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Criteria for equitable allocations: the heart of international water conflict

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Abstract

At the heart of most international water conflicts is the question of 'equitable' allocations, criteria for which are vague and often contradictory. However, application of an equitable water-sharing agreement along the volatile waterways of the globe is a prerequisite to hydropolitical stability. This article explores the question of equity measures for water-sharing agreements in the context of global hydropolitics and is divided into three parts. The Introduction provides a brief summary of the general principles of equitable allocations. The second part of the paper describes the practice of water resources allocations as exemplified in the Transboundary Freshwater Dispute Database – a computerized database of 149 treaties relating to international water resources compiled at Oregon State University; 49 of these treaties delineate specific water allocations. The third and fourth parts of the article contrast the principles and practice of water equity. It is noticeable how rarely the general principles are explicitly invoked, particularly the extreme principles of absolute sovereignty or absolute riverain integrity. Most treaties favor existing uses, and/or guarantees to downstream riparians. It is interesting that, while many international water negotiations begin with differing legal interpretations of rights, they often shift to a needs-based criteria for water allocations. Mostly, one is struck by the creativity of the negotiators in addressing specific language to each very specific local setting and concerns. © 1999 United Nations. Published by Elsevier Science Ltd. All rights reserved.

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Introduction

As global populations continue to grow exponentially, and as environmental change threatens the quantity and quality of natural resources, the ability for nations to peacefully resolve conflicts over internationally distributed water resources will increasingly be a factor in stable and secure international relations. There are close to 261 international rivers, covering almost half of the total land surface of the globe, and untold numbers of shared aquifers (Wolf et al., forthcoming). Water has been a cause of political tensions between Arabs and Israelis; Indians and Bangladeshis; Americans and Mexicans; and all 10 riparian States of the Nile River. Water is the only scarce resource for which there is no substitute, over which there is poorly developed international law, and for which the need is overwhelming, constant, and immediate.

These resource conflicts will gain in frequency and intensity as water resources become relatively more scarce and their use within nations no longer can be insulated from impacting on their neighbors. It has been suggested that a more conscious attention to the art and science of

negotiation, mediation and arbitration can provide useful insights for resolving these conflicts without recourse to the limited solutions possible in international courts of law or, worse, the devastating possibility of armed conflict.

The central issue at the heart of the international water quantity disputes is the fact that there are no internationally accepted criteria for allocating shared water resources, or their benefits.¹ The questions considered, although usually dealt with within the realms of law or economics, are inherently geographical (Karan, 1961): Can one generalize a code of conduct for locations (watersheds) which are by nature hydrologically, politically, and culturally unique (White, 1957)? How does one develop guidelines for allocating a vital resource which is mobile, which fluctuates in time and in space, and which ignores political boundaries?

This article begins with a description of criteria for water-sharing which have evolved over time within legal and

¹ As will be argued later, this is true despite the 1997 Convention on the Law of the Non-Navigational Uses of International Watercourses, the guidelines of which do not offer the specificity necessary for unequivocal allocations.

economic frameworks, and their strengths and weaknesses. This is followed by the contrast between these general principles and the practice of allocating water, as exemplified in transboundary water treaties. The Transboundary Freshwater Dispute Database includes a collection of 149 water treaties – 49 of those delineate specific water allocations to co-riparians. Trends in treaty practice and the relative weights of general principles and the unique local setting are then described.

Criteria for water allocations – general principles

At the heart of water conflict management, is the question of 'equity'. A vague and relative term in any event, criteria for equity are particularly difficult to determine in water conflicts, where the international water law is ambiguous and often contradictory, and no mechanism exists to enforce principles which are agreed upon. However, application of an 'equitable' water-sharing agreement along the volatile waterways of the world is a prerequisite to hydropolitical stability which, finally, could help propel political forces away from conflict in favor of cooperation. It took decades of tense negotiations, for example, to reach accords on the Danube, Indus, Ganges, and Jordan Rivers, while talks continue in fits and starts along the Parana, the Nile and the Tigris–Euphrates. This section describes some measures of water-sharing equity which do exist, their strengths, and their weaknesses, in the context of global hydropolitics.

*International water law*²

According to Cano (1989), international water law did not substantially begin to be formulated until after World War I. Since that time, organs of international law have tried to provide a framework for increasingly intensive water use, focusing on general guidelines which could be applied to the world's watersheds. These general principles of customary law, codified and progressively developed by advisory bodies and private organizations, are termed 'soft law', and are not intended to be legally binding, but can provide evidence of customary law and may help crystallize that law. While it is tempting to look to these principles for clear and binding rules, it is more accurate to think in terms of guidelines for the process of conflict resolution: "(T)he principles (of customary law) themselves derive from the process and the outcomes of the process rather than prescribe either the process or its outcome" (Dellapenna, personal communication, 1997).

The concept of a 'drainage basin', for example, was accepted by the International Law Association (ILA) in the Helsinki Rules of 1966, which also provide guidelines for 'reasonable and equitable' sharing of a common waterway (Caponera, 1985). Article V lists no fewer than 11 factors which must be taken into account in defining what

is 'reasonable and equitable'.³ There is no hierarchy among these components of 'reasonable use'; rather they are to be considered as a whole. One important shift in legal thinking in the Helsinki Rules is that they address the right to 'beneficial use' of water, rather than to water per se (Housen-Couriel, 1994, 10). The Helsinki Rules have explicitly been used only once to help define water use: the Mekong Committee used the Helsinki Rules definition of 'reasonable and equitable use' in formulating their Declaration of Principles in 1975, although no specific allocations were determined.⁴

When the United Nations considered the Helsinki Rules in 1970, objections were raised by some nations as to how inclusive the process of drafting had been. In addition and, according to Biswas (1993), more importantly, some States (Brazil, Belgium, China, and France, for instance) objected to the prominence of the drainage basin approach, which might be interpreted as an infringement on a nation's sovereignty. Others, notably Finland and the Netherlands, argued that a watershed was the most 'rational and scientific' unit to be managed. Others argued that, given the complexities and uniqueness of each watershed, general codification should not even be attempted. On 8 December 1970, the General Assembly directed its own legal advisory body, the International Law Commission (ILC) to study "Codification of the Law on Water Courses for Purposes other than Navigation."⁵

It is testimony to the difficulty of marrying legal and hydrologic intricacies that the ILC, despite an additional call for codification at the UN Water Conference at Mar de Plata in 1977, took 21 years to complete its Draft Articles. It took until 1984, for example, for the term 'international watercourse' to be adequately defined (a process described in exquisite detail by Wescoat, 1992; see also Teclaff, 1996). Problems both political and hydrological slowed the definition: in a 1974 questionnaire submitted to member States, about half the respondents (only 32 of 147 nations responded by 1982) supported the concept of a drainage basin (e.g., Argentina, Finland and the Netherlands), while half were strongly negative (e.g. Austria, Brazil, and Spain) or ambivalent (Wescoat, 1992, p. 311); 'watercourse system' connoted a basin, which threatened sovereignty issues; and borderline cases, such as glaciers and confined aquifers, both now excluded, had to be determined. In 1994, more than two decades after

³ The factors include a basin's geography, hydrology, climate, past and existing water utilization, economic and social needs of the riparians, population, comparative costs of alternative sources, availability of other sources, avoidance of waste, practicability of compensation as a means of adjusting conflicts, and the degree to which a state's needs may be satisfied without causing substantial injury to a co-basin state.

⁴ While this is the sole case of the Helsinki Rules definitions being used explicitly in treaty text, the concept of 'reasonable and equitable use' is quite common, as is described below.

⁵ In its reference to the ILC, the General Assembly excised all mention of the Helsinki Rules to allay political concerns over the drainage basin approach (Wescoat, 1992, p. 307).

² Some of the following discussion is drawn from Wolf (1997).

receiving its charge, the ILC adopted a set of 32 draft articles.⁶ The UN General Assembly adopted the articles, with some revisions,⁷ as the Convention on the Law of the Non-Navigational Uses of International Watercourses on 21 May 1997.⁸ The vote was 103 in favor, three against (Burundi, China and Turkey) against, and 27 abstentions.

The 1997 Convention includes language very similar to the Helsinki Rules, requiring riparian States along an international watercourse in general to communicate and cooperate. Provisions are included for exchange of data and information, notification of possible adverse effects, protection of eco-systems, and emergency situations. Allocations are dealt with through equally vague but positive language. Much of the discussions leading to the Convention centered on how 'reasonable and equitable use' within each watercourse State, "with a view to attaining optimal utilization thereof and benefits therefrom", is balanced with an obligation not to cause significant harm (Tanzi, 1997). The definition of 'reasonable and equitable use' is similar to that in the Helsinki Rules; it is to be based on a non-exhaustive list of seven relevant factors.⁹ The text of the ILC articles does not offer guidelines for prioritizing these factors, suggesting in Article 6 only that "the weight to be given to each factor is to be determined by its importance", and that "all relevant factors are to be considered together". Article 10 says both that, "in the absence of agreement or custom to the contrary, no use enjoys inherent priority over other uses", and that, "in the event of a conflict between uses ... (it shall be resolved) with special regard being given to the requirements of vital human needs".

Groundwater is focused on, most recently, in the Ballagio Draft Treaty, developed as a document of 'soft law' in a process described by Hayton and Utton (1989). This too, includes eight factors for consideration in allocations,¹⁰

and suggests that, "the weight to be given to each factor is to be determined by its importance in comparison with that of the other relevant factors".

The uniqueness of each basin and its riparian States suggest that any universal set of principles must, by necessity, be fairly general. The problems arise when attempts are made to apply this reasonable but vague language to specific water conflicts. For example, riparian positions and consequent legal rights shift with changing boundaries, many of which are still not recognized by the world community. Further, the international law only concerns itself with the rights and responsibilities of States. Some political entities who might claim water rights, therefore, would not be represented, such as the Palestinians along the Jordan or the Kurds along the Euphrates.¹¹

The process is further complicated in the rare cases of formal litigation or arbitration – there are few specialized institutions for international law making, interpreting, or enforcing. The International Court of Justice (ICJ) in the Hague, for example, hears cases only on specific points of law, only with the consent of the parties involved, and no practical enforcement mechanism exists to back up the Court's findings. A State with pressing national interests can therefore disclaim entirely the court's jurisdiction or findings (Rosenne, 1995).

Given all the intricacies and limitations involved, it is hardly surprising that the International Court of Justice has only recently decided its first case regarding international water law.¹²

Rights-based criteria: hydrography vs. chronology

Extreme principles

Customary international law has focused on providing general guidelines for the watersheds of the world. In the absence of such guidelines, some principles have been claimed regularly by riparians in negotiations, often depending on where along a watershed a riparian State is situated. Many of the common claims for water rights are based either on hydrography, i.e., from where a river or aquifer originates and how much of that territory falls within a certain State, or on chronology, i.e., who has been using the water the longest.

⁶ ILC Draft Articles on the Non-navigational Uses of International Watercourses, 1994. UN Doc. A/CN.4/L.492 (1994). For history and commentary, see United Nations. Yearbook of the ILC from 1974–1991.

⁷ Much of the debate focused on issues such as the place of environmental sustainability, the degree to which the Convention affected past and future treaties, and the relationship between 'reasonable and equitable use' and the 'obligation not to commit harm', as will be explored later. See Tanzi (1997) for more detail.

⁸ The final text of the Convention adopted by the UN General Assembly is contained in document A/RES/51/229 of 8 July 1997.

⁹ These factors include: geographic, hydrographic, hydrological, climatic, ecological, and other natural factors; social and economic needs of each riparian state; population dependent on the watercourse; effects of use in one state on the uses of other states; existing and potential uses; conservation, protection, development and economy of use, and the costs of measures taken to that effect; and the availability of alternatives, of corresponding value, to a particular planned or existing use.

¹⁰ The eight factors for consideration are: hydrogeology and meteorology; existing and planned uses; environmental sensitivity; quality control requirements; socio-economic implications; water conservation practices; artificial recharge potential; and comparative costs and implications of alternative sources of supply. In separate comments, Hayton and Utton (1989) suggest that a Commission, established under treaty, should also consider the traditional rights of nomadic or tribal peoples of a border region.

¹¹ Dellapenna (personal communication, 1997) points out that there are differences between these two examples, in that the Palestinians do have some degree of autonomy and even sovereignty within their territory. He uses the term 'national communities' for the riparians of the Jordan River to make this distinction.

¹² The single ruling was a 1997 case on the Gabčíkovo Dam on the Danube, between Hungary and Slovakia. The ICJ came into being in 1946, with the dissolution of its predecessor, the Permanent Court of International Justice. That earlier body did rule on four international water disputes during its existence from 1922–1946.

Initial positions are usually extreme (Housen-Couriel, 1994; Matthews, 1984). The 'doctrine of absolute sovereignty' is often initially claimed by an upstream riparian. This principle, referred to as the Harmon Doctrine for the US attorney-general who suggested this stance in 1895 regarding a dispute with Mexico over the Rio Grande, argues that a State has absolute rights to water flowing through its territory (LeMarquand, 1993; McCaffrey, 1996).¹³ Considering that this doctrine was immediately rejected by Harmon's successor and later officially repudiated by the US (McCaffrey, 1996); considering further that it was never implemented in any water treaty (with the rare exception of some internal tributaries of international waters), was not invoked as a source for judgment in any legal ruling regarding international waters, and was explicitly rejected by the international tribunal in the Lac Lanoux case in 1957 (described below), the Harmon Doctrine is wildly over-emphasized as a principle of international law.¹⁴

The downstream extreme claim is often a consequence of climate. In a humid watershed, the extreme principle advanced is 'the doctrine of absolute riverain integrity', which suggests that every riparian is entitled to the natural flow of a river system crossing its borders. This principle has reached acceptance in the international setting as rarely as absolute sovereignty. In an arid or exotic (humid headwaters region with an arid downstream) watershed, the downstream riparian often has older water infrastructure which it is in its interest to defend. The principle that rights are acquired through seniority of use is referred to as 'historic rights' (or 'prior appropriations' in the US), that is, "first in time, first in right".

These conflicting doctrines of hydrography and chronology clash along many international rivers, with positions usually defined by relative riparian positions.¹⁵ Downstream riparians, such as Iraq and Egypt, often receive less rainfall than their upstream neighbors and therefore have depended on river water for much longer historically. As a consequence, modern 'rights-based' disputes often take the form of upstream riparians such as Ethiopia and Turkey arguing in favor of the doctrine of absolute sovereignty,

with downstream riparians taking the position of historic rights.¹⁶

Moderate principles

It quickly becomes clear in negotiations that keeping to an extreme position leaves very little room for bargaining. Over time, rights become moderated by responsibility so that most States eventually accept some limitation to both their own sovereignty and to the river's absolute integrity. The process which led to the disavowal of the legal principles of absolute sovereignty and absolute riverain integrity was the Lac Lanoux case (Laylin, 1959; MacChesney, 1959). The Carol river crosses from the French into the Spanish Pyrenees. In the early 1950s, France, asserting absolute sovereignty, proposed diverting water from the river across a divide towards the Font-Vive for hydropower generation – Spain would be compensated monetarily. Spain objected, asserting absolute territorial integrity and the existing irrigation needs on its side of the border. Even when France agreed to divert back first the water needed for Spanish irrigation, then *all* of the water being diverted, through a tunnel between watersheds, Spain insisted on absolute territorial integrity, claiming it did not want French hands on its tap.¹⁷ Both absolute principles were effectively dismissed when a 1957 arbitration tribunal ruled in the case that "territorial sovereignty ... must bend before all international obligations", effectively negating the doctrine of absolute sovereignty. Yet the tribunal also admonished the downstream State from the right to veto 'reasonable' upstream development, thereby negating the principle of natural flow or absolute riverain integrity. This decision made possible the 1958 Lac Lanoux treaty (revised in 1970), in which it is agreed that water is diverted out-of-basin for French hydropower generation, and a similar quantity is returned before the stream reaches Spanish territory.

The 'doctrine of limited territorial sovereignty' reflects rights to reasonably use the waters of an international waterway, yet with the acknowledgment that one should not cause harm to any other riparian State.

In fact, the relationship between 'reasonable and equitable use', and the obligation not to cause 'significant harm', is the more subtle manifestation of the argument between hydrography and chronology. As noted above, the 1997 Convention includes provisions for both concepts, without

¹³ "The fundamental principle of international law is the absolute sovereignty of every nation, as against all others, within its own territory" (cited in Le Marquand, 1993, p. 63). Harmon was making the hydrologically preposterous argument that upstream water diversions within the territorial US would not legally affect downstream navigation on international stretches of the Rio Grande as the diversions were to be carried out by individuals, not states (McCaffrey, 1997).

¹⁴ As far back as 1911, the Institut de Droit International had asserted that the dependence of riparian states on each other precludes the idea of absolute autonomy over shared waters (Laylin and Bianchi, 1959, p. 46).

¹⁵ The inherent conflict between upstream and downstream riparian occurs in most settings and scales. Crawford (1988, 88–90) describes such disputes along the traditional acequia canal systems in New Mexico.

¹⁶ For examples of these respective positions, see the exchange about the Nile between Jovanovic (1985) and Shahin (1989) in respective issues of *Water International*; and the description of political claims along the Euphrates in Kolars (1991).

¹⁷ This is a concern which is raised regularly in negotiations, recently between Egypt and Ethiopia, and for a series of proposed canals from Turkey or Lebanon into the Jordan basin. It is primarily this concern which causes Israel to emphasize desalination over possibly less-expensive water import schemes.

setting a clear priority between the two. The relevant articles are:

Article 5: equitable and reasonable utilization and participation

(1) Watercourse States shall in their respective territories utilize an international watercourse in an equitable and reasonable manner. In particular, an international watercourse shall be used and developed by watercourse States with a view to attaining optimal and sustainable utilization thereof and benefits therefrom, taking into account the interests of the watercourse States concerned, consistent with adequate protection of the watercourse.

(2) Watercourse States shall participate in the use, development and protection of an international watercourse in an equitable and reasonable manner. Such participation includes both the right to utilize the watercourse and the duty to cooperate in the protection and development thereof, as provided in the present Convention.

Article 7: obligation not to cause significant harm

(1) Watercourse States shall, in utilizing an international watercourse in their territories, take all appropriate measures to prevent the causing of significant harm to other watercourse States.

(2) Where significant harm nevertheless is caused to another watercourse State, the States whose use causes such harm shall, in the absence of agreement to such use, take all appropriate measures, having due regard for the provisions of articles 5 and 6, in consultation with the affected State, to eliminate or mitigate such harm and, where appropriate, to discuss the question of compensation.

Article 10: relationship between different kinds of uses

(1) In the absence of agreement or custom to the contrary, no use of an international watercourse enjoys inherent priority over other uses.

(2) In the event of a conflict between uses of an international watercourse, it shall be resolved with reference to the principles and factors set out in articles 5 to 7, with special regard being given to the requirements of vital human needs.

Not surprisingly, upstream riparians have advocated that the emphasis between the two principles be on 'equitable utilization', as that principle gives the needs of the present the same weight as those of the past. Likewise, downstream

riparians (along with the environmental and development communities) have pushed for emphasis on 'no significant harm', effectively the equivalent of the doctrine of historic rights in protecting pre-existing use.

The debate over which doctrine, 'reasonable use' or 'no harm' shall have priority has been intense, and was one of the focuses of discussion leading to the Convention (Tanzi, 1997). According to Khassawneh (1995), the Special Rapporteurs for the ILC project had come down on the side of 'equitable utilization' until the incumbency of J. Evensen, the third Rapporteur who argued for the primacy of 'no appreciable harm'. Commentators have had the same problem reconciling the concepts as the Rapporteurs: Khassawneh (1995) suggests that the latter Rapporteurs are correct that 'no appreciable harm' should take priority, while, in the same volume, Dellapenna (1995) argues for 'equitable use' and suggests that the evolution of Article 7 (which in the Convention includes a clause to mitigate harm and discuss compensation) is evidence of these intentions (personal communication, 1997). Wouters (1996) proposes that the ILC Draft clearly favors 'no harm' but that treaty practice suggests that 'equitable use' is more advisable. Utton (1996) describes the roots of 'no harm' more as a water quality issue, and advises that the Convention be written as such. The World Bank, which must follow prevailing principles of international law in its funded projects, recognizes the importance of equitable use in theory but, for practical considerations, gives: 'no appreciable harm' precedent – it is considered easier to define – and will not finance a project which causes harm without the approval of all affected riparians (World Bank, 1993, p. 120; Krishna, 1995, pp. 43–45).

Even as the principles for sharing scarce water resources evolve and become more moderate over time, the essential argument still emphasizes the *rights* of each State – the sense that a riparian is entitled to a certain quantity or use of water depending on certain physical or historical constructs – generally resting on the fundamental dispute between hydrography and chronology. In addition, defining concepts which are intentionally vague both for reasons of legal interpretation and for political expediency – 'reasonable', 'equitable', and 'significant' – guarantee continued ambiguity in the principles of customary law.

*Economic criteria*¹⁸

One lately emerging principle incorporated into water conflict resolution theory is the allocation of water resources according to its economic value. Here we distinguish between 'efficiency' – the allocation of water to its highest value use – and 'equity' – the distribution of gains from an allocation (Howe, 1996). The idea of an efficient distribution is that different uses and users of the water along a

¹⁸ Some of the following discussion is drawn from Wolf and Dinar (1994).

given water way may place differing values on the resource. Therefore, water-sharing should take into consideration the possibility of increasing the overall efficiency of water utilization by re-allocating the water according to these values. This principle alone may not be accepted as equitable, or fair, by the parties involved. However, inclusion of economic aspects in water resource allocation may enhance better cooperation and future collaboration in joint projects in the region of concern.

Allocation according to the economic value of water has usually been demonstrated using two approaches. The long-standing approach assumes a hypothetical central planning authority who knows what is 'best' for society – a 'social planner' in economic terms – who views the region as one planning unit. The social planner maximizes regional welfare subject to all available water resources in the region and given all possible water utilizing sectors. In some instances the social planner (government) also includes preferences (policy). A second approach is the 'water market' approach which employs the market mechanism to achieve an efficient allocation of scarce water resources among competing users.

Examples of these approaches can be found in several studies which consider institutional and economic aspects of international cooperation for interbasin development. Goslin (1977) examined the economic, legal and technological aspects of the Colorado River Basin allocation between the US riparian states and Mexico. Krutilla (1969) analyzed the economics of the Columbia River Agreement between the US and Canada. LeMarquand (1976; 1977) has developed a framework to analyze economic and political aspects of a water basin development. Also Haynes and Whittington (1981) suggested a social planner solution for the entire Nile Basin. A team of researchers has been working to monetize the water dispute on the Jordan River, arguing that it will be easier to negotiate responsibility for a sum of money than over a scarce and emotionally charged natural resource (Fisher, 1994).

These studies generally argue that to solve cooperatively the problem of water allocations within a basin, the parties involved should realize some mutual benefit that can be achieved only through cooperation and be allocated to the parties. In cases of cooperation, each party needs to participate voluntarily, and to accept the joint outcome from the cooperative project. Once a cooperative interest exists, the only problem which remains to be solved is the allocation of the associated joint costs or benefits. For a cooperative solution to be accepted by the parties involved, it is required that (a) the joint cost or benefit is partitioned so that each participant is better off compared to a non-cooperative outcome; (b) the partitioned cost or benefit to participants are preferred in the cooperative solution compared to sub-coalitions that include part of the potential participants, and (c) all the cost or benefit is allocated.

Recent studies have questioned the equity and justice

associated with market allocations (see, for example, Margat, 1989; London and Miley, 1990; Tsur and Easter, 1994; Fröhlich and Oppenheimer, 1994), while others (e.g., Wolf, 1995; Dellapenna, forthcoming) question whether related issues of property rights, externalities, transaction costs, and intangible values can be resolved to the point necessary for a functional water market. The conclusion from these studies is that economic considerations alone may not provide an acceptable solution to water allocation problems, especially to solve water allocation disputes between nations.

Perhaps as a consequence of these issues, economic criteria have never been explicitly used to determine water allocations in an international treaty and, while in some cases States have compensated co-riparians for water, no international water market has ever been established.

Criteria for water allocations – practice

Transboundary freshwater dispute database

The practice of allocating transboundary water resources can be found in the treaties negotiated between co-riparian States. The UN Food and Agriculture Organization (FAO) has identified more than 3600 treaties relating to international water resources dating between 805 and 1984, the majority of which deal with some aspect of navigation (UN FAO, 1978, 1984). Since 1814, approximately 300 treaties have been negotiated which deal with non-navigational issues of water management, flood control or hydro-power projects, or allocations for consumptive or non-consumptive uses in international basins. The full text of 149 treaties dealing with water per se, excluding those which focus on boundaries or fishing rights, have been collected in a Transboundary Freshwater Dispute Database (described in more detail in Hamner and Wolf, 1998). The database includes a systematic computer compilation of these treaties, which are cataloged by basin, countries involved, date signed, treaty topic, allocations measure, conflict resolution mechanisms, and non-water linkages.¹⁹ It also includes primary and secondary sources on the negotiation processes for 14 detailed case studies.²⁰

The literature includes very little systematic work on the body of international water treaties as a whole, although authors have often used treaty examples to make a point about specific conflicts, areas of cooperation, or larger

¹⁹ The author expects that both the full text of each treaty and the compilation of summaries will be up-loaded to the World Wide Web by the time the present article is published. See the Home Page of the Oregon State University Department of Geosciences for more information: <http://osu.orst.edu/dept/geosciences/>

²⁰ These cases include nine watersheds (the Danube, Euphrates, Jordan, Ganges, Indus, Mekong, Nile, La Plata, and Salween); two sets of aquifer systems (US-Mexico shared systems and the West Bank Aquifers); two lake systems (the Aral Sea and the Great Lakes); and one engineering works (the Lesotho Highlands Project).

Table 1
Unique allocation practices

Principle	Percent (number) of treaties
Half of flow to each of two riparians	6% (9/149)
Absolute sovereignty on tributaries	2% (3/149)
Relinquish prior uses	0.6% (1/149)
Prioritize uses	3% (4/149)
Equal allocations of benefits	1% (2/149)
Compensation for lost benefits	7% (10/149)
Payments for water	3% (4/149)

issues of water law (see for example Vlachos, 1990; Eaton and Eaton, 1994; Housen-Couriel, 1994; Dellapenna, 1995; Kliot, 1995). In two important exceptions, Dellapenna (1994) describes the evolution of treaty practice dating back to the mid-1800s, and Wescoat (1996) assesses historic trends of water treaties dating from 1648 to 1948 in a global perspective. Further, the reports of the ILC Rapporteurs and related commentaries provide rich assessments of water treaty practice.

Those treaties specifically delineating allocations between two or more nations, from the Transboundary Freshwater Dispute Database, are summarized in this section. Excluded are those treaties that establish basin authorities or describe specific flood control or hydroelectricity projects, *unless* specific allocations are described. For example, the 1957 accord which establishes the Mekong Committee is excluded, but a 1975 Declaration of Principles among the same riparians, which describes principles for water allocations, is included.

Of the collection of 149 treaties referred earlier, 49 describe allocations (for consumptive or non-consumptive uses). These treaties with water allocations generally come about in conjunction with boundary waters agreements, river development agreements, and/or single-project agreements. The 49 treaties which delineate allocations are divided into those categories and summarized in the appendix: International Treaties Which Delineate Water Allocations.

Water conflicts and their resolution: a synopsis of experience

What is noticeable in reading through the *practice* of water conflict prevention and resolution, as documented in these 49 treaties, is just how rarely the general *principles* are explicitly invoked, particularly the extreme principles of absolute sovereignty or absolute riverain integrity. Neither of these principles is encoded in a single one of the documents surveyed here. Some have pointed out that the fact that extreme principles are not invoked is *precisely* evidence that 'equitable utilization' is the dominant underlying principle. While it may be true that, for an agreement to be reached, both sides have to see some degree of 'equity' in an arrangement, its legal definition seems overly vague and

Table 2
Examples of needs-based criteria

Treaty	Criteria for allocations
Egypt/Sudan (1929, 1959, Nile)	'Acquired' rights from existing uses, plus even division of any additional water resulting from development projects
Johnston Accord (1956, Jordan)	Amount of irrigable land within the watershed in each State
India/Pakistan (1960, Indus)	Historic and planned use (for Pakistan) plus geographic allocations (western vs. eastern rivers)
South Africa (Southwest Africa)/Portugal (Angola) (1969, Cunene)	Allocations for human and animal needs and initial irrigation
Israel-Palestinian Interim Agreement (1995, shared aquifers)	Population patterns and irrigation needs

relies too heavily on approval by the parties themselves. The argument that a normative principle needs be defined in the application of that principle feels somewhat circular. Further, examination of the negotiating notes of the in-depth case studies reveals that these legal principles simply are not invoked in the process leading up to a treaty.²¹ Rather than building from the legal principles, technocrats generally enlist lawyers late in the process to help codify water management practices, based primarily on the hydrologic and political landscape.

In fact, each local setting is so diverse, both hydrologically and politically, that one is struck by the creativity of the negotiators in addressing specific code to each very specific situation. (See Table 1 – Unique Allocation Practices). As will be explored later, some divide waters equally between riparians; some divide the *benefits* derived from the waters equally – not at all the same thing. Most favor existing uses, and/or guarantees to downstream riparians; the upstream riparian is favored only rarely. But each has sections which address the specific setting and concerns of local geography. The trends found in reading of these treaties are described in the following sections.

From rights to needs

As described above, many of the negotiations surveyed begin with parties basing their initial positions in terms of rights – the sense that a riparian is entitled to a certain allocation based on hydrography or chronology of use. Upstream riparians often invoke some variation of the Harmon Doctrine, claiming that water rights originate where the water falls. India claimed absolute sovereignty in the early phases of negotiations over the Indus Waters Treaty, as did France in the Lac Lanoux case, and Palestine

²¹ The exception in our case studies is the 1995 Mekong Agreement, probably because it is the only case where the mediator/facilitator, George Radosevich, is himself an international lawyer.

over the West Bank aquifer. Downstream riparians often claim absolute riverain integrity, claiming rights to an undisturbed system or, if on an exotic stream, historic rights based on their history of use. Spain insisted on absolute sovereignty regarding the Lac Lanoux project, while Egypt claimed historic rights against first Sudan, and later Ethiopia, on the Nile.

In almost all of the disputes which have been resolved, however, particularly on arid or exotic streams, the paradigms used for negotiations have not been 'rights-based' at all – neither on relative hydrography nor specifically on chronology of use, but rather 'needs-based.' 'Needs' are defined by irrigable land, population, or the requirements of a specific project.²² (See Table 2 – Examples of Needs-Based Allocations.) In agreements between Egypt and Sudan signed in 1929 and in 1959, for example, allocations were arrived at on the basis of local needs, primarily of agriculture. Egypt argued for a greater share of the Nile because of its larger population and extensive irrigation works. In 1959, Sudan and Egypt then divided future water from development equally between the two. Current allocations of 55.5 BCM/y for Egypt and 18.5 BCM/y for Sudan reflect these relative needs (Waterbury, 1979).²³

Likewise along the Jordan River, the only water agreement for that basin ever negotiated (although not ratified) until very recently, the Johnston Accord, emphasized the needs rather than the inherent rights of each of the riparians. Johnston's approach, based on a report performed under the direction of the Tennessee Valley Authority, was to estimate, without regard to political boundaries, the water needs for all irrigable land within the Jordan Valley basin which could be irrigated by gravity flow (Main, 1953). National allocations were then based on these in-basin agricultural needs, with the understanding that each country could then use the water as it wished, including to divert it out-of-basin. This was not only an acceptable formula to the parties at the time, but it also allowed for a breakthrough in negotiations when a land survey of Jordan concluded that its future water needs were lower than previously thought. Years later, Israel and Palestine came back to needs in the Interim Agreement of 1995, where Israel first recognized Palestinian water rights on the West Bank – a formula for agriculture and per capita consumption determined future Palestinian water needs at 70–80 MCM/y and Israel agreed to provide 28.6 MCM/y towards those needs.

²² Here we distinguish between 'rights' in terms of a sense of entitlement, and legal rights. Obviously, once negotiations lead to allocations, regardless of how they are determined, each riparian has legal 'rights' to that water, even if the allocations were determined by 'needs'.

²³ It should be pointed out that not everyone's needs were considered in the Nile Agreements, which included only two of the 10 riparian states – Egypt and Sudan, both minor contributors to the river's flow. The notable exception to the treaty, and the one which might argue most adamantly for greater sovereignty, is Ethiopia, which contributes between 75%–85% of the Nile's flow.

Needs are the most prevalent criteria for allocations along arid or exotic streams outside of the Middle East as well. Allocations of the Rio Grande/Rio Bravo and the Colorado between Mexico and the USA are based on Mexican irrigation requirements; Bangladeshi requirements determined the allocations of the Ganges, and Indus negotiations deferred to Pakistani projects (although estimates of needs are still disputed and changing, particularly in these latter two examples).

One might speculate as to why negotiations move from rights-based to needs-based criteria for allocation. The first reason may have something to do with the psychology of negotiations. Rothman (1995), among others, points out that negotiations ideally move along three stages: the adversarial stage, where each side defines its positions, or rights; the reflexive stage, where the needs of each side bringing them to their positions is addressed; and finally, to the integrative stage, where negotiators brainstorm together to address each side's underlying interests. The negotiations here seem to follow this pattern from rights to needs and, occasionally, to interests. Where each negotiator may initially see him – or herself as Egyptian or Israeli or Indian, where the rights of one's own country are paramount, over time one must empathize to some degree to notice that even one's enemy, be he or she Sudanese, Palestinian, or Pakistani, requires the same amount of water for the same use with the same methods as oneself.

The second reason for the shift from rights to needs may simply be that rights are not quantifiable and needs are. We have seen the vague guidance that the 1997 Convention provide for allocations – a series of occasionally conflicting parameters which are to be considered as a whole. If two nations insist on their respective rights of upstream versus downstream, for example, there is no spectrum along which to bargain; no common frame of reference. One can much more readily determine a needs-based criterion – irrigable land or population, for example – and quantify each nation's needs. Even with differing interpretations, once both sides feel comfortable that their minimum quantitative needs are being met, talks eventually turn to straightforward bargaining over numbers along a common spectrum.

As a result of its relative success, needs-based allocations have been advocated in recent disputes as well, notably in and around the Jordan River watershed where riparian disputes exist not only along the river itself, but also over several shared groundwater aquifers. Gleick (1996) defines basic human needs, regardless of climate, as 50 l per capita per day for personal use alone (18.25 m³/y) and, in earlier work (Gleick, 1994) suggests 75 m³/y as appropriate minimum levels per capita for the Middle East. Shuval (1992) also argues for a minimum baseline allocation between Israel, West Bank Palestinians, and Jordan, based on a per capita allotment of 100 m³/y for domestic and industrial use plus 25 m³/y for agriculture. He adds 65% of urban uses for recycled wastewater, and advocates a series of water import schemes and desalination plants to provide the difference between regional supply and future demand.

Wolf (1993) likewise advocates a needs-based approach, but considers new sources such as recycled wastewater as separate issues. He plans for total urban needs of $100 \text{ m}^3/\text{y}$ per person, and extrapolates to the point in the future where *all* of the basin's 2500 MCM/y has to be allocated first to these needs, in other words when the regional population reaches 25 million, expected in the early part of the next century.

Relative hydrography versus chronology of use

As described earlier, generalized legal principles focus on some version of upstream versus downstream relations, whether defined in the extreme as absolute sovereignty versus absolute riverain integrity or versus historic rights, or more moderately as equitable use versus the obligation not to cause harm. In practice, the only situation in which there is still any ambiguity is along humid, under-developed rivers. Along arid or exotic streams, where some aspect of consumptive use is involved, there is very little debate – prior uses are *always* protected in the treaties which describe them (with only one exception, described later) and, in general, downstream needs are favored. Nine treaties do not address the issue at all, simply basing their allocations equally between two riparians.

Absolute principles: As noted earlier, the dispute which led to the disavowal of the legal principles of both absolute sovereignty and absolute riverain integrity was the Lac Lanoux case of 1957, which found, in short, that, "...the upstream State has a right of initiative...provided it takes into consideration in a reasonable manner the interest of the downstream State" (cited in MacChesney, 1959, p. 170).

The only situations in which absolute rights are codified in treaties are relating to some tributaries of international waterways in conjunction with broader boundary waters accords, always in a *quid pro quo* arrangement. Such is the case in only three of our case studies. Mexico and the USA each retain absolute sovereignty to some internal tributaries of the Rio Grande/Rio Bravo, for example. In a 1950 boundary waters agreement, of five tributaries of the Isar which flow from Austria to Bavaria, one is allowed to flow freely to Bavaria, two can be developed entirely by Austria, and two can be developed by Austria provided it allows minimum flows during winter months. Interestingly in this case, and perhaps adding incentive to a particularly creative agreement, Austria is upstream riparian on these tributaries to the Isar, then becomes a downstream riparian to Bavaria (Germany) after the Isar flows into the Danube, which bends back into Austria. In contrast, a 1925 accord on the streams which form the boundaries between Finland and Norway allocates each state half the boundary streams, but absolute sovereignty to each state over all the tributaries to those streams in which both banks are within one country.

Prior uses: In contrast to the extreme rarity with which absolute principles are codified, prior uses are regularly protected (with one major exception, described below), notably in every single boundary waters accord in our collection.

The entire focus of some treaties is on protecting existing

uses. All of the six existing treaties regarding the Nile, for example, are about protecting Egyptian uses in early years, later those of Egypt and Sudan. More often, a clause is included in a broader treaty, whether the focus is boundary demarcations, boundary waters, or water resources development, which protects existing uses. Peru continues to supply water to Ecuadorian villages, for example, as a part of their 1944 boundary demarcation. The boundary water accords between the USA and Canada, and between the USA and Mexico, all have prior use clauses included. A 1969 accord between Portugal, for Angola, and South Africa, for South-west Africa, which describes an elaborate river development project, includes 'humanitarian' allocations for human and animal requirements in South West Africa.

The supremacy of prior uses would not necessarily be surprising in those cases along arid or exotic streams, where investment in irrigation infrastructure has long relied on the knowledge of a stable supply, but even on humid region rivers, and even as water is divided proportionally, prior uses are generally protected. The boundary agreement between Russia and China along the Horgos River divides the water equally, but protects the uses of existing canals and one Chinese outpost. The three boundary waters accords between Austria, Hungary, and Czechoslovakia, all allocate each two signatories half the natural flow of shared rivers, "without prejudice to acquired (or existing) rights".

The only treaty in which existing uses were relinquished is the 1995 Israel/Palestine accord on West Bank and Gaza aquifers. Israel began tapping into these aquifers as long ago as 1955; before the accord they made up as much as 40% of Israel's renewable freshwater supply (Wolf, 1995). As two of the three West Bank aquifers naturally flow to Israel, and because they had been using the water longer, Israelis had been claiming prior rights in peace negotiations. By recognizing and quantifying Palestinian needs, and by agreeing to provide 28.6 MCM/y towards those needs, the 1995 accord represents the only case in which prior rights are explicitly relinquished.

Again, we might speculate on the inherent supremacy of prior uses. First, we have noted the shift in thinking from rights to needs – existing water use is a pretty clear expression of 'needs'. Second, treaties with clauses for water allocations generally come about in conjunction with a boundary delineation, a division of boundary waters, or an agreement over future river development. In each of these cases, those using the water are important constituents of the negotiating parties. In the former two cases regarding boundary waters, negotiations would probably be carried out in the political arena where the support of those living within a watershed would be vital to the success of an accord. In the case of river development, the technocrats who negotiate these treaties, usually from water agencies, are generally extremely aware of the needs of people living in a basin. In all cases, existing uses represent existing constituents, in contrast to hypothetical users or future generations – groups whose influence is particularly difficult to enlist.

Table 3
Prioritizing uses

	USA/Mexico Boundary Waters (1906, 1944)	USA/Canada Boundary Waters (1910)	Indus Waters Treaty (1960)	Mekong Agreement (1975)
Order of priorities:	(1) Domestic (2) Agriculture (3) Electric power (4) Other industry (5) Navigation (6) Fishing (7) Other beneficial uses	(1) Domestic and sanitary (2) Navigation (3) Power and irrigation	(1) Domestic (2) Non-consumptive (3) Agriculture (4) Hydro-power	(1) Domestic and urban uses (2) Other criteria from Helsinki Rules w/out priority

Upstream/downstream relations: Rights inherent in an upstream or downstream position are not explicitly claimed in any of the treaties in the collection. This should not be understood to suggest that the upstream/downstream relationship is ignored; only that when it is addressed, this is done implicitly.

In general, the downstream riparian is favored, or at least its allocations are protected, along arid and exotic streams. This is not to say that the downstream riparian receives more water, as this is not always the case – Mexico receives less water on both the Colorado and the Rio Grande/Rio Bravo than the USA – only that it is the allocations of the downstream riparian which are generally delineated and protected. Mexico, Egypt, Bangladesh, and Pakistan all have their needs defined and guaranteed in their respective treaties. This precedence probably comes about as a consequence of two earlier observations – that rights give way to needs and that prior uses are generally protected. As there is more, and generally older, irrigated agriculture downstream on an arid or exotic stream, and as agricultural practices predate more recent hydroelectric needs – the sites for which are in the headwater uplands – the downstream riparian would have greater claim whether measured by needs or by prior uses of a stream system.

The only treaties in which upstream allocations are delineated (except for the internal tributaries granted absolute sovereignty noted earlier), are on boundary waters agreements in humid regions. The 1956 boundary waters accord between Austria and Hungary grants the upstream state up to one third of the water of any of the covered river systems. (This is an interesting exception, for which I have no explanation – similar treaties between Austria and Czechoslovakia, and between Czechoslovakia and Hungary, have no such provision.) Three other humid boundary water agreements simply divide the waters equally – Austria/Hungary, Czechoslovakia/Hungary, and Finland/Norway. The only treaty which explicitly favors the upstream riparian, the 1925 accord on the Gash between Italy, for Eritrea, and the UK, for Sudan, not only grants upstream Eritrea all of the low flow and half of the moderate flow of the stream; Sudan also agreed to pay Eritrea a share of what was received for agricultural cultivation in the Gash Delta.

Prioritizing use: The Helsinki Rules list 11 hydrographic

and socio-political factors which ought to be taken into account as a whole in water allocations; the 1997 Convention lists seven, but does suggest that the “requirements of vital human needs” be given “special regard”. Neither set of parameters has been explicitly used in any treaty to derive allocations. The Helsinki Rules *are* listed, verbatim, only in the 1975 Mekong Agreement – and the criteria that a benefit-cost ratio for each proposed project be performed is added – but no allocations are derived.

Four treaties do differentiate between types of use (other than existing uses, described earlier), but they use many less criteria and each list is prioritized (see Table 3 – Prioritizing Uses). After listing the criteria from the Helsinki Rules, for example, the Mekong Agreement gives domestic and urban uses a preference. The two sets of boundary waters agreements, between the USA and Canada and the USA and Mexico, prioritize differently, probably due to the amount of water available along each border region: the former prioritizes by domestic and sanitary, navigation, and power and irrigation; the latter gives descending weight to domestic, agriculture, electric power, other industry, navigation, fishing, and other beneficial uses. The 1960 Indus Waters Treaty lists its order of priority as domestic, non-consumptive, agriculture, and hydro-power. Notably absent in all of these lists are any instream or other environmental requirements.²⁴

Economic criteria: beneficial uses and ‘baskets’ of benefits

As described earlier, economists suggest that water, like any scarce resource, should be allocated to its most efficient use. In practice, economic criteria have influenced water allocations only in the exception.

Beneficial uses: The one topic most affected by economic criteria is when principles of ‘beneficial’ uses are specifically defined, notably in treaties describing hydropower or river development projects. Of the 28 treaties in these two categories, five allocate water equally. Two of the 28 refer not to equal allocations, but to equal allocations of benefits – not at all the same thing. The boundary waters agreement

²⁴ This may be changing: at a 1997 meeting on international waters of Latin America, a representative of the Global Environmental Facility suggested that watershed needs start with the environmental needs at the delta and work backwards.

between the USA and Canada, for example, allocates water according to equal benefits, usually defined by hydropower generation. This results in the odd arrangement that power may be exported out of basin for gain, but the water itself may not. In the 1964 treaty on the Columbia, an arrangement was worked out where the USA paid Canada for the benefits of flood control and Canada was granted rights to divert water between the Columbia and Kootenai for hydropower. Likewise, the 1975 Mekong accord defines 'equality of right' not as equal shares of water, but as equal rights to use water on the basis of each riparian's economic and social needs. The relative nature of 'beneficial' uses is exhibited in a 1950 agreement on the Niagara, which provides a greater flow over the famous falls during 'show times' of summer daylight hours, when tourist dollars are worth more per cubic meter than the alternate use in hydropower generation.

While compensation for lost power generation or flooded land is fairly common, appearing in 10 of the 28 development treaties, compensation for water itself is not – only four of all 49 treaties have such provisions. In the first such accord, a 1910 agreement on Aden groundwater, Great Britain agreed to pay the Sultan of the Abdali 3000 rupees a month if the proposed wells went unmolested; otherwise the price dropped to 15 rupees per 100,000 gallons. In a 1926 accord on the Cunene River, no charge was made for water diverted for subsistence, but South Africa would pay unspecified fees to Portugal if the water were used for 'purposes of gain'. South Africa not only paid much of the development costs of the Lesotho Highlands project, but it also pays Lesotho outright for water delivered. In a slight twist, Great Britain agreed in 1926 to pay upstream Eritrea a share of its cultivation in the Gash delta – 20% of any sales over £50,000. Payments were discontinued when Great Britain took control of Eritrea in WWII.

The treaty with the most economic influence is the 1995 groundwater agreement between Israel and Palestine. While no payments are made outright for water, provisions are included to consider water markets in the future, and the two sides agree not to subsidize marketed water – moves long encouraged by economists to promote efficient use.²⁵

'Baskets' of benefits: In most of these treaties, water issues are dealt with alone, separate from any other political or resource issues between countries – water qua water. By separating the two realms of 'high' and 'low' politics, or by ignoring other resources which might be included in an agreement, some have argued, the process is either likely to fail, as in the case of the 1955 Johnston accords on the Jordan, or more often to achieve a sub-optimal development arrangement, as is currently the case on the Indus agreement, signed in 1960. Increasingly, however, linkages are being made between water and politics, or between water and other resources. These multi-resource linkages may offer more opportunities for creative solutions to be generated, allowing for greater economic efficiency through

a 'basket' of benefits. Some resources which have been included in water negotiations include:

Financial resources

An offer of financial incentives is occasionally able to circumvent impasses in negotiations. World Bank financing helped resolve the Indus dispute, while UN-led investments helped achieve the Mekong Agreement. Cooperation-inducing financing has not always come from outside of the region. Thailand helped finance a project in Laos, as did India in Pakistan, in conjunction with their respective watershed agreements. A provision of the Nile Waters Treaty has Egypt paying Sudan outright for water to which they both agreed Sudan had rights, but that it was not able to use.

Energy resources

One increasingly common linkage being made is that between water and energy resources. As noted above, in conjunction with the Mekong Agreement, Thailand helped fund a hydroelectric project in Laos in exchange for a proportion of the power to be generated. In the particularly elaborate 1986 Lesotho Highlands Treaty, South Africa agreed to help finance a hydroelectric/water diversion facility in Lesotho – South Africa acquired rights to drinking water for Johannesburg, and Lesotho receives all of the power generated. Similar arrangements have been suggested in China on the Mekong, Nepal on the Ganges, and between Syria and Jordan on the Yarmuk.

Political linkages

Political capital, like investment capital, might likewise be linked to water negotiations, although no treaty to date includes such provisions. This linkage might be done implicitly, as for example the parallel but interrelated political and resource tracks of the Middle East peace talks, or explicitly, as talks between Turkish acquiescence on water issues have been linked in a *quid pro quo* with Syrian ties to Kurdish nationalists.

Data

As water management models become more sophisticated, water data are increasingly vital to management agencies. As such, data itself can be used as a form of negotiating capital. Data-sharing can lead to breakthroughs in negotiations – an engineering study allowed circumvention of an impasse in the Johnston negotiations when it was found that Jordan's water needs were not as extensive as had been thought, allowing for more room in the bargaining mix. In contrast, the lack of agreed-to criteria for data in negotiations on the Ganges has hampered progress over the years.

Data issues, when managed effectively, can also allow a framework for developing patterns of cooperation in the absence of more contentious issues, particularly water allocations. For one, data gathering can be delegated to a trusted third party or, better, to a joint fact-finding body made up of representatives from the riparian states. Perhaps

²⁵ Water subsidies within each party's territory are not covered by the agreement and will probably continue.

the best example of this internationally is on the Mekong, where the Mekong Committee's first 5-year plan consisted almost entirely of data-gathering projects, effectively both precluding data disputes in the future, and allowing the riparians to get used to cooperation and trust.

Water-related 'baskets'

Some of the most complete 'baskets' were negotiated between India and Nepal in 1959 on the Bagmati and the Gandak, and in 1966 on the Kosi (all tributaries of the Ganges). These two treaties include provisions for a variety of water related projects, including irrigation/hydropower, navigation, fishing, related transportation, and even afforestation – India plants trees in Nepal to contain downstream sedimentation. While Nepal has expressed recent bitterness to both these accords, the structures of these treaties are good examples of how broader 'baskets' can allow for more creative solutions.

The unique local setting

While most of the debate in the realm of customary law has been over trying to accommodate as many concerns as possible in an attempt to find generalized principles for all of the world's international water, riparians of these basins have in the meantime been negotiating agreements which focus on specifically local concerns and conditions. Further distinguishing the generalized principles from specific practices, while many of these treaties incorporate particularly local issues, they often include a clause which explicitly disavows the treaty as setting an international precedent. The 1950 accord on Austria/Bavaria boundary waters is typical: "Notwithstanding this agreement", it reads, each State maintains its "respective position regarding the legal principles of international waters". The most recent agreement in the Database, the 1996 Ganges Agreement, includes the similar provision that the parties are "desirous of finding a fair and just solution without...establishing any general principles of law or precedent".

The uniqueness of each basin, whether hydrological, political, or cultural, stands out in the creativity of many of the treaties. The 1969 accord on the Cunene River allows for 'humanitarian' diversions solely for human and animal requirements in Southwest Africa as a part of a larger project for hydropower. Water loans are made from Sudan to Egypt (1959), and from the USA to Mexico (1966). Jordan stores water in an Israeli lake while Israel leases Jordanian land and wells (1994), and India plants trees in Nepal to protect its own water (1966). In a 1964 agreement, Iraq 'gives' water to Kuwait, 'in brotherhood', without compensation. In contrast, a 1957 agreement between Iran and the USSR has a clause which allows for cooperation in identifying corpses found in their shared rivers.

The changes of local needs over time are seen in the boundary waters between Canada and the USA. Even as the boundary waters agreements of 1909 were modified in

1941 to allow for greater hydropower generation in both Canada and the United States along the Niagara to bolster the war effort, the two states nevertheless reaffirmed that protecting the "scenic beauty of this great heritage of the two countries" is their primary obligation. As noted above, the 1950 revision continued to allow hydropower generation, but allows a greater minimum flow over the falls during summer daylight hours, when tourism is at its peak.

Cultural geography can overwhelm the capacity of generalized principles as well. In 1997 discussions among the riparians of the Euphrates basin, Syrians objected strenuously to proposals for water pricing. This led to a temporary impasse until it was explained by an outside observer that some Islamic legal interpretation forbids charging money for water itself; the term was modified to 'tariff', to represent costs only for storage, treatment, and delivery, and discussions were able to proceed.

In what will no doubt become a classic modification of the tenets of international law, Israelis and Jordanians invented legal terminology to suit particularly local requirements in their 1994 peace treaty. In negotiations leading up to the treaty, Israelis, arguing that the entire region was running out of water, insisted on discussing only water 'allocations'; that is, the future needs of each riparian. Jordanians, in contrast, refused to discuss the future until past grievances had been addressed – they would not negotiate 'allocations' until the historic question of water 'rights' had been resolved.

There is little room to bargain between the past and the future, between 'rights' and 'allocations'. Negotiations reached an impasse until one of the mediators suggested the term 'rightful allocations' to describe simultaneously historic claims and future goals for cooperative projects – this new term is now immortalized in the water-related clauses of the Israel–Jordan Treaty of Peace.

Conclusions

The major barrier to water's role as an agent of peaceful relations is the lack of a widely accepted measure for equitably dividing shared water resources. This article has explored the generalized principles for delineating water allocations, as manifested in customary water law and the efficiency based context of economic theory, as well as how allocations are delineated in practice, as exhibited in the 49 treaties specifying water allocations within the Transboundary Freshwater Dispute Database.

In describing the current state of international water law, most recently exhibited in the 1997 UN Convention, the authors found a history of attempts at defining general principles applicable to the roughly 261 international waterways of the world. Although the UN Convention has important components towards fostering peaceful relations, it is somewhat vague and even contradictory in its guidelines for the process of allocating international water resources. The document advises 'reasonable and equitable' use, and offers a series of considerations, which ought to be taken into account. But it

also institutionalizes an inherent conflict between the 'rights-based' positions of the upstream riparian—the principle of equitable use, sometimes argued in lieu of absolute sovereignty – and the downstream riparian – the obligation not to cause significant harm, a refined protection of historic rights. Little room for bargaining is left between this rights-based opposition between hydrography and chronology.

Economic theory eschews both upstream and downstream views in favor of the concept of basinwide efficiency. Two economic approaches were described – the social planner and the water market. Each, it has been argued, could contribute an effective measure to the most efficient distribution either of water itself, or of the benefits brought about by its cooperative use. Objections have been raised, however, to the equity and justice of 'efficient' distributions.

In its latter part, the article has described the practice of international water allocations as exemplified in 49 treaties that actually address this question. In the author's reading of these treaties, surprisingly little explicit influence of the generalized principles, whether legal or economic, is to be found. Rather, each treaty shows a sometimes exquisite sensitivity to the unique setting and needs of each basin.

The trends identified by the author generally included the following:

- A tendency for a shift in positions to occur during negotiations, from 'rights-based' criteria, whether hydrography or chronology, towards 'needs-based' values, based on e.g., irrigable land or population. It was speculated that this shift may be based on the psychology of negotiations, or may occur simply because needs are easier to quantify than rights.
- In the inherent disputes between upstream and downstream riparian and existing and future uses, it was often found that the needs of the downstream riparian were more often delineated – upstream needs were mentioned only in boundary waters accords in humid regions – and existing uses were generally protected. It was also found that specific uses were occasionally prioritized, although instream and environmental requirements were ignored in these priorities.
- Economic benefits have not been explicitly used in allocating water, although economic principles have helped guide definitions of 'beneficial' uses and have suggested 'baskets' of benefits, including both water and non-water resources, for positive-sum solutions.
- The uniqueness of each basin is repeatedly suggested, both implicitly and explicitly, in the treaty texts. The generalized guidelines offered for allocations, whether based on legal or economic equity, have difficulty capturing the geographic uniqueness of each of the world's international waterways, whether hydrological, political, or cultural aspects. As Gilbert White has been arguing for at least 40 years – "if there is any conclusion that springs from a comparative study of river systems, it is that no two rivers are the same" (White, 1957, p. 160).

These conclusions suggest a middle ground between the absolute uniqueness of each basin (which implies the futility of searching for common principles) and the feasibility of delineating clear and authoritative guiding principles for allocations which would work like an algorithm for all of the international waters of the world. What Wescoat (personal communications, 1998) refers to as "patterns of practice", suggest that, now that the Convention has been approved, it may be time to shift the emphasis from defining generalized principles to encouraging treaty negotiations for each international basin – there are 'only' about 261 international watersheds. Despite the inherent difficulties, treaties are not only the best representation of local needs and settings, but they also carry the highest priority in international law. By encouraging local negotiations, global political issues could also be better avoided. Why should China's concerns over sovereignty interfere with Belgium, France and the Netherlands developing cooperative integrated management over the Schelde? And in turn, why should the Schelde be the model for the Euphrates, where the direction for international management seems to be toward each riparian being responsible for an agreed-to quantity and quality crossing each respective boundary at agreed-to times?

As Wescoat (1992) has argued in his review of the ILC rules, "a searching examination of past agreements might have underscored the importance of historical and geographical perspectives on international water problems". The author believes it has.

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Appendix A

Appendix 1 gives the International treaties which delineate water allocations.

Appendix A. International treaties which delineate water allocation

Main/sub-basin(s)	Parties/date of treaty	Title of treaty	Method for water allocations ^a	Comments ^a
Boundary waters agreements				
Boundary waters between Canada and USA	Great Britain (for Canada) USA 1/11/1910	Treaty between Great Britain and the United States relating to boundary waters and boundary questions	Existing uses protected; equal shares of benefits (not necessarily of water). Order of precedence for uses: domestic and sanitary; navigation; power and irrigation	Niagara: No diversion above Falls; 20,000 cfs to USA and 36,000 cfs to Canada for hydropower. St. Mary and Milk: Both rivers treated as single unit, with overall equal apportionment to each party; Canada retains prior rights to minimum 500 cfs on St. Mary during irrigation season, USA does likewise on Milk.
Boundary waters between Mexico and USA/Colorado, Tijuana, Rio Grande (Rio Bravo)	Mexico, USA 5/21/1906 2/3/1944	Utilization of water of Colorado and Tijuana Rivers and of the Rio Grande (Rio Bravo)	Full rights to some tributaries, partial rights (by thirds) to others, half rights to main stem of boundary rivers. Minimum flows guaranteed to cross-boundary streams. Uses prioritized by: domestic, agriculture, electric power, other industry, navigation, fishing, other beneficial uses.	Rio Grande: 1906 treaty assures Mexico 60,000 acre-feet/y, mostly in summer, according to set schedule. 1944 treaty allocates full rights to some tributaries, partial rights (by thirds) to others, half rights to main stem. Any shortages due to drought can be made up in following cycle. Colorado: Mexico guaranteed minimum flow of 1,500,000 acre-feet/y Tijuana: Commission agrees to study "equitable distribution". Allocations "are not to be construed as a recognition of any claims to said waters"

^a All units are reported as in original documents. One gallon = 3.61 l; one acre-foot = 1233 m³; one cfs (cusecs) = 0.0283 m³/s (cumecs).

Main/sub-basin(s)	Parties/date of treaty	Title of treaty	Method for water allocations ^a	Comments ^a
Colorado	Mexico, USA 8/24/1966	Exchange of notes constituting an agreement concerning the loan of waters of the Colorado River for irrigation of lands in the Mexicali Valley	USA "loans" water for irrigation to Mexico during one dry year in exchange for value of lost power generation.	USA provides 40,535 acre-feet above 1944 Treaty allocations during September and December 1966 (after an especially dry year), but retains an equal amount the following year (or over three years if low flow). Mexico pays market value for lost power generation at Hoover and Glen Canyon dams. Treaty explicitly mentions that no precedent is being set.
Colorado	Mexico, USA 9/30/1973	Mexico-US Agreement on the permanent and definitive solution to the salinity of the Colorado River (Minute #242)	Reaffirms 1944 agreement for 1,500,000 acre-feet/y to flow to Mexico, but describes salinity and quality of flow. Also restricts some groundwater pumping of shared aquifers.	
Boundary waters between Austria and Bavaria/Blaserbach, Dollmannbach, Durrach, Kesselbach (Danube)	Austria Bavaria 10/16/1950	Agreement between the Austrian Federal Government and the Bavarian State Government concerning the diversion of water in the Rissbach, Durrach and Walchen Districts	Five tributaries to Isar divided: one allowed to flow freely to Bavaria, two can be freely developed by Austria, and two can be developed by Austria, provided minimum flows to Bavaria between August and March.	Austria is upstream on all these tributaries to Isar, but becomes a downstream riparian when Isar flows into the Danube and back into Austria. Upstream/downstream relationships seem not so valid—each tributary divided uniquely, but all follow basin plan. Allocations can be modified if dams are built. "Notwithstanding this agreement," each maintains its "respective position regarding the legal principles of international waters."

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Main/sub-basin(s)	Parties/date of treaty	Title of treaty	Method for water allocations ^a	Comments ^a
Boundary waters between Austria and Czechoslovakia/Danube	Austria, Czechoslovakia 12/7/67	Treaty between the Republic of Austria and the Czechoslovak Socialist Republic concerning the regulation of water management questions relating to frontier waters	“Existing water rights in respect of frontier waters and the obligations connected therewith shall remain unaffected;” all others to be worked out within States or through Commission.	
Boundary waters between Austria and Hungary	Austria, Hungary 4/9/1956	Treaty between the Hungarian People's Republic and the Republic of Austria concerning the regulation of water economy questions in the frontier region	Rights to use of 1/2 of natural (not enhanced by artificial means) flow to each party from rivers which flow along the boundary; “without prejudice to acquired rights;” upstream state of watercourses which intersect boundary may not decrease flow by more than 1/3; no development without joint approval.	
Boundary waters between Czechoslovakia and Hungary/Danube, Tisza	Czechoslovakia, Hungary 4/16/1954	Agreement between the Czechoslovak Republic and the Hungarian People's Republic concerning the settlement of technical and economic questions relating to frontier watercourses	Each State has rights to half the natural (excluding artificially increased) discharge, “without prejudice to acquired rights,” of frontier watercourses; no development which might affect discharge or the bed.	
Boundary waters between Iran and Iraq/Tigris	Iran, Iraq 12/26/1975	Agreement between Iran and Iraq concerning the use of frontier watercourses	Equal parts	Flows of the Bnava Suta, Qurahtu, and Gangir rivers are divided equally. Flows of the Alvend, Kanjan Cham, Tib, and Duverij are divided based on a 1914 commission report on the Ottoman/Iranian border “and in accordance with custom.”
Euphrates (?)	Iraq, Kuwait 2/11/1964	Agreement between Iraq and Kuwait concerning the supply of Kuwait with fresh water	Iraq agrees to supply Kuwait with 120 million imperial gallons per day without compensation, and to discuss additional needs if necessary.	Water source is unspecified in the agreement.

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Main/sub-basin(s)	Parties/date of treaty	Title of treaty	Method for water allocations ^a	Comments ^a
Ganges	Bangladesh, India 11/5/1977 12/1996	Treaty between the Government of the Republic of India and the Government of the People's Republic of Bangladesh on sharing of the Ganga/Ganges water at Farakka	Schedule is established for dry months – January 1 – May 31 which allocates the flow at Farakka: flow of 70,000 cusecs or less – 50% to India, 50% to Bangladesh; 70,000–75,000 cfs – 35,000 cfs to Bangladesh, rest to India; 75,000 cfs or more – 40,000 cfs to India, rest to Bangladesh.	1977 agreement was only to last for five years. Short-term agreements reached in 1982 and 1985; the latter lapsed in 1988. A final agreement was reached December 1996.
Gash	Italy (Eritrea) and United Kingdom (Sudan) 6/12/1925, 4/8/1951	Notes exchanged between the United Kingdom and Italy respecting the regulation of the utilisation of the waters of the River Gash; and 1951 amending letters	Eritrea can divert all water from a flow up to 5 m ³ /s, about half the flow above 5 m ³ /s, and a maximum of 17 m ³ /s, or a total of 65 MCM/yr. The rest flows to Sudan.	Sudan paid Eritrea a share of what was received for cultivation in the Gash Delta–20% of any sales over L50,000 (payments discontinued with British control of Eritrea). One of few agreements which explicitly favors upstream riparian.
Ili/Horgos	China, Russia 6/12/1915	Protocol between China and Russia for the delimitation of the frontier along the River Horgos	Upper reaches: Prior rights for Chinese outpost; lower reaches: prior rights for existing canals, rest to be shared equally.	China "binds itself" to withdraw only the water necessary for one outpost in upper reaches (within Chinese territory), otherwise, water will go to existing canals with remainder to be shared equally.
Pasvik (Patsjoki)/Pasvik (Patsjoki), Jakobselv (Vuoremajoki)	Finland, Norway 2/14/1925	Convention between the Kingdom of Norway and the Republic of Finland concerning the waters of the Pasvik (Patsjoki) and the Jakobselv (Vuoremajoki)	Equal shares of shared boundary waters, absolute sovereignty over tributaries where both banks are within single territory.	Jakobselv (Vuoremajoki) and parts of Pasvik (Patsjoki) form boundary – the waters from these are divided equally. Absolute rights for tributaries of the Pasvik (Patsjoki) which have both banks in one state are retained by that state.

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Main/sub-basin(s)	Parties/date of treaty	Title of treaty	Method for water allocations ^a	Comments ^a
Rhine/Lake Constance	Austria, Germany, Switzerland 4/30/1966	Agreement regulating the withdrawal of water from Lake Constance	Requires notification and agreement for withdrawals over 750 l/s within the catchment area, or 1,400 l/s outside.	Must notify of withdrawals and "afford one another good time to express their views," and to submit to arbitration if disagreement. "Withdrawals...shall not be deemed to justify any claim to the provision of water in a specific volume or of a specific quality."
Roya	Italy, France 10/14/1972	Franco-Italian convention concerning the supply of water to the Commune of Menton	Italy allows 400 l/s withdrawal from alluvial aquifer for French town; Italian town can tap into delivery pipeline for 100 l/s.	Italian government grants 70-year concession to Menton to be governed by Italian law on water-related issues. Menton deposits 10 million lire for security against concession.
West Bank and Gaza Aquifers	Israel, Palestine 9/28/1995	Israeli-Palestinian Interim Agreement	Population and consumption patterns – Israel recognizes Palestinian water rights, and agrees to provide 28.6 MCM/y additional water towards future Palestinian needs of 70–80 MCM/y.	Final allocations and rights to be determined in final status negotiations. Interim accord marks, first time prior rights relinquished in an agreement, first joint management of aquifer systems, and first treaty which allows for future market mechanism, provided water is not subsidized.
Zarumilla	Ecuador, Peru 5/22/1944	Declaration and exchange of notes concerning the termination of the process of demarcation of the Peruvian-Ecuadorian frontier	Prior rights for Ecuadorian villages	"Peru undertakes...to guarantee the supply of water necessary for the life of the Ecuadorian villages on the right bank of the so-called old bed of the river Zarumilla..." in conjunction with boundary delineation

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Main/sub-basin(s)	Parties/date of treaty	Title of treaty	Method for water allocations ^a	Comments ^a
River development agreements				
Araks, Atrak	Iran, USSR 8/11/1957	Agreement between Iran and the Soviet Union for the joint utilisation of the frontier parts of the rivers Araks and Atrak for irrigation and power...	50% of all potential water and power resources on the shared portions of the two rivers.	Provides for "separate and independent division and transmission of water and power in each party's territory, "along with joint data-gathering. Also, each party has rights to potential even "if the activities of one of the parties...are slower than those of the other."
Boundary waters between Canada and USA/Columbia, Kootenai	Canada, USA 9/16/1964	Treaty relating to cooperative development of the water resources of the Columbia River Basin (with annexes)	Equal share of benefits – cooperative management for flood control and hydropower- Water may not be diverted out-of-basin (except for some specified in treaty), but power may (for compensation	Equal share of benefits from power generation. USA pays Canada for benefits of flood control (payment can be in cash or in electric power) and, in 1964 Exchange of Notes, agrees to pay US\$254,000,000 for entitlement. Canada granted diversions from Kootenai to Columbia and from Columbia to Kootenai, provided minimum flows are maintained.
Cunene	Portugal (Angola), South Africa (Southwest Africa) 7/2/1926	Agreement between the Government of the Union of South Africa and the Government of the Republic of Portugal regulating the use of the water of the Cunene River	Up to half of flood water may be diverted to Southwest Africa from above dam	Dam to be constructed in Portuguese territory with shared cost. No charge for diversion if for subsistence, but payment would be made to Portuguese government if water used for "purposes of gain."

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Main/sub-basin(s)	Parties/date of treaty	Title of treaty	Method for water allocations ^a	Comments ^a
Cunene	Portugal (Angola), South Africa (Southwest Africa) 1/21/1969	Agreement between the Government of South Africa and the Government of Portugal in regard to the first phase of development of the water resources of the Cunene River Basin	Diversion solely for water for human and animal requirements in South West Africa and initial irrigation in Ovamboland, limited to 1/2 of flow or 6 m ³ /s.	“Humanitarian” part of larger project for hydropower. South Africa pays for water diversion and compensation to Portugal for land flooded as a result of dam (also royalties for hydropower generated).
Douro	Portugal, Spain 8/11/1927	Convention between Spain and Portugal to regulate the hydro-electric development of the international section of the River Douro	Roughly equal sections of the international stretch of the Douro are allocated to each for development. No diversions permitted, except “for reasons of public health,” and only with joint agreement.	Separate, but equal and coordinated development.
Ganges/Bagmati, Gandak	India, Nepal 12/4/1959	Agreement between His Majesty's Government of Nepal and the Government of India on the Gandak irrigation and power project	Diversion for project – irrigation and power generation – are laid out in a monthly schedule of water requirements, with about 60% to Nepal (5,760–16,060 cfs) and 40% to India (3,690–14,600 cfs). Nepal retains rights to irrigate with any water above these project requirements.	Broad “basket” of benefits to each side: land acquisition, power generation, capital resources (primarily from India), irrigation water, and transportation facilities.
Ganges/Kosi	India, Nepal 12/19/1966	Amended agreement between His Majesty's Government of Nepal and the Government of India concerning the Kosi project	Nepal retains right to divert upstream water, “as may be required from time to time.” India has right to regulate balance.	Broad “basket” of benefits, including irrigation/hydropower project, navigation, fishing, and afforestation (India plants trees in Nepal to contain sedimentation).

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Main/sub-basin(s)	Parties/date of treaty	Title of treaty	Method for water allocations ^a	Comments ^a
Indus	India, Pakistan 5/4/1948	Inter-dominion agreement between the Government of India and the Government of Pakistan, on the canal water dispute between East and West Punjab	Rights are not determined, but India agrees, "without prejudice to its legal rights, "to reduce flows of tributaries at a rate which would allow Pakistan to develop alternative sources.	India was to reduce flow from upper Indus basin rivers progressively, to allow Pakistan to "develop areas where water is scarce and which were under-developed in relation to Parts of West Punjab." Pakistan agreed to pay for some water sources.
Indus,	India, Pakistan, World Bank 9/19/1960	The Indus waters treaty	River divided geographically: three eastern tributaries to India, three western tributaries to Pakistan.	Considerations were made for some withdrawals in other state's tributaries, in order of priority: domestic, non-consumptive, agriculture, hydro-power. Agreement was phased in and India paid for some Pakistani works deemed "replacement."
Jordan/Yarmuk	Jordan, Syria 6/4/1953	Agreement between the Republic of Syria and the Hashemite Kingdom of Jordan concerning the utilization of the Yarmuk waters	Dam would be built to guarantee 10 m ³ /s minimum flow to Jordan, about 7/8 of natural flow of river. Syria relinquishes rights to tributaries between dam and 250m contour, receives 75% of hydropower.	Jordan was to cover 95% of costs, and provide 80% of workforce; Syria the remainder. Dam was never built, although plans were said to have been revived in August 1996.
Jordan	Israel, Jordan, Lebanon, Syria Finalized 1/1/1956, never ratified	Johnston Accord	Allocations of Jordan based on survey of irrigable land within basin: Israel – 31%; Jordan – 56%; Lebanon – 3%; Syria – 10%.	Allocations were based on irrigable land within basin; then each could do what it wished with water. Each tributary had one state without designated flow, to accommodate fluctuating supply. Accord was never ratified for political reasons.

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Main/sub-basin(s)	Parties/date of treaty	Title of treaty	Method for water allocations ^a	Comments ^a
Jordan/Yarmuk, shared aquifers	Israel, Jordan 10/26/1994	Treaty of peace between the State of Israel and the Hashemite Kingdom of Jordan	Allocations of Yarmuk and Jordan based on Johnston accord; agreed in conjunction with joint development projects. Water from shared aquifers allocated on basis of prior use.	“Rightful allocations” divide waters on the basis of historic rights plus future projects. Creative management: land and water historically used by Israel leased from Jordan; in absence of storage facility, Yarmuk water “loaned” to Israel in summer, returned to Jordan from Jordan River during winter.
Mekong/Lower Mekong	Cambodia, Laos, Thailand, Vietnam 1/31/1975	Joint declaration of principles for utilization of the waters of the lower Mekong basin	Allocations are based, verbatim, on eleven parameters of 1966 Hetsinki Rules definition of “reasonable and equitable shares” plus addition of benefit-cost ratio of each project.	“Equality of right” does not mean equal shares of water, but equal right to use water on basis of economic and social needs. Domestic and urban uses should have a preference; existing uses are protected. All parties must agree to any out-of-basin transfers. Groundwater with hydrologic connection to main stream is covered by agreement. Agreement based on 1957 establishment of Mekong Committee – renewed in 1995.

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Main/sub-basin(s)	Parties/date of treaty	Title of treaty	Method for water allocations ^a	Comments ^a
Nile/Atbara Nile/Semliki, Isango	Great Britain, Italy – 1891, 1925 Great Britain, Ethiopia – 1902 Great Britain, Congo – 1906	Series of protocols, agreements, and exchanges of notes	“Prior hydraulic rights” – Great Britain made agreements with upstream riparians to allow Nile tributaries to flow uninterrupted to Sudan and Egypt. Water for “subsistence” of local populations may be used, and existing uses are protected.	Agreements required any upstream development be “in consultation” with Great Britain. 1925 exchange of notes offers British support for Italian concession for railway in Eritrea, Ethiopia, and Somaliland, and recognition of “exclusive character of Italian economic influence” in area to be covered by railway, in exchange for Great Britain gaining concession to build barrage at Lake Tana and, recognizing the “prior hydraulic rights of Egypt and the Sudan,” an agreement by Italy not to modify the flow.
Nile	Egypt, United Kingdom 5/7/1929	Exchange of notes between His Majesty’s Government in the United Kingdom and the Egyptian Government in regard to the use of the waters of the River Nile for irrigation purposes (Nile Waters Agreement)	Prior rights – restricts amount Sudan may use in order to guarantee to Egypt the water needed for existing agriculture.	Entirely protects existing, downstream uses – no irrigation or power works are to be built on the river which would reduce the quantity of water arriving in Egypt. If Egypt were to develop projects in Sudan to enhance flow, agreement would have to be reached beforehand with local authorities, although Egypt would retain direct control of such works.

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Main/sub-basin(s)	Parties/date of treaty	Title of treaty	Method for water allocations ^a	Comments ^a
Nile	Egypt, Sudan 11/8/1959	Agreement between the Government of the United Arab Republic and the Government of Sudan	Prior rights ("present acquired rights") for natural flow, plus benefits of Aswan Dam divided, based on population, on a ratio of 14.5 to Egypt, 7.5 to Sudan. Water from future projects, and the costs borne, would be divided equally.	If benefits of projects are greater than expected, they are to be divided equally. Egypt paid 15 million Egyptian pounds to Sudan for compensation for flooding and relocation from Aswan Dam; Sudan was to loan 1.5 BCM/yr to Egypt until 1977. Both states agreed to develop joint position before negotiating with any other riparian.
Orange/Senqu	Lesotho, South Africa 11/7/1986	Treaty on the Lesotho Highlands water project between the Government of the Kingdom of Lesotho and the Government of the Republic of South Africa	Lesotho agrees to provide increasing water delivery to South Africa, from 57 MCM/yr in 1995 until 2208 MCM/yr after 2020. Lesotho receives hydropower and capital payment from project.	A boycott of international aid for apartheid South Africa required that the project be financed, and managed, in sections. The water transfer component was entirely financed by South Africa, which would also make payments for the water which would be delivered. The hydropower and development components were undertaken by Lesotho, which received international aid from a variety of donor agencies, particularly the World Bank.
<i>Single project agreements</i> Aden groundwater	Great Britain, Sultan of Adali (Aden) 4/11/1910	Terms of a convention regarding the water supply of Aden between Great Britain and the Sultan of the Adali	Great Britain buys groundwater from Sultan of the Adali.	Sultan gives Great Britain land in perpetuity and guarantees safety of headworks. Great Britain agrees to pay 3000 rupees/month if works unmolested; otherwise 15 rupees/100,000 gallons. Early groundwater agreement.

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Main/sub-basin(s)	Parties/date of treaty	Title of treaty	Method for water allocations ^a	Comments ^a
Ebro/Lake Lanoux, Font-Vive, Carol	France, Spain 7/12/1958 (revised 1/27/1970)	Agreement between the Government of the French Republic and the Spanish Government relating to Lake Lanoux	France diverts water out-of-basin, then tunnels same volume back before Carol reaches boundary; guarantees minimum 20 MCM flow timed for Spanish irrigation.	French hydropower project which moves water out-of-basin, then returns through tunnel before boundary. Arbitration for this project led to an important international precedent when a Tribunal ruled in 1957 that "territorial sovereignty... must bend before all international obligations, "effectively negating the water rights doctrine of "absolute sovereignty," while admonishing downstream state from the right to veto "reasonable" upstream development, negating the "natural flow" principle.
Indus/Sirhind Canal	Great Britain, Patiala, Jind, Nabha 8/12/1903	Final working agreement relative to the Sirhind canal between Great Britain and Patiala, Jind and Nabha	Available supply, and development costs, divided by percentage: Patiala – 83.6; Nabha – 8.8; Jind – 7.6. British villages receive water sufficient to irrigate the same proportion of its lands as other villages nearby.	If the flow allocations cannot be met, the engineer may reduce flows proportionally, or may deliver full proportion to one, then shut off entirely while the others receive their full allotments.
Näätämo/Näätämo, Gandvik	Finland, Norway 4/25/1951	Agreement between the Governments of Finland and Norway on the transfer from the course of the Näätämo (Neiden) River to the course of the Gandvik River	Water diverted between basins for power generation in Norway, which agrees to compensate Finland for lost water power.	Fish habitat and timber transport are also described.
Niagara	Canada, USA 5/20/1941; 10/27/1941	Exchange of notes between the Government of the United States and the Government of Canada constituting an arrangement concerning temporary diversion for power purposes of additional waters of the Niagara river above the Falls	5,000 cfs additional diversion to the USA and 3,000 cfs to Canada agreed to for hydropower generation during war effort; raised an additional 7,500 cfs to USA and 6,000 cfs to Canada in addendum.	Despite war effort, protecting the "scenic beauty of this great heritage of the two countries" is described as the primary obligation of the two countries.

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Main/sub-basin(s)	Parties/date of treaty	Title of treaty	Method for water allocations ^a	Comments ^a
Niagara	Canada, USA 2/27/1950	Treaty between the United States of America and Canada relating to the uses of the waters of the Niagara River	Equal amount of water for power generation, and equal share of cost, to each country. Minimum flow of river delineated	Benefits of tourism versus hydropower: 100,000 cfs minimum during "show times" at Falls – summer daylight hours' otherwise 50,000 cfs. "Primary obligation to preserve and enhance scenic beauty..."

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