[88] Additionally, if a state's response to water scarcity involves a premeditated increase in diversions or the disruption of flow acquisition by downstream riparian states, then the perception of a hostile act can be interpreted. Upstream riparian states may choose to increase diversions from the mainstem of a trans-boundary river or modify tributaries or inter-connected groundwater sources that can potentially create negative impact to downstream riparian states. Even threats from outside the basin may encourage a response to secure trans-boundary resources under the flag of national security. For instance, in the Orontes River basin (Lebenon, Syria, and Turkey), Syria, the region hegemon, which currently has occupying forces in Lebenon for unrelated reasons, has stated that any troop withdrawals will not preclude a continuous presence on the Orontes headwaters to protect Syrian interests against possible attack by Israel located only fifty miles to the south.[89]

---

[87] Trolldalen, "International River Systems," p. 63.
[88] Bertram Spector, "Transboundary Disputes: Keeping Backyards Clean," in *Preventive Negotiation: Avoiding Conflict Escalation,* chap. 9, ed. I. William Zartman (Maryland: Rowman and Littlefield Publishers, 2001), p. 207.
[89] Arnon Soffer, *Rivers of Fire: The Conflict over Water in the Middle East*, trans. Murray Rosovsky and Nina Copaken (New York: Bowman & Littlefield Publishers, 1999), p. 205-212.

Additionally, ethnic tensions associated with water scarcity can induce domestic conflict, which indirectly influence intra-basin management concerns. Such ethnic conflicts are far more complex than traditional "north-south" or "east-west" global cultures or post-colonialism paradigms,[90] but rather are more representative of a multipolar world, where at the local level slight ethnic differences, particularly involving one ethnic group holding a superior hegemonic status, can induce distrust and non-cooperation.[91] Thus, there is a significant need to address water scarcity at the local and regional levels, which preserves historical and geographical proximity and common heritage to the water resource.

An example is the Jordan River basin and the water access relationship between the Israeli and Palestinian refugees. Israel is critically dependent upon capturing groundwater flowing from under the West Bank—an area heavily populated by Palestinian refugee camps. As Israel's population swells, demands for reliable access to freshwater increase, particularly as the Israeli government has overdrawn aquifers along the Mediterranean coast, allowing for the intrusion of saltwater into domestic water supplies. In response, the Israeli government has limited the withdrawal of water from West Bank aquifers. As implemented, such limitations pose a greater hardship on the Palestinian refugees than the Israeli settlers. These limitations have translated into the "rapid decline in Palestinian agriculture in the region, to the dependence of Palestinians on day labor within Israel, and, ultimately, to rising frustrations in the Palestinian community."[92]

---

[90] See generally, Edward W. Said, *Orientalism* (New York: Vintage Books, 1979).
[91] Alexander E. Varshavsky and Leonid E. Varshavsky, "Conflicts and Environmental Change: Models and Methods," Gleditsch, *Conflict and the Environment*, p. 109-125.
[92] Homer-Dixon, *Environment, Scarcity, and Violence*, p. 15-16.

MAP 3-1: Lebanon and Syria
Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

Before moving on to the discussion of "water wars," a brief mention should be made to what often is considered an environmental limitation on water resources, namely the anticipated impact global climate change will have on the spatial and temporal availability of global water resources. Trans-boundary river basins are dependent upon surface and groundwater recharge, climatic variations, modifications, and snowfall, which all greatly impact usable water in these systems. These factors become of increasing concern in basins where present or predicated water demand is at or exceeds total available flows. While the precise mechanisms that affect water availability due to global climatic change are not entirely known,[93] several possible scenarios have already been formulated. Increases in evaporative losses and water demands caused by higher average temperatures can impact water availability. Also, modifications to annual precipitation can affect the frequency and magnitude of flood events along trans-boundary rivers, impacting irrigated and non-irrigated agricultural production and the spread of infectious water-borne diseases.[94] Riparian states along the Lower Mekong River Basin are particularly susceptible to hazardous flood events as well as eastern India and Bangladesh. Using "general circulation models" (GCMs) in conjunction with information on per capita water availability and supply, reveals that the Middle East region (Nile and Jordan River basins) is highly vulnerable to climatic changes, as well.[95]

---

[93] See generally, Intergovernmental Panel on Climate Change, *Climate Change: The IPCC Scientific Assessment* (Cambridge, U.K.: Cambridge University Press, 1990).
[94] See generally, Peter H. Gleick, "Climate Change, Hydrology, and Water Resources," *Review of Geophysics* 27, no. 3 (1989): 339-344; Stephen H. Schneider, Linda Mearns, and Peter H. Gleick, "Climate-Change Scenarios for Impact Assessment," in *Global Warming and Biological Diversity*, ed. Robert L. Peters and Thomas E. Lovejoy (New Haven: Yale University Press, 1992), p. 38-55.
[95] Stephen Lonergan, "Climate Warming, Water Resources, and Geopolitical Conflict: A Study of Nations Dependent on the Nile, Litani and Jordan River Systems," Operational Research and Analysis Establishment, ORAE Paper No. 55 (Ottawa: National Defence, 1991).

MAP 3-2: Detail: West Bank

Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

Water Wars

Philosopher Michael Gelven argues that nations go to war to defend something *meaningful*. Below the level of *causes* that may instigate violence operates a more fundamental ontological force, the self-referential sense of one's own identity. An external threat to that identity, which is always an identity *from* and in reference *to* something else (e.g., the surrounding community, region, or significant natural features), is the primordial precursor condition for violence.[96] In this sense, the potential for wars, or more generally, violence, is always a present phenomenal reality, borne from the "we-they" principle, whereby the threat of a foreign, alien presence against "us," which endangers our sense of meaningfulness, captures and inspires a violent reaction through such existential ciphers as courage, heroism, and sacrifice.[97] The creation of political borders and the fundamental imperative to preserve state autonomy, often through control and sole-proprietorship of natural resources, sets the philosophical and geopolitical stage for sociopolitical and economic tension between nations. The multi-objective demands placed upon trans-boundary rivers, from irrigation to municipal consumption, particularly in water scarce basins, represents a continuous stressor, in which even the perception of possible hostile acts are interpreted as aggressive intentions—ultimately, intentions, if carried out, may undermine a community's sense of identity. This is certainly evident in the Israeli-occupied West Bank as Palestinian refugees struggle daily to preserve their socio-historical identity and community sovereignty.

[96] Michael Gelven, *War and Existence: A Philosophical Inquiry* (University Park: Pennsylvania State University Press, 1994).
[97] Ibid., p. 270-71.

Aaron Wolf states that "there is no such thing as managing water for a single purpose—all water management is multi-objective and is therefore, by definition, based on conflicting interests."[98] As such, increasing water scarcity, induced by environmental and anthropogenic stressors, creates inherent conflicts between water users, both domestic and foreign. Such conflicting interests often have complex, broad, and destabilizing sociopolitical, economic, and technological linkages that can serve to isolate or consolidate regional and local power to the detriment of a nation's peoples. Power elites evaluating the perception of scarcity in conjunction with other influencing factors, such as economic development, wealth and status in relation to up- and down-stream riparian states, and prioritization of domestic water resource demands, can lead to a series of water management strategies and actions that create opportunity-costs, which can be construed as hostile to a particular stakeholder group, and therein, create a conflict-dominated relationship. Trans-boundary flows have been a cause of such sociopolitical tensions in the past. Water is the only scarce resource for which there is no substitute, over which there is poorly developed international law, and the need for which is overwhelming, constant, and immediate. It would appear that trans-boundary flows are a *prima facie* conflict-driven phenomenon.

Many researchers have questioned whether such stresses can induce the use of military force.[99] Though many international treaties regulate the use and access of freshwater, particularly governing the flows and protection of trans-boundary rivers,

---

[98] Wolf, *Conflict Prevention and Resolution in Water Systems*, p. xviii.

[99] See generally, Johannes Opschoor, "North South Trade, Resource Degradation and Economic Security," *Bulletin of Peace Proposals* 20, no. 2 (June 1989): 135-142; Sverre Lodgaard, "Environmental Security, World Order, and Environmental Conflict Resolution," in *Conversion and the Environment: Proceedings of a Seminar in Perm, Russia, 24-27 November 1991*, ed. Nils Petter Gleditsch (PRIO Report, no. 2, May 1992), p. 115-136; Norman Myers, *Ultimate Security: The Environmental Basis of Political Stability* (Washington, D.C.: Island Press, 1996); Anthony J. McMichael, *Planetary Overload* (Cambridge: Cambridge University Press, 1993).

such law is inconsistent, rarely enforced and ineffective. Additionally, unrelated geopolitical tensions can become embroiled with trans-boundary water development projects, which by themselves may not exist as an international hot-button, and can increase basin-wide tension. For instance, in the early 1990s Hungary and Slovakia both pursued dam construction along the Danube River until ethnic tensions and economic conflicts drove Hungary to aggressively deploy troops near Slovakian dams in an effort to keep them inoperative.[100] The sociopolitical and military conflict between Croatia and Bosnia-Herzegovina created several trans-boundary rivers and essentially halted all cooperative and unilateral management of their flows. In another example, the Zrmanja River, which is located entirely within Croatia, but after the start of open hostilities with Bosnia-Herzegovina, the river was delineated on the opposite side of the "cease-fire" line, which effectively shut down a hydroelectric plant, pump stations, and a primary drinking water source reservoir for Croatia. The town of Zadar and surrounding areas where without adequate water and electricity for months at a time. Hydroelectric plants and pump stations were also shut down for similar reasons along the Cetina and Trebisnica Rivers.[101]

[100] John Fitzmaurice, *Damming the Danube* (Boulder: Westview, 1996).
[101] Mladen Klemencic, "The Effects of War on Water and Energy Resources in Croatia and Bosnia," Blake, *The Peaceful Management of Transboundary Resources*, p. 167-173.

MAP 3-3: Bosnia and Herzegovina

Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

As alluded to earlier, many researchers argue that conflict over water historically and for the future is a cause for interstate violence. Many argue that competition for limited flows creates political instability that can exacerbate pre-existing tensions between riparian states.[102] Others detail how water resources have historically been used as military and political targets in riparian hostilities.[103] Ultimately, most cite river basins where the riparian states are developing countries, striving to begin fruitful economic development, often with non-democratic or quasi-republican political regimes.[104]

However, the reality of historic water conflict is rife with misunderstanding and theoretical embellishment. Reviewing the dataset of international violence by exploring those conflicts directly related to water, Aaron Wolf discovered that only seven (7) minor skirmishes in the twentieth century can be directly linked to water scarcity. Wolf, however, is quick to point out that this does not mean that there is not a connection between water scarcity and violence. On the contrary, he notes, along with multiple other researchers, that there is a connection between water scarcity and domestic conflict.[105]

Wolf further uncovers the basic argument many researchers have used to explain or 'predict' the advent of hostility due to water scarcity. Many argue that water is

---

[102] See generally, A. H. Westing, ed., *Global Resources and International Conflict: Environmental Factors in Strategic Policy and Action* (New York: Oxford University Press, 1986).
[103] Peter H. Gleick, "Water and Conflict: Fresh Water Resources and International Security," *International Security* 18, no. 2 (1993): 112-118.
[104] See generally, W. Remans, "Water and War," Humanaeres *Voelkerrecht* 8, no. 1 (1995); P. Samson and B. Charrier, *International Freshwater Conflict: Issues and Prevention Strategies* (Green Cross Draft Report, 1997); Thomas F. Homer-Dixon, "Environmental Scarcities and Violent Conflict," *International Security* 19, no. 1 (1994).
[105] Aaron T. Wolf, "Conflict and Cooperation along International Waterways," *Water Policy* 1, no. 2 (1998): 254-255. See also, S. Libiszewski, *Water Disputes in the Jordan Basin Region and Their Role in the Resolution of the Arab-Israeli Conflict* Occasional Paper, vol. 13 (Zurich: Center for Security Studies and Conflict Research).

a national resource vital to a nation's survival. Water is the biological nexus for populations, both rural and urban, and is the necessary precursor for a thriving developed economy. Primarily in arid and semi-arid environments, water scarcity can lead to intense political pressures. Complicating the matter, water ignores political boundaries, evading institutional classifications, and eludes legal generalizations. Water management is bound to the unique institutional, sociopolitical, and economic constraints of individual watersheds. The interconnectivity of ground and surface waters, quality, quantity, and use allocations strain institutional and legal capabilities, often creating complex and unreliable decision making models that are ineffective or simply fail.[106]

Using the International Crisis Behavior (ICB) dataset, collected by Jonathan Wilkenfeld and Michael Brecher, Wolf analyzed international conflicts, looking for incidents where water was at least a partial cause of conflict. A total of seven (7) incidents, in three of which no shots were fired, where discovered. In terms of the modern era, no single war has ever been fought solely over the basis of water.[107]

TABLE 3-2: History of acute international water conflict[108]
1948—Partition between India and Pakistan leaves the Indus basin divided in a particularly convoluted fashion. Disputes over irrigation water exacerbate tensions in the still-sensitive Kashmir region, bringing the two riparians "to the brink of war." Twelve years of World Bank led negations led to the 1960 Indus Waters Agreement.
February 1951—September 1953. Syria and Israel exchange sporadic fire over Israeli water development works in the Huleh basin, which lies in the demilitarized zone between the two countries. Israel moves its water intake to the Sea of Galilee.

[106] Ibid., p. 252.
[107] Ibid., p. 255.
[108] Ibid., p. 256.

January—April 1958. Amidst pending negotiations over the Nile waters, Sudanese general elections, and an Egyptian vote on Sudan-Egypt unification, Egypt sends an unsuccessful military expedition into territory in dispute between the two countries. Tensions were eased (and a Nile Waters Treaty signed) when a pro-Egyptian government was elected in Sudan.
June 1963—March 1964. 1948 boundaries left Somali nomads under Ethiopian rule. Border skirmishes between Somalia and Ethiopia are over disputed territory in Ogaden desert, which includes some critical water resources (both sides are also aware of oil resources in the region). Several hundred are killed before cease-fire is negotiated.
March 1965—July 1966. Israel and Syria exchange fire over "all-Arab" plan to divert the Jordan River headwaters, presumably to preempt Israeli "national water carrier," an out-of-basin diversion plan from the Sea of Galilee. Construction of the Syrian diversion is halted in July 1966.
April 1975—August 1975. In a particularly low-flow year along the Euphrates, as upstream dams are being filled, Iraqis claim that the flow reaching its territory was "intolerable," and asked that the Arab League intervene. The Sysrians claim that less than half the river's normal flow is reaching its borders that year and, after a barrage of mutually hostile statements, pull out of an Arab League technical committee formed to mediate the conflict. In May 1975, Syria closes its airspace to Iraqi flights and both Syria and Iraq reportedly transfer troops to their mutual border. Only mediation on the part of Saudi Arabia breaks the increasing tension.
April 1989—July 1991. Two Senegalese peasants were killed over grazing rights along the Senegal River, which forms the boundary between Mauritania and Senegal, sparking smoldering ethnic and land reform tensions in the region. Several hundred are killed as civilians from border towns on either side of the river attack each other before each country uses its army to restore order. Sporadic violence breaks out until diplomatic relations are restored in 1991.

The historic reality is that few, if any, international conflicts have been waged over water and invariably other inter-related issues also factor in. More than 145 international treaties have been signed to address trans-boundary waters, many showing unique and ingenious ways to resolve international water disputes. However, this is not to say that conflict over water does not happen, rather that such conflicts exist at the sub-national level, usually between communities, tribes, water use sectors, or states.[109]

[109] Ibid., p. 258.

Ultimately, Wolf and other researchers claim that nations will probably not go to war over water. Yet, existing international institutions are inadequately equipped to resolve many water disputes. Many of these international treaties lack monitoring provisions, fewer than one-third delineate specific allocations and four-fifths have no enforcement mechanism. Finally, almost without exception, multi-state river basins are governed by bilateral treaties, "precluding the integrated basin management long-advocated by water managers."[110]

Additionally, J. A. Allan argues that water wars have been avoided due to the concept of "virtual water." Virtual water is the idea that water is embedded in key water-intensive commodities such as cereals, which are imported from outside the trans-boundary river basin. This positive externality through international trade can reduce overall local water consumption demands.[111] However, it is important to remember that the cereal production may be coming from a different trans-boundary river system, where the production of wheat or grain may have a negative externality impact within that basin. Therein, globalizing trade of virtual water may represent a shifting of water burdens, without necessarily solving them.

At the international level, various researchers propose that international agencies, such as the United Nations and the International Monetary Fund (IMF), take a greater institutional role in the management of trans-boundary water resources. Many argue for the importance of an integrated approach to basin-wide river planning,

---

[110] Ibid., p. 262. See also, J. Hamner and A. Wolf, "Patterns in international water resource treaties: the Transboundary Freshwater Dispute Database," *Colorado Journal of International Environmental Law and Policy* (Yearbook 1997).

[111] J. A. Allan "Virtual Water: An Essential Element in Stabilizing the Political Economies of the Middle East," in *Transformations of Middle Eastern Natural Environments: Legacies and Lessons*, ed. Jeff Albert, Magnus Bernhardsson, and Roger Kenna (New Haven: Yale School of Forestry and Environmental Studies, 1998).

development, and management.[112] Others claim that the importance of public participation has been historically undervalued as a mechanism to stabilize potentially violent conflicts over water access and allocation.[113] Efforts have been made to provide for environmental conflict resolution, such as the creation of a World Water Council, which was formed, in part, to provide for a "global institutional framework for water."[114]

Environmental Security

In the last several decades, researchers and policymakers have begun to think of a broader concept of national security, one that reflects environmental stressors in addition to traditional notions of military force.[115] Starting in the 1970s, strategic analysis experts began to understand international conflict in terms of the precursor conditions that could produce the potential for violence. Attention turned to events or situations that contributed to the degradation of environmental services that impact the quality of life for inhabitants of a state and how that in turn affects state behavior.[116]

Peter Gleick writes, "Where water is scarce, competition for limited supplies can lead nations to see access to water as a matter of national security."[117] Even if perceived or actual, water scarcity associated with trans-boundary rivers may not

---

[112] See generally, D. J. Lee and A. Dinar, *Review of Integrated Approaches to River Basin Planning, Development and Management* (Washington, D.C.: World Bank Working Paper, 1995); G. J. Young, J. C. Dooge, and J. C. Rodda, *Global Water Resource Issues* (Cambridge: Cambridge University Press, 1994).
[113] See generally, J. Delli Priscoli, "Public Involvement, Conflict Management: Means to EQ and Social Objectives," *Journal of Water Resources Planning and Management* 115, no. 1 (1989): 31-42; J. M. Trolldalen, *International Environmental Conflict Resolution: The Role of the United Nations* (Washington, D.C.: World Foundation for Environment and Development, 1992).
[114] World Water Council, *World Water Council Bulletin* 1, no.1 (1995).
[115] See generally, Ullman, "Redefining Security," 15-19; Ian Rowlands. "The Security Challenges of Global Environmental Change," *Washington Quarterly* 14, no.1 (Winter 1991): 99-114.
[116] See generally, Barry Buzan, "Change and Insecurity: A Critique of Strategic Studies," in *Change and the Study of International Relations: The Evaded Dimension*, ed. Barry Buzan and R. J. Barry Jones (New York: St. Martin's Press, 1981); Lester Brown, "An Untraditional View of National Security," *American Defense Policy*, *5th Edition*, ed. John Reichart and Steven Sturm, (Baltimore: Johns Hopkins University Press, 1984); Norman Myers, "Environment and Security," *Foreign Policy* 74 (1989): 23-41.
[117] Gleick, "Water and Conflict," p. 79.

generally induce international violence. Ever-increasing domestic water demands can challenge and strain domestic and international political relationships, inducing a reluctance or disregard for intra-basin cooperation and resource sharing, particularly under persistent drought conditions. Localized scarcity can translate into an international crisis depending upon the factors that have created the scarcity initially and the national repercussions of that scarcity on domestic demands, economic development, or strategic standing within the region. Gleick goes on to state that there are four characteristics that are likely to be a source of strategic rivalry, which include: (1) the degree of scarcity, (2) the extent to which the water supply is shared by more than one region or state, (3) the relative power of the basin states, and (4) the ease of access to alternative fresh water sources.[118]

Homer-Dixon argues that environmental scarcity, particularly including non-renewable resources like water, can incite international conflict, which may create domestic sociopolitical stress, fragmenting states or populations, and possibly including the loss of control in peripheral regions. Therein, riparian states may choose to take a "hard" regime against other states in the control of water resources to quell domestic unrest and secure military and economic assets.[119]

Dependency on trans-boundary flows can orient a riparian state's national security interests toward protecting or preserving the continued availability of water. This creates the "upstream/downstream" conflict, whereby upstream riparian states divert or pollute waters, sending the negative externalities downstream, threatening the

[118] Ibid., p. 86.
[119] Homer-Dixon, "Thresholds of Turmoil," p. 84-85.

ability of other riparian states to meet mounting domestic demands.[120] Geopolitical research indicates that states are more willing to develop confrontational, non-cooperative positions against neighboring states when the perception of territorial loss or disadvantage becomes evident.[121] When utilization of trans-boundary flows, such as hydroelectric generation, commerce, or irrigation, are negatively impacted by a riparian neighbor, the linkage between territory and water resources may be made by decision makers, thrusting resource management and planning issues to the forefront of a contested national security debate.

For instance, international water development in the Paraná-La Plata Basin (Argentina, Brazil, Bolivia, Paraguay, and Uruguay), one of the largest trans-boundary basins in the world, has been extremely difficult due to continuing security concerns related to national sovereignty and a sustained desire for economic independence. Such security and sovereignty concerns are predominately the result of continuing adjustment to post-colonial rule.[122]

[120] Ashok Swain, "Sharing International Rivers: A Regional Approach," Gleditsch, *Conflict and the Environment*, p. 405.
[121] See generally, John Vasquez, *The War Puzzle* (Cambridge: Cambridge University Press, 1993).
[122] Elhance *Hydropolitics in the 3rd World*, p. 25-52.

MAP 3-4: Argentina, Bolivia, Paraguay, and Brazil
Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

Even in trans-boundary basins where cooperative management of flows exist, as in the Tigris-Euphrates river basin, the very geopolitical presence of dependency can create a certain level of tension and influence the development of water resources. Increasing nationalization and economic development in Turkey and Iraq in the 1960s began to stress international relations, particularly as Turkey proposed extensive water development projects in the highland reaches of the Euphrates. Additionally, Turkey has faced increasing energy demands starting in the 1950s, including severe water shortages in certain areas of the country, hence the present need to fully exploit the Euphrates River.[123] In response, the Iraqi government began developing expansive water diversion and reservoir projects to assure dry-season flows would be available if Turkey releases less water post-development.[124]

The securitization of water scarcity has advantages and disadvantages. One advantage is that water security is elevated to a primary concern for a state government, requiring an appropriate level of responsiveness, including potential cooperative engagements with other riparian states to assure domestic water demands are met through sustainable resource development.[125] Conversely, Lothar Brock argues that securitization leads to enveloping environmental scarcity into an antiquated construction of national security still ultimately dependent upon the concept of eventual military action.[126] By translating scarcity into a threat, responses to scarcity are fashioned in a hegemonic discourse, one ensconced within a militarism paradigm of

[123] Michael Schulz, "Turkey, Syria and Iraq: A Hydropolitical Security Complex," Ohlsson, *Hydropolitics*, p. 98.
[124] Dolatyar and Gray, *Water Politics in the Middle East*, p. 116-161.
[125] Ole Weaver, "Securitization and Desecuritization," in *On Security*, ed. Ronnie Lipschutz (New York: Columbia University Press, 1995), p. 46-86.
[126] Lothar Brock, "The Environment and Security: Conceptual and Theoretical Issues," Gleditsch, *Conflict and the Environment*, p. 17-34.

threat containment or elimination, closing off alternative modes of action, such as negotiated resolution or representative stakeholder involvement.[127] This effect may be compounded in developing countries where security is often a matter of internal political control rather than international threats. Linking environmental scarcity to national security may enhance the power or influence of non-democratic or military regimes, rather than resolving the scarcity concern or alleviating its impact on affected communities.

Furthermore, advocates of environmental security have even argued for the use of military force through the idea of "coerced conservation" to ensure the protection of natural resources and national interests.[128] In this sense, the military would function as "super park wardens," protecting the environment and ensuring appropriate development of natural resources. However, unlike in developed states, militaries in developing countries often hold far more sociopolitical power and tend to be heavily intertwined in political advancement or repression, often well beyond their mandate to preserve the peace and protect the state.[129] For instance, it is the Israeli military that regulates water access to the Jordan River and ground water aquifers underneath the Palestinian West Bank. From the beginning of the occupation, Arab farmers were required to obtain permits from the military for drilling new wells for irrigation, which were nearly impossible to obtain. Additionally, there still exists a marked disparity in water allocations between increasing numbers of Israeli settlements and existing

---

[127] Simon Dalby, "The Politics of Environmental Security," in *Green Security or Militarized Environment*, ed. Jyrki Käkönen (Dartmouth: Brookfield USA, 1994), p. 37, citing Brian Job, *The Insecurity Dilemma: National Security of Third World States* (Boulder: Lynne Rienner, 1992).
[128] See generally, Kent Butts, "Why the Military Is Good for the Environment," Käkönen, *Green Security or Militarized Environment*.
[129] See generally, Mohammad Ayoob, *The Third World Security Predicament* (Boulder: Lynne Rienner, 1995).

Palestinian refugee camps.[130] This example illustrates that prior to the use of military action to protect environmental security issues, it is extremely important to understand and incorporate the sociopolitical and historical conditions that created the water scarcity situation, so as to determine the most appropriate response to the changing environmental condition.[131]

As discussed earlier, water scarcity has rarely instigated military violence, yet plays a critical role in the overall matrix of intra-basin politics and can induce domestic conflict and violence, particularly at the local and regional levels. As such, water scarcity is uniquely situated as simultaneously a security threat and a social concern. A more open concept of security should be one that incorporates mechanisms for encouraging adaptive capacities to changing geopolitical and environmental conditions, as well as, mitigating strategies, through public financing and infrastructure, to preemptively control social and economic stressors of water scarcity. Such an approach balances the need to continue understanding water scarcity as a critical national concern and a potential threat to economic development and social reform, while disengaging traditional militarism rhetoric enough to ensure that resolutions to water scarcity equitably protect the interests of all stakeholders.[132]

---

[130] Dolatyar and Gray, *Water Politics in the Middle East*, 106, citing John K. Cooley, "War Over Water", *Foreign Policy* 54 (1984): 3-26.
[131] Julian Saurin, "International Relations, Social Ecology and the Globalization of Environmental Change" in *The Environment and International Relations*, ed. John Vogler and Mark F. Imber (London: Rutledge, 1996), p. 77-98.
[132] See generally, Richard A. Matthew, "Environmental Security: Demystifying the Concept, Clarifying the Stakes," in *Environmental Change and Security Project*, Report no. 1 (Washington, D.C.: Woodrow Wilson Center, 1995), p. 14-23.

MAP 3-5: Turkey, Syria, and Iraq
Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

Managing Conflicts in Trans-Boundary River Basins

Both obstacles and opportunities are simultaneously present concerning the management of trans-boundary rivers. Additionally, each trans-boundary river basin has a unique set of historical and present-day stressors, demands, and ensconced sociopolitical relationships that establish the context from which these obstacles and principles may produce a positive or conflict-defined management strategy.

The geopolitical confluence of conflict in trans-boundary river basins derives, in part, from the pervasive lack of confinement of hydrological systems within political boundaries. The absence of common goals and visions among developing riparian countries and increasing water scarcity created by inflating demand from an increasingly diversified user base, poses a significant water resource management problem, which is often difficult or impossible to resolve through international treaties or agreements alone. Multiple scopes and scales of resource demands and competing doctrines of resource management evidence the numerous conflicts over trans-boundary water resources. Even with hostilities quelled and treaties signed, opportunities remain for agreements to be broken. Such treaties are subject to change, particularly when new technical data are acquired, or when sociopolitical and economic changes occur. Just and Netanyahu argue that this can produce incentives for "individual nations to exercise the principle of sovereignty strategically."[133] This means that agreements must be renegotiated following changes in disposition, demand, or after the acquisition of new datasets. Such activities are destabilizing and underscore

[133] Just and Netanyahu, "International Water Resource Conflicts," p. 8-9; see also, A.V. Kneese, "Background for Economic Analysis of Environmental Pollution," in *The Economics of Environment*, ed. P. Bohm and A. V. Kneese (London: Macmillan, 1971).

the limitations of trans-boundary water resource management through international legal mechanisms, incentives, or constraints.

There are general limitations that take on a variety of guises that can serve to obscure or marginalize cooperative riparian engagement. Asymmetric information among riparian states, scientific gaps and technological uncertainties, lack of effective enforcement controls and strategies, historical claims of sovereignty, and conflicting national and international interests, can all dissuade decision makers from actively pursuing or upholding international agreements or protocols.[134]

Asymmetric information poses a formidable obstruction to negotiating trans-boundary water resource agreements. Inevitably, riparian states have variable degrees of access to reliable resource management data, which may offer a bargaining value to the countries with the most comprehensive and reliable datasets. [135] Geopolitically, riparian states with strategic management data not possessed by other riparian states facilitate greater flexibility in determining what level of engagement are ultimately most beneficial.[136] For instance, in the Blue Nile River basin (Ethiopia, Sudan, and Egypt), Ethiopia, and to a smaller extent Sudan, are in a disadvantageous position to approach Egypt regarding the renegotiation of existing water allocations due to a general lack of water management, engineering, and hydrology data on the river as compared to the advanced technologies and extensive management history of Egypt.[137]

---

[134] Ibid., p. 9.
[135] Richard E. Just and Sinaia Netanyahu, "International Water Resource Conflicts: Experience and Potential," Just and Netanyahu, *Conflict and Cooperation on Trans-Boundary Water* Resources, 9
[136] R. B. Wilson, "Strategic and Informational Barriers to Negotiation," in *Barriers to Conflict Resolution*, ed. K. Arrow et al. (New York: W. W. Norton & Company, 1995).
[137] Dale Whittington, "Toward a New Nile Waters Agreement," p. 176.

MAP 3-6: Africa, Depicting the Entire Nile River Basin
Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

Scientific gaps and technical uncertainties pose a unique threat to trans-boundary engagement and cooperative water-sharing for a number of reasons.[138] Asymmetric data fuel both scientific and management concerns related to actual water quality and quantity considerations. Difficulties in precisely establishing the impacts of water use, pollutant loading, over-allocation, evaporation, inter-basin transfers, seasonal flow rates, and climatic conditions, create a hostile geopolitical environment for the successful negotiation of international agreements. States often have different measures and standards, coupled by specific strategic water needs, which complicate arriving at final regulatory standards and rules. [139] In addition, the ecological and hydrological characteristics of large, trans-boundary river basins pose a unique and complex data collection problem. The need for expensive and sophisticated technologies to properly assess river flows, conditions, and engineering concerns has required in many instances for environmental agencies to partner with militaries, particularly for use of advanced remote sensing technologies. This 'forced' integration of environmental-military services can function to displace opportunities for intra-basin cooperation, as "spy" satellites overfly and document potentially sensitive information located within other riparian states.[140] Yet, the idea of remote sensing technologies offers an invaluable opportunity to support data transparency and inclusion of

[138] See generally, Gilbert F. White, "The Role of Scientific Information in Anticipation and Prevention of Environmental Disputes," in *Geography, Resources, and Environment: Volume I, Selected Writings of Gilbert F. White*, ed. Robert W. Kates and Ian Burton (Chicago: University of Chicago Press, 1986), p. 377-392.
[139] Just and Netanyahu, "International Water Resource Conflicts," p. 9.
[140] Ronald J. Deibert, "Out of Focus: U.S. Military Satellites and Environmental Rescue," in Deudney and Matthew *Contested Grounds*, p. 267-287.

international third parties in the service of cooperative development and planning of trans-boundary resources.[141]

The capacity to consistently enforce trans-boundary agreements will determine the success of such agreements. Enforcement entails a certain degree of monitoring, which can be expensive, technically challenging, and potentially perceived as an encroachment of a riparian state's sovereignty. Additionally, general principles of sovereignty give riparian states the option to engage or withdraw exposure to international monitoring and legal responsibilities at will. In many instances, international law offers few solutions. It is extremely difficult to establish general criteria for determining when a harm or activity denies equitable access to the trans-boundary river. Particularly in basins predominately composed of developing countries lacking technological and informational resources, it is difficult to establish and document transgressions made by one riparian that may not have a direct, immediate impact on the other states.[142] Furthermore, actions taken within the basin's watershed, but not along the mainstem, such as vegetation clearing in upland areas that increase sedimentation or flooding downstream, may not be immediately noticed or difficult to investigate without encroaching upon national sovereignty rights. For example, over a century of deforestation in Guinea has today lead to massive, irregular flooding along the middle and lower reaches of the Senegal River in Senegal, destroying irrigable lands, property, as well as, degrading the riparian ecosystems.[143]

---

[141] Karen T. Litfin, "Satellites and Sovereign Knowledge: Remote Sensing of the Global Environment," in *The Greening of Sovereignty in World Politics,* ed. Karen T. Litfin (Cambridge: The MIT Press, 1998), p. 193-221.
[142] Swain, "Sharing International Rivers," p. 408.
[143] Wegemund, "Ethnic and Transborder Conflicts," p. 287.

MAP 3-7: Senegal and Guinea

Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

Another example of this enforcement dilemma is the *Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin*, which was signed by Cambodia, Lao PDR, Thailand, and Vietnam in 1995. The agreement was brokered by the United Nations Development Program (UNDP) to continue discussions regarding the effective and sustained development of the Lower Mekong River Basin. Prior to this, the predecessor organization, the (Interim) Mekong Committee, created by the United Nations Economic Commission for Asia and Far East (ECAFE) in 1957, had consistently failed to agree to or establish any major main-stem development projects due to consistent infighting by upstream and downstream riparian states.[144] Veto powers by each voter member effectively halted development and the general lack of intra-basin enforcement brought all major water infrastructure development to a standstill.

Historically, greater autonomy of a nation often corresponds to the sovereign strength of a nation. Collaboration in management among third parties, particularly when such third parties are competing riparian neighbors, can be perceived as encroaching on a state's autonomy and legal right to the waters of the trans-boundary river basin.

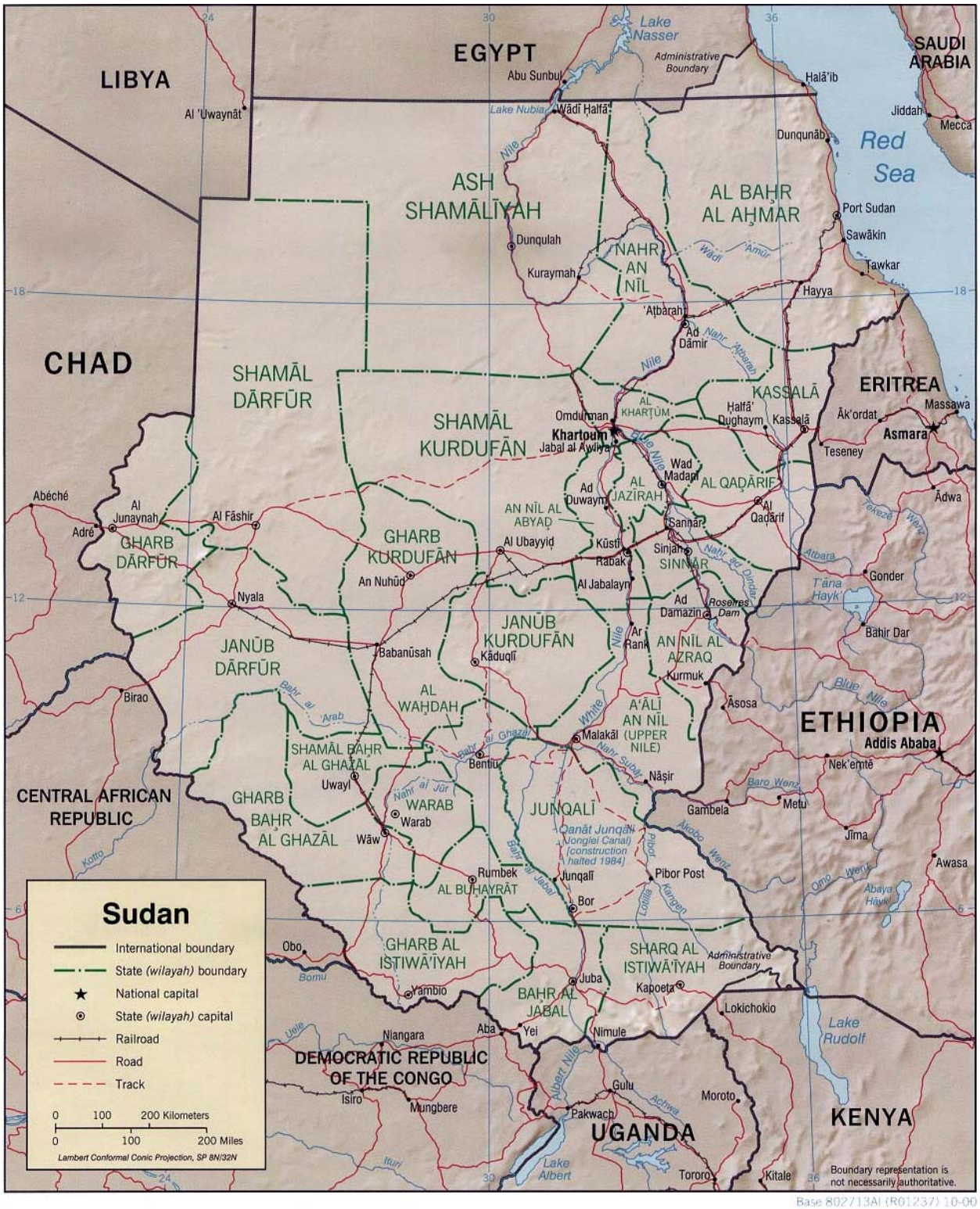
[144] Nakayama, "Successes and Failures of International Organizations," p. 370-372.

MAP 3-8: Thailand, Cambodia, Vietnam, Laos, and Burma
Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

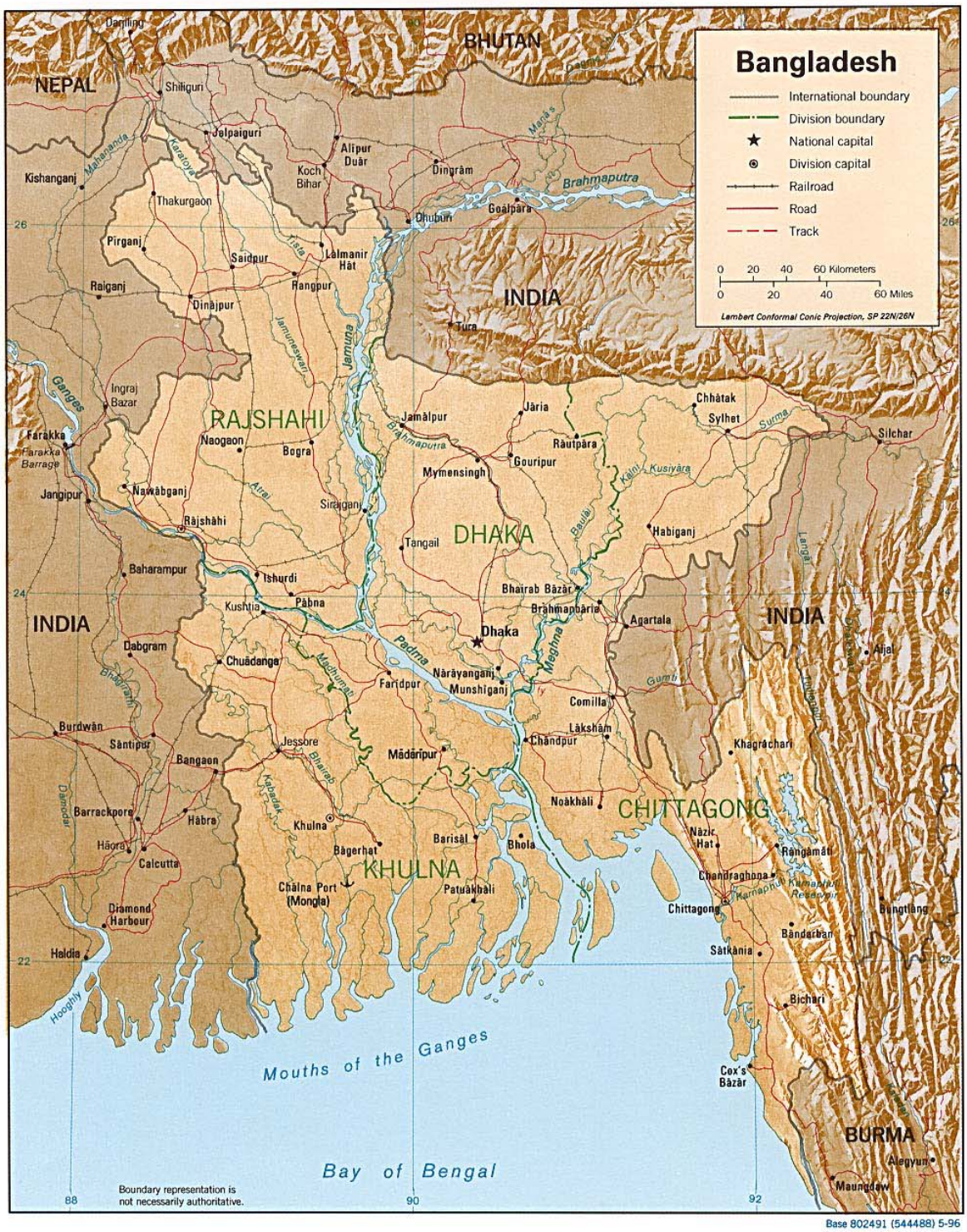
An example of this issue of autonomy can be found in the Blue Nile river basin (Egypt, Sudan, and Ethiopia). Egypt is the regional economic and military hegemon; yet it is in the disadvantageous downstream position, with over 85 percent of the water behind Egypt's Aswan High Dam originating in Ethiopia. As early as the 1980s, with regional population growth and economic development pressures, Egyptian researchers and water managers suggested transferring valley storage from the highly evaporative Aswan Dam to proposed Blue Nile Reservoirs in Ethiopia where evaporation rates are approximately 50 percent lower. Doing so could potentially save approximately 4 to 5 billion cubic meters (bcm) from the annual 70 bcm Blue Nile flow.[145] However, this change would further displace Egypt's power by becoming more dependent upon Ethiopia and Sudan to pass the flows to Aswan. Currently, Egypt maintains the flows domestically and can exert influence through military and economic forces against the upstream riparian states, which means there is little incentive for Egypt to support or participate in such a intra-basin development plan.

Defining the value and level of interest of trans-boundary agreements heavily relies upon national water demands, uses, and various socioeconomic factors. National priorities can often define international priorities, which, in turn, are a function of the water law procedures, alternative resource solutions, industrial development, and geographic location (e.g., upstream/downstream) on the trans-boundary river. Trans-boundary management may disrupt existing economic balances, threatening existing agricultural demands or forcing shifts in economic modalities. International and domestic interests groups will likely seek assurances that existing demands will be met.

[145] G. Guariso and D. Whittington, "Implications of Ethiopian Water Development for Egypt and Sudan," *International Journal of Water Resources Development* 3 (1987): 105-114.



MAP 3-9: Egypt, Sudan, and Ethiopia
Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html



MAP 3-10: Bangladesh and India
Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

In late 1996, India and Bangladesh signed a 30-year-treaty to share the flows of the Ganges River and put to an end decades of dispute over Indian unilateral water diversions from Farakka dam, which is a mere eighteen kilometers from the Bangladesh border. Bangladesh, suffering from flooding, salinization, and lack of irrigation flows, has asked for international assistance from the United Nations and World Bank to mediate new water treaties with India. Bangladesh wanted to involve Nepal, where the headwaters of the Ganges River reside and where excellent hydroelectric generation opportunities exist, in a comprehensive trans-boundary management strategy with India. However, India consistently refused to avoid "internationalizing" the problem. Internal pressure to preserve monsoon flows for the dry summer seasons kept India from actively pursuing meaningful trans-boundary management programs, instead India offered to supplement Ganges flows from other river systems. [146]

In another example, the Okavango River Basin (Botswana, Angola, and Namibia) created the Permanent Okavango River Basin Commission (OKACOM) in the early 1980s to address all water development concerns for the basin. Around 1990, the Botswana government developed a plan to enhance food production by creating a series of channels and reservoirs for collecting overflow from the Okavango wetlands called the Southern Okavango Integrated Water Development Project.[147] Local opposition and pressure from international environmental NGOs stopped the project. The government in response to this political pressure later designated the wetlands as a protected, environmentally sensitive area through the UN. However, in June 1996,

[146] Nakayama, "Successes and Failures of International Organizations," p. 376-378.
[147] Olaf Claus, "'Botswana Say to Dredge a River is to Destroy It.' The Case of the Southern Okavango Integrated Water Development Project," Spillman and Bächler *Environmental Degradation as A Cause of War, Volume III*, p. 269-284.

Namibia unilaterally sought international funds to construct a pipeline to divert flows from the Okavango River upstream of the wetlands. The intended diversions would destroy 150 square kilometers of floodplain habitat and effectively displace between 50,000 and 70,000 people dependent upon the annual flooding. OKACOM was never consulted.[148]

Additionally, in the Lower Mekong River Basin, in 1992, Thailand, facing increasing water shortages in the central, north, and northeastern parts of the country, developed plans to unilaterally divert Mekong flows through constructed canal projects and sought to change the veto rules of the Mekong Committee to assure the projects' success. Furthermore, Thailand has alternatively supported and ignored the Committee depending upon domestic priorities, limiting the overall effectiveness of the Committee and intra-basin water resource development.[149]

Each riparian state often has varying population densities, income per capita, military capacity, and access to natural resources, which creates unique differences in trans-boundary river flow demands. Theses flow demands, in turn, create a complex and difficult environment for negotiating multi-objective river management treaties. This environment raises the question over what strategic planning and development mechanisms should be employed to equitably distribute the costs for developing and utilizing trans-boundary flows. Given these complexities, dependent, downstream riparian states have few incentives to offer upstream states that already have the

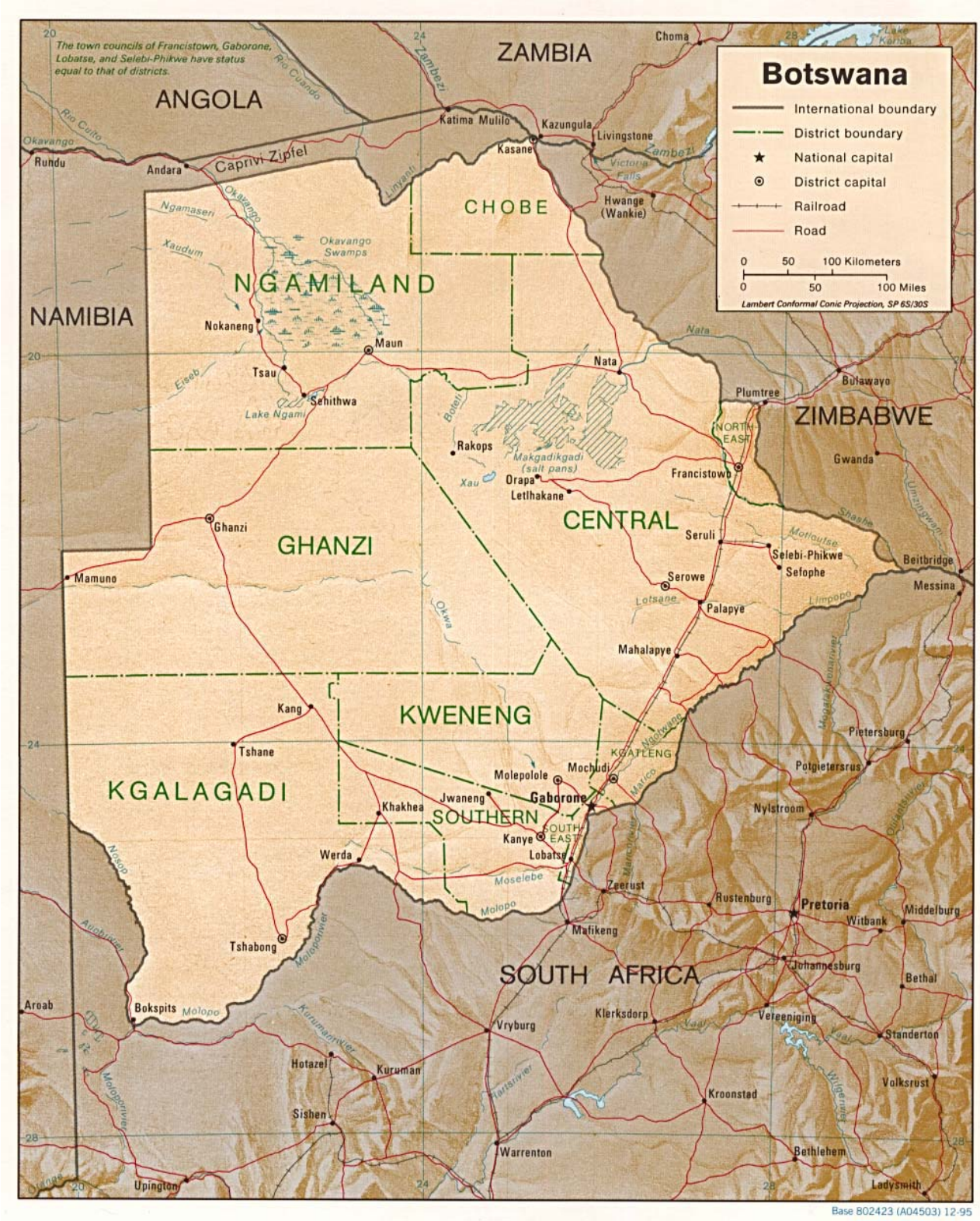
[148] A. R. Turton, *Water and State Sovereignty: The Hydropolitical Challenge for States in Arid Regions* (London: MEWREW, Occasional Paper No. 5, Water Issues Study Group, SOAS, University of London, 1999), 8-9, citing T. Scudder et al., *The IUCN Review of the Southern Okavango Integrated Water Development Project* (Switzerland: IUCN, 1995) and L. Ramberg, "A Pipeline from the Okavango River?" *Ambio* 26, no.2 (1997): 129.

[149] Caroline Thomas, "Water: A Focus for Cooperation or Contention in a Conflict Prone Region? The Example of the Lower Mekong Basin," in Spillman and Bächler, *Environmental Degradation as a Cause of War, Volume III*, p. 65-125.

necessary water supply and service infrastructure to meet domestic demands, and furthermore, are substantially unaffected by the discharge of pollutants down the river.

The Israeli-Arab conflicts within the Jordan River Basin offer one of the best examples of this obstacle. The 1950 Law of Return policy, which allows permanent residence to all Jews in Israel, has dramatically increased the Jewish population and the number of settlements along the west bank of the Jordan River, displacing Palestinian refugees, and stressing already over-allocated trans-boundary surface and aquifer waters.[150] Rapidly urbanizing, and as the leading economic and military riparian state in the basin, Israel has established a series of water infrastructure projects, from piping water from the Nile delta to water diversions along the Jordanian and Lebanese borders. Israeli water demands have also propagated a need to control water flows from the Litani River, the largest Lebanese river, creating persistent tension in southern Lebanon as Israel continues to exert military and political influence to ensure downstream capacity. Finally, the Israeli capture of the Golan Heights in 1967 dispossessed Syria of a major portion of the usable flows of the Yarmouk River. Currently experiencing a ten-year drought and loss of Euphrates river flow due to damming by Turkey, Syria has been forced to build more dams and control structures on the Yarmouk River along the Syrian/Jordanian border above Israel, creating a serious water deficiency in Jordan, which has yet to be recovered by other water sources, increasing instability in the region.[151]

[150] I. Mustafa, "The Arab-Israeli Conflict over Water Resources," in *Water and Peace in the Middle East*, ed. J. Isaac and H. Shuval (Amsterdam: Elsevier, 1994), p. 129.
[151] Ibid., p. 130.



MAP 3-11: Botswana, Namibia, Angola, and Zambia
Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

Another example of changing water demands that affect the management of trans-boundary flows is the Rio Grande River shared by the United States and still-developing Mexico. The United States-Mexico Water Treaty of 1944 established the legal framework for the diversion and use of Rio Grande flows by both countries, primarily for agricultural uses. Over time, population densities have risen dramatically, significantly increasing present water demand needs. Municipal, recreational services, and water quality concerns now vie for water against the traditional agricultural withdrawals. In order to ensure the continuing enforcement of the 1944 treaty, while still preserving individual state autonomy through bi-national management, both states have development complex water agencies to cooperate and manage flow allocations for both countries. The success of these initiatives is a result of continued support for such large, often inefficient agencies, to work out national differences. Such a response to changing water demands in a basin has shown promise, but also economic and effective drawbacks, particularly as water demands consistently outstrip supply during periods of drought.[152] However, the problems of salinity intrusion and the misuse of fertilizers, insecticides, and pesticides, discharge of industrial wastes, toxic chemical dumping, and untreated sanitary sewage, still strains U.S.-Mexican relations. Poor water quality continues to constitute a serious health risk to communities along the Rio Grande banks and associated tributary systems.[153]

[152] See generally, Stephen P. Mumme, "New Challenges for U.S.-Mexico Water Resources Management," in Blake, *The Peaceful Management of Transboundary Resources*, p. 261-275.
[153] Katarina Rogers, "Environmental Conflict and Cooperation between Mexico and the United States," in Spillman and Bächler, *Environmental Degradation as A Cause of War, Volume III*, p. 28-65.

MAP 3-12: Mexico and the United States
Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

Peter Gleick identifies six "principles" for reducing the risk associated with water-related conflicts, namely through (1) international law, (2) equitable utilization, (3) preventing significant harm to other states, (3) obligation to notify and inform, (4) obligation to share data, (5) cooperatively manage international rivers, (6) and the obligation to resolve disputes peacefully.[154] According to Gleick, "international law and international institutions must play a leading role" in the cooperative management of

[154] Ibid., p. 174.

trans-boundary rivers.[155] Although I question the value international institutions play in such management strategies in the next chapter, the ways of reducing risk mentioned by Gleick offer an important insight into the ethical values and fundamental importance of working toward cooperative, peaceful, equitable, and sustainable allocations of trans-boundary flows.

Particularly where developing riparian states share trans-boundary basins, any movement toward general democratic reform or representative stakeholder involvement in the planning and management of trans-boundary flows can set the stage for successful conflict resolution. Such a movement that preserves the autonomy of individual stakeholders' interests through the policy development process has a better opportunity to construct long-term, sustainable management strategies than more traditional command-and-control style governmental edicts.[156] Research has shown that democratic states are less likely to go to war and more likely to work cooperatively to resolve disputes. There are a variety of reasons for this phenomenon, including a more inclusive stakeholder involvement, a philosophical desire to seek peaceful mutual collaboration, a willingness to promote and observe international laws, and a longer and more complex decision making calculus that allows for "cooling-off" periods.[157] Additionally, the involvement of empowered representation of interested stakeholder groups through independent mediating structures, such as oversight or review panels,

[155] Gleick, "Water and Conflict," p. 174.
[156] Maria Davradou and Paul Wood, "The Promotion of Individual Autonomy in Environmental Ethics," *Environmental Ethics* 22, no. 1 (Spring 2000): 73-84.
[157] Nils Petter Gleditsch, "Environmental Conflict and the Democratic Peace," Gleditsch, *Conflict and the Environment*, p. 98, citing Nils Petter Gleditsch and Håvard Hegre, "Peace and Democracy: Three Levels of Analysis," *Journal of Conflict Resolution* 41, no. 2 (April 1997): 283-310; Zeev Maoz and Bruce Russett, "Normative and Structural Causes of Democratic Peace 1946-86," *American Political Science Review* 87, no. 3 (September 1993): 624-638; Samuel P. Huntington, *The Third Wave: Deomcratization in the Late Twentieth Century* (Norman: University of Oklahoma Press, 1991); James Crawford, "Democracy and International Law," *British Year Book of International Law* (1993): 117-133.

facilities an ethic that supports the integration of capitalism, environmental protection, and democratization as key elements in resolving public conflicts arising from resource exploitation.[158]

[158] Denis Collins and John Barkdull, “Capitalism, Environmentalism, and Mediating Structures: From Adam Smith to Stakeholder Panels,” *Environmental Ethics* 17, no. 3 (Fall 1995): 227-244.

CHAPTER 4

TRANS-BOUNDARY WATER RESOURCE MANAGEMENT

The “Allocation Imperative”

A multiplicity of factors—deriving simultaneously from hydro-political and environmental phenomena—influence the perception of water scarcity or abundance, and establish the paradigm from which water management agencies and communities define how, when, and where water is allocated. The management of water represents one of the oldest traditions of using natural resources for human use. Historically, the concept of water as a limitless resource has driven people to the hubris of over-consumption, and therein, over-management.

Throughout the world, various philosophies have emerged relating to how water should be managed, defining water’s purpose, function, or place in society. Some approaches created large, centralized bureaucratic agencies, while others adopted local or regionalized allocation strategies. Both offer advantages and disadvantages against a backdrop of continuing human population growth and widespread dynamic shifts in economies due to globalization. Strategies to effectively manage water resources increasingly must rely on ever more complex matrices of administrative, political, engineering, and management philosophies to meet exceedingly high water demands.

The “allocation imperative” is the final product of water management, the purpose of harnessing flows for use. The allocation imperative consists of the rules society uses to determine how water is distributed, what services it should serve, and whom the water should benefit. The function of management is challenged by a variety of factors influencing decision making. In order to understand present difficulties related to water

scarcity along trans-boundary rivers, it is important to briefly discuss past methods of management.

The Autocratic Inheritance

The need to collectively manage water, collect and distribute it, led to the development of the great autocratic hydraulic societies in Egypt, Mesopotamia, Northern China, Central Mexico, and the coast of Peru. These societies created highly centralized bureaucracies, with sophisticated and complex protocols and authority. Advanced mathematics and writing to manage water emerged. A common thread shared by these societies includes the formation of a complex system of administration of the control, transport, and distribution of water. In many instances, these administrations became extremely powerful, commonly emergent in the form of priestly and educated castes. [159] In Mesopotamia situated in the fertile valley of the Euphrates-Tigris river basin, ancient civilizations were the first to develop cultivated farming and by 4000-3000 BCE created large, complex irrigation and canal infrastructures and central governmental authorities.[160]

However, much of Western Asia, Southern Europe, Taiwan, and parts of Latin America developed a substantially different approach to water management, one that functioned at a local level, often linked specifically to individual water users. These systems are identified by piecemeal growth, individually built and managed, or constructed through private, collective initiatives for control, development, and

[159] Terence Richard Lee, *Water Management in the 21st Century: The Allocation Imperative* (Cheltenham: Edward Elgar, 1999), p. 4-5, citing Karl A. Wittfogel, *Oriental Despotism: A Comparative Study of Total Power* (New Haven: Yale University Press, 1957).
[160] Dolatyar and Gray, *Water Politics in the Middle*, p. 124-127, citing Robert Adams, *Land Behind Baghdad: A History of Settlement on the Diyala Plains* (Chicago: University of Chicago Press, 1965).

distribution.[161] This approach provided for organizational solutions to specific problems, creating a forum for a larger percentage of the effected stakeholders to be heard. These systems can function at a sub-watershed level, or have common elements at larger scales. However, a variety of modern examples can be found where these water-scarce regions have mimicked autocratic water regimes, focusing on expansive, state-funded or run water infrastructure projects along trans-boundary rivers, often the result of western colonization, as in India and South East Asia.

Autocratic hydraulic societies are considered the dominant historical paradigm, employing a "top-down" approach to water allocations, economic development, and water pricing. A "bottom-up" approach defined by smaller, localized systems, primarily for irrigation, represents the other management approach, and can still be seen in several countries.

With the codification of water laws in many countries, in the latter half of the 19th Century, the standardized type of management emerged, one that integrates legal recognition of water rights, resource conservation, public benefit, and the use of science and engineering as development strategies.[162] These developments reflected a generalized acceptance of a philosophy whereby technology was seen as the primary solution to economic and social problems.

The twentieth century was dominated by the centralized "top-down" system approach to water management. Manifested in large, national, and multi-purpose institutions for water supply, irrigation, or hydroelectric production, these systems

[161] Lee, *Water Management*, p. 6.
[162] Ibid., p. 21.

became standard templates modeled from the developed world by developing countries.

Only in the recent past has it become recognized that water users should be given serious roles to play in water management, and that regional and local organizations can be capable of successfully implementing scientific approaches to management. Private sector involvement, market forces, societal awareness, and the valuation of natural resources and the environment, have spurred a reinvestment in the value of "bottom-up" strategies to the traditional model of scientific resources management.[163] Simultaneously, private sector involvement can involve a new form of "top-down" development at the local and regional levels through globalization of economic interests.

Water Management for Economic Development

Economic development of trans-boundary river flow requires envisioning rivers as a basin-wide resource, involving the identification of use prioritization, possible alternative uses, and the selection of applicable control and management strategies to maximize performance and yield. Environmental variables within this economic development decision-calculus include: conservation, environmental flow requirements, structural modifications to the channel and surrounding floodplain area, geophysical or geochemical limitations, and downstream water quantity and quality stressors. Yet, the use of trans-boundary flow creates intentional and unintentional externalities, or byproducts, that can negatively impact downstream riparian states by either increasing pollutant loading or modifying the river's hydrological regime. These externalities can be perceived by downstream riparian states as a source of conflict, particularly, if the

[163] World Bank, *Water Resources Management* (Washington D.C.: A World Bank Policy Paper, 1993).

perception is that the upstream state is creating such negative externalities solely for unilateral gain. One potential solution is to internalize such externalities by considering the basin as a whole.[164] However, doing so is often easier said than accomplished, as will be discussed later in this chapter.

With an expanded definition of environmental security, economic development opportunities of shared, international resources, are becoming linked ever closer with main-stream geopolitical concerns. It has been argued that increasing pressures for developing countries to modernize can instigate rapid economic growth and development at the expense of natural resources through over-consumption.[165] Economists have also argued that applied economic theories and formulas for effective trans-boundary river management must also reflect public-sector and sociopolitical stressors decision makers must face, even if such interests stand in opposition to effective economic practices. This idea facilitates an open, flexible system where local interests can have a voice against larger state or foreign considerations.[166] Environmental ethicists have also posed theories whereby situation-centered models can be developed to ascertain the ethical extent to which humans can "purposively manipulate" natural features without becoming bogged down in fruitless, relativistic debates on acceptable levels of "interference."[167]

Additionally, recent literature in the field of water resource management and economic development has focused on the creation and appropriate influence of water

[164] See generally, Peter Rogers, "The Value of Cooperation in Resolving International River Basin Disputes," *Natural Resources Forum* (May 1993): 117-31.
[165] Gareth Porter and Janet Welsh Brown, *Global Environmental Politics,* 2nd. ed. (Boulder: Westview, 1996).
[166] See generally, Richard E. Just et al., "Using Bargaining Theory and Economic Analysis as an Aid to Trans-boundary Water Cooperation," in Just and Netanyahu, *Conflict and Cooperation*, p. 411-26.
[167] See generally, Mark A. Michael, "How to Interfere with Nature," *Environmental Ethics* 23, no. 2 (Summer 2001): 135-154.

markets on the allocation and distribution of water resources, particularly from trans-boundary rivers. While much research and case study analysis remains, some general conclusions point to privatized water markets as a potentially effective source for developing the needed capital, private-sector involvement, and local stakeholder inputs to design, maintain, and manage trans-boundary river flows.[168]

Developing states often lack the necessary financial or technical resources to appropriately sponsor large scale water projects. In developing states, agricultural consumptive usage of water consumes over 87 percent of total water allocations.[169] As soils are depleted, crop production decreases, requiring greater use of herbicides, fertilizers, and pesticides, which significantly limit the reusability of those waters. However, since the turn of the twentieth century, there has been a general shift in water usage, where industrial and municipal demand has increased, while through efficiency, agricultural demands have reduced.[170] This shift holds a unique opportunity for developing countries. Policy and fiscal movements toward urban and industrial consumption means less total water used and the ability to generally increase the pricing of water.

Particularly in developing states with a high level of democratization, the state can establish policies to encourage property rights as mechanisms to finance beneficial water infrastructure or irrigation projects.[171] In order for such a market-driven scenario

---

[168] Charles W. Howe, Dennis R. Schurmeier and W. Douglass Shaw, Jr., "Innovative Aproaches to Water Allocation: The Potential for Water Markets," *Water Resources Research* 22, no. 4, (April 1986): 439-45.
[169] I. A. Shiklomanov, "World Fresh Water Resources," in *Water in Crisis: A Guide to the World's Fresh Water Resources*, ed. Peter H. Gleick (New York: Oxford University Press, 1993), p. 20.
[170] Asit K., Biswas, "Water for Sustainable Development in Twenty-first Century: A Global Perspective," in *Water for Sustainable Development in Twenty-first Century*, ed. Asit K. Biswas, Mohammed Jellali, and Glenn E. Stout (New Delhi: Oxford University Press, 1994), p. 8.
[171] David Zilberman and Douglas Parker, "Internal Water Disputes: Causes and Solutions," in Just and Netanyahu, *Conflict and Cooperation*, p. 90.

to work, the state would still need to establish consistent and long-range controls on such activities to ensure the public interest is served in association with individual, private gains. Such developments need to directly sustain the equitable distribution of water and assure legal and regulatory rules are in place to protect environmental flows and water quality. Additionally, such projects should focus on restoration and revitalization within the trans-boundary basin to create alternative water-related markets, such as tourism and recreation. Such a broad focus can help alleviate decision makers and economists concerns with uncertainty associated with such expansive *and* expensive initiatives.[172]

Failure to take into consideration environmental impacts and ecological services of trans-boundary watersheds when evaluating the economic development potential of rivers can cause significant harm to local economies, the environment, and the future resource potential of the basin. For instance, the Aral Sea Basin and associated trans-boundary river systems in Central Asia was considered a "national sacrifice area," or a peripheral region intended for resource exploitation without benefit to the local economic interests during the reign of the former Soviet Union.[173] After the Soviet regime collapse, the Aral Sea river system became a trans-boundary resource, and as the now independent states competed to establish domestic economies, conflicts immediately become apparent. For instance, on the Syr Darya River, upstream Kyrgyzstan and downstream Uzbekistan came into direct conflict between Kyrgyzstan's need to maintain hydroelectric production for domestic consumption and export and irrigation

[172] Ibid., p. 96.
[173] Stefan Klötzli, "The 'Aral Sea Syndrome' and Regional Cooperation in Central Asia: Opportunity or Obstacle," in Gleditsch, *Conflict and the* Environment, p. 425-427, citing Volker Böge, *Large-Scale Strip-Mining and Environmentally Induced Conflicts* (Zurich: ETH Zurich and Swiss Peace Foundation, 1993).

flows through Uzbekistan for agricultural production. An agreement was reached in 1996 to support mutual dependencies on crude oil transport and electricity production. Yet, the ecological devastation throughout the entire basin, including toxic dust due to erosion, water pollution, lack of flows, and desertification, all continue to stress intra-basin cooperation, even though more than 300 resolutions and agreements have been executed since the end of the 1980s.[174]

The Aral Sea itself has been significantly impacted by water consumption demands. The sea is currently 56 percent smaller in size than elevation levels in the 1960s and has lost over three-quarters of its volume due to diversions from the Syr Darya and Amu Daryu rivers for industrial and agricultural production. The Aral Sea water is heavily contaminated with phenols, nitrogen compounds, pesticides, salinization, and organic matter. Additionally, ground waters are highly susceptible to contamination from surface water sources. The shrinking surface water elevation and reduced flow from rivers has devastated the river deltas entering the lake and destroying areas of significant ecological value to Central Asia, as well as important local economies.[175] Cotton production during the Soviet-era dominated the agricultural production for the basin. Cotton requires massive amounts of water, including heavy use of chemicals, such as herbicides and pesticides, constituting two-thirds of Uzbekistan's gross output and employing over 40 percent of the local workforce. Unfortunately, a turn toward more environmentally-conscience activities to restore the Aral Sea, deltas, and riparian zones mean the loss of the primary economy for the

[174] Ibid., p. 417-434.
[175] Stefan Klötzli, "The Water and Soil Crisis in Central Asia—A Source for Future Conflicts," in Spillman and Bächler *Environmental Degradation as A Cause of War, Volume III*, p. 260-263.

region.[176] Clearly, the Aral Sea basin demonstrates the significant, long-term negative externalities associated with water resource development without the continuous management of environmental impacts on the local economy and ecosystems.

MAP 4-1: Uzbekistan, Turkmenistan, and Kazakhstan
Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

[176] Ibid., p. 249-334.

International Treaties and Agreements

As stated earlier, many arguments have been brought forward that trans-boundary rivers ought to be managed at the watershed level, which represents the most comprehensive, ecologically-sound approach to sustainable and geopolitically advantageous resource sharing. Few lasting success stories of such management exist. However, one such example is the bilateral development of the Danube River along the Slovak-Hungarian border. The Gabčíkovo-Nagymaros (G-N) Projects, initiated in 1961, consist of a series of flood control and river-step infrastructure, along with hydroelectric power generation. Although political disputes over the last four decades have stopped development on certain projects, many elements have been in operation for some time, reducing the flood risk and opening up the river to increased navigation and commerce. Also, environmental improvements have been documented including water quality, soil stabilization, and groundwater recharge.[177]

Yet ultimately, historical management (as is still the present case) tends to respect national, regional, or local water management strategies, focusing primarily on domestic water demands. When trans-boundary river basin agencies have been established, they tended to be short-lived and functionally restricted to specific geographical regions or water management service areas, most often to regulate the release of scheduled flows in a basin through multiple reservoirs or the conservation of small, critical watersheds.[178] Additionally, riparian states and water demands change, often outdating management strategies created through cooperative international

[177] Miroslav B. Liska, "Development of the Slovak-Hungarian Section of the Danube," in Blake, *The Peaceful Management of Transboundary Resources*, p. 175-185.
[178] Lee, *Water Management in the 21st* Century, p. 38, citing Gilbert F. White, "A Perspective on River Basin Development," *Law and Contemporary Problems* 22, no. 2 (1957; reprint *Geography, Resources, and the Environment*, 1986), p. 39-79.

treaties. For instance, in the Jordan River Basin, current Israeli, Jordanian, and Syrian water demands far exceed allocations defined in the 1955 "Johnston Plan." Palestinian needs along the west bank of the Jordan River have raised the daunting specter that existing water treaties fail to meet present or anticipated water needs for all the riparian states. Compounding the matter are a series of geopolitical shifts in the region since the 1950s, which have provided Israel through military and political hegemonic strength to over-consume original Johnston Plan allocations, along with unilateral control of diversion infrastructure along the Jordan and Yarmouk rivers. Current water projections in the basin reveal that conflicting demands and inadequate supply will continue to be a major development and geopolitical barrier in the region for the foreseeable future.[179]

It should be noted that over two thousand treaty instruments and regimes have been established, which are mostly bilateral and cooperative in scope.[180] Many have offered some element of success through sharing data or costs of certain non-threatening infrastructure development projects. The Indus Water Treaty and the Indus Basin Development Fund Agreement, signed in 1960 to manage the Indus River and tributaries by the then independent and sovereign states of India and Pakistan, provided for the separate management of the river as independent irrigation systems versus a single trans-boundary system. Though earlier, a comprehensive engineering and management solution was found, this independent strategy and subsequent funding by the World Bank, realized a management solution that minimized inter-dependency between the two states, which had been a major riparian development obstacle.[181]

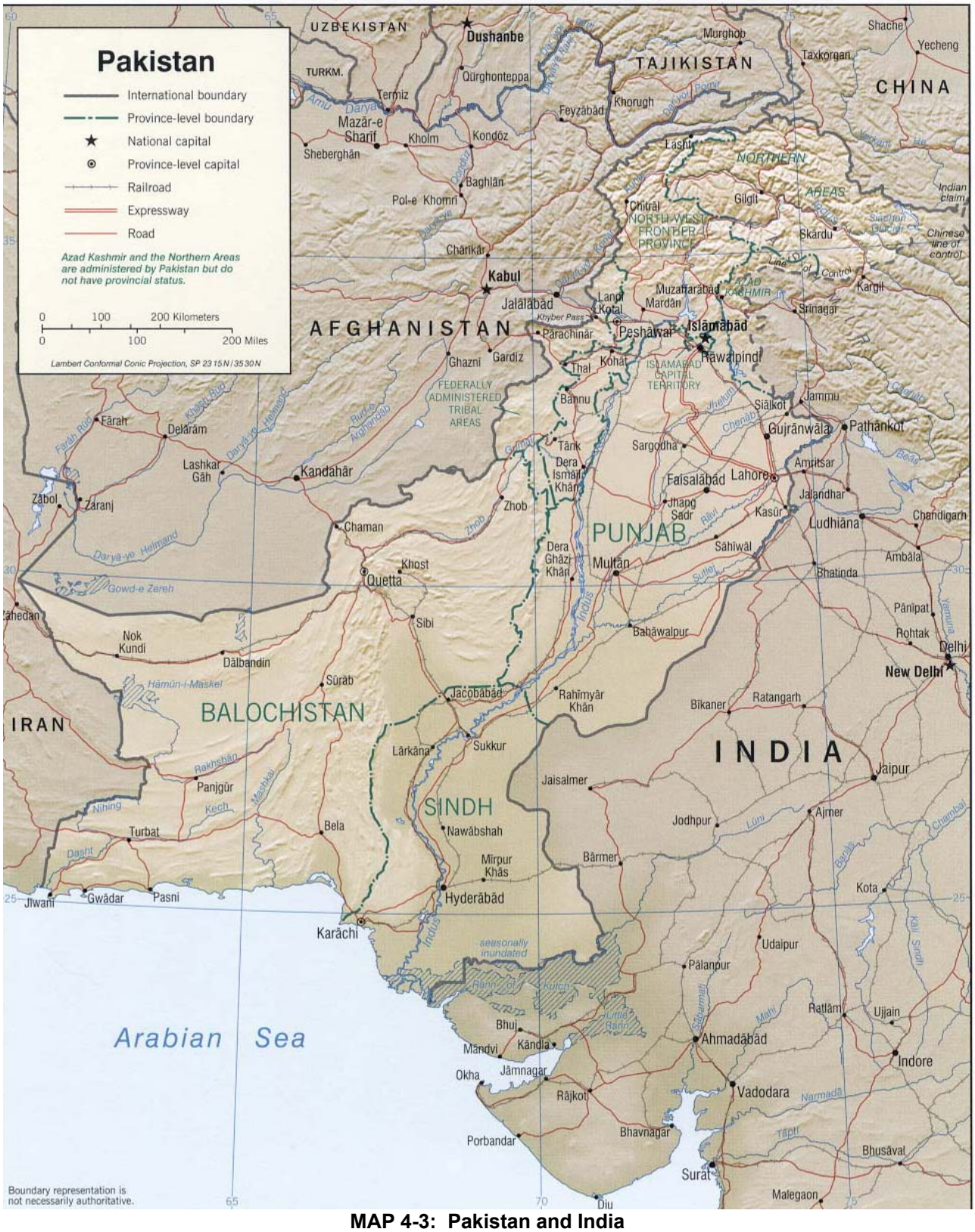
[179] Arnon Soffer, "The Relevance of Johnston Plan to the Reality of 1993 and Beyond," in Isaac and Shuval, *Water and Peace in the Middle East*, p. 123-33.
[180] Stephen C. McCaffrey, "Water, Politics and International Law," in Gleick, *Water in Crisis*, p. 92-116.
[181] Nakayama, "Successes and Failures of International Organizations, p. 370.

MAP 4-2: Hungary and Slovakia
Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

Yet, conversely, many large trans-boundary basins have yet to develop or agree to such treaties. For instance, the Ganges-Brahmaputra-Barak River basin, with five riparian states—India, Nepal, China, Bangladesh, and Bhutan—have continuously failed to establish basin-wide agreements for water sharing and flood damage reduction, even with continuing mediation by international organizations.[182] As a result of these continuing failures, upstream/downstream tensions still persist and represent critical barriers to intra-basin cooperation. Nearly the same geopolitical stalemate exists in the Nile River basin among ten riparian states (Burundi, Ethiopia, Egypt, Eritrea, Kenya, Rwanda, Sudan, Tanzania, Uganda, and Zaire), despite decades of negotiation efforts.[183] This stalemate has resulted in an unstable political climate, military rivalries, unresolved territorial disputes, and ethnic conflicts. The 1959 Nile Waters Agreement was negotiated by Egypt and Sudan for the Nile water resources of the Blue Nile. This bilateral treaty fully divided the Blue Nile's calculated 74 billion cubic meters (bcm) at Aswan Dam, with 55.5 bcm allocated to Egypt and the remainder to Sudan. Ethiopia was not a party to these negotiations and received no water rights.[184] It has been estimated that over the next twenty years, Ethiopia will need over 30 bcm of water for irrigation in the rapidly developing highlands region where over 85 percent of the total Blue Nile River water originates.[185]

---

[182] See generally, Dpak Gyawali, "Nepal-India Water Resource Relations," in *Power and Negotiation,* ed. I. William Zartman and Jeffrey Z. Rubin (Ann Arbor: University of Michigan Press, 2000) and Arun P. Elhance, "Hydropolitics: Conflict and Cooperation in International River Basins," in Deudney and Matthews, *Contested Grounds*.
[183] Elhance, *Hydropolitics in the 3rd World*, p. 53.
[184] Dale Whittington, John Waterbury, and Elizabeth McClelland, "Toward a New Nile Waters Agreement," in *Water Quantity/Quality Management and Conflict Resolution: Institutions, Processes, and Economic Analyses*, chap.14, ed. Ariel Dinar and Edna Tusak Loehman (Westport: Praeger, 1995), p. 167.
[185] Ibid., p. 168.



MAP 4-3: Pakistan and India

Source: Courtesy of the General Libraries, University of Texas at Austin
http://www.lib.utexas.edu/maps/index.html

Even where riparian states negotiate some level of multilateral agreement on utilizing a trans-boundary river, inter-basin conflicts can still disrupt or nullify intra-basin cooperation. For instance, the riparian states along the Lower Mekong River—Myanmar, Laos, Thailand, Cambodia, and Vietnam—in 1958 created the Mekong Committee to coordinate resource development along the river. While generally considered a failure or, at best, a poorly-functioning cooperative management arrangement, a multitude of important scientific and engineering data have been collected and transparently shared among the riparians.[186] However, China, the regional hegemonic power in South East Asia, controls the upper Mekong River Basin, and has aggressively sought to develop the river's waters through a series of fifteen or more dams in the Yunnan Province. Concerns of the downstream riparian states and China's desire for navigation routes to the sea have fostered a certain level of cooperation, particularly with Laos and Thailand who stand to benefit from increased flood protection. Conversely, Vietnam and Cambodia may suffer effects from salinity intrusion into the delta and decreased flows into the Tonle Sap reservoir, respectively. As more riparian states become involved, competing and conflicting interests increase, raising the difficulty in effectively managing the Mekong's flows equitably.[187]

Recent arguments have recognized a need for an international law paradigm-shift away from international treaties and agreements seeking to "bind" riparian states into compliance with third-party intra-basin legal requirements, to empowering states to engage in beneficial projects and facilitate enhanced public participation in securing

[186] See generally, C. Brady, "South-East Asia: the Mekong River," in *Resource Politics: Freshwater and Regional Relations*, ed. C. Thomas and D. Howlett (Buckingham: Open University Press, 1993), p. 86-109.
[187] Thomas, "Water," p. 115-118, citing L. Sluiter, *The Mekong Currency* (Bangkok: Project for Ecological Recovery, 1992).

access to safe and sufficient water supplies.[188] The shift is one from a discretionary role of state intra-basin involvement to a functional engagement in water resource planning and management. Operatively, such a paradigm-shift involves establishing common, mutually accepted minimum standards that all riparian states would adhere to in developing trans-boundary river resources. Even in the highly contested and politically-charged environment of the Jordan River, Israel and the Arab states in the mid-1990s began formulating Joint Water Committees to work toward data and management transparency.[189]

Instead of forcing political boundaries to a subservient role to watersheds, recent discussions have focused on evaluating the necessity of improving existing intra-state water allocations and water use of trans-boundary rivers. The allocation imperative is a question of flexibility inherent within a water management agency to competitively provide water demand services for a variety of sectors (e.g., municipal, agricultural, industrial, and environmental) in such a manner conducive to the needs of other riparian states.[190] In the end, there does not exist a single rule that can legally compel state action to preserve and use trans-boundary flows in a manner always conducive to other riparian states.[191] Due to the uniqueness of each basin, specific arraignments and agreements must be established, whether through cooperative bilateral or multilateral agreements or autonomous, sustainable internal resource planning and development.

---

[188] Ellen Hey, "Sustainable Use of Shared Water Resources: the Need for a Paradigmatic Shift in International Watercourses Law," in Blake, *The Peaceful Management of Transboundary Resources*, p. 127-128.
[189] Nurit N. Kliot, "A Cooperative Framework for Sharing Scarce Water Resources: Israel, Jordan, and the Palestinian Authority," in Amery and Wolf, *Water in the Middle East*, p. 191-217.
[190] Lee, *Water Management in the 21st Century*, 40, citing Gunter Schramm, "Integrated River Basin Planning in a Holistic Universe," *Natural Resources Journal* 20, no. 4 (1980): 787-806.
[191] See generally, Harry Hill, "Strategic Planning and Policy Framework Development: Elements, Priorities and Action Plans," in *River Basin Planning and Management*, ed. Mahmoud A. Abu-zeid and Asit K. Biswas (Calcutta: Oxford University Press, 1996), p. 11-18.

Effective Water Management Strategies

Thayer Scudder once commented that river basins are the "heartlands" for successful development.[192] Within trans-boundary river basins, a myriad of water users, agencies, and sociopolitical forces converge and determine whether water will be allocated equitably and sustainably, while preserving the biotic and ecological functioning of the river itself. R. C. Sharma and Suparna Nag write, "The core of the water resource management problem is water's uneven geographical distribution.…The issues of major concern may be loosely classified into professional or public issues, the former based on science and the latter on politics."[193] Developing states are confronted by multiple development, economic, and sociopolitical forces in establishing policies for the management and exploitation of natural resources. Competing interests—domestic and foreign—can serve as beneficial or disruptive stressors. Political ideologies, poverty, ethnic tensions, and influence from the private sector may induce policy development that encourages the mismanagement of natural resources or misguided preservation activities that affect local indigenous populations.[194] The integration of these concerns is a difficult challenge and each river basin requires individual assessment and unique management strategies developed by each developing state. However, a few general principles can be gleaned from the copious volumes of research.

---

[192] Thayer Scudder, "Recent Experiences with River Basin Development in the Tropics," *Natural Resources Forum* 18, no. 2 (1994): 101-113.
[193] R. C. Sharma and Suparna Nag, "On the Question of Fresh Water Management in South Asia," in Blake, *The Peaceful Management of Transboundary Resources*, p. 222.
[194] William Ascher, *Why Governments Waste Natural Resources: Policy Failures in Developing Countries* (London: The John Hopkins University Press,1999).

First, environmental considerations, often a regulatory afterthought, are fundamental elements of any trans-boundary water management strategy. The construction of dams, drainage of wetlands, irrigation, flood mitigation infrastructure, off-channel water transfers, and creation of surface water reservoirs, all serve to modify the hydrology and hydraulics of the river basin and associated watershed. This construction, in turn, affects the overall ecological functioning and services of the river. Reduced biodiversity, loss of wildlife habitat, and modification or loss of riparian vegetation can produce a significant and negative impact on water quality and quantity, stream bank erosion, and flood control. Ultimately, such impairments reduce the opportunities to reuse water for multiple purposes and modify flow regimes and flood frequencies, placing a serious management strain on downstream water users, while also requiring a greater investment of financial resources to maintain existing and proposed on- and off-channel water services. An emphasis on ecological protection requires a radical shift in understanding the relationship of natural resources and land use. Traditional notions of land use include the interconnection between labor and property to determine ownership. Land unused in many western land use philosophies is considered "wasted."[195] With a modern understanding of the importance of ecological services and protection of watersheds to assure sufficient and clean water supplies, environmental flows need to be considered a beneficial use, as opposed to merely a wasted resource.

Second, unilateral actions by a riparian state can offer some of the most effective ways to mitigate intra-basin conflict through the "development and enforcement of

[195] Thom Kuehls, "Between Sovereignty and Environment: An Exploration of the Discourse of Government," in Litfin, *The Greening of Sovereignty in World Politics*, p. 31-53.

reasonable measures to stem polluting emissions, remediate industrial plants, or put constraints on development activities that are unsustainable."[196] A broaden understanding of national security to include environmental scarcity, empowers and supports a political philosophy known as "neo-realism," which states that countries exist in an anarchic world and act in the interests of self-preservation, motivated ultimately by the power of force.[197] With environmental security as an operative perceptional element in assessing potential threats to a state, policymakers may choose to seek out unilateral means to preserve water resources for domestic consumption and economic development. Yet, an informed neo-realist paradigm includes an awareness of the destabilizing and dangerous forces of resource scarcity as it affects the proper functioning of government. In turn, the preservation of natural resources and restoration of ecological services, both domestically and within the trans-boundary basin, will tend to offer more benefits than the complete isolation and degradation of the system's functions, as was the case with the Aral Sea.

Third, within unilateral development, there is a fundamental importance to incorporate a broader stakeholder vision to achieve the most effective water development strategies for trans-boundary river flows and protections. Particularly with the advent of increasing access to policy decision making through litigation in developing and democratizing states, sub-national interest groups, such as local and regional governing authorities, environmental special interests groups, and the private sector have demanded a greater role in water development planning.[198] Recent

[196] Spector, "Transboundary Disputes," p. 217.
[197] Dougherty and Pfaltzgraff, *Contending Theories of International Relations*, p. 80-89.
[198] Edwin H. Clark II, Gail Bingham, and Suzanne Goulet Orenstein, "Resolving Water Disputes: Obstacles and Opportunities," *Resolve* 23, no. 1 (1991): 1.

research in the field suggests rethinking what is meant by "community" in order to effectively mobilize local and regional stakeholders to actively participate in the management, use, and conservation of water resources.[199] By looking at communities, not as homogenized, small spatial units, but rather as divergent-interest actors with institutional-style decision making capabilities, water managers can effectively bridge the gap between state governments and agencies with local demands for trans-boundary flows.[200] Additionally, this refocusing of communities and the roles of individual stakeholder interests in a more democratic process, operatively develops the opportunity to modify what is considered narrowly-conceived self interest ethical systems, whereby existing value choices that are often only concerned with the maximization of individual benefits over a short-term period can be modified to include a more community-oriented, long-range vision within decision making strategies. Community inclusion in the development and planning of trans-boundary resources facilitates a recognition of competing self-interest decision matrices and incorporates them into an integrated forum that allows for the contingency of these interests to be seen as interrelated in the "web of social interactions," and therein, empowering a broader awareness of the inherent responsibilities held by communities for the potential future outcomes of their present decisions.[201]

---

[199] See generally, R. E. Chambers and M. K. McBeth, "Community Encouragement: Returning to the Basis for Community Development," *Journal of the Community Development Society* 23, no. 2 (1992): 20-38; O. P. Chitere, ed., *Community Development: Its Conceptions and Practice with Emphasis on Africa* (Nairobi: Gideon S. Were Press, 1994); A. Etzioni, "Positive Aspects of Community and the Dangers of Fragmentation," *Development and Change* 27 (1996): 301-314.

[200] Arun Agrawal and Clark C. Gibson, "Enchantment and Disenchantment: The Role of Community in Natural Resource Conservation," *World Development* 27, no. 4 (1999): 629-649.

[201] Jay R. Harmon, "Notions of Self-Interest: Reflections on the Intersection between Contingency and Applied Environmental Ethics," *Environmental Ethics* 23, no. 4 (Winter 2001): 377-390.

Fourth, even with unilateral actions, a basin-wide acceptance of some form of reciprocity[202] should be upheld either through treaties or political, economic, or military coercion. If a riparian state refuses to apply sustainable practices to divert trans-boundary flows, or continues to unjustifiably pollute the same flows, negatively impacting downstream riparian states, then mechanisms should be established to compel compliance with minimum standards of water conservation and environmental protection. Here, the United Nations, World Bank, and other international organizations can play a critical role in successful intra-basin water development. Withholding funds, international trade sanctions, and other economic constraints are all potentially effective tools to re-engage a rogue riparian.[203]

Fifth, under appropriately managed governance, private sector participation can be introduced to traditional, autocratic, top-down approaches to water management by large state agencies.[204] Privatization of appropriate sectors of water allocations, irrigation, and electricity generation can substantially increase the efficiency of water consumption and create a pricing and regulatory market conducive to water conservation and fair-market water pricing. Studies have shown that under certain instances, contracting public sector services to private sector operators can increase operational efficiency.[205] Private sector involvement can spur development investment

---

[202] See generally, David G. LeMarquand, *International Rivers: The Politics of Co-operation* (University of British Columbia and the Waterloo Research Centre, 1977).
[203] David Goldberg, "World Bank Policy on Projects on International Waterways in the Context of Emerging International Law and the Work of the International Law Commission," in Blake, *The Peaceful Management of Transboundary Resources*, p. 153-166.
[204] Ahmend Galal, Leroy Jones, Pankaj Tandoonand Ingo Vogelsang, *Welfare Consequences of Selling Public Enterprises: An Empirical Analysis* (New York: Oxford University Press, 1994).
[205] Barrie Stevens and Wolfgang Michalski, "Infrastructure in the 1990s: An Overview of Trends and Policy Issues," *Infrastructure Policies for the 1990s* (Paris: Organization for Economic Co-operation and Development, 1993), p. 7-19.

from domestic and foreign sources.[206] With decentralized controls and distribution of service providers, coupled with appropriately managed free-market competition, greater opportunities for new emergent technologies and reform of water consumption habitats can change how riparian states use trans-boundary flows.

Sixth, demand-side management strategies for water conservation can act as effective and holistic initiatives to reduce total water consumption, and therein, overall dependency on trans-boundary flows. Effective irrigation strategies and technologies, such as drip irrigation and appropriate crop management, can significantly reduce water demands and increase water quality. Additionally, effective conservation efforts, including the encouraged use of "green" building construction and water efficient domestic and industrial appliances and machinery can sustain a continued campaign of public awareness and reduce municipal water demand.[207] Roger J. H. King argues that, ethically, the built environments created by humans should be responsive and integrated with the natural environment. Such an ethic illuminates a general understanding of limited resources and facilitates an opportunity to create visible structures that function as continuous ciphers reminding us of the codependency and interrelationship between the built and natural worlds.[208] Additionally, Vinay Lal argues for an "ecological vision," modeled to a certain extent from the life and writings of Gandhi, to revitalize the etymological link between the *economic* and *ecologic*, whereby simple, everyday activities and habitats are modified to be cognizant of their

[206] Reyaz Ahmad and Moises Mainster, "Smooth Transitions," *Privatization in Latin America, 1995* (*A Latin Finance Supplement*, 1995), p. 4-13.
[207] See generally, Paul Hawken, Amory Lovins, and L. Hunter Lovins, *Natural Capitalism: Creating the Next Industrial Revolution* (Boston: Little, Brown, and Company, 1999).
[208] Roger J. H. King, "Environmental Ethics and the Built Environment," *Environmental Ethics* 22, no. 2 (Summer 2000): 115-132.

environmental impacts. Such an ethic provides a general, uncomplicated methodological approach to integrate environmental concerns into daily life through the concept of waste minimization and resource conservation.[209]

[209] Vinay Lal, "Gandhi and the Ecological Vision of Life," *Environmental Ethics* 22, no. 2 (Summer 2000): 149-168.

CHAPTER 5

A WATER ETHIC AND CONCLUSIONS

What is a Water Ethic?

Sandra Postel at the end of her book *Last Oasis*, concludes that through discussions of efficient water irrigation, water-saving plumbing fixtures, waste water reuse, rainwater harvesting, and technical discussions on appropriate means of producing food with less water, something is still missing, some fundamental grounding that gives all the incentives, regulations, and policies meaning. Taking a cue from Aldo Leopold, she writes:

> Yet there is something missing from this prescription, something less tangible than drip irrigation lines and low-flow showerheads—but in the final analysis as important. For at the heart of the matter is modern society's disconnection from water's life-giving qualities. For many of us, water simply flows form a faucet, and we think little about it beyond this immediate point of contact. We have lost a sense of respect for the wild river, for the complex workings of a wetland, for the intricate web of life that water supports. By and large, water has become strictly a resource to be dammed, diverted, and drained for human consumption…In short, we need a water ethic—a guide to right conduct in the face of complex decisions about natural systems we do not and cannot fully understand.[210]

Further, Postel states that guided by such a water ethic, societies would have a set of "indicators" to monitor trends and make corrections as needed to undo damage caused by unsustainable development and restore the functioning of riparian ecosystems.[211]

John Kolars assigns value geographically to rivers as "entities," claiming they have the capacity for self-regulation in a natural state. Anthropogenic disturbance

[210] Sandra Postel, *The Last Oasis: Facing Water Scarcity* (London: Earthscan Publications Ltd., 1992), p. 184-185.
[211] Ibid., p. 186.

removes the ability for the river to compensate for changing conditions, such as flow, channel meanders, flooding, and continuous support for biotic communities. Kolars writes:

> A river is an entity unto itself. A river in its natural state assumes a comprehensive gradient from source to mouth. Disturbance or blockage of this gradient telegraphs itself form beginning to end and initiates a series of readjustments in slope and flow and carrying capacity through-out the system. A river adjusts to variations in seasonal changes in volumetric flow by means of its deepest channel (thalweg), its floodplains, and its underground flow. In its natural state, a river neither floods disastrously, nor shrinks capriciously. Those crises are defined by human perceptions, and often brought about by human intervention.[212]

As trans-boundary rivers are divided among riparian states and flows are diverted, used, and returned, often in degraded quality, the river as a whole suffers by loss of homeostatic ability to adjust to changing geomorphic conditions.

Both Postel and Kolar point to a *need* for a water ethic due to modern society's general disconnection with water itself. Most in the developed world lack a general knowledge or appreciation of *where* water comes from and *why* water scarcity is such a pervasive problem. This disassociation with the life cycle of water is particularly evident in urbanizing areas, where the interface with water is mechanically driven and entirely for consumptive purpose—from sanitation and bathing, to aesthetic and architectural functions.[213] The drainage of wetlands, construction of massive irrigation canals, reservoirs, and expensive flood control infrastructure, such as channels, levees and dikes, has significantly modified watersheds, destroying wildlife habitat, and

[212] John Kolars, "The Spatial Attributes of Water Negotiation: The Need for a River Ethic and River Advocacy in the Middle East," in Amery and Wolf, *Water in the Middle East*, p. 246, citing Hans-Henrik Stolum, "River Meandering as a Self-Organization Process," *Science* 27, no.1 (March 1996): 1710-1713.
[213] See generally, Ivan Illich, *H_2O and the Waters of Forgetfulness* (Dallas: The Dallas Institute of Humanities and Culture, 1985).

perceptionally broken the life cycle of water or concealed it under a cloak of reinforced concrete pipes and stark, industrial-looking, and foul-smelling treatment plants.[214] Yet, even in the developed world, a water ethic has emerged through political activism and philosophy. Beginning in the 1960s, scholars and policymakers began to think about national security beyond military conflict to the potential instigating forces of conflict, including environmental scarcity, poverty, and ethnic conflict. The emergence of "environmental security" raised the specter of water scarcity aas more than a technological barrier, but a symptom of consumption and the dangers of ecological degradation.[215]

In the developing world, living upon the banks of trans-boundary rivers, daily life is uniquely intertwined with the flow, use, and return of water. In many instances, informed by religious beliefs, an embedded environmental ethic already is an operative perception in daily life. For instance in India, Hinduism holds that mountains, rivers, and trees are "sacred" and are infused with individual spirits (*jīva*) and suffused with consciousness (*brahman*), all within a cyclic and reciprocity-laden universe that includes humans.[216] Arun P. Elhance writes, "Through mythology and daily rituals, the river and its water are intractably intertwined with deeper issues of identity, spirituality, faith, culture, and many other aspects of this and "other-worldy" existence for the Hindus."[217] And again in India, the overexploitation of water resources by government sponsored or funded private industrial activities that have dammed, diverted, or polluted Indian rivers,

---

[214] See generally, Alice Outwater, *Water: a Natural History* (New York: Basic Books, 1996).
[215] Richard A. Matthew, "Introduction: Mapping Contested Grounds," in Deudney and Matthew, *Contested Grounds*, p. 1-21.
[216] Christopher Key Chapple, "Hindu Environmentalism: Traditional and Contemporary Resources," in *Worldviews and Ecology: Religion, Philosophy, and the* Environment, ed. Mary Evelyn Tucker and John A. Grim (New York: Orbis Books, 1999), p. 113.
[217] Elhance, *Hydropolitics in the 3rd World*, p. 175.

has spawned a series of grassroots, local resistance movements and community protests under the auspices of environmental justice.[218] International non-governmental organizations (NGOs) are working to awaken the global community to the systematically underrepresented groups in water resource management: the 1.3 billion women and children living in poverty who, through gender-specific division of labor, bear an increasingly heavy burden to acquire safe, potable water.[219]

Again, at the local level, "bottom-up" user management models for controlling and allocating trans-boundary flows have been developed in response to addressing a broader stakeholder interest concerning the equitable distribution of water resources. Over the last 150 years in Chile, financially independent and autonomous water control and operation districts called *Asociaciones de Canlistas* (user associations) and *Juntas de Vigilancia* (regulating committees) have managed small-scale water development, primarily for irrigation. Projects, such as dams and reservoirs requiring public funds are heavily financed by the *Asociaciones de Canlistas* or *Juntas de Vigilancia*, which are represented by elected directors. And upon completion, all infrastructure is turned over to the local agencies.[220] Communities, like the experimental village of Gaviotas, Colombia, are demonstrating effective, low-technology ways to equitably develop natural water resources in a sustainable, self-sufficient, and economically viable way.[221] Additionally, recent research and activities have pointed to a modified version of environmental security that emphasizes the ecological harm, cultural rights, poverty,

---

[218] Madhav Gadgil and Ramachandra Guha, *Ecology and Equity: The Use and Abuse of Nature in Contemporary India* (London: Routledge, 1995), p. 76-83.
[219] United Nations Development Programme, *Human Development Report 1995* (New York: Oxford University Press, 1995). See also, C. van Vijk, E. de Lange, and D. Saunders, "Gender Aspects in the Management of Water Resources," *Natural Resources Forum* 20, no. 2 (1998): 91-103.
[220] Lee, *Water Management in the 21st Century*, p. 34-35.
[221] Alan Weisman, *Gaviotas: A Village to Reinvent the World* (White River Junction: Chelsea Green Publishing Company, 1998).

discrimination, and disenfranchisement of local, indigenous groups and the impacts borne by them due to state water resource development activities, particularly in relation to land rights, self-determination, and sovereign recognition.[222] Arguments have also been made for incorporating local, ethnocentric ethics into the globalizing value systems codified in international law for the sustainable development and equitable distribution of resources.[223] In the environmental ethics field, research has been conducted in defining the legitimacy and imperative for environmental rights. In general, such ethical theories articulate that protection from unjustified harm due to environmental degradation or exploitation is a violation of both positive and negative rights protected under traditional notions of democratic jurisprudence.[224] Furthermore, these environmental rights are universal, to be protected regardless of nationality, ethnicity, or compelling state interest to do otherwise, either for economic gain or geopolitical efficiency.

Internationally, a water ethic is already quite prevalent and in many instances codified into international law. For instance, executed in 1994, the *Convention on the Law of the Non-Navigational Uses of International Watercourses* by the United Nations, which explicitly declared that the "utilization, development, conservation, management and protection of international watercourses and the promotion of the optimal and sustainable utilization thereof for present and future generations," was of great international importance, particularly for developing countries.[225] Additionally the

[222] Sheldon Kamienicki and Margaret Scully Granzeirer, "Eco-Cultural Security and Indigenous Self-Determination: Moving Toward a New Conception of Sovereignty," in Litfin, *The Greening of Sovereignty in World Politics*, p. 257-274.
[223] Anton M. Ivanov, "Environmental Ethics and Conflicting Ethnicity: A Value-oriented Analysis," Gleditsch, *Conflict and the Environment*, p. 191-206.
[224] See generally, Shari Collins-Chobanian, "Beyond Sax and Welfare Interests," *Environmental Ethics* 22, no. 2 (Summer 2000): 133-148.
[225] M. A. Salman, "Convention on the Law of the Non-navigational Uses of Intenrational Watercourses," in *International Watercourses: Enhancing Cooperation and Managing Conflict: Proceedings of a World*

convention established obligations not to cause significant harm to other watercourse states," and that should such harm happen, that the state will in consultation with other watercourse states take measures to "eliminate or mitigate such harm and, where appropriate, discuss the question of compensation."[226] International lending institutions, such as the World Bank and the International Monetary Fund (IMF), are increasingly requiring greater considerations for environmental protection and mutually-beneficial agreements among riparian states before funding large infrastructure projects along trans-boundary rivers.

Researchers, water managers, and political elites are considering trans-boundary rivers—how to maximize the benefit of their flows, to harness their energy, and to use them as a conveyance for wastes. They are also thinking about how to preserve their valuable ecological functioning and to protect the unique and endangered habitat they encompass. However, the contrary is still true as well—massive efforts are currently underway to drastically modify, pollute, and consume trans-boundary flows under the old adage that "water reaching the sea is wasted."

Practically and philosophically it is difficult, perhaps impossible, or even undesirable, to articulate one, global encompassing *water ethic* without writing such an idea so vague as to become functionally useless. Bryan Norton writes, "Most environmental ethicists have, to date, assumed that we must, to escape arrogance, posit value as independent of human valuing or human valuers. This value has proven to offer little guidance in action and has raised innumerable and intractable questions in

---

Bank Seminar, Annex I, ed. M. A. Salman and Laurence Boisson de Chazournes (Washington, DC: World Bank, Technical Paper No. 414, 1998), p. 173.

[226] Ibid., p. 177.

the metaphysics of morals."[227] Instead of constructing a generalized water ethic applicable to all but bounded philosophically to none, a more operative solution is one that ethically captures the phenomenal constant intrinsic to trans-boundary rivers—the river itself, yet embraces the diversity of interpretations that define the ways water users identify and value the services of the river. Such an ethic establishes the river as a constant economic, political, and socio-historical presence, embedded within a plurality of interpretations and values. Additionally, by valuing the presence and not the function of the river, initial discussions between competing water users are possible. Once "around the table," Norton argues that a general understanding of ecological and systematic limitations on natural resources can be recognized, often facilitating consensus on policy decisions without dictating individual values.[228] Emphasizing a more pluralistic value system that seeks to engage and respect differing, and often, competing values, facilitates the initial open discourses necessary to peacefully resolve trans-boundary or intra-state water resource disputes.

Norton also argues that most environmental problems are problems of "integration," contextually structured and involving "impacts on multiple levels, in different scales, and it may occur that the same action can have differential moral value, depending on the context in which it occurs."[229] An integrative approach to understanding environmental impacts associated with anthropogenic activities develops the need to look at those actions, not in isolation, but holistically through multiple levels of potential impacts. For instance, at the local level, building dikes and installing flood control devices to allow encroachment in a river's floodplain may be economically and

[227] Norton, *Toward Unity among Environmentalists*, p. 252.
[228] Ibid., p. 203.
[229] Ibid., p. 238.

ethically justified to allow the autonomy of choice and the freedom to develop private property. However, such modifications may increase peak flood elevations and velocities downstream, threatening other riparian property owners, potentially causing significant damage or the loss of life. From the more regional scale of inquiry, due to the expanded potential of impacts, a general recognition of appropriate and inappropriate actions can be deduced. Specific to water scarcity and management of trans-boundary rivers, the phenomenological method can be used for critically understanding and preserving such multiple interpretative levels of review to unify a general framework for policy decisions, while preserving individual values and ethical systems. At the macroscopic level, Norton argues that this general acceptance of "scientific naturalism," or the belief that all "things in nature are related in complex, hierarchically organized systems" and that "humans evolve their personalities and cultures within environing systems that are, ultimately, shaped and limited by hierarchical constraints," is the primary compelling force that allows for the resolution of competing environmental claims.[230]

Focusing on this recognition of hierarchical constraints allows for effective intra-state management of trans-boundary water resources. Local and regional decision making, informed by an understanding of the larger potential impacts of those decisions, facilitates opportunities for water resource planning and development strategies that provide for specific, needed services within the context of maximizing the availability of those resources to other riparian stakeholders. The context for maximization of resources is bounded underneath "hierarchical constraints" which are intrinsic to the river's flow, climatic variability, ecological integrity, and existing or projected

[230] Ibid., p. 239.

anthropogenic stressors, such as population growth, urbanization, industrial modernization, and agricultural production. Even within these "hierarchical constraints" there exists the opportunity to identify non-instrumental claims regarding the value of nonhuman natural features, which can offer effective policy guidance and preserve individual value systems that may be in opposition with other ethical worldviews.[231] Norton writes, "By pursuing convergent goals and experimenting in areas where local viewpoints differ, we can learn which strategies to choose in various situations and therefore to improve our ability to minimize anthropogenic impacts at all levels and scales."[232] This idea of pluralistic stewardship allows for an environmental ethic that incorporates elements of anthropocentrism, biocentrism, and ecocentrism, while emphasizing the multiplicity of potential decision "paths" that may be taken to balance and resolve competing concerns surrounding the provision of basic human needs, advancing economic welfare, and environmental protection.[233] Under this ethical rubric, riparian states can unilaterally exploit trans-boundary resources, such that the diversion, modification, or allocation of those resources does not impede on the dynamic ability of the river to continue functioning in a state conducive to the needs of all riparian stakeholders, including the biological integrity of the river itself. In a certain sense, this is not a new "water ethic," but rather a re-appropriation of a fairly common and accepted resource management strategy applied to geopolitical decision making.[234]

---

[231] Ben A. Minteer, "Intrinsic Value for Pragmatists?" *Environmental Ethics* 23, no. 1 (Spring 2001): 57-76.
[232] Bryan G. Norton, "Convergence and Contextualism: Some Clarifications and a Reply to Steverson," *Environmental Ethics* 19, no. 1 (Spring 1997): 100.
[233] Christopher B. Barrett and Ray Grizzle, "A Holistic Approach to Sustainaability Based on Pluralism Stewardship," *Environmental Ethics* 21, no. 1 (Spring 1999): 23-42.
[234] See generally, Stephen Woodley, James Kay, George Francis, ed., *Ecological Integrity and the Management of Ecosystems* (Ottawa: St. Lucie Press, 1993).

As evidenced above, a water ethic already exists. Efforts to protect and appropriately use water can be found throughout the world with numerous examples from local development to international treaties. Each is unique to a specific region or activity, yet certain generalities can be deduced and applied to other projects. One can find elements of sustainability, equitable access, and ecological preservation that link all such projects, laws, and visions together. And while this holds an important value well worth greater exploration and enumeration, this thesis proposes a different path, one that preserves the uniqueness of each activity and decision that brings humans and water into a more open relationship.

The French philosopher, Michel Foucault, argued that the understanding of history was the science of analyzing the past and creating a "discourse of coherence" where a constantly restored and hidden unity of events is systematically woven together. Yet, in this construction there are always embedded irregularities that fail to complete "history," and for which greater attention is required.[235] The development of an *ethic* can be considered in a similar manner—or the activity of building a fundamental set of rules that establishes a matrix of divergent values, which in turn provides a mechanism for decision making. Specific to water resource management, these values can be derived from a number of sources, including sociopolitical groundings, such as religion, custom, tradition, jurisprudence, geopolitics, and economics, or more metaphysical concepts, such as natural law, moral responsibility, and ecological integrity. Perhaps more realistic is that all of these values are to varying degrees implicitly or explicitly present in a decision making calculus.

[235] Michel Foucault, *The Archaeology of Knowledge and the Discourse on Language*, trans. A. M. Sheridan Smith (New York: Pantheon Books, 1972), p. 149.

It has been argued that organizations, particularly governments, suppress value conflicts rather than confronting them.[236] Trans-boundary rivers are perceived merely as a resource to serve a particular end, be it political or economic. What is often forgotten are the underlying perceptions that identify the river as a *place* from which communities are identified and empowered. Trans-boundary flows provide the means from which billions of global inhabitants in some manner find the ability to survive or flourish. The river exists as a nexus, converging political, religious, historical, and economic ideas into a single presence with many forms. As the ancient philosopher Heraclitus wrote, "The river where you set your foot just now is gone—those waters giving way to this, now this."[237] Just as the river is constantly changing channels, directions, and flows, meandering through different terrain and supporting a diversity of ecosystems, so is the river constantly a changing presence to the different stakeholders that depend upon its flows.

Conflict and competition are an inevitable condition of rivers. An effective water ethic is one that embraces that conflict, recognizing it not as a result of competing water demands, but a fundamental predisposition of the river itself. Management and planning is then a function of best allocating the values of the river in such a manner as to facilitate the equitable means by which each stakeholder obtains the needed resources from the river. When the unfortunate situation arises where all competing demands cannot be met and negotiation is not an option, then a water ethic should

[236] Eric K. Stern, "The Case of Comprehensive Security," Deudney and Matthew *Contested Grounds*, 143 citing John Steinbruner, *The Cybernetic Theory of Decision* (Princeton: Princeton University Press, 1974) and J. March and J. Olsen, *Rediscovering Institutions: The Organizational Basis of Politics* (New York: Free Press, 1989).
[237] Heraclitus, *Fragments: The Collected Wisdom of Heraclitus*, trans. Brooks Haxton (New York: Viking New York, 2001), p. 27.

establish a means of prioritizing the distribution and allocation of flows to the greatest number with the highest need.

In terms of environmental (water) security, an effective water ethic is one that supports the idea of security encompassing human rights and social and environmental values in conjunction with traditional notions of politico-military responses to hegemonic forces. Constructing a *threat* to water security should be expansive and representative of the diverse precursor conditions that created the anthropogenic or environmental scarcity (externally and domestically) so as to avoid unnecessary and potentially dangerous linkages to ethnic, cultural, or economic differences, which may result in conflict or violence. A water ethic should serve as a fundamental grounding value that identifies water security and supports a more focused local and regional response to water scarcity and the protection of communities, rather than as an "addendum to the traditional politico-military security agenda."[238] This grounding value requires thinking beyond threats as merely external forces endangering national sovereignty and the political integrity of the state where security reverts simply to a Cold War relic of protecting "us" against a politically demonized "them."[239] Instead, as discussed earlier, water scarcity and security responses need to include a more comprehensive matrix of factors and consideration of precursor conditions, including internal consumption demands that may have instigated the security threat in the first place.

[238] Hugh C. Dyer, "Environmental Security as a Universal Value: Implications for International Theory," in *The Environment and International Relations,* ed. John Vogler and Mark F. Imber (London: Routledge, 1996), p. 37.
[239] Simon Dalby, "Threats from the South? Geopolitics, Equity, and Environmental Security," in Deudney and Matthew, *Contested Grounds*, p. 160, citing Simon Dalby, *Creating the Second Cold War: The Discourse of Politics* (London: Pinter, 1990).

Returning to one of the original assumptions made at the outset of this thesis, trans-boundary rivers are considered a *phenomenal presence* and that the *perception* of water scarcity was actually a more important operative element in decision making than the actual presence or non-presence of a resource limitation.[240] This assumption empowers the idea that scarcity and resource management is more than merely responding to environmental conditions, but rather is a function of both anthropogenic and environmental systems and actions that create the actual presence of scarcity. Here, too, the perception of values and a water ethic are of critical importance. The foundations for an environmental ethic can be derived from any number of sources—religion, land use law, aesthetics, or the sciences—each of which offers a unique and potentially equally valid way of constructing a water ethic.[241] Instead of reducing these value systems into a generalized manifesto that we would then label a "water ethic," the onus of inquiry should be on empowering individuals' perception of rivers and water scarcity through unique local, historical, political, scientific, or philosophical knowledge. In essence, a water ethic is an individual ethic, universally bounded to other ethics by a singular phenomenon, the flowing river.

Ultimately "effective demand" for water consumption, or the price consumers are willing to pay during any given period, is not merely a function for economists to calculate,[242] but rather represents the perceptions of scarcity and the relative importance of conservation compared against individuals' lifestyles and expectations. A water ethic, as discussed here, provides the means by which individuals can rethink the

[240] Antonio Hill, "Environmental Conflict: A Values-oriented Approach," Gleditsch, *Conflict and the Environment*, p. 51-70.
[241] For a general history of environmental ethics, see Eugene C. Hargrove, *Foundations of Environmental Ethics* (Denton: Environmental Ethics Books, 1989).
[242] Stephen Merrett, *Introduction to the Economics of Water Resources*, p. 53-55.

interface between humanity and the river, to question the volume of water needed and the impact of negative externalities and opportunity costs associated with that want.

Such a proposition returns the ethical question of how to manage water to the individuals that make up the international agencies, state governments, and local stakeholders responsible for or affected by decisions on how the services of trans-boundary rivers are utilized. This type of water ethic creates a foundation from which the opportunity arises to interactively discuss water issues between individuals that may have extremely divergent opinions and values. With the river as a common phenomenal presence, open to interpretation and perceptual modification, meaningful dialogue is always possible. If an ethic compels one's actions, then a water ethic should be one with the greatest potential for open and dynamic conversations about the river. The river is that discoverable place with which we all have some mode of interaction—even if we are unaware of it—and from which all the many manifestations of a water ethic emerge. And with recognition of this unique place and the multitudes of values that spring from it, so does the possibility of a common discourse of different perceptions emerge and become the fruitful foundation for effective water management.

Conclusions

Trans-boundary rivers are complex ecological and geographical phenomena, the management of which poses unique sociopolitical, economic, and engineering challenges for developing riparian states seeking to enhance fiscal independence and ensure the continuing availability of freshwater. Particularly in developing countries, increasing populations and rising water demands through economic modernization will continue to stress already limited water resources. Additionally, as traditionally

underrepresented minorities such as indigenous populations and women begin to take a larger and more active role in state politics and international efforts strive to encourage democratization, water resources will be even further stretched to provide for more equitable distribution of flows.

Situated between competing riparian states, trans-boundary flows will continue to be a potential locale for geopolitical tension. The present disposition of many riparian countries is to control their segments of trans-boundary rivers as critical national resources and to perceive encroachment by other states as a potential threat to national security. The securing of trans-boundary flows, including headwaters and interconnected groundwater aquifers, is a growing concern as more riparian states in a given basin seek new development opportunities, potentially disrupting historical balances of power.

Proposed or actual development inevitably has an impact on other riparian states. Dams and flood control projects can reduce flows to estuaries and destroy commercial fishing stocks and farming along alluvial floodplains. Diversions and the construction of large reservoirs can alter historic hydrologic flow regimes, destroying critical wildlife habitat, inundating bottomland forests, and severely impacting riparian wetland ecosystems. Deforestation and urbanization in the upper reaches of the basin and along the mainstem can cause deadly flooding and erosion. Inefficient farming and industrial activities can pollute the rivers, effectively denying downstream opportunities for beneficial reuse of flows, threatening local economies and public health.

Additionally, water scarcity associated with trans-boundary rivers is as much a sociopolitical force as an existing environmental condition. Inequitable distribution,

population displacement, ethnic conflicts, mismanagement, and ineffective infrastructure have created local or regionalized scarcities, which can exacerbate domestic conflicts among competing water users. Such conflicts can escalate to the national, and potentially international, level. Contrary to some theorists, future wars will not be waged over water alone, but water scarcity in combination with other sociopolitical tensions can serve as a destabilizing stressor that will affect the willingness or ability of riparian states to cooperatively work toward common and mutually beneficial water resource management solutions. Ultimately, the perception of scarcity is a more operative force in state-level decision making than the actual presence of a scarcity condition itself. Extending this idea further, the perception that another riparian state is unilaterally exploiting the trans-boundary river, creating negative externalities, such as decreased flows or increased pollutant loading, may be interpreted as a direct affront to other riparian states' claims to a certain percentage of *useable* water.

In terms of international management of trans-boundary rivers, treaties and cooperative agreements tend to be functionally effective in an inverse relationship to the level of complexity and scope of the management issues faced by affected riparian states. Bilateral agreements addressing single issues generally perceived as non-controversial are often successful in forging limited partnerships. As the number of riparian states increase and competing service demands bring into greater conflict multi-objective management strategies, international treaties and agreements become less effective. And depending upon the level and nature of hostilities in the basin, third-party involvement from international agencies can be a stabilizing or destabilizing presence. If created, such treaties tend to lack adequate enforcement or monitoring provisions and

are subject to selective compliance depending upon the riparian state's perceived understanding of the benefits or disadvantages of cooperation. A variety of geopolitical obstacles can limit the motivation to engage in multilateral basin development, particularly if there exists asymmetric information between states or if unrelated preexisting hostilities dominate the sociopolitical environment.

However, cooperative development of trans-boundary rivers is possible and has happened in many basins. As developing states seek greater economic independence, they increasingly recognize their interdependency to the river and the other riparian states. Depending on the hydrologic and geomorphologic characteristics of the drainage basin, the available resources can vary dramatically throughout the river's reach. For instance, states with significant topographic relief may have limited irrigable land, but a large potential for hydroelectric generation, which can be exported to downstream states located along low-lying bottomlands that are capable of supporting a robust agricultural industry, which can, in turn, sell raw or finished products to the upstream states. Often large diversion, flood control, or reservoir development projects are too expensive to be tackled unilaterally and require cooperative financial and technical cooperation to ensure successful completion. Additionally, international lending institutions, such as the World Bank and the International Monetary Fund (IMF), are now more often requiring legal assurances of cooperative agreements from all potentially affected states by any given project prior to issuing loans or grants.

Ultimately, it is up to individual states to determine projected water demands and assure that water is available. Unilateral action can be considered an effective means to achieving the goal of providing adequate and equitable distribution of freshwater

resources for domestic consumption. Strategic planning and recognition of the importance of resource conservation and effective management, supported by enforceable and consistent laws, can be a strong, defensible foundation for developing appropriate water resources. As water scarcity becomes a more prevalent and salient issue, states are seeing the connection between effective management and environmental protection to sustainable economic development and sociopolitical stability. By initially focusing on development strategies that can be undertaken unilaterally, states can look to cooperative, cost-shared agreements with other riparian states only on projects requiring pooled funds or resources, thereby reducing the overall cost and scope of involvement per participant, reducing the number of potential conflicting interests, and establishing a manageable program with realistic and achievable goals.

As developing states evolve into more representative democratic regimes, the expanding stakeholder interests increase, including the collective voices of environmental special interest groups and indigenous peoples, who have long demanded the protection of natural resources and the equitable distribution of those resources. Greater efforts must be made to grant all stakeholders of trans-boundary flows a voice in determining the best uses of the river. Doing so requires a refocusing from state-level resource development to local or regional-scale projects, designed specifically to meet actual identified needs versus more abstract, politically advantageous national interests. Diversifying water services through the use of free market systems and privatization can offer benefits through increased private sector

participation, revitalization of local economies, and the institution of effective checks-and-balances on government and private sector control of public resources.

Finally, over the last several decades many have called for a global "water ethic," arguing for the sustainable use of water to provide for the needs of all people, while still preserving the rivers and ecosystems that will ensure water for future generations. In this thesis, I have argued that the *effective* formulation of such an ethic is highly dependent upon the unique cultural, historical, religious, and sociopolitical backdrops that define the human-river interface in each basin. However, a common phenomenal presence in all basins is the river itself and our dependency upon it. Conflict is inherent upon trans-boundary rivers and a water ethic cannot solve all of these conflicts. A more useful, and perhaps more authentic, approach is the development of core values that embrace this conflict by returning to the individual's relationship to the river and an understanding of the unique value systems that inform that individual's perception of what the river ultimately means to them. Such an ethic allows for the collective presence of a multiplicity of values; yet retaining the single core phenomenon (the river), which can provide for the common ground to facilitate an open and engaged discourse. In essence, a diversity of core values, derived from innumerable sources, across the entire spectrum from ontology to politics, provides a more effective dialogue revealing the importance of trans-boundary rivers, than a global water manifesto.

BIBLIOGRAPHY

Abu-zeid, Mahmoud A. and Asit K. Biswas, eds. *River Basin Planning and Management*. Calcutta: Oxford University Press, 1996.

Adams, Robert. *Land Behind Baghdad: A History of Settlement on the Diyala Plains*. Chicago: University of Chicago Press, 1965.

Agnew, Clive, and Ewan W. Anderson. *Water Resources in the Arid Realm*. London: Routledge, 1992.

Agrawal, Arun, and Clark C. Gibson. "Enchantment and Disenchantment: The Role of Community in Natural Resource Conservation." *World Development* 27, no. 4 (1999): 629-649.

Ahmad, Reyaz, and Moises Mainster. "Smooth Transitions." *Privatization in Latin America*. A Latin Finance Supplement, 1995.

Allan, J. A. "Virtual Water: An Essential Element in Stabilizing the Political Economies of the Middle East." In *Transformations of Middle Eastern Natural Environments: Legacies and Lessons*, edited by Jeff Albert, Magnus Bernhardsson, and Roger Kenna. New Haven: Yale School of Forestry and Environmental Studies, 1998.

Amery, Hussein A., and Aaron T. Wolf, eds. *Water in the Middle East: A Geography of Peace*. Austin: The University of Texas Press, 2000.

---. and Aaron T. Wolf. "Water, Geography, and Peace in the Middle East." In *Water in the Middle East: A Geography of Peace*, edited by Hussein A. Amery and Aaron T. Wolf. Austin: The University of Texas Press, 2000.

Anderson, Ewan W. "Water: The Next Strategic Resource." In *The Politics of Scarcity — Water in the Middle East*, edited by Joyce R. Starr and Daniel C. Stoll. Boulder: Westview, for Centre for Strategic and International Studies, 1988.

Asafuddowlah, M. "Sharing of Transboundary Rivers: The Ganges Tragedy." In *The Peaceful Management of Transboundary Resources*, edited by Gerald H. Blake, William J Hildesley, Martin A Pratt, Rebecca J. Ridley, and Clive H. Schofield. London: Graham & Trotman/Martinus Nijhoff, 1995.

Ascher, William. *Why Governments Waste Natural Resources: Policy Failures in Developing Countries*. London: The John Hopkins University Press, 1999.

Ayoob, Mohammad. *The Third World Security Predicament*. Boulder: Lynne Rienner, 1995.

Barrett, Christopher B., and Ray Grizzle. "A Holistic Approach to Sustainaability Based on Pluralism Stewardship." *Environmental Ethics* 21, no. 1 (Spring 1999): 23-42.

Beaumont, Peter. "Water and Armed Conflict in the Middle East—Fantasy or Reality?" In *Conflict and the Environment*, edited by Nils Petter Gleditsch. London: Kluwer Academic Publishers, 1997.

Berthold-Bond, Daniel. "The Ethics of 'Place': Reflections on Bioregionalism." *Environmental Ethics* 22, no. 1 (Spring 2000): 5-24.

Biswas, Asit K. "Indus Water Treaty: the Negotiating Process." *Water International* 17 (1992): 201-209.

---. "Water for Sustainable Development in Twenty-first Century: A Global Perspective." In *Water for Sustainable Development in Twenty-first Century*, edited by Asit K. Biswas, Mohammed Jellali, and Glenn E. Stout. New Delhi: Oxford University Press, 1994.

Blake, Gerald H., and Alasdair Drysdale. *The Middle East and North Africa: a Political Geography*. New York: Oxford University Press, 1985.

---. "International Transboundary Collaborative Ventures." In *Political Boundaries and Coexistence*, edited by Werner A. Gallusser. Berlin: Peter Lang, Proceedings of the IGU-Symposium, May 1994.

Blake, Gerald, H., William J Hildesley, Martin A Pratt, Rebecca J. Ridley, and Clive H. Schofield, eds. *The Peaceful Management of Transboundary Resources*. London: Graham & Trotman/Martinus Nijhoff, 1995.

Böge, Volker. *Large-Scale Strip-Mining and Environmentally Induced Conflicts*. Zurich: ETH Zurich and Swiss Peace Foundation, 1993.

Brock, Lothar. "The Environment and Security: Conceptual and Theoretical Issues." ." In *Conflict and the Environment*, edited by Nils Petter Gleditsch. London: Kluwer Academic Publishers, 1997.

Brady, C. "South-East Asia: the Mekong River." In *Resource Politics: Freshwater and Regional Relations*, edited by. C. Thomas and D. Howlett. Buckingham: Open University Press, 1993.

Brown, Lester R. "An Untraditional View of National Security." *American Defense Policy*, *5th Edition*, edited by. John Reichart and Steven Sturm. Baltimore: Johns Hopkins University Press, 1984.

---. *State of the World 1997*. New York: W.W. Norton, 1997.

Brown, Lester R., and H. Kane. *Full House: Reassessing the Earth's Population Carrying Capacity*. Washington, D.C.: Worldwatch Institute, 1994.

Butts, Kent. "Why the Military Is Good for the Environment." In *Green Security or Militarized Environment*, edited by Jyrki Käkönen. Dartmouth: Brookfield USA, 1994.

Buzan, Barry. "Change and Insecurity: A Critique of Strategic Studies." In *Change and the Study of International Relations: The Evaded Dimension*, edited by Barry Buzan and R. J. Barry Jones. New York: St. Martin's Press, 1981.

Cafaro, Philip. "Thoreau, Leopold, and Carson: Toward an Environmental Virtue Ethics." *Environmental Ethics* 23, no. 1 (Spring 2001): 3-18.

Care, Norman S. "Future Generations, Public Policy, and the Motivation Problem." *Environmental Ethics* 4, no. 3 (Fall 1983): 195-214.

Carruthers, I. "Going, Going, Gone! Tropical Agriculture as We Know It." *Tropical Agriculture Association Newsletter* 13, no. 3 (1993): 1-5.

Chambers, R. E., and , M. K. McBeth. "Community Encouragement: Returning to the Basis for Community Development." *Journal of the Community Development Society* 23, no. 2 (1992): 20-38.

Chapple, Christopher Key. "Hindu Environmentalism: Traditional and Contemporary Resources." In *Worldviews and Ecology: Religion, Philosophy, and the* Environment, edited by Mary Evelyn Tucker and John A. Grim. New York: Orbis Books, 1999.

Chitere, O. P., ed. *Community Development: Its Conceptions and Practice with Emphasis on Africa*. Nairobi: Gideon S. Were Press, 1994.

Chomchai, Prachoom. "Management of Transboundary Water Resources: A Case Study of the Mekong." In Gerald H. Blake, William J Hildesley, Martin A Pratt, Rebecca J. Ridley, and Clive H. Schofield, eds. *The Peaceful Management of Transboundary Resources*. London: Graham & Trotman/Martinus Nijhoff, 1995.

Christmas, Joseph, and Carel de Rooy. "The Decade and Beyond: At a Glance." *Water International* 16, no. 3 (1991).

Clark, Edwin H. II, Gail Bingham, and Suzanne Goulet Orenstein. "Resolving Water Disputes: Obstacles and Opportunities." *Resolve* 23, no. 1 (1991) .

Claus, Olaf. "'Botswana Say to Dredge a River is to Destroy It.' The Case of the Southern Okavango Integrated Water Development Project," In *Environmental Degradation as A Cause of War, Volume III*, edited by Kurt R. Spillman and Günther Bächler. Zürich: Verlag Rüegger, 1996.

Collins, Denis, and John Barkdull. "Capitalism, Environmentalism, and Mediating Structures: From Adam Smith to Stakeholder Panels." *Environmental Ethics* 17, no. 3 (Fall 1995): 227-244.

Collins-Chobanian, Shari. "Beyond Sax and Welfare Interests." *Environmental Ethics* 22, no. 2 (Summer 2000): 133-148.

Cooley, John K. "War Over Water." *Foreign Policy* 54 (1984): 3-26.

Cosgrove, William J., and Frank R. Rijsberman. *World Water Vision: Making Water Everybody's Business*. London: Earthscan Publications Ltd., 2000.

Cowan, Ian. "Security Implications of Global Climatic Changes." *Canadian Defence Quarterly* (October 1989).

Crawford, James. "Democracy and International Law." *British Year Book of International Law* (1993): 117-133.

Dalby, Simon. *Creating the Second Cold War: The Discourse of Politics*. London: Pinter, 1990.

---. "The Politics of Environmental Security." In *Green Security or Militarized Environment*, edited by Jyrki Käkönen. Dartmouth: Brookfield USA, 1994.

---. "Threats from the South? Geopolitics, Equity, and Environmental Security." In *Contested Grounds: Security and Conflict in the New Environmental Politics*, edited by Daniel H. Deudney, and Richard A. Matthew. New York: State University of New York Press, 1999.

Davradou, Maria, and Paul Wood. "The Promotion of Individual Autonomy in Environmental Ethics." *Environmental Ethics* 22, no. 1 (Spring 2000): 73-84.

de Chazournes, Laurence Boisson, ed. *International Watercourses: Enhancing Cooperation and Managing Conflict*, edited. Washington, D.C.: World Bank, Technical Paper No. 414.

Deibert, Ronald J. "Out of Focus: U.S. Military Satellites and Environmental Rescue." In *Contested Grounds: Security and Conflict in the New Environmental Politics*, edited by Daniel H. Deudney, and Richard A. Matthew. New York: State University of New York Press, 1999.

Deudney, Daniel H., and Richard A. Matthew, eds. *Contested Grounds: Security and Conflict in the New Environmental Politics*. New York: State University of New York Press, 1999.

Dolatyar, Mostafa, and Tim S. Gray. *Water Politics in the Middle East: A Context for Conflict or Co-operation*. New York: Macmillan Press, 2000.

Dougherty, James E., and Robert L. Pfaltzgraff, Jr. *Contending Theories of International Relations: A Comprehensive Survey, 4th Addition*. New York: Longman New York, 1997.

Dyer, Hugh C. "Environmental Security as a Universal Value: Implications for International Theory." In *The Environment and International Relations,* edited by John Vogler and Mark F. Imber. London: Routledge, 1996.

Elhance, Arun P. *Hydropolitics in the 3rd World: Conflict and Cooperation in International River Basins*. Washington, D.C.: United States Institute of Peace Press, 1999.

---. "Hydropolitics: Conflict and Cooperation in International River Basins." In *Contested Grounds: Conflict and Security in the New Environmental Politics*, edited by Daniel Deudney and Richard Matthews. Albany: State University of New York Press, 1996.

Etzioni, A. "Positive Aspects of Community and the Dangers of Fragmentation." *Development and Change* 27 (1996): 301-314.

Falkenmark, Malin. "Fresh Water-Time for a Modified Approach." *Ambio* 15, no. 4 (1986): 194-200.

---. "Middle East Hydropolitics: Water Scarcity and Conflicts in the Middle East." *Ambio*, 18, no. 6 (1989): 350-352.

Fitzmaurice, John. *Damming the Danube*. Boulder: Westview, 1996.

Gadgil, Madhav, and Ramachandra Guha. *Ecology and Equity: The Use and Abuse of Nature in Contemporary India*. London: Routledge, 1995.

Galal, Ahmend, Leroy Jones, Pankaj Tandoon, and Ingo Vogelsang. *Welfare Consequences of Selling Public Enterprises: An Empirical Analysis*. New York: Oxford University Press, 1994.

Gardner, G. "Preserving Global Cropland." In *State of the World 1997*, edited by L. Brown. New York: W.W. Norton, 1997.

Gelven, Michael. *War and Existence: A Philosophical Inquiry*. University Park: Pennsylvania State University Press, 1994.

Ghassemi, F., J. A. Jakeman, and H. A. Nix. *Salinisation of Land and Water Resources: Human Causes, Extent, Management and Case Studies*. Sydney: University of New South Wales Press, Ltd, 1995.

Gilpin, Robert. *War and Change in World Politics*. Cambridge: Cambridge University Press, 1981.

Gleditsch, Nils Petter, ed. *Conflict and the Environment*. London: Kluwer Academic Publishers, 1997.

Gleditsch, Nils Petter, and Håvard Hegre. "Peace and Democracy: Three Levels of Analysis." *Journal of Conflict Resolution* 41, no. 2 (April 1997): 283-310.

Gleick, Peter H.,ed. *Water in Crisis: A Guide to the World's Fresh Water Resources*. New York: Oxford University Press, 1993.

Gleick, Peter H. *The World's Water 2000-2001: the Biennial Report on Freshwater Resources*. Island Press: Washington, D.C., 2000.

---. "Climate Change, Hydrology, and Water Resources." *Review of Geophysics* 27, no. 3 (1989): 339-344.

---. "Water and Conflict: Fresh Water Resources and International Security." *International Security* 18, no. 2 (1993): 79-112.

Goldberg, David. "World Bank Policy on Projects on International Waterways in the Context of Emerging International Law and the Work of the International Law Commission." In *The Peaceful Management of Transboundary Resources*, edited by Gerald H. Blake, William J Hildesley, Martin A Pratt, Rebecca J. Ridley, and Clive H. Schofield. London: Graham & Trotman/Martinus Nijhoff, 1995.

Guariso, G., and D. Whittington. "Implications of Ethiopian Water Development for Egypt and Sudan." *International Journal of Water Resources Development* 3 (1987): 105-114.

Gubser, Peter. *Jordan: Crossroads of Middle Eastern Events*. Boulder, Colorado: Westview Press, 1983.

Gurr, Tedd R. "On the Political Consequences of Scarcity and Economic Decline." *International Studies Quarterly* 29 (1985).

Gyawali, Dpak. "Nepal-India Water Resource Relations." In *Power and Negotiation,*, edited by I. William Zartman and Jeffrey Z. Rubin. Ann Arbor: University of Michigan Press, 2000.

Hafiz, M. Abdul, and Nahid Islam. "Environmental Degradation and Intra/Interstate Conflicts in Bangladesh." In *Environmental Degradation as A Cause of War, Volume III*, edited by Kurt R. Spillman and Günther Bächler. Zürich: Verlag Rüegger, 1996.

Hamner, J., and A. Wolf. "Patterns in international water resource treaties: the Transboundary Freshwater Dispute Database." *Colorado Journal of International Environmental Law and Policy* (Yearbook 1997).

Hampson, Fen. "The Climate for War." *Peace and Security* 3, no. 3 (1988).

Hargrove, Eugene C. *Foundations of Environmental Ethics*. Denton: Environmental Ethics Books, 1989.

Harmon, Jay R. "Notions of Self-Interest: Reflections on the Intersection between Contingency and Applied Environmental Ethics." *Environmental Ethics* 23, no. 4 (Winter 2001): 377-390.

Hawken, Paul, Amory Lovins, and L. Hunter Lovins. *Natural Capitalism: Creating the Next Industrial Revolution*. Boston: Little, Brown, and Company, 1999.

Heidegger, Martin. *Being and Time*. Translated by Joan Stambaugh. Albany: State University of New York Press, 1996.

---. *Contributions to Philosophy (From Enowning)*. Translated by Parvis Emad and Kenneth Maly. Bloomington: Indiana University Press, 1999.

---. "A Question Concerning Technology." In *Martin Heidegger: Basic Writings*, edited by David Farrell Krell. San Francisco: HarperSanFrancisco Press, 1993.

Heraclitus. *Fragments: The Collected Wisdom of Heraclitus*, trans. Brooks Haxton. New York: Viking New York, 2001.

Hey, Ellen. "Sustainable Use of Shared Water Resources: the Need for a Paradigmatic Shift in International Watercourses Law." In *The Peaceful Management of Transboundary Resources*, edited by Gerald H. Blake, William J Hildesley, Martin A Pratt, Rebecca J. Ridley, and Clive H. Schofield. London: Graham & Trotman/Martinus Nijhoff, 1995.

Hill, Antonio. "Environmental Conflict: A Values-oriented Approach." In *Conflict and the Environment*, edited by Nils Petter Gleditsch. London: Kluwer Academic Publishers, 1997.

Hill, Harry. "Strategic Planning and Policy Framework Development: Elements, Priorities and Action Plans." In *River Basin Planning and Management*, edited by Mahmoud A. Abu-zeid and Asit K. Biswas. Calcutta: Oxford University Press, 1996.

Homer-Dixon, Thomas F. *Environment, Scarcity, and Violence*. Princeton: Princeton University Press, 1999.

---. "On the Threshold: Environmental Changes as Causes of Acute Conflict." *International Security* 16, no. 2 (Fall 1991): 76-116.

---. "Environmental Scarcities and Violent Conflict." *International Security* 19, no. 1 (1994).

---. "Thresholds of Turmoil: Environmental Scarcities and Violent Conflict." In *Contested Grounds: Security and Conflict in the New Environmental Politics*, edited by Daniel H. Deudney, and Richard A. Matthew. New York: State University of New York Press, 1999.

Howe, Charles W. , Dennis R. Schurmeier, and W. Douglass Shaw, Jr. "Innovative Aproaches to Water Allocation: The Potential for Water Markets." *Water Resources Research* 22, no. 4, (April 1986): 439-45.

Huntington, Samuel P. *The Third Wave: Deomcratization in the Late Twentieth Century*. Norman: University of Oklahoma Press, 1991.

Hurewtiz, Jacob. "The Zionist Organization's Memorandum to the Supreme Council at the Peace Conference." In *Diplomacy in the Near and Middle East* vol. 2. Princeton: D. Van Nostrand Co., 1956.

Illich, Ivan. *H2O and the Waters of Forgetfulness*. Dallas: The Dallas Institute of Humanities and Culture, 1985.

Intergovernmental Panel on Climate Change. *Climate Change: The IPCC Scientific Assessment*. Cambridge, U.K.: Cambridge University Press, 1990.

Isaac, J., and H. Shuval, eds. In *Water and Peace in the Middle East*, edited by J. Isaac and H. Shuval. Amsterdam: Elsevier, 1994.

Ivanov, Anton M. "Environmental Ethics and Conflicting Ethnicity: A Value-oriented Analysis." In *Conflict and the Environment*, edited by Nils Petter Gleditsch. London: Kluwer Academic Publishers, 1997.

Jacobson, Jodi. *Environmental Refugees: A Yardstick of Habitability*. Worldwatch Paper 86. Washington, D.C.: Worldwatch Institute, 1988.

Job, Brian. *The Insecurity Dilemma: National Security of Third World States*. Boulder: Lynne Rienner, 1992.

Just, Richard E., George Frisvold, Verna Harrison, Joe Oppenheimer, and David Zilberman. "Using Bargaining Theory and Economic Analysis as an Aid to Trans-boundary Water Cooperation." In *Conflict and Cooperation on Trans-Boundary Water Resources*, edited by Richard E. Just and Sinaia Netanyahu. Boston: Kluwer Academic Publishers, 1998.

Just, Richard E., and Sinaia Netanyahu, eds. *Conflict and Cooperation on Trans-Boundary Water Resources*. Boston: Kluwer Academic Publishers, 1998.

---. "International Water Resource Conflicts: Experience and Potential." In *Conflict and Cooperation on Trans-Boundary Water Resources*, edited by Richard E. Just and Sinaia Netanyahu. Boston: Kluwer Academic Publishers, 1998.

Jyrki Käkönen, ed. *Green Security or Militarized Environment*. Dartmouth: Brookfield USA, 1994.

Kamienicki, Sheldon, and Margaret Scully Granzeirer. "Eco-Cultural Security and Indigenous Self-Determination: Moving Toward a New Conception of Sovereignty." In *The Greening of Sovereignty in World Politics,* edited by Karen T. Litfin. Cambridge: The MIT Press, 1998.

Kendall, H. W., and D. Pimetal. "Constraints on the Expansion of the Global Food Supply." *Ambio* 23, no. 3 (May 1994).

King, Roger J. H. "Environmental Ethics and the Built Environment." *Environmental Ethics* 22, no. 2 (Summer 2000): 115-132.

Kinsley, David. *Ecology and Religion: Ecological Spirtuality in Cross-Cultural Perspective*. Englewood Cliffs: Prentice Hall, 1995.

Kirmani, S., and G. Le Moigne. *Fostering Riparian Cooperation in International River Basins*. World Bank Technical Paper No. 239. Washington, DC: World Bank, 1997.

Klemencic, Mladen. "The Effects of War on Water and Energy Resources in Croatia and Bosnia," In *The Peaceful Management of Transboundary Resources*, edited by Gerald H. Blake, William J Hildesley, Martin A Pratt, Rebecca J. Ridley, and Clive H. Schofield. London: Graham & Trotman/Martinus Nijhoff, 1995.

Kliot, Nurit N. "A Cooperative Framework for Sharing Scarce Water Resources: Israel, Jordan, and the Palestinian Authority." ." In *Water in the Middle East: A Geography of Peace*, edited by Hussein A. Amery and Aaron T. Wolf. Austin: The University of Texas Press, 2000.

Klötzli, Stefan. "The Water and Soil Crisis in Central Asia—A Source for Future Conflicts." In *Environmental Degradation as A Cause of War, Volume III*, edited by Kurt R. Spillman and Günther Bächler. Zürich: Verlag Rüegger, 1996.

---. "The 'Aral Sea Syndrome' and Regional Cooperation in Central Asia: Opportunity or Obstacle." In *Conflict and the Environment*, edited by Nils Petter Gleditsch. London: Kluwer Academic Publishers, 1997.

Kneese, A.V. "Background for Economic Analysis of Environmental Pollution." In *The Economics of Environment*, edited by P. Bohm and A. V. Kneese. London: Macmillan, 1971.

Kolars, John. "The Spatial Attributes of Water Negotiation: The Need for a River Ethic and River Advocacy in the Middle East." In *Water in the Middle East: A Geography of Peace*, edited by Hussein A. Amery and Aaron T. Wolf. Austin: The University of Texas Press, 2000.

König, Thomas. "Environmental Issues in Thailand. A Case Study with Special Reference to the Struggle about Eucalyptus Plantations." In *Environmental Degradation as A Cause of War, Volume III* edited by Spillman, Kurt R., and Günther Bächler. Zürich: Verlag Rüegger, 1996.

Kuehls, Thom. "Between Sovereignty and Environment: An Exploration of the Discourse of Government." In *The Greening of Sovereignty in World Politics,* edited by Karen T. Litfin. Cambridge: The MIT Press, 1998.

Lal, Vinay. "Gandhi and the Ecological Vision of Life." *Environmental Ethics* 22, no. 2 (Summer 2000): 149-168.

Laqueur, Walter. *A History of Zionism*. New York: Schocken Books, 1972.

Lee, D. J., and A. Dinar. "Review of Integrated Approaches to River Basin Planning, Development and Management." Washington, D.C.: World Bank Working Paper, 1995.

Lee, Terence Richard. *Water Management in the 21st Century: The Allocation Imperative*. Cheltenham: Edward Elgar, 1999.

LeMarquand, David G. *International Rivers: The Politics of Co-operation*. University of British Columbia and the Waterloo Research Centre, 1977.

Leopold, Aldo. *A Sand County Almanac: and Sketches Here and There*. New York: Oxford University Press, 1949.

Levy, Jack. "Research Note: Declining Power and the Preventive Motivation for War." *World Politics* 40, no. 1 (1987): 82-107.

Libiszewski, S. *Water Disputes in the Jordan Basin Region and Their Role in the Resolution of the Arab-Israeli Conflict* ,Occasional Paper, vol. 13. Zurich: Center for Security Studies and Conflict Research.

Litfin, Karen T, ed. *The Greening of Sovereignty in World Politics*. Cambridge: The MIT Press, 1998.

---. “Satellites and Sovereign Knowledge: Remote Sensing of the Global Environment.” In *The Greening of Sovereignty in World Politics,* edited by Karen T. Litfin. Cambridge: The MIT Press, 1998.

Lipschutz, Ronnie D. *When Nations Clash: Raw Materials, Ideology and Foreign Policy*. Cambridge: Ballinger, 1989.

---. *On Security*. New York: Columbia University Press, 1995.

---. “Environmental Conflict and Environmental Determinism: The Relative Importance of Social and Natural Factors.” In *Conflict and the Environment*, edited by Nils Petter Gleditsch. London: Kluwer Academic Publishers, 1997.

Liska, Miroslav B. “Development of the Slovak-Hungarian Section of the Danube.” In *The Peaceful Management of Transboundary Resources*, edited by Gerald H. Blake, William J Hildesley, Martin A Pratt, Rebecca J. Ridley, and Clive H. Schofield. London: Graham & Trotman/Martinus Nijhoff, 1995.

Lodgaard, Sverre. “Environmental Security, World Order, and Environmental Conflict Resolution.” in *Conversion and the Environment: Proceedings of a Seminar in Perm, Russia, 24-27 November 1991*, edited by Nils Petter Gleditsch. PRIO Report, no. 2, May 1992.

Lonergan, Stephen. “Climate Warming, Water Resources, and Geopolitical Conflict: A Study of Nations Dependent on the Nile, Litani and Jordan River Systems.” Operational Research and Analysis Establishment, ORAE Paper No. 55. Ottawa: National Defence, 1991.

Lowi, Miriam R. *Water and Power: The Politics of a Scarce Resource in the Jordan River Basin*. New York: Cambridge University Press, 1995.

---, Miriam R. “Transboundary Resource Disputes and Their Resolution.” In *Contested Grounds: Security and Conflict in the New Environmental Politics*, edited by Daniel H. Deudney and Richard A. Matthew. New York: State University of New York Press, 1999.

Maoz, Zeev, and Bruce Russett. “Normative and Structural Causes of Democratic Peace 1946-86.” *American Political Science Review* 87, no. 3 (September 1993): 624-638.

March, J., and J. Olsen. *Rediscovering Institutions: The Organizational Basis of Politics*. New York: Free Press, 1989.

Matthew, Richard A. “Environmental Security: Demystifying the Concept, Clarifying the Stakes.” In *Environmental Change and Security Project*, Report no. 1. Washington, D.C.: Woodrow Wilson Center, 1995.

---. “Introduction: Mapping Contested Grounds.” In *Contested Grounds: Security and Conflict in the New Environmental Politics*, edited by Daniel H. Deudney, and Richard A. Matthew. New York: State University of New York Press, 1999.

Matthews, Jessica Tuchman. “Redefining Security.” *Foreign Affairs* 68, no. 2 (1989).

McCaffrey, Stephen. “The UN Convention on the Law of the Non-Navigational Uses of International Watercourses: Prospects and Pitfalls.” In *International Watercourses: Enhancing Cooperation and Managing Conflict*, edited by Laurence Boisson de Chazournes. Washington, D.C.: World Bank, Technical Paper No. 414.

---. “Water, Politics and International Law.” In *Water in Crisis: A Guide to the World’s Fresh Water Resources*, edited by. Peter H. Gleick. New York: Oxford University Press, 1993.

McDonald, Hugh. “Toward a Deontological Environmental Ethics.” *Environmental Ethics* 23, no. 4 (Winter 2001): 411-430.

McMichael, Anthony J. *Planetary Overload*. Cambridge: Cambridge University Press, 1993.

Merrett, Stephen. *Introduction to the Economics of Water Resources: An International Perspective*. Boulder: Rowman & Littlefield Publishers, 1997.

Michael, Mark A. “How to Interfere with Nature.” *Environmental Ethics* 23, no. 2 (Summer 2001): 135-154.

Minteer, Ben A. “Intrinsic Value for Pragmatists?” *Environmental Ethics* 23, no. 1 (Spring 2001): 57-76.

Moran, Dermot. *Introduction to Phenomenology*. New York: Routledge, 2000.

Mumme, Stephen P. “New Challenges for U.S.-Mexico Water Resources Management.” In *The Peaceful Management of Transboundary Resources*, edited by Gerald H. Blake, William J Hildesley, Martin A Pratt, Rebecca J. Ridley, and Clive H. Schofield. London: Graham & Trotman/Martinus Nijhoff, 1995.

Mustafa, I. “The Arab-Israeli Conflict over Water Resources.” In *Water and Peace in the Middle East*, edited by J. Isaac and H. Shuval. Amsterdam: Elsevier, 1994.

Myers, Norman. *Ultimate Security: The Environmental Basis of Political Stability*. Washington, D.C.: Island Press, 1996.

Nachtnebel, Hans-Peter. “The Danube River Basin Environmental Programme: Plans and Actions for a Basin Wide Approach.” W*ater Policy* 2, no. 1-2 (1999/2000): 116.

Nakayama, Mikiyasu. "Successes and Failures of International Organizations in Dealing with International Waters." *Water Resources Development* 13, no. 2 (1997).

Netanyahu, Sinaia, Richard E. Just, and John K. Horowitz. "Bargaining Over Shared Aquifers: The Case of Israel and the Palestinians." In *Conflict and Cooperation on Trans-Boundary Water Resources*, edited by Richard E. Just and Sinaia Netanyahu. Boston: Kluwer Academic Publishers, 1998.

Norton, Bryan G. *Toward Unity Among Environmentalists*. New York: Oxford University Press, 1991.

---. "Convergence and Contextualism: Some Clarifications and a Reply to Steverson." *Environmental Ethics* 19, no. 1 (Spring 1997): 100, 87-100.

Nurit, Kliot. *Water Resources and Conflict in the Middle East*. London: Routledge, 1994.

Ohlsson, Leif, ed. *Hydropolitics: Conflicts over Water as a Development Constraint*. London: University Press, 1995.

---. "The Role of Water and Origins of Conflict." In *Hydropolitics: Conflicts over Water as a Development Constraint*, edited by Leif Ohlsson. London: University Press, 1995.

Ophuls, William. *Ecology and Politics of Scarcity: A Prologue to a Political Theory of the Steady State*. San Francisco: Freeman, 1977.

Opschoor, Johannes. "North South Trade, Resource Degradation and Economic Security." *Bulletin of Peace Proposals* 20, no. 2 (June 1989): 135-142.

Organski, A. F. K., and Jacek Kugler. *The War Ledger*. Chicago: University of Chicago Press, 1980.

Ostrom, Elinor. "Crafting Institutions." In *Crafting Institutions for Self-governing Irrigation Systems*. San Francisco: Institute for Contemporary Studies, 1992.

Outwater, Alice. *Water: a Natural History*. New York: BasicBooks, 1996.

Peters, Robert L., and Thomas E. Lovejoy, eds. *Global Warming and Biological Diversity*. New Haven: Yale University Press, 1992.

Pielou, E. C. *Fresh Water*. Chicago: The University of Chicago Press, 1998.

Porter, Gareth, and Janet Welsh Brown. *Global Environmental Politics, 2nd. Ed*. Boulder: Westview, 1996.

Postel, Sandra. *The Last Oasis: Facing Water Scarcity*. London: Earthscan Publications Ltd., 1992.

Postel, Sandra L., *Pillar of Sand: Can the Irrigation Miracle Last?* (New York: W.W. Norton, 1999.

---, "Water for Food Production: Will There Be Enough in 2025?" *Bio-Sciences* 28 (1998): 629-637.

Preston, Christopher J. "Conversing with Nature in a Postmodern Epistemological Framework." *Environmental Ethics* 22, no. 3 (Fall 2000): 227-240.

Priscoli, J. Delli. "Public Involvement, Conflict Management: Means to EQ and Social Objectives." *Journal of Water Resources Planning and Management* 115, no. 1 (1989): 31-42.

Ramberg, L. "A Pipeline from the Okavango River?" *Ambio* 26, no.2 (1997): 129.

Remans, W. "Water and war." Humanaeres *Voelkerrecht* 8, no. 1 (1995).

Revenga, C., S. Murray, J. Abramovitz, and A. Hammond. *Watersheds of the World: Ecological Value and Vulnerability*. Washington, D.C.: World Resources Institute, 1998.

Rogers, Katarina. "Environmental Conflict and Cooperation Between Mexico and the United States." In *Environmental Degradation as A Cause of War, Volume III* edited by Spillman, Kurt R., and Günther Bächler. Zürich: Verlag Rüegger, 1996.

Rogers, Peter. "The Value of Cooperation in Resolving International River Basin Disputes." *Natural Resources Forum* (May 1993): 117-31.

Rowlands, Ian. "The Security Challenges of Global Environmental Change." *Washington Quarterly* 14, no.1 (Winter 1991): 99-114.

Rowley, Gwyn. "Political Controls of River Waters and Abstractions between Various States within the Middle East: Laws and Operations, with Special Reference to the Jordan Basin." In *Water in the Middle East: A Geography of Peace*, edited by Hussein A. Amery and Aaron T. Wolf. Austin: The University of Texas Press, 2000.

Said, Edward W. *Orientalism*. New York: Vintage Books, 1979.

Salman, M. A. "Convention on the Law of the Non-navigational Uses of International Watercourses." In *International Watercourses: Enhancing Cooperation and Managing Conflict: Proceedings of a World Bank Seminar*, Annex I, edited by M. A.

Salman and Laurence Boisson de Chazournes. Washington, DC: World Bank, Technical Paper No. 414, 1998.

Samson, P., and B. Charrier. *International Freshwater Conflict: Issues and Prevention Strategies*. Green Cross Draft Report, 1997.

Saurin, Julian. "International Relations, Social Ecology and the Globalization of Environmental Change." In *The Environment and International Relations*, edited by John Vogler and Mark F. Imber. London: Routledge, 1996.

Schmidtz, David. "Natural Enemies: An Anatomy of Environmental Conflict." *Environmental Ethics* 22, no. 4 (Winter 2000): 397-408.

Schneider, Stephen H., Linda Mearns, and Peter H. Gleick. "Climate-Change Scenarios for Impact Assessment." In *Global Warming and Biological Diversity*, edited by Robert L. Peters and Thomas E. Lovejoy. New Haven: Yale University Press, 1992.

Schramm, Gunter. "Integrated River Basin Planning in a Holistic Universe." *Natural Resources Journal* 20, no. 4 (1980): 787-806.

Schulz, Michael. "Turkey, Syria and Iraq: A Hydropolitical Security Complex." In *Hydropolitics: Conflicts over Water as a Development Constraint*, edited by Leif Ohlsson. London: University Press, 1995.

Scudder, T., R. E. Manley, R. W. Coley, R. K. Davis, J. Green, G. W. Howard, S. W. Lawry, D. Martz, P. O. Rogers, A. R. D. Taylor, S. D. Turner, G. F. White, and E. P. Wright. *The IUCN Review of the Southern Okavango Integrated Water Development Project*. Switzerland: IUCN, 1993.

Scudder, Thayer. "Recent Experiences with River Basin Development in the Tropics." *Natural Resources Forum* 18, no. 2 (1994): 101-113.

Sharma, R. C., and Suparna Nag. "On the Question of Fresh Water Management in South Asia In *The Peaceful Management of Transboundary Resources*, edited by Gerald H. Blake, William J Hildesley, Martin A Pratt, Rebecca J. Ridley, and Clive H. Schofield. London: Graham & Trotman/Martinus Nijhoff, 1995.

Sherr, S. J. "Soil Degradation: A Threat to Developing Country Food Security by 2020?" International Food Policy Research Institute (IFPRI), 2020 Brief 58, Washington, D.C, 1999.

Shiklomanov, I. A. "World Fresh Water Resources." In *Water in Crisis: A Guide to the World's Fresh Water Resources*, edited by Peter H. Gleick. New York: Oxford University Press, 1993.

---. *World Water Resources: A New Appraisal and Assessment for the 21st Century*. Paris: International Hydrological Programme Report, United Nations Educational, Scientific, and Cultural Organization, 1998.

---. "World Water Resources and Water Use: Present Assessment and Outlook for 2025." State Hydrological Institute, St. Petersburg, Russia, 1999.

Sluiter, L. *The Mekong Currency*. Bangkok: Project for Ecological Recovery, 1992.

Soffer, Arnon. *Rivers of Fire: The Conflict over Water in the Middle East*. Translated by Murray Rosovsky and Nina Copaken. New York: Bowman & Littlefield Publishers, 1999.

---. "The Relevance of Johnston Plan to the Reality of 1993 and Beyond." In *Water and Peace in the Middle East*, edited by Isaac, J., and H. Shuval. Amsterdam: Elsevier, 1994.

Spector, Bertram. "Transboundary Disputes: Keeping Backyards Clean." In *Preventive Negotiation: Avoiding Conflict Escalation,* chap 9, ed. I. William Zartman. Maryland: Rowman and Littlefield Publishers, 2001.

Spillman, Kurt R., and Günther Bächler, eds. *Environmental Degradation as A Cause of War, Volume III*. Zürich: Verlag Rüegger, 1996.

Sprout, Harold, and Margaret Sprout. "Environmental Factors in the Study of International Policies." In *Conflict Prevention and Resolution in Water Systems*, edited by Aaron T. Wolf. Northampton: Elgar Reference Collection, 2003. First published in *The Journal of Conflict Resolution* (1957).

Starr, Joyce. "Water Wars." *Foreign Policy*, no. 82 (Spring 1991): 17-36.

Steinbruner, John. *The Cybernetic Theory of Decision*. Princeton: Princeton University Press, 1974.

Stern, Eric K. "The Case of Comprehensive Security." In *Contested Grounds: Security and Conflict in the New Environmental Politics*, edited by Daniel H. Deudney, and Richard A. Matthew. New York: State University of New York Press, 1999.

Stevens, Barrie, and Wolfgang Michalski. "Infrastructure in the 1990s: An Overview of Trends and Policy Issues." *Infrastructure Policies for the 1990s*. Paris: Organization for Economic Co-operation and Development, 1993.

Stolum, Hans-Henrik. "River Meandering as a Self-Organization Process." *Science* 27, no.1 (March 1996): 1710-1713

Swain, Ashok. "Sharing International Rivers: A Regional Approach." In *Conflict and the Environment*, edited by Nils Petter Gleditsch. London: Kluwer Academic Publishers, 1997.

Taylor, Paul W. *Respect for Nature*. Princeton: Princeton University Press, 1986.

Teclaff, Ludwik A. "Fiat or Custom: the Checkered Development of International Water Law." *Natural Resources Journal* 31, no. 45 (1991).

Thiele, Leslie Paul. "Nature and Freedom: A Heideggerian Critique of Biocentric and Sociocentric Environmentalism." *Environmental Ethics* 17, no 2 (Summer 1995): 171-190.

Thomas, Caroline. "Water: A Focus for Cooperation or Contention in a Conflict Prone Region? The Example of the Lower Mekong Basin." In *Environmental Degradation as A Cause of War, Volume III* edited by Spillman, Kurt R., and Günther Bächler. Zürich: Verlag Rüegger, 1996.

Thompson, Janna. "Environmental Heritage." *Environmental Ethics* 22, no. 3 (Fall 2000): 241-258.

Thoreau, Henry David. *"* Week on the Concord and Merrimack Rivers." In *Walden and Other Writings of Henry David Thoreau*, edited by Brooks Atkinson. New York: The Modern Library, 1992.

Trolldalen, Jon Martin. "International River Systems." Chap. 8 in *International Environmental Conflict Resolution: The Role of the United Nations*. Oslo: World Foundation for Environment and Development, 1992.

---. *International Environmental Conflict Resolution: The Role of the United Nations*. Washington, D.C.: World Foundation for Environment and Development, 1992.

Turton, A. R. *Water and State Sovereignty: The Hydropolitical Challenge for States in Arid Regions*. London: MEWREW, Occasional Paper No. 5, Water Issues Study Group, SOAS, University of London, 1999.

Ullman, Richard. "Redefining Security." *International Security* 8, no. 1 (1983).

United Nations. *Integrated River Basin Development*. New York: UN Publications, 1958.

United Nations Development Programme. *Human Development Report 1995*. New York: Oxford University Press, 1995.

United Nations Food and Agriculture Organization. *World Agriculture: Toward 2010*, edited by N. Alexandratos, an FAO Study. Rome: J. Wiley and Sons, 1995.

van Buren, John. "Critical Environmental Hermeneutics." *Environmental Ethics* 17, no. 3 (Fall 1995): 259-276.

van Vijk, C., E. de Lange, and D. Saunders. "Gender Aspects in the Management of Water Resources." *Natural Resources Forum* 20, no. 2 (1998): 91-103.

van Wensveen, Louke. "Ecosystem Sustainability as a Criterion for Genuine Virtue." *Environmental Ethics* 23, no. 3 (Fall 2001): 227-242.

Varshavsky, Alexander E., and Leonid E. Varshavsky. "Conflicts and Environmental Change: Models and Methods." In *Conflict and the Environment*, edited by Nils Petter Gleditsch. London: Kluwer Academic Publishers, 1997.

---, *Registry of International Rivers*. Oxford: Pergamon Press, prepared by the Centre for Natural Resources, Energy and Transport of the Department of Economics and Social Affairs, 1978.

Vasquez, John. *The War Puzzle*. Cambridge: Cambridge University Press, 1993.

Vogler, John, and Mark F. Imber, eds. *The Environment and International Relations*. London: Routledge, 1996.

Weaver, Ole. "Securitization and Desecuritization." In *On Security*, edited by Ronnie Lipschutz. New York: Columbia University Press, 1995.

Wegemund, Regina. "Ethnic and Transborder Conflicts in the Senegambian Region Caused by Environmental Degradation." In *Environmental Degradation as A Cause of War, Volume III*, edited by Kurt R. Spillman, and Günther Bächler. Zürich: Verlag Rüegger, 1996.

Weisman, Alan. *Gaviotas: A Village to Reinvent the World*. White River Junction: Chelsea Green Publishing Company, 1998.

Westcoat, James L., Jr. "Main Currents in Early Multilateral Water Treaties: A Historical-Geographic Perspective, 1648-1948." *Colorado Journal of International Environmental Law and Policy* 7, no.1 (Winter 1996): 39-74.

Westing, A. H., ed. *Global Resources and International Conflict: Environmental Factors in Strategic Policy and Action*. New York: Oxford University Press, 1986.

White, Gilbert F. "The Role of Scientific Information in Anticipation and Prevention of Environmental Disputes." In *Geography, Resources, and Environment: Volume I,*

Selected Writings of Gilbert F. White, edited by. Robert W. Kates and Ian Burton. Chicago: University of Chicago Press, 1986.

---. "A Perspective on River Basin Development," *Law and Contemporary Problems* 22, no.2. 1957. Reprint, *Geography, Resources, and Environment: Volume I, Selected Writings of Gilbert F. White*, edited by. Robert W. Kates and Ian Burton. Chicago: University of Chicago Press, 1986.

Whittington, Dale, John Waterbury, and Elizabeth McClelland. "Toward a New Nile Waters Agreement." In *Water Quantity/Quality Management and Conflict Resolution: Institutions, Processes, and Economic Analyses*, chap.14, edited by Ariel Dinar and Edna Tusak Loehman. Westport: Praeger, 1995.

Wilkenfield, Jonathan, ed. *Conflict Behavior and Linkage Politics*. New York: David McKay, 1973.

Wilson, R. B. "Strategic and Informational Barriers to Negotiation." In *Barriers to Conflict Resolution*, edited by K. Arrow, R. H. Mnookin, L. Ross, A. Tversky, and R. Wilson. New York: W. W. Norton & Company, 1995.

Wirth, David. "Climate Chaos." *Foreign Policy*, no. 74 (Spring 1989).

Wittfogel, Karl A. *Oriental Despotism: a Comparative Study of Total Power*. New Haven: Yale University Press, 1957.

Wolf, Aaron T. *Conflict Prevention and Resolution in Water Systems*. Northampton: Elgar Reference Collection, 2003.

---. "Conflict and Cooperation along International Waterways." *Water Policy* 1, no. 2 (1998): 254-255.

---. "'Hydrostrategic' Territory in the Jordan Basin: Water, War, and Arab-Israeli Peace Negotiations." In *Water in the Middle East: A Geography of Peace*, edited by Hussein A. Amery and Aaron T. Wolf. Austin: The University of Texas Press, 2000.

Wolf, Aaron T., J. A. Natharious, J. J. Danielson, B. S. Ward, and J. Pender. "International River Basins of the World." *International Journal of Water Resources Development*, Vol. 15, No. 4 (December 1999).

Woodley, Stephen, James Kay, George Francis, eds. *Ecological Integrity and the Management of Ecosystems*. Ottawa: St. Lucie Press, 1993.

World Bank. *Water Resources Management*. Washington D.C.: A World Bank Policy Paper, 1993.

World Health Organization. *Water Supply and Sanitation Sector Monitoring Report*. Geneva, 1996.

World Water Council. *World Water Council Bulletin* 1, no.1 (1995).

Yoffe, Shira B., and Aaron T. Wolf. "Water, Conflict and Cooperation: Geographical Perspectives." *Cambridge Review of International Affairs* 12, no. 3 (Spring-Summer 1999).

Young,G. J., J. C. Dooge, and J. C. Rodda. *Global Water Resource Issues*. Cambridge: Cambridge University Press, 1994.

Zartman, I. William. *Preventive Negotiation: Avoiding Conflict Escalation*. Maryland: Rowman and Littlefield Publishers, 2001.

Zilberman, David, and Douglas Parker. "Internal Water Disputes: Causes and Solutions." Just and Netanyahu, *Conflict and Cooperation,* 90. ." In *Conflict and Cooperation on Trans-Boundary Water Resources*, edited by Richard E. Just and Sinaia Netanyahu. Boston: Kluwer Academic Publishers, 1998.