

Governance Mechanisms to Address Flow Variability in Water Treaties

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1. Introduction

Concerns about variability in the flow of transboundary waters, and the development of institutional mechanisms to ensure that variability is cooperatively managed, are not new. As early as 1863, the Netherlands and Belgium made allocation of the Meuse's water conditional on annual availability. More recently diplomats, lawyers, and hydrologists have focused on generalized guidelines and principles for governing flow variability in internationally shared waters. For example, the principle of equitable utilization included in the 1997 UN Convention on the Law of the Non-navigational Uses of International Watercourses was drafted with intentional ambiguity in order to allow flexibility to meet unexpected changes in water availability and other conditions (McIntyre, 1998). The

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inclusion of guidelines to respond to extreme conditions and the recognition of ecological flow in the latest Berlin Rules on Water Resources, initiated by the International Law Association in 2004, is another example. The expectation of increasing flow variability due to climate change has furthered calls by many experts to include flexible mechanisms into treaties in order to further the efficient management of transboundary waters (Goldenman, 1990).

Research on conflict related to transboundary waters has suggested that one cause of escalated tensions can be a change in resource environments which outpaces the capacity of existing institutions to deal with that change (Yoffe et al., 2003). Mechanisms that allow flexibility in treaty implementation, it is thus argued, have the capacity to defuse the potential conflict between states when resource availability changes.

While the importance of considering flow variability in shared-water agreements is acknowledged, numerous in-depth case studies have revealed that many agreements still lack mechanisms to handle changes in resource availability (Fischhendler, 2004; Goldenman, 1990). This implies that there are barriers impeding organizational adaptation; some of which may be inherent to the difficulties of building cooperative institutions while others may be political or technical.

The present study aims to partially fill this gap by examining the use and potential use of variability management mechanisms in transboundary water law. It does this by first to frame an analysis of the commonality of mechanisms, and their variation, to address flow

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variability in 50 treaties signed between 1980 and 2002. Finally, it presents a rudimentary model for the choice of governance mechanisms to address variability, discussing the likely advantages and disadvantages of each.

2. The State of Variability Management

In order to ascertain if and how transboundary water treaties address resource variability, a content analysis of available agreements signed since 1980 was undertaken and placed within the framework presented above. For the analysis, a treaty is considered to be “an international agreement concluded between States in written form and governed by international law, whether embodied in a single instrument or in two or more related instruments and whatever its particular designation” (United Nations, 1969, Article 2). To limit the analysis to those of primary relevance to flow variability, only treaties concerning “water as a scarce or consumable resource, a quantity to be managed, or an ecosystem to be improved or maintained” are included in the analysis, while those dealing “only with boundaries, navigation or fishing rights” were excluded (Hamner and Wolf, 1998, p. 158).

The Transboundary Freshwater Dispute Database (TFDD) is the most comprehensive source of agreements meeting these definitions and criteria. Of the more than 400 agreements included in the TFDD, 118 were signed between 1980 and 2002, the last year the database was updated. The full-text of 99 of these agreements is available for analysis. Of those, 21 did not satisfy the criteria outlined above and are therefore not considered.

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The remaining 78 documents were categorized as primary agreements, protocols to primary agreements, or amendments to primary agreements. If an amendment or protocol was related to or replaced a primary agreement included in the sample, it was considered jointly with the primary agreement. Amendments and protocols related to primary agreements signed prior to 1980 were excluded. In addition, two primary agreements, which were replaced by later agreements, were excluded. In this way we reduced redundancy and limited the analysis to agreements actually in force. Of the remaining agreements, two were broad conventions rather than basin specific agreements. While conventions can set basic norms and principles on handling flow variability, they do not directly solve concrete issues between states. Their basic purpose thus differs from the other agreements considered here, and they are therefore excluded. In total then there were 50 basin specific agreements for analysis.

Flow variability is explicitly mentioned in the text of 34 of the 50 treaties. The fact that 68% of the agreements explicitly mention flow variability strongly indicates the degree to which the issue is an important element in transboundary water management.

Furthermore, even some of the agreements without specific reference to variability implicitly include mechanisms for its management. In fact, of the 16 agreements, which do not explicitly mention flow variability, 7 are framework treaties laying down general principles of cooperation between states or creating joint management institutions, and another 8 deal exclusively with water quality. As our analysis will show, even these agreements which would not generally be assumed to concern themselves with variability

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also frequently incorporate mechanisms for its management. Thus it is important to look beyond the explicit text of agreements in considering mechanisms, which might facilitate or influence variability management. The remainder of this section provides more insights into these possible mechanisms and the frequency of their use in treaties.

2.1 Allocation mechanisms

As discussed above, allocation is a key topic in transboundary water management and the manner in which it is codified can have significant implications for the resilience of agreements as resource conditions vary. The mechanisms through which allocation may be addressed can be divided into three general categories. First, Direct Allocation mechanisms can be used to explicitly divide waters between co-riparians. Second, Indirect Allocation mechanisms can be used to establish the processes through which allocation will be determined, but without codifying the specific quantities or proportions to be shared. Consultations as a step to determine later allocations, an obligation to notify co-riparians when new water needs arise, a requirement for co-riparians to consent to any increased water use, prioritization of water uses, and vague commitments on the need to allocate shared water resources can all be considered as Indirect Allocation mechanisms. Finally, Principles for Allocations can establish the broader ideas or concepts for determining how water should be allocated now or in the future. These principles include concepts discussed in the 1997 UN Convention such as equitable and reasonable use, rational use, sustainable use, the requirement not to cause significant harm and the protection of existing uses.

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At least one of the three allocation mechanisms was included in 60% of the agreements and 26% of the agreements included one or more Direct Allocation methods. More than half of those agreements that contained Direct Allocation mechanisms tied water rights at least to a certain degree to water availability (16% of the whole treaty sample). Some treaties allocate percentages of flow (6%). Others allocate fixed quantities which themselves vary depending on water availability (10%). Such an allocation mechanism is more appropriate for the management of intra-annual flow variability, in particular when a large part of the variability is regular and predictable. Alternatively, and more appropriate for the management of inter-annual flow variability, some treaties.

Indirect Allocation mechanisms were used in almost half of the treaties (48%). However, in some cases, the indirect mechanisms operated only as complements to a direct mechanism. When the flow is less than 65-70% (dependent on the individual river) of normal conditions, the parties to the agreement should inform the Commission, which then divides the available water on the basis of a set of Allocation Principles stated in article 1 of the Additional Protocol.

Interestingly, all of the agreements which allocate water, also incorporate at least one Principle of Allocation and Principles of Allocation are rarely employed independently. In situations of unexpected flow variability, these principles allow parties to maintain the spirit of agreements and in disputes they provide guidelines, on which tribunals can base their decisions. Equity in allocation is the principle employed most frequently; it appears in

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22% of the studied agreements. It is followed by rational use (18%), no significant harm (16%), protection of existing uses (8%) and sustainability (8%).

2.2 Resource Change Mechanism

An alternative to allocating existing resources is to change the level of resource availability. Some of the surveyed agreements (14%) provide for the common construction of infrastructure to increase available water supplies or to disperse water supply throughout time. An additional 16% of agreements vaguely mention that the riparians would like to take joint measures to increase water supply, but without specifying the form that cooperation would take..

In 14% of agreements riparians consented to assist each other in the event of unforeseen flow variability. For instance the Convention on Cooperation for the Protection and Sustainable Use of the Danube states in article 17 that “in the interest of enhanced cooperation and to facilitate compliance with obligations of this Convention, in particular where a critical situation of riverine conditions should arise, Contracting Parties shall provide mutual assistance upon the request of other Contracting Parties”. Such clauses suggest that the riparians respect a shared responsibility to keep treaty provisions in the face of flow variability.

Finally, 42% of the agreements in the sample included provisions for the transfer of technology, which might be used to address variability. However, it is not generally clear

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from the treaty text to what extent the technology will be used for variability management. It should be noted though that a number of treaties incorporate more than one resource pooling mechanism.

2.3 Formalized Communication

As discussed above, variability can also be managed through the establishment of formalized channels of communication. The specific communication mechanisms identified in the sample treaties include the formation of joint management institutions (88%), regular political consultations (46%), consultations as conflict resolution (90%), data exchange (86%) and arbitration (42%). While the incorporation of these mechanisms within treaties does not provide any guarantee that the parties will effectively address flow variability, it provides at least an institutional environment conducive for the search of cooperative solutions. Ultimately, in any concrete situation of variability, it depends upon the political will and agency of states or political entrepreneurs to use the existing institutional environment for the mutual benefit of each riparian.

2.4 Broadened Cooperation

Another mechanism, which can be used to address variability, is the broadening of cooperation beyond the direct focus on water. This can provide a larger scope to negotiate side-payments and develop issue linkages in cases of flow variability, which can but does not have to be used by the parties to an agreement. Within the sample agreements, non-

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water linkages in allocation appeared in 16% of treaties. Broadening negotiations beyond flow variability and water as a “consumable resource” through a focus on hydropower generation is also an important form of cooperation and was included in 28% of the cases. Finally, treaties can also move beyond the quantitative focus on surface water. For example, groundwater is mentioned in 24% of the treaties and water quality issues are mentioned in 70%. Finally, it is also clear from the data that many treaties, which broaden cooperation beyond direct water quantity issues, often do so using more than one of the mechanisms highlighted here.

2.5 Synthesis

Figure 1 provides a picture of the frequency with which the 4 variability management mechanisms outlined here have been used. The majority of treaties (60%) address water allocation between riparians, and 64% provide provisions to increase or decrease availability. In 74% of the treaties cooperation is broadened through the incorporation of issues not directly related to flow variability. Finally, 90% of the agreements incorporate some level of formalized communication channels.

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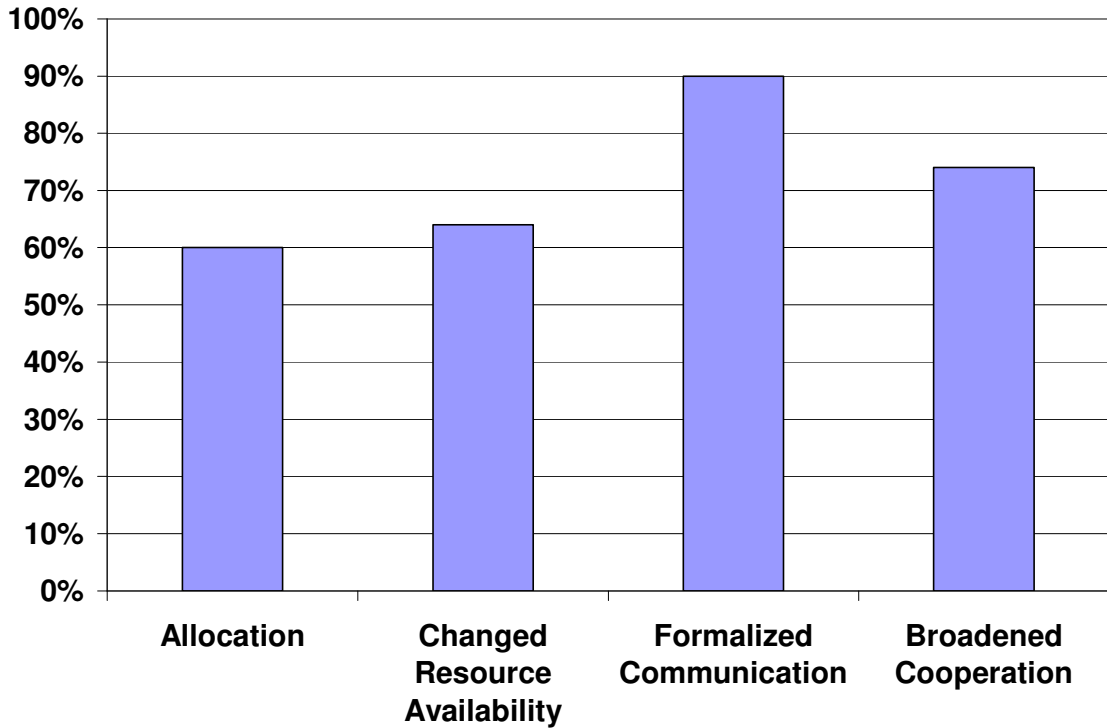


Figure 1. Percentage of water treaties incorporating specified flow variability management mechanisms, 1980-2002 here.

It is also important to note that the mechanisms outlined here are rarely employed in isolation. Instead they tend to form part of larger treaty packages, with all four mechanisms being incorporated in 34% of the agreements, three mechanisms in 26%, two mechanisms in 34% and one mechanism in only 6%.

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3. Discussion: Governance strategies to address variability

The nature of the mechanisms identified here for managing the flow variability of rivers shared between states can be conceptualized as consisting of two primary dimensions. The first related to the degree of flexibility in the mechanism for coping with changed conditions—for example inflexible fixed allocations versus highly flexible allocations based on percentages of flow. The second is the degree of enforceability, for example an agreement, which has specific penalties for failure to deliver agreed quantities of water arbitrated through an outside body versus a vague voluntary agreement to share water equitably. To manage variability, we can thus think of states as choosing strategies, which combine varying degrees of both flexibility and enforceability for any given mechanism they employ. Figure 2 provides a conceptual framework for considering the flexibility/enforceability relationship, and the resulting quadrants can be used to outline 4 basic variability management strategies. The figure is also used to indicate where each of the sub-mechanisms identified in the analysis above might fall within the strategy framework as well as the frequency with which each sub-mechanism occurred in our treaty sample.

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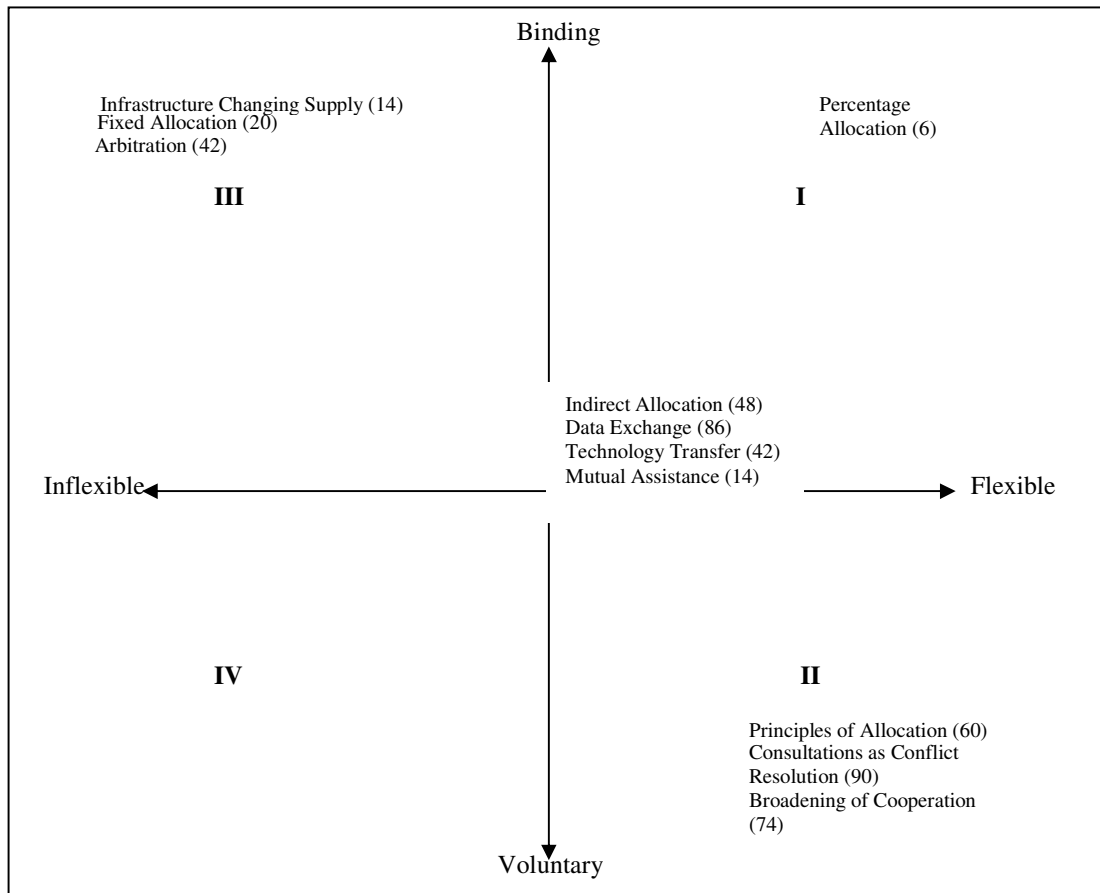


Figure 2. Governance strategies and mechanisms in transboundary water law to address flow variability here

The figure conceptualizes strategies for managing flow variability in transboundary water law resulting from the interplay between the flexibility and enforceability of any given governance mechanism. The mechanisms identified in the study sample of 50 treaties signed between 1980 and 2002 are located within the conceptual framework with percentage of use indicated in brackets. Of note is the finding that the vast majority of flow variability management mechanisms are either flexible or enforceable, but not both.

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Using strategies which are both highly flexible so as to account for unforeseen conditions as well as binding so as to ensure credibility and action may in some senses be seen as an “ideal” form for variability management. However, it is clear from figure 2 that only a minority of mechanisms fall strongly within this category (Strategy I). The only sub-mechanism, which has a very high degree of both flexibility and enforceability, is the allocation of waters based on percentage of flow. The use of this mechanism in the treaty sample was in fact very low. Some of the sub-mechanisms most often adopted in practice are those, which provide a high degree of flexibility and have a low degree of enforceability (Strategy II) including consultations as conflict resolution, principles of allocation, and broadening of cooperation. The high propensity to incorporate cooperation broadening clauses is not surprising, since many of the cooperation broadening sub-mechanisms (in particular non-water and water linkages) have been found to contribute to the stability and longevity of treaties during their implementation phase (Goldenman, 1990). Relatively few sub-mechanisms had a high degree of enforceability, but were relatively inflexible (Strategy III). No mechanisms were found that are both voluntary and inflexible (Strategy IV).

Another set of mechanisms with a high degree of adoption is located somewhere towards the center of the figure and includes data exchange, mutual assistance, indirect allocation and technology transfer. While joint management institutions have a very high degree of flexibility, their degree of enforceability varies considerably by treaty. Thus we did not locate joint management institutions in the figure.

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With those caveats in mind, it is still striking that only a minority of mechanisms adopted are both flexible and binding. This at least suggests certain barriers to the use of this “ideal” management form. This finding is supported by several in-depth case studies, which have revealed some of the barriers that hinder incorporating mechanisms to handle changes in resource availability (Fischhendler, 2004; Goldenman, 1990).

The finding also suggests a trade-off between flexibility and enforceability; i.e. the risk of too much flexibility, which increases the likelihood of a treaty breach, against the risk of entering an agreement so constraining that it impedes state actions in regime implementation. A high degree of flexibility may be of particular importance under conditions of resource uncertainty, while a high degree of enforceability may be of relevance in situations when a high degree of distrust prevails among the parties (Cook et al., 2005).

While it is true that figure 2 reveals a certain preponderance of flexible mechanisms, we can also identify a high frequency of mechanisms located towards the center of the figure and reflecting a compromise between flexibility and enforceability. The trade-off between flexibility and enforceability can also explain the commonality of informal, broad commitments and institutions prevailing in international climate change negotiations (Karkkainen, 2004). These agreements that are less binding and flexible are often referred to as “soft” law (Abbott and Snidal, 2000). Unlike hard law, soft law does not create formally binding obligations (Craik, 1998). Instead, it sets out only general rules or ideas to be followed, leaving exact interpretation and implementation to the signatories.

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Conclusion

In recent years the concepts of resiliency, vulnerability and adaptability have increasingly been used in research on the human dimensions of global environmental change. However, in international water management this topic has not received much attention. As a result, there is a lack of knowledge about the potential mechanisms available to address flow variability and about the frequency of their employment. This study is a first look at the use of mechanisms to manage flow variability and uncertainty in transboundary water law, a subject area of rapidly increasing importance in an age of growing understanding and awareness of potential climate change. The study showed that flow variability can be and has been governed using a variety of mechanisms. Some mechanisms, such as allocation of waters based on a percentage of flows, explicitly address variability while the majority of mechanisms use less direct approaches that create open-ended rules for regulating water. Broadening of cooperation, establishing communication channels and adopting indirect allocation mechanisms are three examples for this approach. These open-ended governance mechanisms may provide a means for addressing variability while at the same time accommodating the sovereignty and power concerns that are still a corner stone of water negotiations. They also may provide a structure to facilitate cooperation, while it depends upon the agency of the individual actors to effectively use this structure in order to find cooperative solutions to flow variability.

While each of the mechanisms discussed was shown to play a possible role in variability management, the study did not attempt to determine the actual intent of negotiators in

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including the mechanisms in agreements nor the role the individual mechanisms actually played in mitigating, or exacerbating, the impacts of variability on the relations of signatory states. Flexibility and enforceability in rules regulating transboundary waters are often stressed as key positive attributes for governing shared water resources, in particular in regions where water scarcity is important. However, flexibility can reduce the certainty around the actual flows of water parties will receive from an agreement, and enforceability can increase negotiation costs and may impinge on sovereignty. In agreements dealing with the zero-sum game of allocation, countries have generally tried to find a compromise between these two extreme and possibly contradicting positions.

In the face of climate change, it is of crucial importance to identify the factors, which make a society vulnerable and how a society can physically and socially adapt to a modifying environment. With increasing water variability and scarcity, the ability of countries sharing a water resource to adapt partly depends upon the type, number and effectiveness of mechanisms to address variability incorporated in water agreements. Some mechanisms allow changing the rules of the game, while others enhance the capacity to absorb unexpected shocks. Some are based on high flexibility while others are based on high enforceability.

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References

Abbott, K. W. and Snidal, D. (2000) Hard and Soft Law in International Governance, *International Organization* **54**, 421-456.

Cook, K. S., Hardin R. and Levi, M. (2005) *Cooperation without Trust?* Russel Sage Foundation, New York.

Craik, A. N. (1998) Recalcitrant Reality and Chosen Ideals: The Public Function of Dispute Settlement in International Environmental Law, *Georgetown International Environmental Law Review* **10**, 551-580.

Fischhendler, I. (2004) Legal and institutional adaptation to climate uncertainty: A study of international rivers, *Water Policy* **6**, 281-302.

Giordano, M. A. (2003) Managing the Quality of Transboundary Rivers: International Principles and Basin-level Practice, *Natural Resources Journal* **43**, 111-136.

Goldenman, G. (1990) Adapting to climate change: a study of international rivers and their legal arrangements, *Ecology Law Review* **17**, 741-802.

Hamner, J. and Wolf, A. (1998) Patterns in international water resource treaties: the transboundary freshwater dispute database, *1997 Yearbook of the Colorado Journal of International Environmental Law and Policy*, 157-177.

Karkkainen, B. C. (2004) Post-Sovereign Environmental Governance, *Global Environmental Politics* **4**, 72-96.

McIntyre, O. (1998) Case law analysis: environmental protection of international rivers, *Journal of Environmental Law* **10**, 80-91.

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United Nations (1969) Vienna Convention of the Law of Treaties, Treaty Series, vol. 1155, 331.

Yoffe, S. Wolf, A. and Giordano, M. (2003) Conflict and Cooperation over International Freshwater Resources: Indicators of Basins at Risk, *Journal of the American Water Resources Association* **39**, 1109-1126.