THE COMING FRESH WATER CRISIS: INTERNATIONAL LEGAL AND INSTITUTIONAL RESPONSES*

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INTRODUCTION

In approximately 3100 B.C., Eannatum, governor of Lagash, presided over a bloody but victorious battle against the neighboring Mesopotamian city-state of Umma.[1] The governor of Umma was slain and a boundary stone was laid. The cause of the hostilities? A dispute over water. With a view to removing the source of the dispute once and for all, a boundary canal was dug into which Euphrates waters were diverted.[2] A treaty concluded between the two city-states is recorded on the well-known "Stele of the Vultures," which is housed in the Louvre.[3] But the agreement, which has been called the earliest recorded treaty, did not hold.[4] Umma, the upper riparian, later took up arms against its downstream neighbor and returned the favor, killing Eannatum. These conflicts were only two incidents in what has been described as a "perpetual quarrel" between Lagash and Umma over water supplies.[5]

In some ways, very little has changed in the intervening five thousand years. The World Bank tells us that "[t]he wars of the next century will be over water."[6] But that should come as no surprise because even this century has seen its share of international disputes over fresh water, some

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1. This conflict is discussed more fully in Stephen McCaffrey, The Law of International Watercourses (1997) (unpublished manuscript, on file with author).

2. *See id.*

3. *See* LUDWIK A. TECLAFF, THE RIVER BASIN IN HISTORY AND LAW 21 (1967); *see also* SETON LLOYD, TWIN RIVERS 29 (3d ed. 1961).

4. *See* ARTHUR NUSSBAUM, A CONCISE HISTORY OF THE LAW OF NATIONS 2 (rev. ed. 1954).

5. LLOYD, *supra* note 3, at 29. For a useful survey of ancient water disputes, see Peter H. Gleick, *Water, War and Peace in the Middle East*, ENV'T, April 1994, at 6, 11.

6. John Vidal, *As the World Runs Dry . . . Next, Wars Over Water?*, GUARDIAN WKLY, Aug. 20, 1995, *reprinted in* WORLD PRESS REV., Nov. 1995, at 8. This statement, by Ismail Serageldin, the Bank's Vice President for environmental affairs, was widely quoted in the media in the summer of 1995.

of which have erupted into hostilities.[7] Water works have been bombed,[8] threats have been made to divert or cut off the flow of no less a river than the Nile,[9] and, according to some experts, whole wars have been fought over water security.[10] Given that the amount of available fresh water per capita has declined precipitously with the explosive growth of the world's population, this does not present a rosy picture.

I have been asked to provide a general overview of the legal and institutional aspects of the scarcity of water—a daunting task, given the complexity of the problem and the limited space available. But in order to understand the legal and institutional challenges we need to know something about the factual aspects of water scarcity, because law is simply a tool a community can use to implement policy responses to particular problems. Identification of the problem is easy enough, one might say: there's simply not enough water! But, is it that simple? To find out, let us look behind the fact of water scarcity to try to find out why it exists.

I. WATER SCARCITY: THE NATURE OF THE PROBLEM

A. The World's Water Supply

The absolute quantity of water on Earth does not change. It is thought to have been the same for billions of years. However, ninety-seven percent of all water is salt water while only three percent is fresh.[11] Of that amount of fresh water, most is locked in polar ice caps and deep

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7. For a survey of selected international conflicts over shared water resources, see Stephen McCaffrey, *Water, Politics, and International Law*, *in* WATER IN CRISIS 92-97 (Peter H. Gleick ed., 1993).

8. *See id.* at 92-93. Israeli jets struck the Arab states' Headwater Diversion Project in the 1960s. This project would have diverted headwaters of the Jordan River into the Yarmouk. The dispute over water was a major factor contributing to the 1967 Six Day War. *See id.*

9. *See* Christopher Walker, *Egypt Warns Sudan Over New Threat to Cut Nile Waters*, TIMES (London), July 4, 1995, at 11. This incident occurred in the context of the series of charges and counter-charges that followed the attempted assassination of Egyptian President Hosni Mubarak in Addis Ababa during the summer of 1995. According to press accounts, "[t]he war of words intensified with a Sudanese threat to cut off Nile waters to Egypt, provoking . . . the Egyptian Foreign Minister[] to warn: 'I urge [Sudanese spiritual leader Hassan] al-Turabi not to play with fire, and at the same time not to play with water.'" *Id.*

10. *See, e.g.*, *Water-related Ceasefire Violations in Jordan River System from 1951 to 1967*, *in* WATER IN THE MIDDLE EAST: CONFLICT OR COOPERATION? 36, 37 tbl.3 (Thomas Naff & Ruth C. Matson eds., 1984); Joyce R. Starr, *Water Wars*, 82 FOREIGN POL'Y 17 (1991); John K. Cooley, *The War Over Water*, 54 FOREIGN POL'Y 3 (1984).

11. *See* Peter H. Gleick, *An Introduction to Global Fresh Water Issues*, *in* WATER IN CRISIS, *supra* note 7, at 3.

underground aquifers—effectively beyond human reach.[12] Only .3% of total fresh water reserves on Earth is found in rivers and lakes.[13] The largest share of fresh water that is available to humans takes the form of groundwater, which constitutes about thirty percent of global fresh water reserves. While the quantity of fresh water does not change on an absolute basis, the amount available to each individual does change with the growth of the human population.

B. Population

While it took all of human history up to the year 1950 for the population to reach two and a half billion, it took fewer than forty years for it to double. And by the year 2000 it will have topped the six billion mark. If present trends continue, the United Nations estimates that after 2100 the world's human population will stabilize at around twelve billion.[14] What does this mean in terms of the availability of fresh water? "In 1850, the average amount of water available per person worldwide was 43,000 cubic meters per year; today it is under 9,000—a change brought about only by increases in population . . . ."[15]

C. Access to Water and Sanitation

It is not only the fact of population increases that poses problems of water scarcity, but also the places in which those increases are for the most part occurring. "[O]ver 90% of all future population increases will occur in the developing world. This means that almost all new births will be in regions where access to clean water and sanitation services [and] adequate health care [, among other things,] . . . are severely lacking."[16] The difficulty of merely maintaining the same position, as bad as it is, with regard to safe drinking water and sanitation is dramatically illustrated by the results of the International Drinking Water Supply and Sanitation Decade, a program carried out by the United Nations in the 1980s. The goal of the program was to provide potable water and adequate sanitation

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12. *See id.*

13. *See id.*

14. *See* UNITED NATIONS POPULATION DIV., LONG-RANGE WORLD POPULATION PROJECTIONS: TWO CENTURIES OF POPULATION GROWTH 1950-2150 (1992).

15. Peter H. Gleick, *Water Resources: A Long-Range Global Evaluation*, 20 ECOLOGY L.Q. 141, 143 (1993) (footnote omitted).

16. Peter H. Gleick, *Water in the 21st Century*, *in* WATER IN CRISIS, *supra* note 7, at 105.

facilities to those without them.[17] In 1980, "1.74 billion people in the developing world alone did not have access to adequate sanitation services."[18] After ten years of tremendous effort and expense, minimal sanitation services had been provided to 748 million of these unserved people. But during that same decade, the number of people in need of these services grew by 750 million. "In other words, population growth entirely wiped out the progress achieved in this area—1.74 billion people are still without access to sanitation services."[19] The picture with regard to drinking water is somewhat better. The number of people with access to potable water actually increased during the decade, by 1.35 billion. But even this sign of progress is overshadowed by the fact that nearly 1.23 billion people remain without access to clean drinking water.[20]

Among the consequences of the lack of clean water and sanitation services is the tragedy of millions of preventable illnesses and deaths due to water-borne diseases. "[A]n estimated 2 million deaths from diarrhea alone could be avoided each year if all people had access to satisfactory water supply and sanitation services."[21]

D. Urbanization

Another phenomenon having profound effects on the availability of fresh water and sanitation is that the world's population is increasingly concentrated in urban areas.[22] The percentage of world population living in cities was 29.2% in 1950 and had skyrocketed to 41% by 1985.[23] It is estimated that half the world's population will be living in urban centers by the year 2000.[24] These growing urban areas will experience increasing

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17. *See* Gleick, *supra* note 15, at 143.

18. *Id.*

19. *Id.*

20. *See* Joseph Christmas & Carel de Rooy, *The Decade and Beyond: At a Glance*, 16 WATER INT'L 127, 128 (1991); *see also* Gleick, *supra* note 15, at 143; ISMAIL SERAGELDIN, TOWARD SUSTAINABLE MANAGEMENT OF WATER RESOURCES 3 (monograph, The World Bank, Washington, D.C. 1995).

21. ISMAIL SERAGELDIN, WATER SUPPLY, SANITATION, AND ENVIRONMENTAL SUSTAINABILITY: THE FINANCING CHALLENGE 4 (monograph, The World Bank, Washington, D.C. 1994) (published version of keynote address to Ministerial Conference, *Drinking Water and Environmental Sanitation: Implementing Agenda 21*, Noordwijk, The Netherlands, March 22, 1994).

22. *See* WORLD COMM'N ON ENV'T & DEV., OUR COMMON FUTURE 235-58 (1987).

23. *See id.* at 235.

24. *See* Malin Falkenmark & Gunnar Lindh, *Water and Economic Development*, *in* WATER IN CRISIS, *supra* note 7, at 86. For the statistics concerning urbanization in developing countries, see *Review of Sectoral Clusters, First Phase: Health, Human Settlements and Freshwater, Freshwater Resources, Report of the Secretary-General*, U.N. ESCOR, 2d Sess., at 15-16, U.N. Doc.

difficulty in providing adequate supplies of water to their inhabitants,[25] not to mention in disposing of the large quantities of wastewater those inhabitants will produce.[26] In urban areas the number of people without access to sanitation actually increased by about seventy million during the 1980s.[27] In many of these cases, steady streams of immigrants quickly exhausted readily available water supplies, forcing the cities to obtain water from increasingly great distances—sometimes with effects on other countries. And often, cities grow at the expense of farmland. This has led some countries, such as Indonesia, to close whole regions to further development in order to preserve increasingly precious agricultural areas.[28]

E. Water Stress and Scarcity

What does all this mean in terms of the availability of water to humans in the coming decades? Let us take as a yardstick the generally accepted definitions of water "scarcity" as one thousand cubic meters of fresh water or less available to each person per year and water "stress" as between one thousand and seventeen thousand cubic meters of available fresh water per capita.[29] Experts believe that: "By the year 2025, over 30 countries will be unable to provide 1,000 [cubic meters] per person per year, simply because of population growth."[30] That is, in thirty years over thirty countries will be under water scarcity. In some countries the situation is much worse. In 1990, there were twelve countries in which water availability was fewer than five hundred cubic meters per person per year. This number is projected to increase to nineteen by 2025.[31] By the year 2025, thirty-two percent of the global population will live in some

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E/CN.17/1994/4 (1994) [hereinafter *Report of the Secretary-General.*]

25. *See* Falkenmark & Lindh, *supra* note 24, at 86-87; *see also* SERAGELDIN, *supra* note 20, at 12-14. For an early analysis, questioning the ability of municipal governments to plan for long-range resource needs, see NELSON MANFRED BLAKE, WATER FOR THE CITIES: A HISTORY OF THE URBAN WATER SUPPLY PROBLEM IN THE UNITED STATES (1956).

26. *See* Falkenmark & Lindh, *supra* note 24, at 87. "Waste is expensive and creates the greatest problems where urban populations grow most rapidly, namely in developing countries. Unfortunately, these regions also have some of the world's lowest GNPs, which limits the capital available for wastewater treatment." *Id.*

27. *See* SERAGELDIN, *supra* note 20, at 3.

28. *See* Michael Richardson, *Water and Rice: Crisis Lies Ahead*, INT'L HERALD TRIB. (Neuilly-sur-Seine, France), Oct. 26, 1995, at 4.

29. *See Report of the Secretary-General*, *supra* note 24, at 3.

30. Gleick, *supra* note 16, at 105-06.

31. *See id.* at 106. Most of these countries are in Africa and Asia. Gleick notes that 500 cubic meters per person per year "might suffice in a semi-arid society with extremely sophisticated water management, as in Israel, but even here water resources scarcity is already causing political and social stresses." *Id.*

fifty-two countries suffering from water stress or chronic water scarcity.[32] By contrast, in 1990, a mere six percent of the world's population were living under these conditions.[33]

F. Human Use of Water

We will next examine how humans use water. To begin, humans are composed mostly of it. We use about eight percent of the world's fresh water supplies for health and sanitation purposes.[34] Agriculture consumes about sixty-seven percent of the available supply.[35] In developing countries the figure is closer to seventy percent.[36] Industrial uses account for roughly twenty percent of the global water supply.[37] This leaves precious little for freshwater ecosystems that nourish countless species of plants and animals and constitute a vital part of the human life-support system.

Human consumption of fresh water is escalating at alarming rates. On a worldwide basis, demand is doubling every twenty-one years.[38] Agricultural use is increasing most rapidly. It is projected to double in the forty years from 1960 to 2000, from about 1500 to 3000 cubic kilometers per year.[39] Contributing to, and perhaps exacerbating this trend, is the fact that the new, high-yielding crop varieties that are strongly promoted by governments and international institutions require considerably more water than traditional varieties.[40] A recent newspaper article made this same point about new rice varieties in Asia.[41] The result of all this is that within the lifetime of a person living in regions as arid as the Middle East or North Africa, the amount of available water per capita will have decreased by eighty percent by the year 2025.[42]

Inefficient use of water also inflates demand. According to a World Bank official, "the water problem in most countries stems mainly from

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32. *See* SERAGELDIN, *supra* note 20, at 2; *Report of the Secretary-General*, *supra* note 24, at 3.

33. *See Report of the Secretary-General*, *supra* note 24, at 3.

34. *See* SERAGELDIN, *supra* note 20, at 1

35. *See id.*

36. *See id.*

37. *See id.*

38. *See* Vidal, *supra* note 6, *reprinted in* WORLD PRESS REV., Nov. 1995, at 8.

39. *See id.* (according to a reproduced FAO graph).

40. *See id.* at 9.

41. *See generally* Richardson, *supra* note 28.

42. *See* Vidal, *supra* note 6, *reprinted in* WORLD PRESS REV., Nov. 1995, at 8 (quoting Ismail Serageldin, Vice President for the Environment of the World Bank).

inefficient and unsustainable use of water."[43] Since "a third of the world's food crops are produced by irrigated agriculture,"[44] much of this waste could be eliminated through improved irrigation practices. Waste also results from leaks in water supply systems, which in urban areas are generally responsible for losses of from thirty to fifty percent of the water in those systems.[45]

G. Water Quality

Another factor that reduces the amount of usable water is degradation of water quality. While the focus of this paper is upon the quantity of water available to meet human needs, water may not be usable by humans if it is polluted. In fact, contamination of fresh water resources—whether by industrial discharges, inadequate sanitation facilities, or saltwater intrusion—strikes directly at vital human needs such as water for food and drinking. Therefore, considerations of water quality play an important role in determining whether water of adequate quantity is available for human use.

H. The International Dimension

Some forty percent of the world's population lives in the 250 drainage basins that are shared by more than one country.[46] These international watersheds make up nearly half the Earth's surface, excluding Antarctica, and some sixty percent of Africa and Latin America.[47] We know that many of the African countries are among the most water-stressed or water-scarce on the planet. According to Ismail Serageldin of the World Bank, "[i]ssues of scarcity have put water at the top of the international political agenda."[48] He observes that international water problems "are not confined to historically conflicted or dry areas. . . . As populations and

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43. *Flowing Uphill: Water*, ECONOMIST, Aug. 12, 1995, at 36 (quoting Ismail Serageldin) [hereinafter *Flowing Uphill: Water*].

44. SERAGELDIN, *supra* note 20, at 1.

45. *Flowing Uphill: Water*, *supra* note 43 (noting that two countries with the greatest shortages of water, Jordan and Malta, lose 56% and over 60%, respectively, of their water through leaks).

46. *See* Vidal, *supra* note 6, *reprinted in* WORLD PRESS REV., Nov. 1995, at 8 (according to Peter H. Gleick of the Pacific Institute for Studies in Development, Environment, and Security).

47. *See* McCaffrey, *supra* note 7, at 97 (citing A.K. Biswas, *Water for Sustainable Development: A Global Perspective*, 5 DEV. & COOPERATION 17, 17-20 (German Foundation for International Development and Cooperation 1991)). The proportion is probably greater now, after the dissolution of the Soviet Union and Yugoslavia.

48. SERAGELDIN, *supra* note 20, at 2.

demand for limited supplies of water increase, [intra-national] and international frictions over water can be expected to intensify."[49]

II. STRATEGIES TO ALLEVIATE WATER SCARCITY

And so we have come full circle: from Umma and Lagash and the water wars of the past to growing scarcity and predictions of water wars in the future. What, if anything, can be done to alleviate these problems? Just make more fresh water, one might suggest, through desalination. But while this is technically possible, it is not a practical alternative for the vast majority of the countries of the world because of the extremely high amounts of energy the desalination process requires.[50] It is thus not surprising that half the world's installed desalination capacity is in the Gulf countries.[51] Instead, it seems likely that the solutions—to the extent that there are any—are much less direct and dramatic. They will have to address the pervasive and diffuse problems identified above, through such strategies as comprehensive water planning, education, integrated management, enhancing the role of women, and increased efficiency in irrigation. These are in fact the very kinds of techniques that are being applied by agencies within the United Nations system and by individual countries as a result of United Nations action. Let us then take a closer look at how the United Nations is dealing with the problem of water scarcity.

A. Water Scarcity and the United Nations

The United Nations has been active in this field for some time. The United Nations Water Conference, held in Mar del Plata in 1977, produced the Mar del Plata Action Plan, a wide-ranging program for the protection, management, and development of fresh water resources.[52] This Action Plan is still very much alive and countries continue to strive to

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49. *Id.*

50. *See* Peter H. Gleick, *Water and Energy*, *in* WATER IN CRISIS, *supra* note 7, at 67, 69. "While desalination provides a substantial part of the water supply in certain oil-rich Middle Eastern nations, globally, desalination provides just one one-thousandth of total world fresh water use." *Id.*

51. *See Report of the Secretary-General*, *supra* note 24, at 25 (citing Economic and Social Commission for Western Asia, *Water Resources Planning, Management, Use and Conservation in the ESCWA Region*, U.N. Doc. E/ESCWA/NR/1993/21 (1993)). The actual percentage of installed capacity in the Gulf states is 49.5%. *See id.*

52. *Report of the United Nations Water Conference, Mar del Plata, 14-25 March 1977*, at 5-65, U.N. Doc. E/CONF.70/29 (1977) [hereinafter *United Nations Water Conference, Mar del Plata*].

implement its programs, although progress has been slow.[53] In 1990, the Global Consultation on Safe Water and Sanitation for the 1990s, held in New Delhi, adopted the New Delhi Statement. This instrument emphasized the need to provide all people with access to sufficient quantities of safe water and proper sanitation. It took the approach of "some for all rather than more for some."[54]

Today, efforts to address water problems are underway in a bewildering array of agencies within the United Nations family. These organizations include FAO, UNDP, UNESCO, UNEP, UNICEF, UNIDO, WHO, WMO,[55] and the various regional economic commissions.[56] And U.N. agencies are increasingly cooperating on water-related projects and programs, such as the UNDP/World Bank Water and Sanitation Programme, and the WHO/UNICEF Joint Monitoring Programme.[57] In this connection, there is an Inter-Agency Steering Committee for Water Supply and Sanitation that for some time has coordinated the implementation of joint activities relating to drinking water supply and sanitation within the United Nations system.[58]

The latest United Nations-based effort to address fresh water problems is found in Chapter 18 of Agenda 21, the program of action in the field of environment and development adopted at the United Nations Conference on Environment and Development (UNCED) in June 1992.[59] To avoid confusion, it should be noted at the outset that Agenda 21 is not a binding legal instrument, as is sometimes thought. It was, however, unanimously adopted by 178 states participating in UNCED, indicating a broad measure

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53. *See, e.g., Water Resources: Progress in the Implementation of the Mar Del Plata Action Plan, Strategies and Measures for the implementation of the Mar Del Plata Action Plan in the 1990s*, Committee on Natural Resources, U.N. ESCOR, 12th Sess., Item 4 (Provisional Agenda), U.N. Doc. E/C.7/1991/8 (1991); *Report of the Secretary-General*, *supra* note 24, at 6.

54. *Report of the United Nations Conference on Environment and Development (Rio de Janeiro, 3-14 June 1992)*, Annex II, Agenda Item 21 para. 18.48, U.N. Doc. A/CONF.151/26 (1992) [hereinafter *United Nations Conference on Environment and Development (Rio de Janeiro)*] (referring to the New Deli Statement, including its four guiding principals).

55. The full titles of each of these organizations are respectively: Food and Agricultural Organization of the U.N.; U.N. Development Programme; U.N. Education, Scientific and Cultural Organization; U.N. Environment Programme; U.N. International Childrens' Education Fund; U.N. Industrial Development Organization; World Health Organization; World Meteorological Organization.

56. See the *Report of the Secretary-General*, *supra* note 24, at 15, for a brief summary of the activities of these agencies with regard to the different program areas of Chapter 18 of Agenda 21.

57. *See id.* para. 55; *see also id.* para. 56 (discussing joint programs).

58. *See id.* para. 57.

59. Agenda 21 is contained in an annex to the *United Nations Conference on Environment and Development (Rio de Janeiro)*, *supra* note 54.

of support for its programs.[60] Agenda 21 is already being applied and implemented widely, both by states and by international organizations.

Chapter 18 is entitled "Protection of the Quality and Supply of Freshwater Resources: Application of Integrated Approaches to the Development, Management and Use of Water Resources." The ambitious "general objective" of the program contained in Chapter 18 is stated as follows: "to make certain that adequate supplies of water of good quality are maintained for the entire population of this planet, while preserving the hydrological, biological and chemical functions of ecosystems, adapting human activities within the capacity limits of nature and combating vectors of water-related diseases."[61] With regard to water scarcity, the Chapter states in its introductory paragraphs that "widespread scarcity, gradual destruction and aggravated pollution of freshwater resources . . . demand integrated water resources planning and management" that "must cover all types of interrelated freshwater bodies, including both surface water and groundwater, and duly consider water quantity and quality aspects."[62]

Chapter 18 addresses the following seven program areas: (1) Integrated water resources development and management; (2) Water resources assessment; (3) Protection of water resources, water quality and aquatic ecosystems; (4) Drinking-water supply and sanitation; (5) Water and sustainable urban development; (6) Water for sustainable food production and rural development; and (7) Impacts of climate change on water resources. The Chapter constitutes a comprehensive approach to the planning and management of fresh water resources to ensure the availability of adequate supplies of good quality fresh water. If the Chapter has a weakness, it is that it does not contain a thorough set of recommendations concerning transboundary water resource problems.[63]

The United Nations Commission on Sustainable Development (CSD) was established by the General Assembly on the recommendation of UNCED to oversee the implementation of Agenda 21. At its second session in 1994, the CSD noted "with great concern that many countries are facing a water crisis, with rapid deterioration of water quality, serious water shortages and reduced availability of freshwater, which severely

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60. *See* AGENDA 21: PROGRAMME OF ACTION FOR SUSTAINABLE DEVELOPMENT, RIO DECLARATION ON ENVIRONMENT AND DEVELOPMENT, STATE OF FOREST PRINCIPLES, THE FINAL TEXT OF AGREEMENTS NEGOTIATED BY GOVERNMENTS AT THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT (UNCED), 3-14 JUNE 1992, RIO DE JANEIRO, BRAZIL, Introduction at 3.

61. *Id.* para. 18.2.

62. *Id.* para. 18.3.

63. *See generally* Stephen McCaffrey, *The Management of Water Resources*, *in* THE ENVIRONMENT AFTER RIO: LAW AND ECONOMICS 149 (L. Campiglio et al. eds., 1994).

affect human health, the ecosystem and economic development . . . ."[64] It recognized "that the crisis needs urgent and concrete action by national Governments as well as international organizations in order to implement Chapter 18 of Agenda 21, particularly by supporting developing countries."[65] To lay the foundation for Chapter 18's fresh water program, the CSD called for a comprehensive assessment of the world's fresh water resources.[66] The assessment is presently being carried out under the auspices of the Subcommittee on Water Resources of the Administrative Committee on Coordination (ACC) by a group of U.N. agencies[67] together with the Stockholm Environment Institute. It is to be presented to the CSD at its fifth session in 1997 together with a report which will address the following four subjects: first, the need to conduct an assessment and devise strategies for dealing with fresh water problems; second, an assessment of the availability of fresh water for different purposes on a regional basis, taking into account both water quantity and water quality; third, different possible scenarios based on varying assumptions as to water availability; and finally, recommendations and proposed strategies for dealing with the different possible scenarios.[68] Given the discrepancies in currently available data, this assessment will provide an important basis for future forecasts, planning, and action.

United Nations agencies have provided assistance in other important ways, particularly in developing countries. It is here that progress, especially in the areas of education, training, and overall capacity-building, is most crucial. In the words of the Secretary-General's Report on the implementation of Chapter 18: "[I]nstitutional constraints constitute the major obstacles to the implementation of the recommendations for the sustainable development of water resources contained in chapter 18 . . . ."[69] The report specifically refers to such problems as: the lack of policy frameworks that define the nature of government interventions

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64. Commission on Sustainable Development, U.N. ESCOR, 2d Sess., Supp. No. 13, para. 133, U.N. Doc. E/CN.17/1994/20/Rev.1 (1994)

65. *Id.* para. 135.

66. *See id.* paras. 148-50.

67. This group includes the Department for Policy Coordination and Sustainable Development of the U.N. Secretariat, the United Nations Environment Programme (UNEP), the Food and Agriculture Organization of the United Nations (FAO), the United Nations Industrial Development Organization (UNIDO), the World Health Organization (WHO), the World Meteorological Organization (WMO), and the United Nations Educational, Scientific and Cultural Organization (UNESCO), who are to work in collaboration with the United Nations Development Programme (UNDP), the World Bank, and other relevant United Nations bodies. *See id.* para. 148.

68. *See* Interview with Pierre Najlis, the responsible member of the CSD Secretariat, (October 17, 1995) (on file with author).

69. *Report of the Secretary-General*, *supra* note 24, para. 97.

and strategies for water resources development and management, the lack of suitable legislative frameworks, the fragmentation of water management responsibilities, and the inability of many government agencies to attract and retain trained personnel.[70] These are serious problems indeed. They show that it is not enough to have laws on the books (though many states lack effective water legislation); a country must also have trained personnel to administer and implement those laws. And especially in the case of water, it must foster a culture of citizen participation in the making and implementation of water policy and law.

B. The Role of Law

Two principal roles law can play with regard to problems of water scarcity are ensuring the stability and facilitating the implementation of effective strategies for dealing with water scarcity; and preventing and resolving disputes, both within and between countries, over increasingly scarce water resources. The following paragraphs will touch briefly upon the ways that law can assist in the implementation of Agenda 21, legal and institutional approaches to water scarcity on both the national and international levels, legal principles for sustainable development and their relation to water scarcity, international human rights law, and the law of international watercourses.

1. Agenda 21

We start from the premise that Agenda 21 does not contain legally binding obligations. But its recommendations in each of the seven program areas are intended to be taken into account by states in enacting or updating water-related legislation. In this sense, Agenda 21, and Chapter 18 in particular, is a blueprint for legislative action in the field of the protection and management of fresh water resources. Unfortunately, it is difficult to tell exactly what the status of implementation by states is, because only a few governments have reported to the United Nations on their implementation of the programs of Chapter 18.[71] Despite this lack of information on what states are doing, we do know that a wide array of international organizations in the United Nations system—including, importantly, international financial institutions such as the World Bank—are actively implementing Agenda 21, including its fresh water

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70. *See id.*

71. *See Report of the Secretary-General, supra* note 24, paras. 76-96 (providing a summary of "national experience").

programs, and are assisting states with their own implementation efforts. Thus, it appears that the fresh water program of Agenda 21 is being gradually implemented—not because it has the force of law, but because governments realize that it is in their own self-interest to do so. In this sense, one might even say that Agenda 21 has already been more successful than some legislation and treaties.

2. Institutional Approaches to Water Scarcity

It is widely recognized by experts in the field that any strategy to address water scarcity must employ basin-wide, integrated planning and management. On the international level, this is difficult to achieve without a mechanism for ongoing communication between the countries concerned, such as a joint commission. On both the national and international levels, water resources are best protected and managed as a unit, that is, by the drainage basin as a whole, rather than parts thereof. Otherwise, policy coordination for a basin will be difficult, if not impossible, leading to inefficiencies and disputes. Further, it is important that water resources planning, management, and development be conducted in an integrated manner so that gains in one sector—e.g., industrial uses—will not be offset by losses in another—e.g., domestic uses.[72]

3. Water Scarcity and Sustainable Development

The concept of sustainable development plays a pervasive role in strategies to avoid and alleviate water scarcity; development that exacerbates conditions of water scarcity cannot be sustainable. And development is virtually guaranteed to be unsustainable unless it is based upon basin-wide, integrated planning and management of fresh water resources.

As far as legal principles for sustainable development are concerned, efforts have been, and are being made, to define such principles under the auspices of such bodies as the World Conservation Union (IUCN),

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72. *See generally Integrated River Basin Development, Report of a Panel of Experts*, Department of Economic and Social Affairs, U.N. Doc. E/3066/Rev.1 (1970); *Report of the International Law Commission*, U.N. GAOR, 49th Sess., Supp. No. 10, at 300, U.N. Doc. A/49/10 (1994) [hereinafter *1994 ILC Report*]; *Sixth Report on the Law of the Non-Navigational Uses of International Watercourses*, Stephen McCaffrey, U.N. GAOR International Law Comm., 42nd Sess., U.N. Doc. A/CN.4/427 (1990).

International Council for Environmental Law (ICEL),[73] the United Nations Secretariat of the CSD,[74] the Government of Austria,[75] and the Foundation for International Environmental Law and Development (FIELD).[76] About the most that can be said at this stage is that general principles such as those of prevention, precaution, environmental impact assessment, polluter pays (in the sense at least of cost internalization), and citizen participation should be included among the principles of international law for sustainable development. However, it is not yet entirely clear whether these principles operate on the inter-state or the national level, or both. For problems of water scarcity to be addressed effectively, it is essential that the principles be implemented on both levels.

4. Water Scarcity and International Human Rights Law

I have argued elsewhere that there is a human right to water, while recognizing that the contours of the right are not entirely clear.[77] At minimum, it obligates governments not to discriminate among elements of its population in providing clean drinking water and sanitation services, and not to mismanage its resources—for example, by launching massive demonstration projects—in such a way as to deprive its population of fresh water. Abuses have also been observed in occupied territories and in countries where large elements of the population have been relocated to areas severely lacking in fresh water. Reflecting a broad recognition of a right to fresh water, the United Nations Water Conference declared in 1977: "All peoples, whatever their stage of development and their social

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73. *See* COMM. ON ENVIRONMENTAL LAW OF IUCN-THE WORLD CONSERVATION UNION & INTERNATIONAL COUNCIL OF ENVIRONMENTAL LAW; DRAFT INTERNATIONAL COVENANT ON ENVIRONMENT AND DEVELOPMENT (1995).

74. The Department of Policy Coordination for Sustainable Development (DPCSD) convened a meeting of the Expert Group on Identification of Principles in International Law for Sustainable Development in Geneva from September 26-28, 1995. The Expert Group's mandate derived both from Agenda 21 (in particular para. 39.5) and the request of the CSD at its second session that the concept, requirements and implications of sustainable development and international law be studied further. *See* U.N. ESCOR, Comm. on Sustainable Development, 2d Sess., Item 8, U.N. Doc. E/CN.17/1994/13 (1994).

75. *See Report of the International Symposium "Sustainable Development and International Law", in* SUSTAINABLE DEVELOPMENT AND INTERNATIONAL LAW app. at 291-305 (Winfried Lang ed., 1995). The symposium was held in Baden Bei Wien at the invitation of the Austrian Ministry of Foreign Affairs, April 14-16, 1994.

76. *See Report of a Consultation on Sustainable Development: The Challenge to International Law*, Foundation for International Environmental Law and Development (published in 2(4) RECIEL) (1993).

77. *See generally* Stephen McCaffrey, *A Human Right to Water: Domestic and International Implications*, 5 GEO. INT'L ENVTL. L. REV. 1 (1992).

and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs; . . . ."[78] The Conference recommended: "That where human needs have not yet been satisfied, national development policies and plans should give priority to the supplying of drinking water for the entire population and to the final disposal of waste water; . . . ."[79] While the international community, as well as individual states, have an obligation to come to the assistance of these deprived individuals, it does not appear that as a practical matter human rights law presently offers much hope to the vast majority of those in grave need of access to potable water and adequate sanitation services.

The purported "controversy" between those who would treat water as an economic good and those urging that water is a human right has not been helpful.[80] There is broad agreement that users should be charged appropriately for water lest it be *over*consumed, especially by economic activities such as industry and agriculture.[81] But what is "appropriate" will, of course, vary with the ability of the user to pay. Those below the poverty line should not have to pay for water required for basic needs, which means that governments will have to subsidize their water from fees paid by other users who are better off.[82]

5. The Law of International Watercourses

It may happen, of course, that one country's use of the waters of an international watercourse is at least partly responsible for water scarcity in another country. This problem is likely to arise with increasing frequency due to the large number of international drainage basins in the world as well as the location of many of them in water-short regions.[83] In the absence of an applicable treaty between the states concerned, the situation would be governed by rules of general international law. In 1994, the International Law Commission of the United Nations (ILC) completed

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78. *United Nations Water Conference, Mar del Plata, supra* note 52, at 66.

79. *Id.* at 67.

80. *See generally* Vidal, *supra* note 6, *reprinted in* WORLD PRESS REV., Nov. 1995, at 9.

81. This agreement is reflected both in the Mar del Plata Action Plan, *see United Nations Water Conference, Mar del Plata, supra* note 52, para. 7, adopted in 1977 and the New Deli Statement, *see United Nations Conference on Environment and Development (Rio de Janeiro), supra* note 54, paras. 12, 59.

82. *See United Nations Conference on Environment and Development (Rio de Janeiro), supra* note 54, para. 18.59. Among those "activities" listed under the topic, "Water and sustainable urban development" of the conference report is: "Introduction of water tariffs, taking into account the circumstances in each country and where affordable, that reflect the marginal and opportunity cost of water, especially for productive activities; . . . ." *Id.* para. 18.59(b)(iii).

83. *See supra* text accompanying notes 46-49.

work on a set of draft articles on the Law of the Non-Navigational Uses of International Watercourses.[84] In short, the draft would require a state to notify other potentially affected states of any planned activity that might be harmful to those other states, and to consult and negotiate with them in good faith concerning the plans.[85] It also requires states to use international watercourses in an equitable and reasonable manner, and to refrain from uses that would cause other states significant harm.[86] In the fall of 1996, the draft articles were considered by a "Working Group of the Whole" of the U.N. General Assembly, "open to States Members of the United Nations or members of specialized agencies . . . to elaborate a framework convention on the law of the non-navigational uses of international watercourses on the basis of the draft articles adopted by the International Law Commission."[87] The Working Group was unable to complete the convention in the three weeks allotted to it and will re-convene in the spring of 1997.

These general rules—many of which are undoubtedly part of customary international law—are already being cited and relied upon by governments in disputes over international watercourses. The attention focused upon them by the international community, as well as the fact that they were prepared by a respected United Nations expert commission, will make it more difficult for states to ignore them or challenge their existence. This should be of assistance to states in reaching accommodations of conflicting uses of or plans concerning international watercourses. Rules of international law cannot by themselves alleviate the scarcity of water, but they can both prevent one state from causing another to suffer needlessly from it, and promote cooperative efforts by states in managing their shared water resources to avoid conditions of water scarcity to the extent permitted by natural conditions.

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84. *See 1994 ILC Report*, *supra* note 72, at 199. For an overview of and comments on the draft, see generally Stephen McCaffrey, *The International Law Commission Adopts Draft Articles on International Watercourses*, 89 AM. J. INT'L L. 395 (1995).

85. *See 1994 ILC Report*, *supra* note 72, at 259-80.

86. *See id.* at 218-31, 236-44. There is a possibility that these two principles will come into conflict. That is, a use that is "equitable and reasonable" may nonetheless result in harm to another state. In this case, the draft articles require the states concerned to enter into consultations and, failing a resolution, to have recourse to the dispute settlement procedures provided for in article 33. *See id.* at 322-26.

87. G.A. Res. 49/52, U.N. GAOR, 49th Sess., Agenda Item 137, U.N. Doc. A/Res/49/52 (1995).

III. OUTLOOK

There is really no need to wait until the next century for a glimpse of things to come. Fantastic schemes have already been proposed, and even tried, for bringing water to areas under water stress or scarcity. Thus we have the "Peace Pipeline," through which Turkey proposes to bring water, on commercial terms, to water-short countries of the Middle East and Persian Gulf;[88] we have the spectacle of icebergs being towed from the seas off Antarctica to water-starved regions[89]—for a price, of course; and we have water being shipped not only in tankers (which has not yet proved commercially viable),[90] but also, as envisioned by would-be entrepreneurs, in 660-meter-long "Medusa Bags" from Turkey to countries in the Middle East.[91] The legal questions raised by these schemes are manifold, difficult, and important. But a fundamental question that will have to be addressed as water resources continue to dwindle is who "owns" the water in constant motion in the hydrologic cycle? Is this not a classic "common pool resource" that should be shared equitably by the international community? More concretely, is an iceberg floating in the sea beyond the limits of national jurisdiction *res nullius*, so that it is subject to appropriation? Or is it *res communis*, subject to allocation only by the international community?

These questions lead me to inquire whether the day is far away when water-short states begin to assert a "right" to a portion of the water that evaporates from areas of the sea beyond the limits of national

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88. *See generally* McCaffrey, *supra* note 7, at 94 (providing a general description).

89. *See* Stephen Braun, *A Deluge of Drought Solutions*, L.A. TIMES, June 21, 1990, at 1 (citing a 1973 RAND Corp. report stating that icebergs could be towed to needy areas in twelve-mile-long "trains"). "According to researchers John Hult and Neill Ostrander, the trains would be driven by electric propellers, nudged by ice-breaking ships and escorted by a floating nuclear power plant." *Id.*; *accord* Arab Press Serv. Org., *Iceberg Water Project Promoted*, APS DIPLOMAT RECORDER, Feb. 19, 1994, *available in* 1994 WL 2227379.

90. *See* James Cran, *The Supply of Water to Jordan, Israel, Gaza and Egypt from Turkey by Medusa Bag*, October 15, 1993 (on file with the author) (referring to the "vain efforts . . . to develop water markets for surplus supertankers in the mid-1980's").

91. *See id.* Under the author's principal proposal, water would be transported from the Manavgat River in "Medusa bags," very large, slow moving, flexible barges, to Haifa and Gaza. Four deliveries would be made per year, each of 500 million cubic meters of water. The water would be then be supplied to Gaza, Israel and the Egyptian Sinai, and would make other water, currently pumped from the Sea of Galilee to Haifa, available for delivery to Jordan. Deliveries to such water-short areas as Cyprus, Malta, and the Greek Islands would also be possible. *See id.* Furthermore, "paper studies showed that a bag with the content of five supertankers could be constructed for about 1/80 the cost." *Id.* at 11.

jurisdiction.[92] While such a claim might seem far-fetched at first blush, this would not be the first time international law recognized rights of states in natural resources located in "the commons" because those states were geographically disadvantaged. As is well known, somewhat similar rights were conferred upon landlocked and geographically disadvantaged states in respect to the living resources of the sea by the United Nations Convention on the Law of the Sea (UNCLOS).[93] For example, article 70, paragraph 1 of UNCLOS provides:

> Geographically disadvantaged States shall have the right to participate, on an equitable basis, in the exploitation of an appropriate part of the surplus of the living resources of the exclusive economic zones of coastal States of the same subregion or region, taking into account the relevant economic and geographical circumstances of all the States concerned and in conformity with the provisions of this article and of articles 61 and 62.[94]

The expression "geographically disadvantaged states" is defined as:

> [C]oastal States . . . whose geographical situation makes them dependent upon the exploitation of the living resources of the exclusive economic zones of other States in the subregion or region for adequate supplies of fish for the nutritional purposes of their populations or parts thereof, and coastal States which can claim no exclusive economic zones of their own.[95]

This is not the place for a full analysis of how the law-of-the-sea model might apply to water scarcity problems.[96] It is clear, however, that the above-quoted provisions recognize rights in states for which geography has caused hardships, which is precisely the case with regard to the arid states of the world. And the rights the articles recognize are in fact entitlements to an equitable share of natural resources that would otherwise

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92. I am grateful to Dr. Malin Falkenmark, whose question "who owns the rain" at the Freshwater Forum, held in Geneva, opened my mind to the need to think in new ways about rights in the world's fresh water resources. *See* Dr. Malin Falkenmark, Address to the United Nations Freshwater Consultative Forum (Dec. 13-16, 1994).

93. *The Law of the Sea,* United Nations Convention on the Law of the Sea, at 24-25, U.N. Doc. A/Conf.62/122 (1983) (addressing these rights specifically as the "Right of land-locked States" and the "Right of geographically disadvantaged States").

94. *Id.* Articles 61 and 62 concern, respectively, conservation and utilization of living resources. *See id.*

95. *Id.*

96. For a fuller description, see generally McCaffrey, *supra* note 1.

be under the jurisdiction of other states. The fact that the international community has accepted such rights represents a recognition that states should not have to suffer geographically-caused hardships alone. Rather, other states that are more fortunate may be called upon to share their resources, on an equitable basis, with those that are disadvantaged, as a matter of international solidarity. The same principles would seem to apply with equal or greater force to the sharing of fresh water.

Implementation of such a right would not be a simple matter, but neither would it be impossible. The machinery created in Part XI of UNCLOS for allocation of the resources of the deep seabed, as modified by the Implementation Agreement,[97] could provide a model. Alternatively, would it be out of the question to entrust the presently quiescent Trusteeship Council with the responsibility to determine, say, the equitable share of *hydrologically*-disadvantaged states in this water on the basis of a number of factors, such as human need, efficiency of use of indigenous water, availability of water from other countries—even on the same international watercourse—or from icebergs calved by Antarctica, and so on? After all, what we are faced with is not a problem of global water shortage *per se*, but one of many severe regional and local water shortages. Perhaps part of the solution, then, could lie in this kind of redistribution based on the theory that water evaporated from the high seas is *res communis* and should be allocated equitably among the peoples of our One Earth.

97. G.A. Res. 48/263, U.N. GAOR, 48th Sess., Agenda Item 36, U.N. Doc. A/Res/48/263 (1994) *reprinted in*, 33 I.L.M. 1311 (1994). This agreement cleared the way for the United States and other industrialized states that had objected to Part XI to accept the Convention. It was adopted by the United Nations General Assembly on July 28, 1994; the Agreement, which is annexed to the resolution, was opened for signature the following day, and it has been signed by virtually all industrialized states. *See id.*