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PRINCIPLES FOR INTERNATIONAL GROUNDWATER LAW*

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International groundwater resources have not received their full share of legal investigation. This paper outlines some principles applicable to the development of international cooperation concerning this important resource, bearing in mind that ground and surface waters are the same resource. In the absence of positive international law covering groundwater resources, national laws are investigated to examine their suitability for adaptation to the international level. Then, the interjurisdictional experience among federated states and among independent states is examined. Finally, a general conclusion is drawn.

INTRODUCTION

Over the last fifty years, International Public Law has undergone a steady development and refinement. The law of international water resources in particular has benefited from a number of detailed studies and has attracted the attention of many intergovernmental and non-governmental organizations and associations including, recently, the International Law Commission of the United Nations. Yet, the

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special case of international groundwater resources has not received a full share of legal investigation. In spite of wide acceptance of the drainage basin concept, most research has been directed to surface water resources. International law used to follow the restrictive concepts of the international river, river system or river basin. These concepts generally did not include, as does the concept of the drainage basin, groundwater resources.

The purpose of this paper is to verify the slow progress of international law as applied to groundwater resources and to indicate some principles for an emerging international groundwater law as an integral part of international water resources law in general.

Like surface water, groundwater knows no political boundaries. Many huge aquifers are shared by several countries, sometimes in areas where water is a coveted resource. Examples are the North Eastern African aquifer which extends under Libya, Egypt, Chad, and Sudan; or the Arabian Peninsula aquifer shared by Saudi Arabia, Bahrain and perhaps Qatar and the United Arab Emirates. In such areas the steady, controlled development of groundwater is the best, if not the only, guarantee for the development of industry and food production. Other examples of international aquifers of major economic importance are: the Northern Sahara basin shared by Algeria, Tunisia and Libya; the Chad aquifer shared by Chad, Niger, Sudan, the Central African Empire, Nigeria, and Cameroon; the Taoudeni basin in Chad, Egypt, Libya and Sudan; and the Maestrichian basin shared by Senegal, Gambia, Guinea Bissau and Mauritania. Additional examples could be cited in North America, Asia and Europe. In fact, apart from remote islands, virtually all countries share a groundwater system with one or more other countries.¹

The importance of groundwater and the large number of international groundwater systems has not automatically caused international legal problems nor made necessary the development of legal principles in this field. Fortunately, international groundwater disputes have rarely been a cause of tension. Nevertheless, groundwater has been the subject of some international communications and negotiations, such as those between the United States and Mexico, Sudan and Egypt, Algeria and Tunisia, Hungary and Romania.

Despite the relative inactivity in the field of international groundwater law in the past, international relations concerning groundwater resources are likely to develop very quickly for two major reasons. First, the nature of the resource itself makes it an ideal

1. Ground Water in Africa, E 71, II Annexes (Agenda Item 16) (1971). Ground Water in the Western Hemisphere, E 76, II Annexes (Agenda Item 5) (1976).

subject for international cooperation. Second, countries are coming to attach increasing importance to water in general, and to groundwater in particular, so that international cooperation is becoming increasingly vital. The greater desire of states to conserve this precious resource and a rapidly rising demand for its use will induce countries sharing a ground water system to negotiate.

The problem with international regulation of groundwater lies in the fact that international law may not have developed principles which are flexible, yet specific enough to foster the necessary cooperation or to reduce conflict over ground water. While intergovernmental organizations have spared no effort in developing legal principles for surface water, the same cannot be said where ground water is concerned. Almost all international treaties on water are limited to surface water problems. They fail to encompass ground water, with the result that the legal principles which are followed for surface water have not yet passed the tests presented by ground water problems.²

The International Law Commission does not deal with groundwater and sees its work restricted to the law of non-navigational uses of international watercourses.³ Several countries oppose the concept of an international drainage basin as an appropriate basis for study of the legal aspects of either non-navigational uses or pollution of international watercourses. Poland, for instance, suggests that "from the legal point of view one cannot speak of the unity of the international drainage basin extending on the territory of more than one state until the states of this basin will not recognize the restriction of their territorial sovereignty on internal waters under their control."⁴

The Ad Hoc Intergovernmental Working Group of Experts on natural resources shared by two or more states confines its activities to cooperation in the field of the environment. It will probably include groundwater within its terms of reference, but its consideration will be so broad that detailed principles for this particular resource are not likely to be proposed.⁵ Groundwater is considered in the Principles concerning Transfrontier Pollution adopted by OECD

2. Whatever principles of international surface water may exist, they should be adaptable to ground water if the physical differences of ground water vis-a-vis surface water are taken into account. Certainly, for the settlement of disputes, the legal principles applicable to international surface water should be applicable to ground water.

3. Report of the International Law Commission, 31 U.N. GAOR, Supp. (No. 10) A/31/10 (1976).

4. The Law of the Non-Navigational Uses of International Watercourses, A/CN-4/294, 8-9, 39 (1976).

5. Report of the Intergovernmental Working Group of Experts on Natural Resources Shared by Two or More States, UNEP/GC/44 (Feb. 1975), and UNEP/GC/74 (June 1976).

in 1974, but they are limited to qualitative aspects of the issue.⁶ Principles 21 to 24 and Recommendation 51 of the Stockholm Conference are so broad that groundwater is only a small part of their scope.⁷ The European Convention for the Protection of International Watercourses Against Pollution, prepared under the aegis of the Council of Europe, does not include groundwater. The Organization of American States (OAS) Declaration of Montevideo of 1963 is concerned with the industrial and agricultural uses of international rivers and disregards international groundwaters. In this context, it seems that the Asian-African Legal Consultative Committee has been one of the few intergovernmental organizations to have specifically included groundwater in its research.⁸ The Council of Europe in 1971 adopted a recommendation on the pollution of the Rhine Valley water table.⁹ The recent United Nations Water Conference has made interesting detailed recommendations on "shared water resources," without clearly stating that its recommendations cover groundwater. Precise references will be made to the recommendations and to the results of the United Nations Conference on Desertification in the last section of this study.

Non-governmental organizations have been more active in the field of groundwater although their work is rather recent. The "Helsinki rules" developed by the International Law Association and adopted in 1966 unquestionably cover groundwater. This association is now refining proposals specifically covering international groundwater systems. At its second Conference, the International Association for Water Law emphasized groundwater issues, but it did so more in terms of national than of international law. The concept of an international drainage basin, promoted and followed up by these two associations, is a decided step forward on other, more restrictive, concepts. However, it is still a compromise between the total approach of the hydrologic cycle concept and the unduly partial approach of stream, watercourse, river system or river basin.¹⁰

Few international treaties related to water refer to groundwater;

6. Recommendation of the Council on Principles Concerning Transfrontier Pollution, OECD C (74) 224 (Nov. 1974).

7. Report of the United Nations Conference on the Human Environment, E 73, II Annexes (Agenda Item 14) (1973).

8. Report of the Fourteenth Session held at New Delhi (proposition II-1), 7-14 (Jan. 1973).

9. E.75.V.7 (Part 2) Y.B. INT'L L. COMM'N 349 (1976).

10. See, e.g., L. TECLAFF, *THE RIVER BASIN IN HISTORY AND LAW*, 9 (1967), which cites the following incongruity: "Seepage of water from the upper Danube main-stream which percolates and reemerges in the Aach River, lying within the Rhine basin, is given the same legal effect as a diversion of surface water."

in some cases this failure is a major cause of difficulty in the implementation of treaties. The treaty between the United States and Mexico relating to the Utilization of the Waters of the Colorado and Tijuana Rivers, signed in 1944, is a case in point.¹¹ Among the few examples of international treaties relating in part to groundwater, one may mention the 1925 Agreement between Egypt and Italy on the Ramba Well,¹² the 1927 Convention and Protocol between USSR and Turkey regarding the use of frontier waters,¹³ the 1947 Treaty of Peace between the Allies and Italy which outlines mutual guarantees given by Italy and Yugoslavia concerning the utilization of springs in the Commune of Gorizia and vicinity,¹⁴ the 1958 Agreement concerning water economy questions between Yugoslavia and Bulgaria,¹⁵ the Agreement with Statutes of the Yugoslav-Hungarian Water Economy Commission of 1955,¹⁶ the Agreement concerning the use of water resources in frontier areas between Czechoslovakia and Poland,¹⁷ the 1964 Agreement between Poland and USSR concerning the use of water resources in frontier waters,¹⁸ the 1972 Convention between Switzerland and Italy concerning water pollution control,¹⁹ and the 1965 Agreement between Poland and the Democratic Republic of Germany concerning groundwater.²⁰ Although this is not an exhaustive list of such treaties, few others could be quoted. In the near future, new agreements, entirely devoted to groundwater issues, will have to be added to the list. The most interesting of the more recent or pending treaties is an agreement signed between the *Prefet de Haute-Savoie* in France and the Swiss *Canton* of Geneva, which came into effect in January 1978.²¹

Other agreements, often dealing with frontier demarcation, mention the use of groundwater, in the form of wells or springs. Examples are the Agreement between the United Kingdom (Somalia) and France (Djibouti) of 1888, stating that the use of the Hadou well shall be common to both parties,²² in the delimitation of the com-

11. 3 U.N.T.S. 314.

12. See 4 Legislative Texts and Treaty Provisions Concerning the Utilization of International Rivers for Other Purposes than Navigation, Treaty No. 6, 63 (1963).

13. *Id.*, Treaty No. 106.

14. *Id.*, Treaty No. 120. See also the 1957 Agreement between Italy and Yugoslavia on the same subject, *id.*, Treaty No. 236.

15. *Id.*, Treaty No. 161.

16. *Id.*, Treaty No. 830.

17. 538 U.N. T.S. 89.

18. 552 U.N. T.S. 175.

19. Ratified in August, 1973.

20. S.D.R. Gesetzblatt, Jul. 20, 1967 at 0000.

21. Arrangement relatif a la Protection, a l'Utilisation et a la Realimentation de la Nappe souterraine franco-suisse du Genevois (Sep. 1977).

22. Treaty of 2-9 Feb., 1889, B.F.S.P. 672.

mon border of Germany and Belgium under the Versailles treaty, where the use of spring and groundwaters is mentioned;^{2 3} similarly, with regard to the use of spring waters, between Syria and Palestine of 1923;^{2 4} an exchange of notes between France and the UK concerning the use of surface and spring waters between the Central African Empire, Chad, and the Sudan in 1924;^{2 5} the boundary convention of 1926 between Portugal and Spain;^{2 6} and that of 1932 between Persia and Turkey.^{2 7} Other agreements again, dealing with mining activities, sometimes refer to groundwater use: the agreement regarding water rights on the boundary between Tanganyika and Ruanda Urundi of 1934;^{2 8} the agreement regarding the mining of coal in areas parallel to the frontier along the Meuse between Belgium and the Netherlands^{2 9} and concerning mining between Belgium and Luxemburg of 1843.^{3 0}

Finally, a few international agreements which deal with the utilization of the sub-soil and the sea-bed are also relevant to the legal aspects of groundwaters. Such is the case with the Treaty of 1973 relating to the Rio de la Plata and its Maritime Front signed by Argentina and Uruguay.

The small number of legal texts which have considered ground and surface water as indissociable elements tends to demonstrate that law has been an important factor contributing to what has been called "hydroschizophrenia:" the mental attitude which leads some decision-makers to perpetuate a radical difference between projects relating to surface water and those relating to groundwater.^{3 1}

In the absence of detailed principles of international law for ground water, one might look for analogies in domestic, municipal or administrative law. Two fields of investigation seem to be of particular relevance: the first is to investigate how groundwater is treated by major past and present legal régimes; the second is to look at the interjurisdictional experience which has developed in federal countries.

PRINCIPLES DERIVING FROM MAIN LEGAL SYSTEMS

National law may be one source of inspiration for the develop-

23. UN/ST/LEG/SGR B/12 411 (F) (Nov. 6, 1922).

24. B.F.S.T. 293, Exchange of notes between UK and France.

25. 28 L.N.T.S. 461.

26. 82 L.N.T.S. 95.

27. ST/LEG/SER B/12, 370. A more Comprehensive list is being compiled by the Legislative Branch of the Food and Agriculture Organization of the United Nations.

28. 190 L.N.T.S. 103.

29. 235 U.N. T.S. 596.

30. ST/LEG/SER B/12 535.

31. Llamas, *Hydroschizophrenia*, 82 AGUA (1974).

ment of international law. Six legal families have been considered for this purpose: ancient China, the Hebrew and Moslem worlds, Roman law and its derivatives, common and civil law, and countries with modern water legislation. Not all of them are of equal relevance to our subject and limitation of space means that none of them can be analysed in detail.

A. *Earlier or original legal systems of ground water*

The first régime in time which appears to be of special relevance is the Chinese.³² Chinese civilization emerged around the Hwang Ho (Yellow River), and represents the largest and most ancient irrigation civilization in the world. Although Chinese water law has been concerned mainly with surface water, some basic philosophical and legal principles underlying it are a useful source of inspiration. Two concepts emerge in China's complex legal history: the high price placed on flexibility, and that placed on equity.

Flexibility is at the heart of Chinese legal thought, based on belief in a close interconnection between the human social order and the natural cosmic order. Harmony and unity, which were felt to prevail throughout all creation, were considered to be in close relationship with all aspects of human behavior. Social order was based not on laws but on *li*, *i.e.* rites, rules of conduct, or customs, which prescribed behavior in harmony with the natural order of things. Whenever private interests conflicted, it was the duty of everyone to find, as far as possible, a solution which would take into account the interests of all parties and avoid creating a winner and a loser. Recourse to justice would be made only after all possibilities of conciliation or transaction at the family, village or guild level had failed. It was important not to act in such a way as to have the other party lose face, so that the door would be left open for the possibility of re-establishing harmony and order between the parties, which had been shaken by legal proceedings.

The giving of publicity to written laws, upheld by the Legalists under the Ch'in Dynasty (249-207 B.C.) was considered by the Confucianists to attach rigidity to the law, leaving no room for the study of circumstances. The flexibility of human judgment adapted to concrete cases was preferred to an immutable law. This search for flexibility leads to the concept of "equalization of water." "Agreements for the equalization of water," which were engraved on stones and placed in the fields "to prevent strife," are mentioned for the Nan-Yang Commandery, about 35 B.C. This is the first time that the

32. Caponera, *Water Law Principles in the Chinese Legal System*, 1 INDIAN J. INT'L L. 239 (1960-61).

concept of equalization of water appears; to reappear in subsequent and contemporary water laws as "equitable apportionment of water." The importance that ancient China attached to equitable distribution of waters is evident and heavy punishments and shame fell upon those who performed disrespectful actions in this "equalization," especially during the Han Dynasty (206-220 A.D.).

The Han period also reaffirmed the concept of water as within a category of things common to all (the *res communes* of Roman law),³³ but the concept of equitable distribution prevented later recognition of inflexible rights (such as riparian rights). The Ordinances of the Board of Waterways (737 A.D.) read: "Those living on the upper stream must not block up the source and monopolize its richness." It was also written that "It is the first duty of the authorities to ensure that water benefits are *equitably* spread everywhere."

Another ancient civilization, the Hebraic, is a guide in this connection, probably because it grew up in a semi-arid environment where surface water is scarce. The basic principles of early Jewish law are contained in the Bible and other Talmudic texts.³⁴ Legal doctrines and opinions are contained in the *Talmud*, a code written between the IV and the III Century B.C., which includes a few references to water which are the development of the basic principles contained in the Torah, or revelation of biblical texts. The existence of public wells and the right of every traveler to use them is recognized. It is possible that the rules for protected areas (the Moslem "harim") applied to wells. Domestic and irrigation water was subject to an order of priorities. In the case of several irrigators receiving water from a common well, the one closest to the well conduit filled his cistern first and the other irrigators did so in turn.

The laws of Babylon, which partly influenced the *Talmud*, consider the criterion of the ease with which the respective owner may use the water. The order of priority and the importance given to the position of the user in terms of proximity and ease of access to the well are pertinent to the present study.

Due to special regional geoclimatic conditions, Moslem law is one of the legal régimes which has dealt the most with groundwater.³⁵ Many legal principles in Moslem law are similar to those in Talmudic law. According to Moslem water law, groundwater is considered to be a public good and cannot be individually appropriated, wells be-

33. This is now the subject of Article 6 of the Constitution of the People's Republic of China.

34. Caponera, *Earliest Water Law Systems* in I GLOBAL WATER LAW SYSTEMS 168 (G. Radosevich ed 1976) [hereinafter cited as Radosevich].

35. D. Caponera, *Water Laws in Moslem Countries*, FAO (1953), revised edition as 20 FAO Irrigation and Drainage Paper (1973).

long either to an entire tribe or to an individual whose ancestors dug it. However, appropriation of a well does not give ownership rights to the water itself; it only gives exclusive or priority rights of use.

According to the tradition of the Prophet, there is an absolute right of thirst and no owner of a well can abuse the water. The use of groundwater is subject to a strict order of priority. Stock watering in a desert area is high in the order. In Moslem water law, the notion of alternative source for water supply has an important bearing. Moslem law establishes a close relation between groundwater and land use through the concept of *harim* or "forbidden area." In order to prevent new wells from depleting the aquifer, all schools have adopted the principle that the ownership of wells entails ownership of a certain amount of adjacent land—the *harim*.

These fundamentals of Moslem water law entail established customs and uses which have been respected even during the most anarchistic periods in arid zones. Customs governing water ownership are dominated by the fact that in deserts water constitutes the main object of real property. As water becomes scarcer, the land proportionately becomes an accessory to it, contrary to the case in European legislation.

Codified Moslem law is the third basic source of law in Moslem countries. According to article 1235 of the Mejlle Code (Ottoman Civil Code), groundwater belongs to the community. The definition of water as a non-saleable, publicly-owned, commodity applies to water in wells dug by unknown persons. Article 1268 provides that "anyone who has on his property a well may prevent any person from trespassing upon his land to obtain drinking water" unless there is no other public water source. The *harim* of a well is the private property of the owner. Another person cannot exercise control over it in any way. If someone sinks a well in another's *harim*, the owner of the land can cause it to be closed. If a well is dug with permission next to another well, the *harim* of the new well cannot encroach on that of the original well (article 1287). If a well is sunk outside the *harim* of another well and the water of the old well flows into the new well, nothing can be done about it. A well dug by someone in his own *mulk* (private property) has no *harim*. A neighbor can thus dig another well near it on his own *mulk*, and the owner of the first well cannot prevent the digging of that well by arguing that it takes the water from his well (article 1291).

Modern trends in water law in Moslem countries aim at institutionalizing the concept of community of interest. This concept constitutes the traditional basis not only of Moslem but also of many

present-day traditional societies with regard to both surface and groundwater law.³⁶ In Brunei, all groundwaters are declared state property. In Iran, the utilization of groundwater by wells or *ghanats* is subject to government authorization. The drilling of the *ghanat* with mechanized equipment is subject to a drilling permit issued by the Ministry of Water and Power. *The Water Nationalization Act* specifies control measures to prevent the depletion of aquifers. Holders of groundwater use permits are required, upon demand by the Ministry, to report the amount of water used. In Jordan, the Natural Resources Authority is responsible for the control, exploration and exploitation of groundwater, and in Morocco and Tunisia ground water is part of the public domain.

From the Moslem experience, the following points are worthy of consideration: groundwater is a highly regulated resource; control of the community (tribe, village, state) is far-reaching; attention is paid to the protection of the groundwater and groundwater works; uses are always ranked according to a precise order of priority; the notion of alternative source is well developed; a close relation is established between groundwater and land use; the role of customs and traditions is of paramount importance. Moslem law regards all countries where a majority of Moslems live as one land. It is the abode of Islam (*dar al-islam*). There is little record in Islamic history of any international water dispute prior to this century, so that Moslem law has little or no provision concerning such disputes. Non-Moslem countries are regarded as the abode of war (*dar-al-harb*). However, where water is concerned, Islamic law speaks of man and mankind, and not of Moslems. Water rights therefore extend to all human beings.³⁷

The importance of Roman law³⁸ is that it is the origin of two major legal systems which have spread over the world: the Common Law and the Civil Code systems. Under these systems, groundwater is either considered as part of the land and hence can be appropriated by the owner of the land, or as a commodity susceptible to ownership. In Common Law countries, a distinction is usually made between underground streams (which were treated in the same way as surface waters, *i.e.* were never subject as such to private ownership) and other forms of groundwater which were susceptible to exclusive ownership rights to the benefit of the landlord of the overlying land.³⁹

36. D. Caponera, *Legal Institutional Aspects of Water Resources Development in Africa*, 10 FAO Background Paper (1976).

37. Maktari, *Islamic Water Law* in Radosevich, *supra* note 35, at 304.

38. Caponera, *Roman Water Law System*, *id.*, at 173.

39. L. Teclaff, *Abstraction and Use of Water: A Comparison of Legal Regimes*, E.72, II Annexes (Agenda Item 10) (1972) 57.

Countries under the influence of Roman law have dominated most of the world during the past four centuries and as such became the cradle of early principles of international law. Roman law, as applied to water resources and to groundwater in particular, was bound to favor, at the international level, the development of the sovereign rights of states over their resources. It is logical that states, having full control of territory and land, would affirm full sovereignty over underlying resources. Such a principle would have produced many disputes in private law if both the courts (in Common Law countries) and the legislative bodies (in Civil Code countries) had not refined it in order to temper the principle of ownership or exclusive rights of use.

Although surface water use rights are, under the riparian doctrine, limited by the theory of natural flow and the notion of reasonable use, these limitations do not affect the exclusive right of the landowner over groundwater beneath his land nor on the flowing groundwater once it has been extracted. The same can be said of another variant of the Common Law doctrine which evolved in California and Utah and is known as the "correlative rights doctrine." According to this doctrine, the rights of all landowners over a common underground reservoir are co-equal or "correlative." One landowner cannot extract more than his share even for use on his own land where the rights of others are injured thereby.⁴⁰

Under the French Civil Code, the right of ownership that a landlord enjoyed over springs located on his land was defined very early. A landowner could fully use the spring waters of his land, but in doing so he might not harmfully affect the lands of his neighbors. The basic law of 1898 on the legal régime of water resources limited this ownership right whenever the spring waters were vital to the population of a nearby community.

Under the Spanish Civil Code of 1889, all groundwater resources accrued to the régime of the land above them. They were private if underlying private lands, and public under public lands (article 408). Water brought to the surface by artesian wells or galleries became the property of whoever developed it.⁴¹ This régime influenced ground water law in the Ibero-american world and still is in force in many countries.

Virtually all of these basic, traditional, legal régimes have either been amended by court decisions and new legislative developments

40. See A. Piper, *Interpretation and Current Status of Ground-Water Rights*, U.S. GEOLOGICAL SURVEY CIRCULAR 432.

41. S. MARTIN-RETORTILLO, *PROBLEMAS ACTUALES DE LA ORDENACION JURIDICA DE LOS RECURSOS HIDRAULICOS* 89 (1976).

or abandoned. In the former case the evolution has produced many hybrid régimes, such as in the United States.⁴² In the latter case they have been replaced by modern legislation and new institutional arrangements.

B. *Modern legal régimes of ground water*

Although the prior appropriation doctrine had its beginning in mining use during the California gold rush of 1849, and hence may appear as old as some of the régimes above, it definitely pertains, as far as groundwater is concerned, to the modern régimes. This is so because it provided a basis for the establishment of the modern permit system. The appropriation doctrine is based on the principle that a water user first in time is first in right.⁴³ Courts in states following the prior appropriation principle decided that groundwaters supplying a natural stream "are open to appropriation like surface waters, because they belong to the river." The burden of proof in claiming that groundwater is not tributary lies on the party making the assertion.⁴⁴ The appropriation system generally led to a permit system which considered the seniority of existing uses and their reasonableness as decisive criteria for the confirmation of water use rights.

Under the impulse of economic development, increasing needs for water, the introduction of modern extraction methods, and the uncontrolled use of groundwater have compelled states to introduce groundwater regulations in order to replace the private litigation system afforded by Civil and Common Law. One author⁴⁵ has identified three main legislative methods in this respect:

One method, which has been followed by countries with a non-consolidated water legislation, has consisted in the promulgation of groundwater laws aiming at solving this new problem as a unique and isolated one. Belgium, Cyprus, Denmark, France, the Netherlands and Turkey may be cited as examples. All these legislations have tended toward the limitation of exclusive private ownership rights in favor of a form of central administrative control over groundwater uses, thereby creating a formal separation between ownership (*nuda proprietas*) and use rights. In certain cases, private ownership rights have been suppressed altogether by the transfer of

42. An excellent synthesis of these numerous regimes is Clark, *The Role of State Legislation in Ground Water Management*, 10 CREIGHTON L. REV. 469 (1977).

43. See EVOLUTION AND ADMINISTRATION OF COLORADO WATER LAW, 1876-1976, at 20-22 and 135-37 (G. Radosevich ed. 1976).

44. *Id.*

45. B. Wohlwend, *Legal and Institutional Aspects of Ground Water Development for Irrigation*, I.C.I.D., Ninth Congress 31.404 (1974).

the resource from the private patrimonium to the community, or by its incorporation into the Public Domain (nationalization). In other cases, only quantitative or geographical limitations to the use of groundwater could be introduced because of vested interest.

Another method, which has been adopted by countries with a consolidated surface water legislation, has allowed for existing rules to extend to, or incorporate groundwater. The Australian States of Victoria and New South Wales, or New Mexico in the United States, are examples. In the latter case, groundwater was thus equally subjected to the prior appropriation system and, in the former, to the existing administrative control system. Here again, only quantitative and geographical limitations to groundwater ownership have been introduced, still leaving a part of the resource in the private dominion of the landowner. The recent legislations of the United Kingdom and of France illustrate the extension of the permit system to abstractions of water in excess of a statutory minimum and the institution of administrative control over groundwater uses within the declared water areas or basins.

The third and most recent method has presided over the promulgation of consolidated water resources laws which, either by vesting the over-all water resource in the community as in Australia and South Africa, or by incorporating it into the Public Domain as in Germany, Israel or Peru for instance, have institutionalized central administrative control over water resources conservation, development and use.

Irrespective of the legal technique used and whatever the political motivation, these tendencies are present in all modern systems of law.

These methods have led to increased public control over groundwater through the permit system. This is a basic feature of modern régimes, another being the declaration of special zones where the use of groundwater is subject to strict controls.

Thus, the permit system and the declaration of special zones have now spread over almost all parts of the world.⁴⁶ In Latin American countries the following examples may be noted: in Chile, exploration permits must be obtained before an individual or governmental agency may prospect even private property; in Bolivia, this authorization is limited to exploration on national lands; in Ecuador and Peru, all persons drilling wells for groundwater must obtain a license; in Bolivia, Chile, Ecuador and Peru, water discovered pursuant to a valid exploration or drilling permit cannot be used without a water use permit. The need for concessions or permits to use groundwater

46. R. Hayton, *The Ground-Water Legal Regime as Instrument of Policy Objectives and Management Requirements*, II ANUALES JURIS AQUARUM (AIDA) 271 (1978).

is now becoming more and more frequent.⁴⁷ In Central America the necessity for a permit or concession to abstract groundwater for purposes other than domestic use is also becoming more common. This is the case in El Salvador, in Jamaica (within declared areas), and in the Dominican Republic.⁴⁸

In Western Europe, the permit system with regard to groundwater has gradually superseded the more traditional systems inspired by Roman Law. Thus, in Belgium tapping of groundwater is subject to prior authorization, except in special cases. In England and Wales groundwater extraction is subject to a license granted by the water authority. In France any installation intended for extracting groundwater for non-domestic purposes is subject to the supervision of the administration. Prior authorization for exploration is needed within the water resources protection districts of Italy. The same applies in Spain for private groundwater extraction (on public lands a concession is required). Special legislation applies in the Canary Islands, where all extraction requires authorization. In Turkey, almost all groundwater exploration operations require a permit. Once groundwater has been found, its use is authorized immediately, but is limited to beneficial use criteria.⁴⁹

In Asia, a similar tendency toward increased public control over groundwater may be noted. Often, as in Burma, New Zealand and Australia,⁵⁰ protected areas are declared. Regulations may prescribe norms and standards for groundwater exploration and exploitation and the authorities concerned may issue licenses to pump such water under prescribed conditions.⁵¹ The Philippines Water Code of 1976 takes an integrated view of all waters and requires a water permit for any use.

The permit system is also found in modern African legislation. The National Water Resources Commission Order of Ethiopia, for instance, holds broad powers which allow the imposition of any necessary licensing procedures. Under the Tanzanian Water Act⁵² of 1974 groundwater rights are granted by a regional water officer, subject to cancellation where beneficial use has not been maintained.

47. D. DAINES & G. FALCONI, WATER LEGISLATION IN THE ANDEAN PACT COUNTRIES 252 (1974); Lopez, *El Derecho y la Administracion de Aguas en Iberoamerica* in 2 Radosevich, *supra* note 35, at 586, 633, 646, 670.

48. M. Sandoval, *Legislacion de Aguas en America Central Caribe y Mexico*, 8 FAO estudio legislativo 15, 18, 183 (1975).

49. *Water Law in Selected European Countries*, 10 FAO Legislative Studies 13, 41, 67-69, 136-138, 188-192, 236, 237 (1975).

50. Davis, *Nationalization of Water Use Rights by the Australian States*, 9 U. QUEENSLAND L. J. 1 (1975).

51. Clark, *The Asian Region* in 2 Radosevich, *supra* note 35, at 503 & 516.

52. An Act to Repeal and Replace the Water Ordinance, No. 42 (1974).

Israeli water legislation, the first to modernize concepts and criteria for water management, has integrated ground and surface waters under the same legal system: groundwater exploration, extraction, and use is subject to the general requirements which apply to surface water: the obligation of obtaining administrative authorization (drilling license, water use permit and recharge license).⁵³

The need for modern groundwater legislation or regulation is now becoming felt everywhere,⁵⁴ and in most states where the modern system has not yet been introduced, consideration is being given to the adoption of the permit system.

The introduction of the permit system is a highly significant factor in the present study. First, it shows the importance now attached to groundwater. Secondly, it will gradually give states adopting this system a more exact picture of groundwater use patterns. This is very important if one bears in mind that sound international cooperation in the field of water development requires more exact technical data.⁵⁵ Thirdly, national criteria for permits could provide a model for criteria to be followed at the international level for the allocation between states of shared groundwater.

Although the concept of equitable use remains fundamental in many modern legal systems, the weight assigned to the various criteria used to define what is equitable have changed considerably over time. The determination of what is "equitable" and the determination of the importance to be given to the ownership of the land overlying the water, to the seniority of existing water use rights, or to the type of use, is gradually yielding to the criteria of reasonable and beneficial use and in some instances to the optimum use criteria. This is true at least in areas where the water supply/demand relationship is delicate. Of course, this change in criteria leaves considerable room for speculation as to what is a "reasonable," "beneficial," or an "optimum" use, but it affords greater justification for attempting to propose new solutions for conflicting claims on the water, and in promoting cooperation between the parties concerned.

Another element to be retained is the need to determine special goals or areas where control of extraction and of recharge is rendered indispensable as a consequence of increased ground water use.

53. Tamir, *Legal and Administrative Aspects of the Water Laws in Israel* in 3 Radosevich, *supra* note 35, at 849.

54. Wolff, *The Need for a Reform of Water Use Law in Illinois*, 53 CHICAGO-KENT L. REV. 22 (1976).

55. River Basin Development, Policies and Planning, E 77, II Annexes (Agenda Item 4), Water Series No. 6 (1976).

PRINCIPLES EMERGING FROM INTERJURISDICTIONAL EXPERIENCE

Interjurisdictional experience may cover relations between various types of jurisdiction: between municipalities,⁵⁶ regions or counties, between member states of a federation and between independent, sovereign States. The latter two cases are of particular relevance.

A. Groundwater interstate law and practice in federal countries

Federal systems have always been an interesting reference for international law in water resources utilization.⁵⁷ To settle interstate disputes and enhance interstate cooperation, federal systems have developed three basic mechanisms: 1) the interstate agreement or compact, which creates rules for regulating the relationship between the parties; 2) judicial decision, which ascertains the existing better rights as between the parties; and 3) paramount federal power. The Swiss Constitution, which vests broad powers in the federal government to regulate water management, is an example of the federal power mechanism. News article 24 Bis refers specifically to groundwater resources (groundwater recharge conservation) and groundwater table regulations.⁵⁸ It empowers the federal government to allocate water use rights among the cantons concerned, whenever these fail to reach an agreement. Thus, the prospect of federal intervention may encourage intercantonal cooperation.

In other federal systems with a higher degree of decentralization, as in the case of the Federal Republic of Germany, the trend is rather to promote the individual initiative of Member States and to ensure coordination at the federal level. Thus the basic federal Water Conservation Law of 1957, amended in 1974, echoes many specific water laws adopted by the eleven *Länder*.⁵⁹ Water management being a subject which falls under the legislative powers of the *Länder*, the federal government may enact only framework legislation, which the *Länder* can elaborate according to their own priorities and concepts. However, Article 74 of the *Basic Law* makes waste disposal a

56. *City of Los Angeles v. City of San Fernando*, 14 Cal.3d 199, 537 P.2d 1250, 123 Cal. Rptr. 1 (1975).

57. G. Cano, *Treaties and Compacts Between the Political Divisions of Federal Countries as Sources of International Water Law* (prepared for the 48th Conference of Int'l L. Ass'n, N.Y. 1958); Alh riti re, *International Co-operation and Inland Waters: The Influence of Federalism*, 16 NAT. RES. J. 903 (1976).

58. *Arrete federal concernant une revision de la constitution dans le domaine de l'economie des eaux*, (RO) *Arrete federal du 20 juin 1975*, 715 (1976).

59. 1960 for Baden-W rtemberg, Berlin, Hamburg, Hessen, Rhineland-Palatinate and the Saar, all amended in 1974, 1962 for Bremen and North Rhine-Westphalia amended in 1974 and 1975 respectively, 1970 for Bavaria and Lower Saxony amended in 1974 for Schleswig-Holstein amended in 1974.

matter of concurrent jurisdiction, that is, the federal government has the right to legislate whenever there is a need for a legal ruling at the federal level. The *Länder* are then limited to legislative measures to the extent that the federal authority has left gaps in the legal coverage.

According to the Federal Water Act, any discharge of materials into groundwater is subject to the permission or consent of the authorities. This may be granted only if harmful pollution or other adverse changes in the composition of groundwater are unlikely.⁶⁰ For the rest, the Federal Republic of Germany, like other federal countries, encourages the Member States to develop cooperation among themselves.

The Canadian Federal system is one of the most decentralized as far as water management is concerned.⁶¹ Yet, Canadian experience does not provide any answer to interjurisdictional groundwater issues, for there are virtually no interprovincial groundwater problems in that country. The Prairie Provinces Water Board concerns itself incidentally with groundwater from a strictly quantitative standpoint and only to the extent that groundwater flow affects the surface water régime. Between all other provinces, water use practices or obvious geographical conditions prevent any groundwater issues from arising.

In Yugoslavia, the Federation has the power to set up a legal basis for water resources of interest to two or more member republics, while the republics themselves and the autonomous regions are responsible for the implementation of the basic law.⁶² In 1973 the Federal Assembly enacted a Law on Inter-Republic and Inter-State Waters,⁶³ amended in 1976. Long-term planning for inter-Republic waters has been established, including groundwater. By agreement between the republics, the latter are subject to the water management scheme established by federal law. Detailed implementation measures are adopted jointly by the republics concerned.

In Argentina there are a few interprovincial groundwater problems but they are not of such magnitude as to warrant the description of conflicts (for example between the Federal Capital District and the Province of Buenos Aires). A Federal Decree of 1945 on the

60. H. STEIGER & O. KIMMINICH, *THE LAW AND PRACTICE RELATING TO POLLUTION CONTROL IN THE FEDERAL REPUBLIC OF GERMANY* (1976).

61. Gibson, *The Constitutional Context of Canadian Water Planning*, 7 ALBERTA L. REV. 71 (1968-69); *La gestion des eaux en droit constitutionnel canadien* (D. Alhéritière, éditeur officiel du Québec) 300 (1976).

62. T. Kuzmanovski, *Legal Aspects of Modern Water Protection*, paper submitted by Yugoslavia to the UN Water Conference, E. CONF. 70/TP 228 (1976).

63. Official Gazette, 2 SFR Yugoslavia (January 10, 1974).

use of interprovincial waters⁶⁴ provides that the federal government may regulate the allocation and use of stream waters and ground water which cross the boundary of two or more provinces. This law has never been enforced, and some authors think it may well be *ultra vires*.⁶⁵ A promising effort at interprovincial cooperation began with the creation of the Groundwater Regional Centre.⁶⁶ The Centre was established by a federal law, reinforced by a special act of the provinces concerned (Mendoza, la Rioja and San Juan).

In the United States, the three mechanisms exist⁶⁷: 1) inter-State agreements, 2) Court decisions, and 3) the exercise of a paramount federal power. Compacts between member states of a federation offer the most interesting models for international law, in view of the similarities that such compacts provide under both systems, except where member states of a federation require previous federal consent for negotiating water compacts. It must be acknowledged that a juridical relevance of an agreement under international law (including the procedures for the resolution of conflicts and the organization of the subjects through the vesting of functions and powers to special institutions) may only be conferred on the basis of mutual consent. In the United States some 35 interstate compacts have been approved by Congress relating to water resources management⁶⁸; while very few deal with groundwater, American experience in this field is richer than any other federal country.

The general purpose of all water allocation compacts has been to bring about an equitable apportionment of the resource. Powers to allocate the waters of a basin among the signatory states in accordance with the doctrine of equitable apportionment is in certain cases conferred upon the Commission concerned (see, for example, the Delaware River Basin Compact). Among interstate compacts referring to groundwater may be mentioned in the Lower Niobrara River and Ponca Creek Compact, which apportions resources common to Nebraska and South Dakota, and the Upper Niobrara River Basin Compact, which apportions the resources common to Nebraska

64. Boletín Oficial (April 19, 1945). The Decree has since become Federal Law No. 13030.

65. See dimensions between Lopez, Spota & Rattiello, *Interjurisdictional River Basin Administration*, INCYTH-INELA 16 (1976).

66. Bridge, *Considerations on some Basic Elements which should be kept in Mind for a Planning Model of the Water Sector, with Special Reference to Underground Water* in 4 Radosevich, *supra* note 35, at 1298 & 1303.

67. Muys, *Allocation and Management of Interstate Water Resources; The Emergence of the Federal-Interstate Compact*, 6 DENVER J. INT'L L. & POLICY 307 (1976).

68. Muys, *Interstate Compacts and Regional Water Resources Planning and Management*, 6 NAT. RESOURCES LAW. 153 (1973).

and Wyoming.⁶⁹ The real innovation of the latter compact is that it clearly recognizes the essential physical facts, namely the effects of groundwater withdrawals on surface streamflow.⁷⁰

Perhaps the most interesting compact in groundwater is that of the Delaware River Basin Commission. The Commission is a four-state and federal organization involving the states of New York, New Jersey, Pennsylvania and Delaware. Part of the compact⁷¹ specifically deals with pollution control and gives the Commission broad powers to undertake investigations and surveys and to construct, operate and maintain projects and facilities to control pollution. It also confers powers to establish policies and standards and publish rules and regulations to control pollution in both surface and groundwater. Article 10 empowers the Commission to regulate and control withdrawals and diversions from surface and groundwater. The first Commission policies with respect to groundwater were added to the Comprehensive Plan in 1964;⁷² those portions pertaining to groundwater pollution control are as follows:

1. The underground water-bearing formations of the Basin, their waters, storage capacity, recharge areas and ability to convey water, shall be preserved and protected subject to the Compact as follows:

* * *

- c. No underground waters, or surface waters which are or may be the sources of replenishment thereof, shall be polluted in violation of water quality standards duly promulgated by the Commission or by any of the signatory parties;
- d. The principal natural recharge areas through which the underground waters of the Basin are replenished shall be protected from unreasonable interference with their recharge function;
- e. The underground water resources of the Basin shall be utilized, conserved, developed, managed and controlled in view of the needs of present and future generations, and of the resources available to them. To that end, the use, interference, impairment, penetration or artificial recharge of an aquifer or of any underground water resource shall be subject to review and evaluation under the Compact.

* * *

3. The Commission will exercise jurisdiction over underground

69. 83 Stat. 86 (1969).

70. Fischer, *Management of Interstate Groundwater*, 7 NAT. RESOURCES LAW. 521, 533 (1974).

71. Delaware River Basin Compact, 75 Stat. 689 (1961).

72. See Res. 8 & 11, Cong., Sess. CONG. REC. (1964). (Note—July & Sept. of that year).

waters in such manner as to supplement such regulatory authority of a signatory party as may be applicable to any project.

In 1972, after several years of experience, the Commission adopted more detailed addenda specifically relating groundwater quality. In 1973, a further amendment was adopted relating to the protection of groundwater. The Delaware River Commission maintains surveillance of possible movement of contaminated groundwater across interstate boundaries. Such movements seem to be from the general area of southern Philadelphia toward the New Jersey side of the Delaware River. The Susquehanna River Basin Compact⁷³ follows a format similar to that of the Delaware.

In other parts of the United States, there is already a comprehensive exchange of information between states with common groundwater problems. At the initiative of the Great Plains States (Texas, Oklahoma, Colorado, Kansas, Nebraska) a Groundwater Management Districts Association was created in 1975 to facilitate the exchange of technical and managerial information.⁷⁴ Interstate cooperation on groundwater is therefore increasing and new compacts are envisaged. One new compact could be between South Dakota and Wyoming to resolve a conflict between the two states. Water in this area is scarce, and the development of coal-fields is creating an enormous demand for water; the supply commonly comes from shared groundwater resources.⁷⁵ Another groundwater compact may be appropriate between New Mexico and Texas.⁷⁶

Judicial decisions made within the municipal legal system of federal states, although their value as a source of international law may be questioned, are now examined. In the United States, many Supreme Court decisions have been rendered on disputes over the consumption or pollution of the waters of fourteen interstate river basins. The guiding principle which the Supreme Court has applied in interstate water disputes is the doctrine of "equitable apportionment."⁷⁷ Where states follow the same legal doctrine, this common doctrine can be applied.⁷⁸ In a rare groundwater-related case the Court found that "the right to pump in reasonable quantities for the beneficial enjoyment of the overlying land is allowed. . . ."⁷⁹

73. 84 Stat. 1509 (1970).

74. See Clark, *Institutional Alternatives for Managing Groundwater Resources: Notes for a Proposal*, 18 NAT. RES. J. 153 (1978).

75. Comment, *Interstate Groundwater Rights: Protecting the Interests of the States*, 20 S.D. L. REV. 641 (1975).

76. Clark, *Groundwater Law: Problem Areas*, 8 NAT. RESOURCES LAW. 377, 389 (1975).

77. *Nebraska v. Wyoming*, 325 U.S. 589 (1945).

78. *Wyoming v. Colorado*, 259 U.S. 419 (1922).

79. *Washington v. Oregon*, 297 U.S. 517, 525 (1936).

Increased competition for water, especially in the western United States, is multiplying the potential conflicts between states, and often affects the internal water policy of the states concerned. Sometimes border areas are engaged in a race for water development in order to increase the number and importance of their prior valid claims to the water before negotiating a compact or prior to being heard by the Court. The fear of losing water to other states is widespread, a phenomenon that can be observed at the international level.

In Germany, in 1927 a dispute arose between the *Länder* of Württemberg and Prussia *versus* the Land of Baden concerning the Danube-Aachen Rivers, as a result of ground infiltration from the former two *Länder* originating in the latter. This infiltration was artificially increased. The Supreme Court of Justice solved the dispute by reference to general international legal principles.

There have been no interprovincial disputes in Australia relating to groundwater, although the establishment of an interprovincial cooperative committee to deal with groundwater resources planning was considered some years ago following a minor problem of drawdown in the border region between South Australia and Victoria. Disputes over water questions, such as the case of the Murray River, have been settled through compacts between the states concerned. As a matter of politics, states involved in a water dispute prefer to use the threat of litigation as a bargaining lever.

Many interesting lessons can be learned from the Indian experience in interstate cooperation or disputes on water.⁸⁰ In the River Krishna dispute, the tribunal constituted by the Central Government to settle the dispute between the states of Maharashtra, Karnataka and Andhra Pradesh, decided that "groundwater is a relevant factor to be taken into consideration for equitable distribution of water." The tribunal followed very closely the Helsinki rules which thus, seven years after their final drafting, passed the test of practice. In another case, the Narmada dispute, between the states of Madhya Pradesh, Maharashtra and Gujarat, the tribunal decided that the principle of equitable apportionment was the basic reference. However, most water disputes in India are settled by negotiation among the states concerned with the help of the Central Government. The Inter-State Water Disputes Act of 1956 provides that a tribunal is to be established only if the Central Government is of the opinion that a negotiated settlement is impossible.⁸¹

From this brief review of groundwater issues between various

80. S. JAIN, A. JACOB & S. JAIN, *INTERSTATE WATER DISPUTES IN INDIA* (1971).

81. See §4(1) of the Act; Reddy, *The Indian Experience, Interjurisdictional River Basin Administration* in INCYTH-INELA 93 (Mendoza ed. 1976).

jurisdictions in federal countries, it can be said that groundwater disputes are often resolved by cooperation between the authorities of the respective jurisdictions. Cooperation of this kind generally follows a very pragmatic course. When, for lack of it, judicial disputes arise or more formal relations are observed, the principle of equitable use is sometimes followed, and much effort is made to avoid the perpetuation of the distinction between surface and groundwater resources.

As early as 1956, Cano wrote on the occasion of the Conference on the Colorado River (Argentina) that in allocating water resources between states (in this case member states of a federation) it would be inappropriate not to take into consideration groundwater.⁸² This call is now being heard by many more negotiators at the international level.

B. *Principles deriving from international State practice*

The criteria which it is possible to derive from international State practice with regard to international law principles governing "shared" groundwater resources are fragmentary. Although some reference may be found in certain recent international conventions, international judicial decisions have, as yet, little relevance. However, the evolution of recent forms of international cooperation for the management of water resources of common interest to two or more States is of great significance; the same applies to the attention being paid to this problem by international jurists and the most highly qualified publicists.

Few international treaties deal with groundwater, and therefore, give little help in the search for international legal principles in this sphere. However, there is a growing tendency to include groundwater within boundary or shared water treaties, as may be seen in new treaties, additions to or amendments of older treaties, or in joint interpretations to such treaties. Thus, a 1973 agreement between Mexico and the United States supplements previous agreements between these two countries on the Colorado River.⁸³ The agreement establishes a protective and regulatory groundwater pumping program for a strip of land along the border in the vicinity of San Luis, Arizona. The area concerned extends 5 miles on both sides of

82. Cano, *Derecho política y administracion de aguas* in 2 INCYTH-INELA 579 (Mendoza ed. 1976).

83. *Minute No. 242, International Boundary and Water Commission*, 68 AM. J. INT'L L 376 (1974); Brownell & Eaton, *The Colorado River Salinity Problem with Mexico*, 69 AM J. INT'L L. 2 (1975).

the international border.⁸⁴ The United States will supply most of the 140,000 acre-feet, historically attributed by treaty to Mexico, from this new groundwater resource.⁸⁵ The agreement requires the United States and Mexico to consult with each other "prior to the undertaking of any new development of either the surface or the groundwater resources, or undertaking substantial modifications of present developments, in its own territory in the border area that might adversely affect the other country." This is consistent with the "Helsinki Rules" on the uses of the waters of international rivers.⁸⁶

Elsewhere along the same border, cooperation over international groundwater has not always been so fertile. The case of the shared ground water fields of the American city of El Paso and the Mexican city of Juárez is a clear example of non-cooperation. In spite of the interrelated character of aquifers north and south of the Río Grande, liaison to permit coordinated groundwater management has not been maintained between municipal water departments whose offices are less than a mile apart.⁸⁷

Current levels of development on both sides of the border vary greatly. Any groundwater treaty will have to face situations where: a) there is concurrent overexploitation of groundwater (California-Baja California border and Lower Río Grande area), or b) underdevelopment on both sides (Yuma-San Luis area, Santa Cruz basin, Douglas basin, Hidalgo County), or c) overdevelopment on the American side (San Símon basin, Upper Río Grande basin) or on the Mexican side alone (Mimbres Valley). For some shared groundwater resources, data are lacking (Prince County basin, Hachita basin).⁸⁸ Such a diversity of situations along the border makes this a very interesting subject of study and could, paradoxically enough, facilitate negotiations. The fact that one country has an advantage at one point while the reverse occurs at another should lead both countries to avoid extreme attitudes.⁸⁹

In Europe, international conventional practice tends to consider

84. Bradley & DeCook, *Ground Water Occurrence and Utilization in the Arizona-Sonora Border Region*, 18 NAT. RES. J. 29 (1978).

85. 6 (10) THE GROUNDWATER NEWSLETTER 1 (1977).

86. Helsinki Rules on the Uses of the Waters of International Rivers (1967), I.L.A. Art. XXIX, §§ 1 and 2.

87. Day, *Urban Water Management of an International River: The Case of El Paso-Juarez*, 15 NAT. RES. J. 453, 469 (1975); Day, *International Aquifer Management: The Hueco Bolson on the Río Grande River*, 18 NAT. RES. J. 163 (1978).

88. Note, *Needed: A Groundwater Treaty Between the United States and Mexico*, 15 NAT. RES. J. 385 (1975).

89. Hayton, *Institutional Alternatives for Mexico-U.S. Groundwater Management*, 18 NAT. RES. J. 201 (1978).

groundwater together with surface water. This tendency is marked in recent bilateral negotiations and is confirmed in certain new water treaties. A draft agreement between Spain and France concerning the water allocation of the Err River between the Spanish gorge of Llivia and the French Legre Valley discerns a definite relationship between surface water abstractions and groundwater levels,⁹⁰ and draws legal implications from this fact. Groundwater is considered in an agreement that Belgium and France are negotiating on water pollution control of the Espierre River basin: France is asked to decrease surface water pollution and, in turn, requires Belgium to diminish its groundwater abstraction in that basin.⁹¹

An agreement has been signed recently between France (Préfecture de Haute-Savoie) and Switzerland (Canton de Genève) on the ground water resources of the basin of Lake Geneva.⁹² References to ground water are made in the International Convention on Lake Geneva⁹³ and in the Netherlands-Federal Republic of Germany Convention.⁹⁴ Of special interest is the 1972 Convention between Italy and Switzerland on water pollution control. This has been in force since 7 August 1973: it establishes a Pollution Control Joint Commission to undertake all necessary investigation on the origin, nature and magnitude of pollution of surface and groundwater which may contribute to the pollution of Lake Maggiore, Lake Lugano and of other waters. The Commission may also propose to the two Governments any measures necessary for pollution abatement or prevention and submit draft regulations to this effect.⁹⁵

Europe is an interesting area to test the extent of the attention paid to groundwater in multilateral negotiations and conventions. Under the auspices of the Council of Europe, groundwater problems on the Alsatian border between France and Germany are being studied. The OECD has adopted an integrated approach to water problems,⁹⁶ as shown by a draft conclusion on water management policies and instruments, which reads: "Underground and surface

90. Smets, *La gestion commune des eaux de l'enclave de Llivia dans les Pyrenees franco espagnoles*, 2 REVUE JURIDIQUE DE L'ENVIRONNEMENT (1977).

91. OECD, *Le probleme de l'Espierre, un cas de pollution transfrontiere*, (Comite de l'Environnement de l'OCDE), Doc. ENV/TFP/76.1 (Mar. 8, 1976).

92. In Force in January, 1978.

93. See Article I of the 1960 Convention.

94. See Article 56 (§2) of the Convention of April 8, 1960.

95. R.G.D.I.P. (1976).

96. OECD, *Pollution transfrontiere dans les bassins hydrographiques internationaux* (comite de l'Environnement de l'OCDE), Doc. ENV/TFP/77.13 (July 11, 1977); OECD Draft Conclusions on Water Management Policies and Instruments (Environment Committee of OECD), Doc. ENV. 77.21 (April 4, 1977).

waters constitute a closely interrelated system which should be managed as a single entity in order to prevent uncontrolled pollution and depletion of these resources."⁹⁷

In Africa, the 1964 Convention and Statutes between Cameroon, Chad, Niger and Nigeria relating to the development of the Chad Basin refer to the use of both surface and ground water (*Statutes, Article 4*).

There is no direct reference to the notion of groundwater resources in international court decisions. However, it is often mentioned in the different forms of international institutional frameworks, both bilateral and multilateral. An example of bilateral institutional cooperation is the treaty of 1909 concerning the boundary waters between the United States and Canada. Although it does not mention groundwaters directly, the authors generally agree that under section 9 of the treaty, the International Joint Commission could be requested by the two parties to study any problems concerning this resource.

The confidence placed in the flexibility of this agreement has not been unfounded. By a letter of 2 August 1977 from the Canadian Secretary of State for External Affairs (eliciting a similar letter from the American Secretary of State), the Commission was asked to examine the significant transboundary impact that a thermal power plant built on the Poplar River by the Saskatchewan Power Corporation might have on the water level of surrounding aquifers. This is the first groundwater case that the Commission has received. It will not be the last, since groundwater problems are found along the border, particularly in the area of Sarnia (Ontario)-Detroit (Michigan) concerning deep well disposals which might affect the water quality of Lake St. Clair, and at the North Dakota-Saskatchewan border due to coal-mining operations. In addition, the 1972 Agreement between Canada and the United States on Great Lakes Water Quality⁹⁸ provides a very broad definition of the "Great Lakes System," which should encompass groundwater.

Within the framework of international cooperation, two recent United Nations conferences have drawn attention to groundwater issues and international cooperation. The United Nations Water Conference at Mar del Plata in 1977 recommended that "countries sharing water resources . . . should review existing and available techniques for managing shared water resources and cooperate in the establishment of programs, machinery and institutions necessary for

97. Canada, T.S. No. 12 (1972).

98. *Id.*

the coordinated development of such resources.”⁹⁹ The principles of exchange of information is re-affirmed.¹⁰⁰ Equitable utilization is referred to as follows: “In relation to the use, management and development of shared water resources, national policies should take into consideration the right of each state sharing the resources to equitably utilize such resources as the means to promote bonds of solidarity and cooperation.”¹⁰¹

The United Nations Conference on Desertification, held in September 1977 at Nairobi, recommended the “wise and efficient management of shared water resources for rational use.”¹⁰² Although such a formulation is much closer to the doctrines of beneficial and optimum use, the recommendation refers to the Mar del Plata plan of action which insisted on equitable utilization, a different doctrine. The Conference on Desertification suggested the execution of “transnational projects for studying, screening, processing, interpreting and integrating available data, and for refining management guidelines for rational, economical and sustained exploitation of regional aquifers,” and for “developing and strengthening regional activities concerning the assessment of surface and groundwater resources.”¹⁰³ The Intergovernmental Group of Experts on Shared Natural Resources held its fifth and final session in February 1978. It drafted fifteen principles of conduct in the field of the environment for the guidance of States in the conservation and harmonious use of natural resources shared by two or more States for transmission to the sixth Governing Council of the United Nations Environmental Programme to be held in May.

The teachings of qualified publicists of various nations are a subsidiary means of determining rules of law concerning relationships between States.

The major theories regarding the water rights of different riparian States are recalled below.¹⁰⁴ The first theory is that of “unrestricted territorial sovereignty,” whereby a State has an unrestricted sovereign right over the waters located within (and below) its territory. As a consequence, a State may use the waters in any manner it chooses

99. Report of the United Nations Water Conference, E 77, II Annexes (Agenda Item 12) (1977) 51.

100. *Id.*, at 52.

101. *Id.*, at 53.

102. Report of the United Nations Conference on Desertification, U.S. Doc. A/CONF. 74/36 (1977) 20.

103. *Id.*, at 20-21, 56.

104. For a treatment of these various theories, see Lipper, *Equitable Utilization*, in A. GARRETSON, R. HAYTON & C. OLMSTEAD, *THE LAW OF INTERNATIONAL DRAINAGE BASINS* (1967); Florio, *Sur l'utilisation des eaux non maritimes en droit international* (Festschrift) (1973); and F. BERBER, *RIVERS IN INTERNATIONAL LAW* 151 (1959).

without regard to the effects on the territory of another riparian State. This doctrine is also known as the Harmon doctrine, having been put forward by the Attorney General Harmon of the United States in 1896 in connection with a controversy with Mexico over the use of the Rio Grande. While this theory has found some support in the past, it has been weakened by modern theories and by such recent developments as the International Law Association Helsinki Rules of 1966.

Another theory is that of "unrestricted territorial integrity" or "natural water flow," according to which water is part of the territory of a State and therefore its natural flow must be unhampered by other riparian States: otherwise, a violation of its territorial integrity results. Under this doctrine (derived from the English principle of riparianism in a unitary State) an upper riparian State may make a reasonable use of waters located within its territory provided it does not modify the natural flow of the waters in another State.

These two theories, if applied to groundwater, do not provide an adequate basis for solving problems as "they are grounded in an individualistic and anarchical conception of international law in which personal and egotistical interests are raised to the level of guiding principles."¹⁰⁵ More recent theories are those of "equitable apportionment" and "community of interest." These are based on the emerging principle of "limited territorial sovereignty" over shared resources. Shared resources include international waters and groundwater resources which, in view of their physical characteristics, cannot be utilized unilaterally in an unrestricted and unlimited way—as if the State concerned were to claim a *jus abutendi* in their regard—without unavoidably causing some effect or injury to another State.

Underlying the "community of interest" theory is the reasoning that international water resources, including groundwater, defy State frontiers. A drainage basin, whether surface or underground, is regarded as an economic unit irrespective of political boundaries, and the waters are vested in the community of the basin or riparian States. This theory is the most conducive to international cooperation and to joint or integrated development of shared water resources.

A final theory, which is gaining wide acceptance in international law, is the principle of equitable utilization of the waters of an international drainage basin, both surface and underground. This theory is put forward by the International Law Association and seeks

105. F. BERBER, RIVERS IN INTERNATIONAL LAW 96 (1959).

to weigh the benefit to one State in the use of water against the injury which might thereby result to another, by evaluating the elements of the Helsinki rules. These elements are:

1. *The geography of the basin*, particularly the extent of the drainage area in the territory of each basin State. This will cause many practical difficulties groundwater disputes, pending a more exhaustive collection of hydrogeological data which would allow a meaningful evaluation of the recharge provided by the territory of each sharing State.

2. *The hydrogeology of the basin*. Consideration of this factor requires a better understanding of surface/groundwater relationships. This integration is gaining strength at all levels of water law. There is a trend in this direction in modern national water laws, which is being felt at the interstate level within federal countries. It is now understood that the surface/groundwater water dichotomy is artificial. Surface and groundwater form a linked system and are often part of the same water cycle. Flow can be in either direction and, even if the interchange is virtually nil for some aquifers, it has been estimated that about 30% of the total flow in surface streams is supplied from groundwater, while seepage from streams is known to be a main source of recharge to many aquifers.¹⁰⁶

3. *The past and present use of the water of the drainage basin*. This factor is of lower priority for groundwater than for surface water cases. The basic premise that prior use secures a prior right is unfair in a situation where there is an imbalance in development between two sides of a border. It could lead one Government and citizens, in an area where development has been inexistent, "to rush helter-skelter to the area in expectation of a treaty, grabbing all the water they could," as an author has vividly described.¹⁰⁷ Such an incentive to overexploitation is disastrous for the resource, especially in the case of contained or low-recharge aquifers. The same applies to priority based on present use.

4. *The economic and social needs of each basin state*.

5. *The population dependent on the waters of the basin*. This factor can lead to irreconcilable disputes. In the case of a dispute, a state may quote figures which are challenged by the contending party. In this case the question as to whether the absolute or the relative figure should be followed is also relevant to criteria 1 and 4 and but has not yet been clarified.¹⁰⁸

106. Resources and Needs: Assessment of the World Water Situation, U.N. Doc. E/CONF 70/CBP/1 (July 2, 1976) 14.

107. Note, *supra*, note 89, at 402.

108. Compare for instance, the "Statement by His Excellency Mr. J. S. Mehta, Foreign

6. *The comparative costs of alternative means of satisfying needs and the availability of other resources.* This factor has often been a decisive one in federal countries. The financial assistance of federal governments to member states in developing alternative solutions, thereby settling interstate disputes, has done much to foster cooperation. International financing institutions have such a role at the international level. The concept of alternative use was well developed by Moslem Law.

7. *The avoidance of unnecessary waste.* This factor is stressed in Moslem water law and in modern legal systems, and is close to the concept of efficient and beneficial use. It is particularly relevant in the case of contained groundwater reservoirs shared by two countries in arid and semi-arid areas.

8. *The practicability of compensation.* This is the transposition to the international level of what has been followed under municipal law in connection with indemnities which have to be paid for expropriation, servitudes and damages. Concerning damages, their evaluation and the determination of liability or compensation in ground water matters present a major difficulty. A long time may elapse between the act causing the damage and the actual occurrence of the damage. A change in recharge patterns will sometimes have an effect on the reservoir years after the change started. Another complicating factor is the distance between the place of the act and that of its effects. In some areas fresh water is known to have traveled as much as 100 or 200 kilometers from the recharge area to the pumping site. Again, a better understanding of the hydrogeological conditions of the basin is an absolute requirement.

Another factor concerns pre-existing agreements among states. This matter is not mentioned as such in the Helsinki rules. Nonetheless, it might be a decisive one. The Helsinki rules, moreover, purposely avoided proposing a rigid order or priority among uses. These should be considered in each particular case. It is worth recalling that most ancient legal systems contemplated a rather strict order of priorities while modern systems tend to allow full flexibility.

Secretary, Government of India in the Special Political Committee on Agenda Item 121 relating to Ganga Waters," New York, India News (November 16, 1976) to the "Statement by the Chairman of Bangladesh Delegation in the Special Political Committee, Thirty-First General Assembly Session on Agenda Item 121, Situation Arising out of the Unilateral Withdrawal of Ganges Water at Farakka," New York, Press release of the Bangladesh Mission to the United Nations (November 15, 1976). On November 5, 1977 the two countries signed an agreement to settle their dispute.

CONCLUSION

Several elements concerning legal rules governing groundwater have been underlined. These have been abstracted from the practice followed by individual states within their own legislative, judicial, and administrative experience. Particular mention has been made of the principles emerging from the various legal systems of the world, which may be regarded as the basis for general principles of international law. Of these may be mentioned the principles of "water equalization" (of the Chinese), of "correlative rights" and "reasonable use" (of the Americans) which are the forerunners of the "equitable utilization" doctrine under international law to be applied among all users; another principle deriving from municipal and federal law is that of the social value of water which, under international law corresponds to the concept of the "benefit of mankind." Finally, the need for adequate institutional frameworks for managing groundwater resources at the national level corresponds to the emerging duty to cooperate and establish appropriate joint machinery at the international level. Reference has been made also to the state and judicial practice of federal systems, in view of the analogy between member states and subjects of international law, without forgetting the differences between national and international law. The same emerging principles are confirmed by analysis of the interjurisdictional experience of federal countries. International practice has been analyzed through existing agreements and "judicial decisions" and the present forms of institutionalized cooperation at the global, regional and bilateral levels.

The international practice of States provides a certain number of examples of groundwater regulation. However, these examples are still scattered and specific principles of international law cannot be inferred from them. One indication of significance is the tendency to consider water resources, both surface and underground, in their entirety. This is true both when groundwaters are mentioned specifically in legislative texts—in order to associate them to surface waters within a certain region—and when the drainage basin concept is used.

In international treaties, references to groundwater are scanty and too limited in scope to propose them in terms of customary law.

The international courts do not appear to have rendered any decision specifically on groundwater. There is, however, the experience of joint commissions set up to establish continuous cooperation between states for the use of water resources common to two or

more states. In this experience the assimilation of the groundwater régime to that of surface water through the notion of the "international drainage basin" seems to represent a constant and a necessary feature. One conclusion may therefore be derived: whenever water resources of common interest to two or more states in terms of an hydrological management unit exist, it seems reasonable to assimilate the legal régime of underground water to that of surface water on the basis of a *de facto* connection between the two types of the same resource, since they both belong to the same hydrological cycle. Since the adoption of the Helsinki rules in 1966 the unity of a drainage basin in international relationships is always considered as a desirable principle whenever it is not already a binding principle in the relationship between several states. It is in this sense that the bulk of opinion among publicists seems to be oriented, and the same may be said of the various recommendations and the different codification projects promoted by international non-governmental organizations.

Regarding applicable legal standards, while there are no specific rules which may be derived from treaties or from court decisions, the same criterion of equitable utilization as has been accepted for surface water is also valid for groundwater. International law on this matter limits itself, in substance—in the absence of specific rules of conduct—to reference to general principles of responsibility and of equity in order to identify the law applicable in each particular case. If, under international law, we may speak of new emerging principles regarding underground water, these should be construed not so much as general principles of law enjoying recognition by nations nor even as international customary principles, but rather as "systematic" or "interpretative" principles deriving from the acknowledgment of a given hydrologic management unit.

This notion may provide, according to circumstances, new elements of international responsibility and new guidelines for international cooperation within the principles of the United Nations Charter.