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WATER: I. **Patterns in International Water Resource Treaties:
 The Transboundary Freshwater Dispute Database**

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BIO:

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&number:S.N. Kulshreshtha, World Water **Resources** and Regional Vulnerability: Impact of Future Changes (1993).

* Water in Crisis: A guide to the World's Fresh Water **Resources** (Peter Gleick ed., 1993); United Nations, Register of International Rivers (1973).

* Values for lakes under "Annual Flow" are for storage volumes.

LEXISNEXIS SUMMARY:

... Negotiating notes and published descriptions of **treaty** negotiations are also being collected in the **database**, which presently includes fourteen detailed case studies. ... To organize and analyze these **treaties**, a systematic computer compilation has been developed which catalogs the **treaties** by basin, countries involved, date signed, **treaty** topic, allocations measure, conflict resolution mechanisms, and nonwater linkages. ... Only one multilateral **treaty** exists between industrialized nations for access to a water source, namely the **treaty** regarding water withdrawals from Lake Constance, signed by Germany, Austria, and Switzerland in 1966. ... Data collected by signatories of the **treaty** can provide a solid base for later discussions. ... Finally, the uniqueness of each basin is repeatedly suggested, both implicitly and explicitly, in the **treaty** texts. ... This last point is exemplified in the unique **treaty** elements devised by negotiators. ... The Bellagio Draft **Treaty**, developed in 1989, attempts to provide a legal framework for groundwater negotiations. ... Historically, force or the threat of force has ensured that a water **treaty** will be followed (for example, British colonial **treaties** and the 1947 Allied peace **treaty** with Italy), but power is less desirable and more expensive as a guarantor of compliance than mutual agreement. ... Table 1 **Treaty** Titles, Listed Chronologically ... Table 3 **Database Treaty** Example ... Table 4 **Treaty** Statistics Summary ...

TEXT:
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A. Introduction: The **Transboundary Freshwater Dispute Database**

Approximately 265 international watersheds, and an untold number of **transboundary** aquifers, cover about one-half of the globe's land surface. ⁿ¹ This vital **resource** - a scarce **resource** which has no substitute, which has poorly developed international law, and the need for which is overwhelming, constant, and immediate ⁿ² - has driven its share of political conflicts. Water has exacerbated tensions around the globe, most famously in the arid and hostile Middle East, but also throughout Africa and Asia.

The fortunate corollary of water as an inducement to conflict is that water, by its very nature, tends to induce even hostile coriparians to cooperate, even as **disputes** rage over other issues. In fact, the weight of historic evidence tends to favor water as a catalyst for cooperation: organized political bodies have signed 3,600 water-related **treaties** since a.d. 805, versus only seven minor **international water**-related skirmishes [*158] (each of which included other nonwater issues). ⁿ³ The only water-related war between states on record occurred about 4,500 years ago. ⁿ⁴ Given this disproportionate evidence in favor of "hydro-cooperation," the processes of conflict resolution and amelioration warrant more study, although at present many scholars focus on the potential for violent conflict sparked by water disagreements.

The UN Food and Agriculture Organisation has identified more than 3,600 **treaties** relating to **international water resources** dating between a.d. 805 and 1984, the majority of which deal with some aspect of navigation. ⁿ⁵ Since 1814, states have negotiated a smaller body of **treaties** that deal with the nonnavigational issues of water management, flood control, hydropower projects, or allocations for consumptive or nonconsumptive uses in international basins. Including only those dating from 1870 and later that deal with water per se, and excluding those that deal only with boundaries, navigation, or fishing rights, the authors have collected full and partial texts of 145 **treaties** in a **Transboundary Freshwater Dispute Database** at the University of Alabama. The collection and translation efforts continue in an ongoing project of the Department of Geography and the Center for **Freshwater Studies**, in conjunction with projects funded by the World Bank and the US Institute of Peace. Table 1 lists the **treaties** in the **database** chronologically.

Negotiating notes and published descriptions of **treaty** negotiations are also being collected in the **database**, which presently includes fourteen detailed case studies. These cases include nine watersheds (the Danube, Euphrates, Jordan, Ganges, Indus, Mekong, Nile, La Plata, and Salween); two sets of aquifer systems (US-Mexico shared systems and the West Bank Aquifers); two lake systems (the Aral Sea and the Great Lakes); and one engineering works (the Lesotho Highlands Project). Table 2 lists these case studies with some defining characteristics.

[*159] At present, few authors have undertaken systematic work on the body of **international water treaties** as a whole, although some use **treaty** examples to make a point about specific conflicts, areas of cooperation, or larger issues of water law. ⁿ⁶

Treaties can tell about regional hegemony, about how and which water needs are met, about the relative importance of water in the political climate, about development issues, and whether earlier **treaties** have successfully guided or guaranteed state behavior. This article summarizes the general findings from a comparative assessment of the **treaties** in the **Database**. To organize and analyze these **treaties**, a systematic computer compilation has been developed which catalogs the **treaties** by basin, countries involved, date signed, **treaty** topic, allocations measure, conflict resolution mechanisms, and nonwater linkages. ⁿ⁷

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B. Major Findings

The contents of the **Transboundary Freshwater Dispute Database** are qualitatively and quantitatively assessed for their provisions regarding the following criteria: basin involved; principal focus; number of signatories; nonwater linkages (such as money, land, or concessions in exchange for water supply or access to water); provisions for

monitoring, enforcement, and conflict resolution; method and amount of water division, if any; and the date signed (two sample summary sheets are included as Table 3). Preliminary descriptions of our findings follow, and Table 4 provides a statistical summary.

1. **Treaty** Signatories

One hundred twenty-four of the 145 **treaties** (86%) are bilateral. Twenty-one (14%) of the **treaties** are multilateral; two of these multilateral **treaties** are unsigned agreements or drafts.

It is unclear whether so many of the **treaties** are bilateral because only two states share a majority of international watersheds or because, according to negotiation theory, the difficulty of negotiation increases as the number of parties increases. ⁿ⁸ In basins with more than two riparians, this preference for bilateral agreements can preclude the comprehensive regional management long advocated by water **resource** managers. One who ignores the watershed as the fundamental planning unit - where the quality and quantity of surface- and groundwater are all interrelated - also ignores hydrologic reality. The Jordan Basin, for example, has been controlled by bilateral arrangements; the only regional talks on the Basin, the Johnston negotiations of 1953-1955, went unratified. As unilateral development in the Basin proceeded in the absence of agreement, each state's goals and plans abutted against those of the other coriparians, leading to inefficient development and even to exchanges of fire in the early 1950s and mid-1960s. ⁿ⁹ Similarly, India has a long-standing policy of adhering to bilateral negotiations, ⁿ¹⁰ presumably because it can best address its own needs vis-a-vis each of its neighbors separately. Partly as a consequence, neither the Ganges-Brahmaputra nor the Indus River systems have ever been managed to their potential efficiency. ⁿ¹¹

[*161] Of the twenty-one multilateral **treaties**/agreements, developing nations are parties to thirteen. Only one multilateral **treaty** exists between industrialized nations for access to a water source, namely the **treaty** regarding water withdrawals from Lake Constance, signed by Germany, Austria, and Switzerland in 1966. ⁿ¹² None of the preindustrial-nation multilateral agreements specify any water allocations - all involve hydropower or industrial uses or both.

The states surrounding the Aral Sea have an agreement, dated 1993, dealing with several joint issues, but the text lacks allocations and provides too little detail for planning water use. ⁿ¹³ Like the Aral Sea, Lake Chad also suffers from intense, poorly managed use and current deficit water withdrawals. ⁿ¹⁴ The Chad Basin **treaty** of 1964 between Cameroon, Niger, Nigeria, and Chad deals with economic development inside the basin, the lake's tributaries, and industrial uses of the lake, but it lacks specific allocations. ⁿ¹⁵ The agreement does create a commission that, among other things, arbitrates **disputes** concerning implementation of the **treaty**. The commission prepares general regulations, coordinates the research activities of the four states, examines their development schemes, makes recommendations, and maintains contact among the four states. ⁿ¹⁶

2. Principal Focus

Most **treaties** focus on hydropower and water supplies: fifty-seven (39%) **treaties** discuss hydroelectric generation, and fifty-three (37%) distribute water for consumption. Nine (6%) mention industrial uses, six (4%) navigation, and six (4%) primarily discuss pollution. Thirteen of the 145 (9%) focus on flood control. The **database** includes one **treaty** (less than 1%) that primarily discusses fishing, which is included in the **database** for other elements.

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3. Monitoring

Seventy-eight (54%) **treaties** have provisions for monitoring, while sixty-seven (46%) do not. When monitoring is mentioned, it is addressed in detail and often includes provisions for data sharing, surveying, and schedules for collecting data.

Information sharing generally engenders goodwill and can provide confidence building between coriparians. Unfortunately, some states classify river flows as secrets, ⁿ¹⁷ and others use the lack of mutually acceptable data as a stalling technique in their negotiations. ⁿ¹⁸ Most monitoring clauses contain only the most rudimentary elements, perhaps due to the time and labor costs of gathering data.

Data collected by signatories of the **treaty** can provide a solid base for later discussions. For example, India and Bangladesh previously could not agree on the accuracy of each other's hydrologic records, but they eventually agreed on Ganges flow data and based a workable agreement on that data in 1977. ⁿ¹⁹ The cooperation between engineers or among council members of different nations can result in the formation of an epistemic community, another positive outcome of data gathering and sharing. ⁿ²⁰ **Treaties** do not yet include provisions for monitoring compliance, but such additions may bolster trust and increase the strength of these epistemic bonds.

4. Method for Water Division

Few **treaties** allocate water: clearly defined allocations account for only fifty-four (37%) of the agreements. Of that number, fifteen (28%) specify equal portions and thirty-nine (72%) provide a specific means of allocation. All but three multilateral agreements lack definite allotments, although a few establish advisory and governing bodies among states.

There are four general trends in those **treaties** that specify allocations. First, a shift in position often occurs during negotiations from "rights-based" criteria (whether hydrographical or chronological) to "needs-based" values (based on irrigable land or population, for example). Second, in the inherent **disputes** between upstream and downstream riparians over existing and future uses, the needs of the downstream riparian are more often [*163] delineated (agreements mention upstream needs only in boundary waters accords in humid regions), and existing uses, when mentioned, are always protected. Third, economic benefits are not explicitly used in allocating water, although economic principles have helped guide definitions of "beneficial" uses and have suggested "baskets" of benefits, including both water and nonwater **resources**, for positive-sum solutions. Finally, the uniqueness of each basin is repeatedly suggested, both implicitly and explicitly, in the **treaty** texts. ⁿ²¹

This last point is exemplified in the unique **treaty** elements devised by negotiators. The 1959 Nile Waters **Treaty** divides the average flow based on existing uses, then evenly divides any future supplies among the Parties (projected from the Aswan High Dam and the Jonglei Canal Project). ⁿ²² The Johnston negotiations led to allocations between Jordan River riparians based on the irrigable land within the watershed; each Party could then do what it wished with its allocations, including divert it out-of-basin. ⁿ²³ The Boundary Waters Agreement, negotiated with a hydropower focus between Canada and the United States, allows a greater minimum flow of the Niagara River over the famous falls during summer daylight hours, when tourism is at its peak. ⁿ²⁴

5. Hydropower

Fifty-seven of the **treaties** (39%) focus on hydropower. Power-generating facilities bring development, and hydropower provides a cheap source of electricity to spur developing economies. Some, however, suggest that the age of building dams will soon end, due to lack of funding for large dams, a general lack of suitable new dam sites, and environmental concerns. ⁿ²⁵

Not surprisingly, mountainous nations at the headwaters of the world's rivers are signatories to the bulk of the hydropower agreements. Nepal alone, with a potential capacity of 83,000 megawatts of hydropower for [*164] sale, ⁿ²⁶ has four **treaties** with India (the Kosi River agreements of 1954, 1966, 1978, and the Gandak Power Project of 1959) to exploit the huge power potential in the region.

6. Groundwater

Only three agreements deal with groundwater supply: the 1910 convention between Great Britain and the Sultan of

Abdali, ⁿ²⁷ the 1994 Jordan-Israeli agreement, ⁿ²⁸ and the 1995 Palestinian-Israeli agreement. ⁿ²⁹ **Treaties** that focus on pollution usually mention groundwater but do not quantitatively address the issue.

The complexities of groundwater law have been described by more than a few authors. ⁿ³⁰ Overpumping can destroy cropland by creating salinity problems, either from seawater intrusion or evaporation-deposition, and therefore the allocation of too much water (or one party's overpumping) can decimate future **freshwater** supplies. ⁿ³¹

The Bellagio Draft **Treaty**, developed in 1989, attempts to provide a legal framework for groundwater negotiations. ⁿ³² The draft **treaty** requires joint management of shared aquifers and describes principles based on mutual respect, good neighborliness, and reciprocity. ⁿ³³ While the draft **treaty** recognizes that obtaining groundwater data can prove difficult and expensive, ⁿ³⁴ and mutually acceptable information relies on cooperative and reciprocal negotiations, it does provide a useful framework for future groundwater diplomacy.

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7. Nonwater Linkages

Negotiators may facilitate the success of a **treaty** by enlarging the scope of water **disputes** to include nonwater issues. If pollution causes trouble in a downstream country, an upstream neighbor may opt to pay for a treatment plant in lieu of reduced inputs or reduced withdrawals. In such a case, lesser amounts of high-quality water may improve relations more than a greater quantity of polluted or marginal-quality water. Such tactics "enlarge the pie" of available water and other **resources** in a basin. Nonwater linkages include capital (44, or 30%), land (6, or 4%), and political concessions (2, or 1%). Other linkages account for ten of the 145 **treaties** (7%), and there are no linkages for eighty-three **treaties** (57%).

Examples of these linkages can be found in the 1929 Nile agreement, in which the British agreed to give technical support to both Sudan and Egypt. ⁿ³⁵ In another example, the Soviet Union agreed, in lieu of payments, to compensate lost power generation to Finland in perpetuity (the 1972 Vuoksa agreement). ⁿ³⁶ Britain even established ferry service across newly widened parts of the Hathmatee in India in compensation for the inaccessibility problems created by a dam project in the late 1800s. ⁿ³⁷

Compensation for land flooded by dam projects is common. For example, British colonies usually agreed to pay for water delivery and reservoir upkeep, and the British government agreed to pay for flood damage to houses. ⁿ³⁸ However, capital can provide compensation for a greater array of **treaty** externalities and requirements, such as the construction of new water facilities; the India-Nepal Kosi River Project Agreements, signed in 1954 and 1966, provide two examples. ⁿ³⁹

Treaties that allocate water also include payments for water: forty-four **treaties** (30%) include monetary transfers or future payments. As early as 1925, Britain moved toward equitable use of the rivers in its colonies: Sudan agreed to pay a portion of the income generated by new irrigation projects to Eritrea, because the Gash River flowed through that state as [*166] well. ⁿ⁴⁰ **Treaties** also recognize the need to compensate for hydropower losses and irrigation losses due to reservoir storage: the 1951 Finland-Norway **treaty** ⁿ⁴¹ and the 1952 Egypt-Uganda **treaty** ⁿ⁴² both include such compensation. Again, these agreements emphasize the monetary aspect of water; they do not describe water as a right.

8. Enforcement

Treaties may handle **disputes** with technical commissions, basin commissions, or via government officials. Fifty-two (36%) **treaties** provide for an advisory council or conflict-addressing body within the Parties' governments. Fourteen (10%) refer **disputes** to a third party or the United Nations. Thirty-two (22%) make no provisions for **dispute** resolution, and forty-seven (32%) of the texts are either incomplete or ambiguous as to the creation of **dispute** resolution mechanisms. Can a technical advisory body address **disputes**? Perhaps, but the **treaties** do not expressly

provide for such activity.

Historically, force or the threat of force has ensured that a water **treaty** will be followed (for example, British colonial **treaties** and the 1947 Allied peace **treaty** with Italy ⁿ⁴³), but power is less desirable and more expensive as a guarantor of compliance than mutual agreement. Britain could oversee its colonial water **treaties** because it had one of the more powerful administrative and military organizations in the world. Similarly, agreements on the Nile generally favor Egypt, while those on the Jordan River favor Israel because of their respective power.

While the conflict resolution mechanisms in these **treaties** do not generally show tremendous sophistication, new enforcement possibilities exist with new monitoring technology. It is now possible to manage a watershed in real time, using a combination of remote sensing and radio- [*167] operated control systems. In fact, the next major step in **treaty** development may well be mutually enforceable provisions, based in part on this technology of objective and highly detailed remote images, better chemical testing, and more accurate flow computations than have been previously available.

C. Discussion

The 145 **treaties** that govern the world's international watersheds, and the international law on which they are based, are in their respective infancies. More than half of these **treaties** include no monitoring provisions whatsoever and, perhaps as a consequence, two-thirds do not delineate specific allocations and four-fifths have no enforcement mechanism. Moreover, those **treaties** that do allocate specific quantities allocate a fixed amount to all riparian states but one - that one state must then accept the balance of the river flow, regardless of fluctuations.

One problem hampering the development of sophisticated water **treaties** may have been the difficulty in acquiring information on similar settings. Thus far, each set of negotiators has had to, in effect, independently invent solutions. However, by compiling **treaties** in a single, searchable collection, along with negotiation notes and case studies, the **Transboundary Freshwater Dispute Database** hopes to provide researchers and diplomats with a useful tool to assess negotiating trends and workable **treaty** solutions in the future. ⁿ⁴⁴

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Table 1

Treaty Titles, Listed Chronologically

[SEE TABLE IN ORIGINAL]

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Table 1 (continued) [SEE TABLE IN ORIGINAL] [*170]

Table 1 (continued) [SEE TABLE IN ORIGINAL] [*171]

Table 1 (continued) [SEE TABLE IN ORIGINAL] [*172]

Table 1 (continued) [SEE TABLE IN ORIGINAL] [*173]

Table 1 (continued) [SEE TABLE IN ORIGINAL]

[*174]

Table 2&number

In-Depth Case Studies*

[SEE TABLE IN ORIGINAL]* [*175]

Table 2 (continued) [SEE TABLE IN ORIGINAL] [*176]

Table 3

Database Treaty Example

[SEE TABLE IN ORIGINAL] [*177]

Table 4

Treaty Statistics Summary

[SEE TABLE IN ORIGINAL]

Legal Topics:

For related research and practice materials, see the following legal topics:

Energy & Utilities LawHydroelectric Power IndustryGeneral OverviewInternational LawTreaty
FormationNegotiationsReal Property LawWater RightsProcedure

FOOTNOTES:

n1. See Aaron T. Wolf et al., **Transboundary** Rivers of the World: An Updated Register 1 (1998) (unpublished manuscript, on file with the author).

n2. See Thomas Naff, Conflict and Water Use in the Middle East, in *Water in the Arab World* 253, 273-74 (Peter Rogers & Peter Lydon eds., 1994).

n3. See Aaron T. Wolf, "Water Wars" and Water Reality: Conflict and Cooperation Along International Waterways 9-10, Presentation at the North Atlantic **Treaty** Organisation (NATO) Advanced Research Workshop on Environmental Change, Adaptation and Human Security, Budapest, Hungary (Oct. 9, 1997) (unpublished manuscript of the presentation on file with the author).

n4. See Jerrold S. Cooper, *Int'l Inst. for Mesopotamian Area Studies, Reconstructing History from Ancient Inscriptions: The Lagash-Umma Border Conflict* 9, Vol. 2, fascicle 1 (1983).

n5. See Food And Agriculture Organisation of the United Nations, *Systematic Index of International Water Resources by Treaties, Declarations, Acts and Cases, By Basin*, Legis. Study No. 15 (1978); Food And Agriculture Organisation of the United Nations, *Systematic Index of International Water Resources by Treaties, Declarations, Acts and Cases, By Basin*, Vol. II, Legis. Study No. 34 (1984).

n6. See, e.g., Deborah Housen-Couriel, *Some Examples of Cooperation in the Management and Use of International Water Resources*

(The Harry S. Truman Institute for the Advancement of Peace, Hebrew University of Jerusalem, 1994); Nurit Kliot et al., Institutional Frameworks for the Management of **Transboundary Water Resources**, Volume One: Institutional Frameworks as Reflected in Thirteen River Basins (Water Research Inst., 1997); Joseph Dellapenna, Building **International Water** Management Institutions: The Role of **Treaties** and Other Legal Arrangements, in *Water in the Middle East: Legal, Political, and Commercial Implications*, 55 (J.A. Allan & Chibli Mallat eds., 1995); David Eaton & Joseph W. Eaton, Joint Management of Aquifers Between the Jordan River Basin and the Mediterranean Sea by Israelis and Palestinians: An International Perspective, in *Joint Management of Shared Aquifers: The First Workshop*, 131 (Eran Feitelson & Marwan Haddad eds., 1994); Ludwik A. Teclaff, Fiat or Custom: The Checkered Development of **International Water** Law, 31 Nat. **Resources** J. 45 (1991); Evan Vlachos, Prologue: Water, Peace and Conflict Management, 15 *Water Int'l* 15, 185 (1990).

See Joseph W. Dellapenna, **Treaties** as Instruments for Managing Internationally-Shared Water **Resources**: Restricted Sovereignty vs. Community of Property, 26 *Case W. Res. J. Int'l L.* 27, 42-47 (1994), for a description of the evolution of **treaty** practice dating back to the mid-1800s. For an argument that international law should better address hydrologic processes, see Robert D. Hayton, Reflections on the Estuarine Zone, 31 Nat. **Resources** J. 123, 133-36 (1991). See Stephen C. McCaffrey, The Evolution of the Law of International Watercourses, 45 *Australian J. Pub. Int'l L.* 87 (1993), for a presentation of theories about trends in **treaty** making, specifically the move toward integrated management from unilateral development, the move away from navigation as the primary use, and the trend towards "equitable utilization." See James L. Wescoat, Jr., Main Currents in Early Multilateral Water **Treaties**: A Historical-Geographical Perspective, 1648-1948, 7 *Colo. J. Int'l Envtl. L. & Pol'y* 39 (1996), for an assessment of historic trends of water **treaties** dating from 1648 to 1948 in global perspective.

n7. The compilation was created by Jesse Hamner. The authors expect that both the full text of each **treaty** and the compilation of summaries will be uploaded to the World Wide Web by the fall of 1998. In the meantime, an electronic version, including one-page summaries of each **treaty**, is available on disk from either author upon request.

n8. See I. William Zartman, The Structure of Negotiation, in *International Negotiation* 65, 74-76 (Victor A. Kremenyuk ed., 1991).

n9. See Aaron T. Wolf, *Hydropolitics along the Jordan River: Scarce Water and Its Impact on the Arab-Israeli Conflict* 44-52 (1995).

n10. See Gail Bingham et al., *Irrigation Support Project for Asia and the Near East, Resolving Water Disputes: Conflict and Cooperation in the United States, the Near East, and Asia* 121 (1994).

n11. See *id.* at 107-11, 121.

n12. See *Agreement Regulating the Withdrawal of Water from Lake Constance*, Apr. 30, 1966, Aus.-F.R.G.-Switz., 620 U.N.T.S. 191.

n13. See *Agreement on Joint Activities in Addressing the Aral Sea and the Zone Around the Sea Crisis, Improving the Environment, and Enduring the Social and Economic Development of the Aral Sea Region*, Mar. 26, 1993 (on file with the author).

n14. See Robert Rangeley et al., International River Basin Organizations in Sub-Saharan Africa 10, 49-53 (World Bank Technical Paper No. 250, Afr. Technical Dep't Series, 1994).

n15. See Convention and Statutes Relating to the Development of the Chad Basin, May 22, 1964, in Natural **Resources** Water Series No. 13: **Treaties** Concerning the Utilization of **International Water** Courses for Other Purposes than Navigation: Africa at 8, U.N. Doc. ST/ESA/141, U.N. Sales No. E/F.84.II.A.7 (1984).

n16. See id. at 11.

n17. Personal Communication with Sumit Ganguly, Professor of Political Science, City University of New York (Nov. 17, 1997).

n18. See Lincoln Kaye, The Wasted Waters, Far E. Econ. Rev., Feb. 2, 1989, at 16, 17.

n19. See Agreement on Sharing of the Ganges Waters at Farakka and on Augmenting Its Flows, Nov. 5, 1977, Bangl.-India, 1066 U.N.T.S. 3.

n20. See Edy Kaufman, Innovative Problem Solving 34 (1996).

n21. See Aaron T. Wolf, Criteria for Equitable Allocations: The Heart of **International Water** Conflict 32-33 (Mar. 28, 1997) (unpublished manuscript, on file with the Colorado Journal of International Environmental Law and Policy).

n22. See Agreement for the Full Utilization of the Nile Waters, Nov. 8, 1959, United Arab Republic-Sudan, 453 U.N.T.S. 51.

n23. See The Jordan Valley Plan, Jan. 1, 1956 (Summary of Ambassador Eric Johnston's negotiations between the governments of Israel, Lebanon, Syria, and Jordan regarding the allocation of Jordan Valley water **resources**) (unpublished document, on file with the author).

n24. See **Treaty** Relating to the Uses of the Niagara River, Feb. 27, 1950, U.S.-Can., 132 U.N.T.S. 223.

n25. See Sandra Postel, Last Oasis: Facing Water Scarcity 40-43 (The Worldwatch Environmental Alert Series, Linda Starke, series ed., 1992).

n26. See Manisha Aryal, Dams: The Vocabulary of Protest, *Himalayan Mag.*, July-Aug. 1995, at 16.

n27. See Terms of a Convention Regarding the Water Supply of Aden Between Great Britain and the Sultan of Abdali, Apr. 11, 1910, 210 Consol. T.S. 403.

n28. See **Treaty** of Peace, Oct. 26, 1994, Isr.-Jordan, art. 6, 34 I.L.M. 43, 48.

n29. See Israeli-Palestinian Interim Agreement on the West Bank and the Gaza Strip, Sept. 28, 1995, Annex III, art. 40, Israel Ministry of Foreign Affairs (visited Feb. 9, 1998) <<http://www.israel.org/peace/iaannex3.html#app-40>>.

n30. See e.g., Robert D. Hayton, The Law of International Aquifers, 22 *Nat. Resources J.* 71 (1982); Albert E. Utton, The Development of International Groundwater Law, 22 *Nat. Resources J.* 95 (1982).

n31. See R. Allen Freeze & John A. Cherry, *Groundwater* 364-67 (1979).

n32. See Robert D. Hayton & Albert D. Utton, **Transboundary** Groundwaters: The Bellagio Draft **Treaty**, 29 *Nat. Resources J.* 663, 663 (1989).

n33. See *id.*

n34. Although costly, gathering accurate groundwater data to help determine safe yield for wells is probably not as expensive in human terms as ruined cropland and saline water supplies.

n35. See Exchange of Notes Between His Majesty's Government in the United Kingdom and the Egyptian Government in Regard to the Use of the Waters of the River Nile for Irrigation Purposes, May 7, 1929, in *The Sharing of Water Resources in the River Basins of Africa* 24 (U.K. Foreign Pol'y Doc. No. 4, 1978).

n36. See Agreement Concerning the Production of Electric Power in the Part of the Vuoksa River Bounded by the Imatra and Svetogorsk Hydroelectric Stations, July 12, 1972, Fin.-U.S.S.R., 884 U.N.T.S. 57.

n37. See Agreement Between Great Britain and the Edur State, July 20, 1874, para. 6, 148 Consol. T.S. 69, 71.

n38. See *id.* para. 8, at 72.

n39. See Agreement Between the Government of India and the Government of Nepal on the Kosi Project, Apr. 25, 1954, in Agreements on Development of Inter-State and International Rivers 355, 369, 47-1 DD/CWC/79 (1979).

n40. See Notes Exchanged Between the United Kingdom and Italy Respecting the Regulation of the Utilisation of the Waters of the River Gash, June 15, 1925, in The Sharing of Water **Resources** in the River Basins of Africa 14 (U.K. Foreign Pol'y Doc. No. 4, 1978).

n41. See Agreement Between the Governments of Finland and Norway on the Transfer from the Course of the Neiden River to the Course of the Gandvik River of Water from the Gjerringvatn and Frstevannene Lakes, Apr. 25, 1951, in United Nations Legislative Series, Legislative Texts and **Treaty** Provisions Concerning the Utilization of International Rivers for Other Purposes than Navigation 609, U.N. Doc. ST/LEG/SER.B/12, U.N. Sales No. 63.V.4 (1963).

n42. See Exchange of Notes Constituting an Agreement Regarding the Construction of the Owen Falls Dam in Uganda, July 16, 1952-Jan. 5, 1953, U.K.-Egypt, 207 U.N.T.S. 277.

n43. See **Treaty** of Peace with Italy, Feb. 10, 1947, U.S.S.R.-U.K.-U.S.-Fr.-Austl., 49 U.N.T.S. 3.

n44. This summary assessment is the first result from what we hope will be continued systematic study of the **treaties** we have collected in our **database**. In other work, Wolf describes generally the process of water **disputes and dispute** resolution, and specifically how the **database treaties** allocate water. See Aaron T. Wolf, **International Water** Conflict Resolution: Lessons From Comparative Analysis, 13 **Water Resources** Dev. 333 (1997). In a future study, we hope to assess the relationship between the substance of the **treaties** and other geographic variables, particularly climate, power relationships, types of government, and changes over time. We would also like to assess mechanisms for conflict resolution for their relative effectiveness.

Broad accessibility to the **database** is encouraged. The **database** is not copyrighted (although due credit is appreciated), and, as mentioned above, should be available in its entirety on the World Wide Web by the end of 1998. Any comments or suggestions for future

work are welcome. We would also appreciate knowing about any omissions or errors.