

Floods and International Relations in South Asia: An Assessment of Multi-Track Diplomacy

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Abstract

International cooperation over the major rivers in South Asia became closer with the signing in 1996 and 1997 of five innovative water, power and economic cooperation agreements. The innovations include four elements: (i) the transfer of some previously diplomatic questions into the sphere of the private economy, (ii) bringing third parties, other than governments, into the design and negotiation of cooperative projects, (iii) the principle of sharing costs and benefits, and (iv) taking steps toward multilateral discussion. This paper examines how innovations in diplomacy like these could influence flood mitigation.

I South Asian Rivers and Flood Mitigation

The great rivers of South Asia, particularly the Ganges and Brahmaputra, have been the subject of five decades of discussion between governments of the region. While those discussions have continued, these rivers have contributed, through flood and drought, to the uncertainty and impoverishment of the lives of the largest concentration of poor people anywhere in the world.² Prosperity will come from harnessing the potential of these rivers for irrigation and power, and by controlling their perils, particularly those of floods. This paper explores some of the possibilities opened up by recent innovations in international cooperation.

In this first section, we describe the problems and promise of South Asian rivers, including a discussion of the relationship and differences between flood problems and potential benefits of irrigation and power generation. We also provide an overview of the region's international relations over water, and outline new directions enabled through multi-track diplomacy.

Section II summarizes the course of past diplomacy. Section III introduces a range of conceptual issues relevant for negotiations over flood mitigation and water development: conflict over the allocation of property rights, who is included in the bargaining process, the scope of their negotiations, and the rules that govern the process. These issues are related to the historical problems in South Asian river development discussed in Section II.

Section IV examines the innovations incorporated in the five treaties signed in 1996 and 1997, how they address some of the past obstacles to successful agreement as discussed in Sections II and III, and the subsequent implementation problems that have arisen. This section also considers directions in which current innovations might be extended as bases of regional cooperation. Section V provides a summary conclusion.

The problems and the promise of South Asian rivers

South Asian governments seek to control the great rivers of their region³ because river control offers partial, but tangible, solutions to the most fundamental problems of rural poverty, industrial constraints, and urban stress that those governments seek to address. At present, the ways in which control has been sought -- through national visions, covert appropriation and bilateral bargaining -- constrain what can be achieved.

There is a growing community of scholars, officials and politicians⁴ in South Asia that believes that the region's rivers can be better harnessed in support of economic

development. For example, George Verghese, a prominent former Indian-newspaper-editor and long-time proponent of river development, has written:

There is no reason why the immiserised population of this resource-rich Basin should remain poor and hostage to a recurring cycle of devastating flood and drought. There is sufficient indication that international funding and technical assistance will be forthcoming in ample measure if the Basin-states decide cooperatively to harness the waters of these mighty rivers, green the mountains and conserve 'losing ground'.⁵

A complementary view (Boyce, 1987), agrees about the promise of water development, and argues that conflict between rich and poor hinders the emergence of local cooperative institutions which could employ water resources effectively. Together these arguments make a powerful case for those types of river development which recognize the political and economic forces shaping current conflict at international and local levels.

To make more precise the different issues involved, we can identify three areas where there are potential benefits to be gained from improved water management and development. These are flood mitigation, availability (for agriculture and industry, as well as for drinking and other human uses), and power generation. In different circumstances one or two of these areas may be more salient, but they are typically interconnected. In some cases, this linkage is positive: for example, a single dam may assist in flood mitigation, availability and power generation. In other cases, however, there can be negative relationships, where pursuing water development for one goal, such as flood mitigation, may hurt availability for a set of users. The specificity of these relationships with respect to topography, hydrology, social institutions and other factors complicates analysis and implementation of policies to actualize any potential benefits. Further complications come about from uncertainty, lack of technical expertise, lack of understanding of interrelationships among technical, social and environmental factors, and diversity in the locus of beneficiaries and those who bear the (often substantial) costs involved in realizing benefits. Many of these issues underlie our subsequent discussion.

Flood Mitigation

With respect to flood mitigation in particular, there are several particularly thorny issues. While water development for irrigation and power may be susceptible to smaller scale, more environmentally friendly approaches, flood mitigation has been thought to require larger investments and projects that alter the surrounding

environment more dramatically. We are focusing mostly on large scale investments in this paper, but we also touch upon some smaller scale alternatives (see box). Flooding itself may be tied in to diverse environmental factors, such as deforestation and global climate change. These broader environmental issues also influence water availability, but the latter may be amenable to specific responses such as rainwater harvesting and improved irrigation technology and institutions, without having to tackle larger scale problems. Flood mitigation, on the other hand, may require large-scale responses with high costs and uncertain impacts. Even without these problems, flood mitigation is complicated by the diffuseness of benefits: it is conceivable to implement user charges for water used for irrigation or drinking, or for hydroelectric power. Flood mitigation may be more difficult. Flood mitigation may be a classic public good, and its burden of necessity may fall on the already extended public treasury. Again, we treat these special problems of flood mitigation in assessing the workings of international river diplomacy in South Asia.

International diplomacy and relations are central to flood mitigation to the extent that cross-border river flows contribute to the floods. Flood events frequently have multiple causation, including heavy rainfall nearby, inadequate drainage downstream, and high river flows. In South Asia, floods in India and Bangladesh are often exacerbated and sometimes caused by cross-border river flows. In these circumstances the form, content and efficacy of relations between South Asian nations may have implications for flood warning, the range of possibilities for mitigating floods, and the extent to which precautionary investment can be made. There has been progress in the last ten years in the exchange of data for flood warning, but there is considerable scope for more extensive exchanges in real time (Ahmad and Ahmed 2003). In this, as in other cases, the state of diplomatic relations between the governments seems to constrain simple, effective responses to pressing questions.

The nature of diplomacy may thus shape the possibilities for flood mitigation. And, the ramifications of conflict over the great rivers of South Asia may foreclose promising alternatives. To avoid that happening, we think it is worthwhile to consider what possibilities the opening of a wider form of diplomacy might foster. We explain below that some of these changes are prefigured by recent innovations in South Asian agreements.

What contribution could small scale initiatives make to flood mitigation?

There are at least two possibilities for small scale intervention in floods. One practical and important proposal is to reduce the flood vulnerability of the poor and increase their resilience to floods (Dixit 2003; Ahmad and Ahmed 2003; Chapman 1995; Crow 1996). A second, more speculative, possibility relates to the idea of using groundwater recharge as a way of tackling both water shortages and floods.

This second idea was first suggested in a paper by Revelle and Lakshminarayana (1975) entitled 'The Ganges Water machine'. They proposed increasing groundwater recharge through

- 1 water spreading in the piemont deposit north of the Terai marshes;
- 2 constructing bunds at right angles to the flow lines in uncultivated fields to slow down run-off and increase infiltration;
- 3 pumping out underground aquifers during the dry season in the neighborhood of nallahs (natural drains)
- 4 pumping out groundwater in some Ganges tributaries to provide space for recharge
- 5 extending canals for kharif irrigation to increase water recharge.

Revelle and Lakshminarayana's estimates (1975: 615) suggested that 60 million hectare meters of water could be stored by these methods, and that more could be stored by using diversion barrages to create controlled flooding of land adjacent to appropriate tributaries of the Ganges (616). The 'water machine' could thus store flood flows underground. A network of large tubewells, powered primarily by hydroelectricity generated upstream, could then pump out this water for irrigation during the dry season.

Revelle and Lakshminarayana did not investigate the three-nation institutional arrangements that could make a groundwater recharge scheme workable. It is possible that the ideas developed in this paper could form a basis for small-scale contributions generating a substantial effect. With appropriate international exchange systems, a private company in Nepal or India might arrange groundwater storage and sell both flood storage notes to a flood-mitigation agency, and dry-season water to an irrigation agency, in India or Bangladesh. The system of exchange would need to be regulated, perhaps by a new South Asian environmental authority. In principle, such a scheme could contribute to flood mitigation, increased availability of dry season water, and generate significant employment.

Wood (1999: 731) reminds us that ‘water management is a democratic not a technocratic issue.’ And, in several parts of South Asia, water development has become the focus of social organization (Phadke 2002; Agarwal and Narain 1997; Adnan 1993). Flood mitigation, in particular, is centrally about democratic representation as well as technical possibility. The demise of the G8-backed Bangladesh Flood Action Plan underlines that conclusion. This well-intentioned and potentially well-financed initiative foundered when groups of donors disagreed over the best approach to take to flood mitigation, and most centrally, when it became apparent that local and international nongovernmental agencies opposed the plan. Much good research and investigation was funded in the aftermath of the plan, but the initiative to finance flood mitigation schemes was lost (Wood 1999; Adnan 1993; Paul 1995; World Bank 1997).

Flood mitigation has diffuse consequences for livelihoods, and requires popular support for its implementation. Therefore, where international negotiations are involved, the democratic space for negotiation opened by multi-track diplomacy may be preferable to the confines of intergovernmental negotiation. Through improved representation of multiple stakeholders, multi-track diplomacy could generate better plans and wider political support for those plans.

II Facilitating Cooperation: Conceptual Issues

In this section, we describe in abstract the problems in achieving cooperation, and how these arise in the case of managing international rivers and related problems of floods. Cooperation can occur when mutual benefits are possible. However, the existence of mutual gains is not sufficient for cooperation: the prisoner's dilemma is the most famous example of failure to achieve mutual gains. In the prisoner's dilemma game— given the relative payoffs of different courses of action – the inability to communicate and, especially, to commit to a binding agreement, are the sources of this failure. In the case of international diplomacy, constraints on communication may matter, but the inability to enforce agreements is more likely to be a problem.

Cooperation can be achieved in a prisoner's-dilemma-type situation by changing the structure of payoffs. This may be done, for example, through allowing for repeated interactions, the existence of certain kinds of asymmetric information about the preferences of players⁶, the ability to punish violation of agreements, or tying the game to others that are also taking place between the players. The game remains one of noncooperative behavior, but such behavior can support a cooperative outcome in the expanded game. While some types of asymmetric information help resolve the prisoner's dilemma, in other cases, incomplete

information makes achievement of mutual benefits limited or even impossible, this being a version of the "lemons problem"⁷.

This abstract discussion helps to focus on the following questions in discussing how cooperation in the management of water resources may be facilitated. First, are there truly potential mutual benefits, or is the situation one of conflict (one party can only gain at another's expense)? Second, if the answer to the first question is negative, can the situation be redefined (e.g. broadened in scope by considering other dimensions, or repeated interaction) to transform it to one of potential mutual benefit? Third, what are the impediments to actually achieving mutual benefits: uncertainty, asymmetries of information, exclusion of key parties affected by the transaction, or inefficient bargaining protocols? Obviously, the answers to all three questions will overlap. We will explore the experience of international negotiations over the use of South Asia's water resources in this framework. To illustrate, we briefly consider the Indus waters case.

Which governments 'owned' the five rivers making up the Indus system was the basis of dispute between India and Pakistan after independence and partition in 1947. There was uncertainty about property rights, which made any *de facto* property rights of limited value. However, any division of the flows was viewed as potentially providing a gain to one side at the expense of the other. This is the common problem in the allocation of property rights: mutual benefits from agreement are unclear or nonexistent. The Indus Waters Treaty of 1960 established that the rivers would be divided between India and Pakistan. This division resolved the property rights, but to either Pakistan or India's disadvantage, depending on who bore the cost of investments required to make the proposed division workable. Intervention that changed the nature of the game came in the form of external funding via the World Bank. Secure property rights and financing from the World Bank allowed each country's share of the system to provide much more than could have been achieved while property rights were uncertain.

The example illustrates answers to the first two questions above: a situation of conflict was transformed in a simple way to one of mutual benefit, by a third party "sweetening the deal". The answers, and the solution to the problem, however, are both limited. The theoretical issue of why the World Bank intervened can be answered briefly: the geopolitical incentives underlying that institution and its backers determined this role. The practical solution to the Indus waters problem was limited, however, because the waters that "belong" to Pakistan partly flow through Indian territory. If optimal usage of these waters requires large fixed investments, a different set of issues, well beyond the allocation of property rights to water, arise. In fact, these issues have prevented such investment occurring. To

the extent that flood mitigation requires such investments, the difficulties are greater than those inherent in the case of agreeing on the sharing the Indus waters. We turn to these issues after discussing the problem of allocation of property rights.

Conflict and cooperation

A situation of pure conflict is one where no mutual benefits are possible: in a bilateral negotiation, a gain for one party must result in a loss for the other. A simple reallocation of property of rights is therefore a situation of pure conflict. Therefore, to the extent that international river disputes are disputes over property rights, one would be pessimistic about resolving conflict. Only when property rights are sorted out can mutually beneficial agreements contingent on those rights be contemplated. This suggests that mutually beneficial international flood mitigation agreements may require more basic conflicts over rights to be sorted out first.

Several factors soften this pessimism, and provide the basis for our subsequent analysis. While the geography of rivers and underground aquifers creates *de facto* property rights, even when there is no explicit agreement on rights, these property rights may be uncertain enough that a certain right to less may be more valuable than an uncertain claim to more. Thus the removal of uncertainty on one or both sides in a bilateral negotiation may create the scope for mutually beneficial agreement. One example of the benefits of the removal of uncertainty would be in the perceived returns to investments that support the effective management of water resources.

Another way of going beyond a situation of pure conflict is to expand the dimension of the bargaining space. The relinquishing of a property right, or a claim, can be compensated by a transfer in the opposite direction, just as in any mutually beneficial trade. The transfer in this case may be of money, material goods or intangibles such as security. This need not involve going outside the sphere of conventional diplomacy (including commercial diplomacy), but private exchanges may be helpful, for reasons we discuss below.

While multilateral negotiations do not provide any direct advantage with respect to the resolution of property rights conflicts, the different aspects of ameliorating conflict that we have outlined apply to multilateral as well as bilateral bargaining situations.

Property rights and investment

While we have noted above the benefits for water-related investment of a transformation of uncertain claims into certain property rights, we earlier pointed out the limits of this transformation in the Indus case. Here we explain these limits. As we remarked earlier, the river waters allocated to Pakistan through the Indus treaty partly flow through Indian territory. The treaty rules out consumptive uses of this water –such as irrigation – by India. What about nonconsumptive uses such as hydroelectric power? In principle, India should be able to negotiate such uses and undertake the investments required. However, Pakistan might desire to monitor the investment to make sure that no water is being diverted. Such monitoring would raise currently insurmountable issues of security and sovereignty. Even greater problems would arise with respect to Pakistani investment within Indian territory. As a result of these issues, the full hydroelectric potential of the Chenab and Jhelum remains untapped.⁸ Flood mitigation investments that are made in one country to benefit another country are subject to similar potential monitoring problems.

Bilateralism vs. multilateralism

Bilateralism has been an important aspect of India's policy with respect to its South Asian neighbors. Bilateralism may be justified for all parties in terms of simplicity of negotiations or, for some participants in the negotiations, as a way of avoiding opposing coalitions and preserving bargaining power. However, in the case of rivers flowing through more than two nations, or where an entire river basin spans more than two territories, bilateral bargaining may neglect positive and negative externalities, and limit the mutual benefits of possible agreements on water development and usage. Bilateralism combined with conventional barter diplomacy may also limit the gains from trade, though in this case it is the lack of fully transferable value that is the culprit, rather than bilateralism. Hence it is the existence of externalities that provides a case for multilateralism over bilateralism in negotiations over the management of international river waters.

Private exchange vs. diplomacy

Conventional diplomacy is characterized by barter, either involving specific items, or of broader scope (general reciprocity). More and more, over time, diplomacy has extended to the commercial sphere, covering international trade and investment in particular. Again, this can involve specific exchanges between governments or, instead, the setting of rules under which private parties operate. Whether the actual exchange takes place between governments or private parties depends on who owns the potential objects of trade.

Natural resources such as river waters have conventionally been treated as government-owned, and therefore international negotiations over their shared development and use have been firmly in the sphere of diplomacy, albeit with economic components and economic implications. Where private parties, such as farmers and industrialists, have been the ultimate users of water (for irrigation, power and navigation), they have had only an indirect say in such negotiations, through political influence or political pressure. This political model has also governed the domestic allocation of water at subnational levels, through politically determined pricing and investment subsidies.

What changes with private involvement in water development decisions, whether at the subnational or the international level? To the extent that ownership is transferred to private entities, decision-making will be determined by different objective functions. Private entities may range from corporations that maximize profits to nongovernmental organizations (NGOs) that maximize some aggregate measure of their members' welfare. Though governments may also theoretically maximize aggregate welfare, in practice, the incentive mechanisms to enforce this may be too weak, particularly at the national level. Thus, even for public goods such as flood mitigation, the greater involvement of different stakeholder groups may be beneficial: this is the point taken up more explicitly in considering multi-track diplomacy in the next section.

Even if ownership is not privatized, when private parties are involved in sharing the costs and benefits of water development, their objectives will have a more direct impact on decision-making than in the conventional model of political influence. We can think of their participation in contracting and bargaining as similar to multilateralism in extending the set of those who bargain. If this helps to internalize externalities, then greater efficiency in bargaining may be realized. A further benefit goes beyond overcoming externalities. While the nations in a multilateral negotiation are determined by geography, private entities such as multinational firms can be asked to compete for seats at the bargaining table, enhancing the potential gains to others involved in the negotiation.

The inclusion of private parties in negotiation over water development and use not only changes objectives, but also makes them generally more transparent. National governments may not have easily identifiable objectives, since they are a complex mix of the preferences of constituents, politicians (the agents of constituents) and bureaucrats (the agents of politicians). Lower level governments provide some degree of disaggregation, but subnational private entities are required to be more open about their goals and performance than is traditional for governments in

South Asia. One can conjecture that greater transparency will, on the whole, aid agreement in water negotiations.

There are two final implications of the inclusion of private parties. First, there is, perhaps, greater flexibility in the kinds of contracts that can be signed. In principle, there is nothing to stop governments from signing commercial contracts (including those specifying sharing of costs and benefits), but there may be problems due to incomplete information: in particular, the appearance of possible impropriety may prevent even the signing of honest contracts. This assumes that profit-making entities have better internal monitoring and mitigation mechanisms. A stronger argument is based on commitment. Sovereign governments may not be able to credibly commit to certain kinds of agreements, while private parties can. This simply reflects the nature of sovereignty. Governments can expropriate and renege on contracts involving private parties, but this may involve greater reputation loss than breaking or bending vaguely worded treaties.

Overall, therefore, it may be that the inclusion of private or nongovernmental entities in negotiations over water development and use implies changes more profound than those involved in shifting to multilateralism. At the same time, the role of private parties would be impossible or severely limited without both those changes. We turn now to the recent experience in South Asia, with a focus on multi-track diplomacy, as well as multilateralism.

III Multi-Track Diplomacy

The inclusion of private parties in international negotiations, which we have discussed in the previous section, can be subsumed in the general concept of multi-track diplomacy. Originally, 'Track II diplomacy' was distinguished from traditional (hence Track I) diplomacy,⁹ and characterized by third party interventions, including the participation of non-policymaking officials and non-governmental leaders in negotiations. The advantages of this two-track approach are thought to include a shift in focus from 'positions' to 'interests', and an avoidance of government officials and policymakers risking their public positions. "Since the participants in the discussions are not ultimate decision makers, there are no high-level (Track I) public commitments and policy-making."¹⁰ Beyond such benefits, there is also the possibility of incorporating economic matters more explicitly, as we discussed in the previous section.

After the original formalization of 'two-track' diplomacy, there have been various attempts to refine the concept. McDonald and Diamond (1996) elaborated McDonald's initial five-track classification to come up with a nine track 'system'. The nine tracks in this system are government, nongovernmental professionals,

business, private citizens, researchers and educators, activists, religious organizations, funding agencies, and the media. We would tend to agree with critics¹¹ that this classification loses analytical crispness. Nevertheless, it highlights the different actors and channels of interaction that are possible once official avenues of diplomacy are supplemented. Perhaps the most useful distinction is one which allows for three tracks, with Track II including all interactions involving nongovernmental elites, whereas Track III encompasses grassroots actions by those directly involved in, or affected by, the conflict.

There are at least two ways in which a wider diplomacy might open new options. The first relates to the planning, negotiation and financing of large-scale schemes. A wider diplomacy, including new actors with different mandates and incentives, could make technically better schemes and, through wider representation, generate greater support for them. So, there is the possibility that multi-track diplomacy could make large-scale flood mitigation schemes better and more acceptable.

The second way in which wider diplomacy might open new options concerns the possibilities for small contributions to large-scale flood mitigation. There are some advantages to large-scale flood mitigation. For example, large dams may store more water, than small dams, per unit of land lost under water. Large polders may also be more efficient than small embankments. There are also advantages to small-scale water development. These may include decentralized control, environmental conservation, rural employment generation, and more effective representation of diverse needs for water. Small-scale, decentralized development of water resources is more likely to be driven by demand than is large-scale development. There is, of course, a rich, and only partially documented, history of small and large-scale water development in India. That history offers examples of small-scale initiatives that could assist flood mitigation as well as drought mitigation (Rosin 1993; Agarwal and Narain (eds.) 1997)

It is possible that multi-track diplomacy could open new possibilities for small-scale water development including flood mitigation. For example, we wonder, as noted earlier, if it is time to re-consider the visionary suggestion of the 'Ganges Water Machine' (Revelle and Lakshminarayana 1975). This idea suggested that decentralized groundwater recharge and pumping, using hydroelectric power generated in the upper reaches of the big rivers, could mitigate floods, through a large expansion of groundwater recharge, and enable expansion of water supply, particularly irrigation, throughout the river basin. Decentralized water development of this kind could be socially and environmentally preferable to large interventions.

How might multi-track diplomacy make such a vision possible? Cross-border trading in water services could enable the governments of India and Bangladesh, or

intermediary agencies, possibly including public-private partnerships, to purchase flood mitigation and drought services from a range of agencies in Nepal and India. Rather than elephantine governments plodding toward large scale water storage many decades hence, cross-border trading might enable fleet-footed institutions, be they nongovernmental organizations, private companies or public-private partnerships, to provide services over a much shorter time span. Is this so different from what is envisaged for the sale of power in the India Nepal Power Trade Agreement of 1996? There is a history of cross-border trade in electric power. Trade in water services would require research and innovation, not least to develop appropriate units and prices. It would also require oversight by one or a group of regulatory agencies. But it is not unthinkable and it could generate labor-intensive employment at the same time as providing flood mitigation and expansion of dry season water supply.

The evolution of multi-track river diplomacy

Conventional diplomatic negotiations, what is referred to as ‘track I diplomacy’, have had limited success in the arena of south Asia’s great rivers. There has been little regional cooperation in South Asia, least of all about the contentious topic of water. The South Asian Association for Regional Cooperation (SAARC), established in the 1980s, provides a forum for discussion of the least controversial topics. However, the most heated ones, particularly water resource negotiations, were excluded from its brief at the start. With the exception of one meeting in 1986, negotiations over water have been exclusively bilateral, that is, involving only two states. India, in fact, has repeatedly insisted on this bilateralism.

The most heated and long running, river disagreement has been between Bangladesh (and its predecessor, East Pakistan) and India over the sharing of the flow of the Ganges. This question has sometimes been temporarily settled by interim agreements, and has occasionally erupted into internationally publicized disagreement. More typically, as for the decade up to 1996, it has been marked by chronic lack of agreement: intergovernmental negotiations of varying frequency that repeatedly fail to make substantive progress.

The governments of India and Nepal have had many rounds of sometimes tense negotiations relating to hydroelectricity generation, irrigation water, and flood mitigation, and early agreements about shared projects have been controversial in Nepal. Water has the potential to be Nepal’s major economic resource, and successive governments have expected that the sale of hydroelectric power to India would generate significant revenues for economic development. Until 1996, little progress had been made toward this goal.

In section II, two of the most prominent elements obstructing international cooperation will be identified and described: the Indian government's insistence on bilateral rather than multilateral negotiations (termed *bilateralism*) and competing national visions for water development.

Though these obstructions persist, recent agreements open new directions in regional cooperation, including:

- i) shifting some negotiations from the *diplomatic* or *governmental* sphere at least partly into the sphere of the *private economy*
- ii) bringing *third parties*, other than governments, into negotiation, design and implementation of cooperative projects
- iii) moving toward the *sharing* of eventual benefits and costs, rather than establishing *fixed* payments based on anticipated outcomes
- iv) making tentative steps toward limited multilateral discussion.

Multi-track diplomacy and flood mitigation

How might multi-track diplomacy, and specifically the four new directions identified above, influence flood mitigation possibilities?

i) Shifting some negotiations from the diplomatic or governmental sphere at least partly into the sphere of the private economy

Social practices with distant origins dictate that certain issues are economic and others diplomatic. In the diplomatic sphere, a range of issues of national interest, possibly including economic matters, are negotiated by governments. In the private economic sphere various exchanges of trade, investment, lending and labor are negotiated between private parties, and government regulates only the broad framework.

There are contrasts between diplomatic and private economic practices which suggest that there are advantages to the transfer of some international river negotiations from diplomacy to commerce. In the private economic sphere, enterprises enter negotiations with clear private incentives, that is, to generate a return for owners or shareholders. By contrast, diplomacy involves negotiation between governments having multiple objectives and less direct incentives, including the approval of bureaucratic superiors and the various processes of collective representation or protest. This suggests that negotiations within the private economic sphere can have the advantages of simple goals, clear rules and pressures for quick completion. The shift from diplomatic to private economic

negotiation parallels the widely debated processes of privatization and liberalization, and is discussed in Sections III and IV.

The widespread and unevenly distributed benefits of flood mitigation may not easily be turned into tradable goods, and private corporations have shown little interest in flood mitigation but there are some possibilities. It may be possible to develop trade in water storage benefits. The government of Nepal, or a public private partnership, for example, might agree to store a quantity of water for its downstream neighbors. The payment for this storage might reflect both the benefits of flood mitigation as well as the supply of dry season water.

ii) Bringing third parties, other than governments, into negotiation, design and implementation of cooperative projects.

The second new direction suggested by the 1996 agreements relates to the inclusion of third parties such as corporations, local governments and nongovernmental organizations (NGOs) in international negotiations. This may be advantageous if new social, economic and intellectual resources are to be brought to bear upon concerns shared across national boundaries. When negotiations are shifted from diplomacy to commerce third parties are necessarily involved. A further widening can be seen, however, in the growth of nongovernmental networks involved in international negotiation about environmental risks and possibilities. In particular, the diffuse nature of flood mitigation, and its influence on large populations cutting across existing political boundaries or constituencies, can be more effectively addressed by the inclusion of NGOs in multi-track diplomacy.

iii) Moving toward the sharing of eventual benefits and costs, rather than establishing fixed payments based on anticipated outcomes.

The third new direction relates to the sharing of costs and benefits of international environmental change. Situations of uncertainty present a challenge to intergovernmental cooperation. In the case of South Asia, climatic and tectonic variations combined with the unpredictable consequences of agriculture, land clearance and other human interventions, constitute a significant source of uncertainty influencing international environmental negotiations. River flows, sediment loads and groundwater levels are only partially predictable. In addition, projects to harness natural resources have uncertain benefits and costs.

In these conditions, the sharing of benefits and costs constitutes a promising direction for international cooperation. This does not, of course, exclude governments from this risk sharing: large-scale projects, in particular, will require

their participation, even if only as guarantors or underwriters. Flood mitigation is an area where active government participation is essential.

iv) Making tentative steps toward limited multilateral discussion.

The fourth new direction, of multilateralism, has parallels with the second: new resources are brought to bear on problems, and unintended negative impacts on those otherwise excluded are avoided. Agreements based on multilateral consultation and discussion are more likely to be stable in the long run. In addition, there is the possibility of expanding the "gains to trade" by expanding the set of bargainers. These issues are taken up in Sections III and IV.

IV Impediments to Agreement: Bilateralism and National Visions

International river negotiations frequently take many decades before agreement can be achieved. Water resource cooperation in the basins of the rivers Ganges and Brahmaputra may constitute the most complex of all international water negotiations. The combined scale of the environmental, social and technical issues has no equivalent anywhere else in the world. Given the scale of these problems, and the paucity of regional resources that can be garnered to address them,¹² it is not surprising that the negotiation of international cooperation should be protracted and uncertain. Nevertheless, it is arguable that the past focus on bilateral negotiations, and on national, rather than regional, perspectives, has slowed the achievement of cooperation and river development.¹³ Here we focus on India's policy of bilateralism, and its consequences for India, Bangladesh and Nepal in past river negotiations.

Bilateralism has been a consistent Indian government prerequisite for negotiations with its South Asian neighbors ever since Independence in 1947. Almost all negotiations about a range of key issues, from river development to trade and transit, have been negotiated on that basis.

Rose (1987) identifies bilateralism as one of two main principles of Indian government policy towards its neighbors, acceptance of India as the major regional power being the other. He describes bilateralism:

As defined by India, the South Asian system would function through the greater coordination of India's bilateral economic relations with the other regional states; any substantial integration of the economies of the other states (e.g., Pakistan and Sri Lanka or Nepal and Bangladesh) or any use of a multilateral approach to regional economic issues (e.g., the river systems of Nepal, Bhutan, Bangladesh and India) should be discouraged.

This policy of bilateralism is a complex aspect of Indian foreign policy. We argue here that it constitutes a serious obstacle to achieving the potential of South Asian water resource development. Two alternative perspectives on bilateralism can be identified.

Firstly, spokespersons for the Indian Ministry of External Affairs have emphasized the additional complexity and duration implied by multilateral negotiations¹⁴. In this perspective, bilateral negotiations on specific bilateral questions or projects are more expeditious than multilateral negotiations. This argument is plausible, but has to be tempered by the experience of delays in bilateral negotiations between the Indian government and its neighbors.

A second perspective on bilateralism, sometimes found in political and academic discussion in Nepal and Bangladesh, is that bilateralism allows India to dominate the subcontinent, presumably by hindering the formation of a "bargaining coalition" by India's neighbors. This perspective may have historical validity but gives little immediate purchase on current questions of cooperation. It is also unclear to what extent, and in what ways, it actually impinges upon Indian governmental discussions and decisions.

The emphasis on bilateral relations leads to a particular focus on the sequence of issues that have dominated the relations between two governments. It has been argued that this focus encourages the perception that river development is a 'zero sum game,' a common obstacle in international river discussions.¹⁵ This perception, that the gain of one country is necessarily the loss of the other, gives the negotiations a particular charge: any compromise of prior national objectives can be portrayed as a victory for the other side. Whether this perception is rational is another matter, however: even bilateral situations may involve mutual gains. The real question is whether multilateralism might substantially expand the gains -- enough to overcome additional complexity or bargaining costs.

The focus on histories of bilateral relations may also create fertile ground for the growth of myths about the nature and possibilities of those relations. In the case of India and Bangladesh, perceptions of river negotiations are deeply influenced by the history and myths of past negotiation over one project, India's Farakka Barrage across the Ganges. All subsequent discussion about water between these two governments, and in their national media, tends to be mired in the myths and colored by the particular paths of past bilateral relations.¹⁶

These myths, with complex foundations in the colonial division of the subcontinent, as well as in the technical uncertainties and ambiguities of water development, posit negotiations over water as a 'zero-sum game'. This structuring

of the discussion leaves little space for the possibility that water development could be an enterprise from which all sides gain much more than they lose. The boundaries of discussion could be relaxed in the context of regional, in place of bilateral, discussion.

Examination of the historical record and of national water proposals (Crow and Singh 2000: 1911-1913) illustrates how nationally constituted visions of water resource development frequently overlook the concerns of neighbors. Thus, when India and Bangladesh approached Nepal, the concerns of Nepal were overlooked. And, when India decided to build the Farakka Barrage in the early 1960s, Nehru was convinced (presumably by his engineers) that it would cause 'no real injury' downstream.

Recent visions of national water development express national visions making little accommodation to the concerns of other states. There has been no recognition that compromise might achieve greater benefits for the region. To some extent, these visions were shaped by the failure of conventional bilateral diplomacy. In section V, we examine recent innovations and future directions that may overcome this failure.

V Innovations at the international level

When representatives of the Nepalese government, in the trilateral meeting of October 1986, asked the governments of India and Bangladesh to spell out the 'mutual benefits' of joint river development, they were asking two fundamental and related questions. How will Nepal benefit from the water development proposed by India and Bangladesh? What can be achieved through regional cooperation that could not be achieved bilaterally? There is at least one answer to the latter question: Table 1 lists what governments have sought from each other in relation to regional water resources. The realization of a significant proportion of these, or similar, proposals could constitute an important advance, mitigating power and irrigation-water shortages, flood and drought, and contributing to the potential for regional stability and economic development.

The realization of these transactions will, however, be limited under a strictly bilateral regime because the possible multiple uses of river water and the basin-wide consequences of many development proposals do not respect territorial boundaries. For example, the development of hydroelectric power bilaterally by Nepal and India may preclude consideration of other potential water storage services. Flood mitigation and irrigation expansion, for Bangladesh and eastern India's plains states, could be achieved through the construction of water storage in Nepal. If that construction is undertaken bilaterally by Nepal and India, it is less

likely that services other than hydroelectric power generation will be given serious consideration. However, innovations in water use and negotiations over water development are beginning to relax past limitations.

By examining innovations at the international level, we aim to bring out the general principles that can transform international negotiations over water rights and usage. These general principles include rights allocation mechanisms, governing institutions, and rules for exchange.

Five International Agreements

1996 was a great year for river treaties in South Asia. In January, Nepal and India signed a treaty advancing a decades-old river development proposal, and in its last month India and Bangladesh signed a 30-year treaty seeking to resolve the dispute between the two nations over the sharing of the Ganges waters. In between, two other agreements were signed, establishing procedures for power supply from Nepal and Bhutan to India. A fifth, more tentative agreement came in April 1997, when representatives of India, Bhutan, Nepal and Bangladesh considered forming a sub-regional economic group within the SAARC framework that would include the shared rivers of the four nations. The four 1996 agreements¹⁷ establish innovations for South Asia, with only limited precedent elsewhere, which start to address the uncertainties of Himalayan development, and bring new resources and initiative to the process of harnessing the geographical assets of South Asia. They begin creating a regional trade in hydroelectric power development, with sharing of the costs, risks and benefits of joint river development.

In broad terms, the India-Nepal Power Trade agreement transfers negotiations for the sale of hydroelectric power from the purely diplomatic to the economic sphere, and in doing so brings agencies other than national government into the process. The Mahakali Treaty establishes a process of sharing future benefits of water resource development on the Mahakali River (the border river between Western Nepal and India). The Tala Hydrel Project negotiations illustrate a process similar to that envisaged in the Mahakali Treaty, at a later stage of negotiation. The Ganges Treaty resolves 40 years of dispute about dividing the low flow of that river. We consider each of these four treaties in more detail, and then the fifth development, involving all the four nations.

Therefore, in our view, the most significant trend incorporated in the five international agreements discussed above is the introduction of private actors and explicit economic valuations into the process of the development and use of water.

Progress and future directions

The trends we have identified are only a beginning. Progress has been slow, and fraught with continued suspicion and political uncertainty. We discuss two cases here. Despite the difficulties, innovations can continue in several directions. We highlight two related sets of possibilities: i) extending bilateral barter to multilateral exchange, and ii) expanding negotiations from conventional diplomacy to incorporate private economic actors.

Difficulties in progress: The complexity of the Mahakali agreement, its vagueness with respect to details, political changes and uncertainty in India and Nepal, and even external events such as the collapse of Enron have all hampered progress between those two nations. In the Enron case, however, the difficulty of identifying and incorporating the benefits of flood mitigation played a role in delaying implementation. While internal Nepali politics and Enron's own maneuvering were more public problems, it has also been recognized that India was reluctant to admit that it would receive benefits from irrigation, and especially flood mitigation, in addition to the ability to purchase power. Enron itself also downplayed the importance of the latter, since it could not contract for those benefits.

India's somewhat unilateral approach also continues in the case of older agreements with Nepal. Under the Kosi agreement, India built a dam across the Kosi River in Nepal to control floods in its own state of Bihar during the monsoon season, as well as supply extra water to the state in the dry season. However, the diversion of the Kosi for flood prevention in Bihar submerges arable land in Bihar, destroying standing crops and temporarily dislocating residents of the area in Nepal. The problem is four decades old, but remains unresolved.¹⁸

Bilateral barter or multilateral exchange: Bilateral barter in international diplomacy is subject to the need to find a 'double coincidence of wants'. In the history of South Asian river development, the wants of several governments have not been met partly because there is no 'double coincidence of wants'. Nepal's offer, for example, to assist in the mitigation of flood and drought in Bangladesh could not be easily reciprocated by Bangladesh, because a third party, India, had to be involved, and bilateral barter precludes third party involvement. Even where bilateral agreements and exchanges occur, they can have externalities for third parties: this is still potentially the case with the bilateral agreements discussed earlier in this section. For example, water storage facilities on tributaries of the Ganges in Nepal that enable the use of hydroelectric power in India can have externalities for Bangladesh by affecting the flow of the Ganges downstream at different times of the year.

By contrast to bilateral barter, multilateral exchanges could enable parties from more than two national economies to be involved. Thus, the establishment of "rates of exchange" for water development services could enable exchanges amongst three or more countries and transcend the limits of bilateral barter. The goods and services that could be valued and exchanged are unlikely to be globally traded commodities. Flood mitigation services, transit rights, minimum flow guarantees, equalizing of seasonal flow disparities, and sediment transport reductions are not currently traded services, and there is little reason to suppose that they will be in the future. If the proposed exchange is established, it will constitute a segmented market, confined to the region of those countries wishing to participate.

Some water services could be appropriately transferred outside the diplomatic sphere, to be negotiated by nongovernmental agencies, as the Nepal India Power Trade Agreement has permitted with electric power. Other services could be monetized within diplomacy. In all these cases, the existence of publicly verifiable contracts involving private parties, and competition among those private entities will be important in determining the "rates of exchange" for various services connected to water use and control.

Given the Indian government's past adherence to bilateralism, and despite recent tentative steps toward multilateral negotiation, one can also explore how multilateral exchange might be established *within* a pattern of bilateral diplomacy. We term this option *regionally appraised bilateralism*.¹⁹ The need for a regionally appraised bilateralism can be illustrated in the case of the Nepal-India Power Trade Agreement. One objection to this agreement is that it privatizes one (already monetized) service to be provided by river development, and apparently makes no mention of other services, such as flood mitigation and dry-season flow augmentation, which could be incorporated into projects. This is understandable. Indian cities, industries and irrigation pumps have pressing needs for power which are forcefully represented to the Indian government by organized lobbies. The needs for flood mitigation and dry-season flow augmentation are less well represented to the Indian government. Furthermore, these services may be more desirable to a third nation, Bangladesh. In order to achieve the full range of goods and services that can be generated by the development of South Asian rivers, there are strong reasons for related negotiations over several of these exchanges. Without relinquishing sovereign rights to the development of the shared basin, it may be feasible to establish a system which enables the concerns of more than one party to be incorporated into bilateral negotiation processes.

Expanding negotiations to include private economic actors: The right hand column of Table 1 illustrates the different forms of negotiation which are

anticipated for each transaction. Most are presumed to be traditional diplomatic negotiations between two governments. Within that sphere, some forms of transaction are monetized and others are not. The transfer of hydroelectricity development from diplomacy to economics in the India-Nepal Power Trade Agreement was described earlier.

The fact that one service to be offered from river development can be shifted to the economic sphere suggests that it might be possible to shift others at least part of the way. In this case, the diplomatic negotiation of the supply of hydroelectricity was already assumed to be a monetized exchange, presumably because there are many precedents for the large-scale sale of electricity between countries. Many other services are not monetized, and their negotiation is undertaken fully in the traditional, barter-driven diplomatic sphere. To understand what might be possible, it is useful to look at the border between the traditional diplomatic and private economic spheres.

Diplomacy can be conceptualized as a zone of intergovernmental exchanges based upon reciprocity. Progress in the India-Bangladesh water negotiations following the independence of Bangladesh may be an example of this kind of diplomacy. India's support for the independence struggle created a debt of the new Bangladesh government to India, as well as better relations between the two governments, allowing agreement on trade and a Treaty of Friendship, as well as on the river Ganges, to be achieved. Diplomacy may also encompass more specific barter exchange. The exchange may or may not be publicly acknowledged. The 1977 Ganges Waters Treaty and the prior agreement by India to desist support for armed incursions on Bangladesh is an example of a covert barter exchange.

Diplomacy may also include monetized exchanges negotiated between governments by diplomats, such as negotiations over hydroelectricity before the India-Nepal Power Trade Agreement. This type of exchange is economic -- a trade of a commodity for money is explicit -- but it is also diplomatic since it occurs through negotiation between sovereign governments.

Finally, in the broader economic sphere monetized exchanges take place between a range of agents, including, but not restricted to, private enterprises. There is no particular reason why other services arising from the development of water resources, in addition to hydroelectric power, should not be moved from generalized reciprocity and barter exchange into the sphere of monetized diplomacy. However, this may not be a sufficiently radical shift, and the involvement of nongovernmental actors may be important, for reasons discussed in section III. The agreements discussed above illustrate initial moves in this direction, with respect to hydroelectric power.

Drought reduction and flood mitigation measures are areas where further progress may be made. They are not currently treated as economic variables in any international river sharing agreement. Part of the problem is the public good nature of their benefits. However, both services are measurable, at least in principle, as flows of water greater or smaller than those which would have flowed down the river without intervention. Values can be allocated to water flows by comparison with their values for agriculture or industry.

Transfers of water from one river basin to another have also been sought. The Indian government has made strong arguments for transfers from the Brahmaputra to the Ganges. Transfers from the River Kosi in Nepal to the Teesta in Bangladesh have also been discussed. As the objects of potential diplomatic barter, discussion of such water transfers has become highly charged. Shifting negotiations from the realm of national conflict to one of mutual economic benefit, again including private actors, could help to reduce this issue's political charge. The measurement and valuation of water transfers is, as noted, relatively straightforward.

Guarantees of minimum dry season flows are more problematic, because they may involve survival situations. However, clear allocations of contingent property rights, together with appropriate trading mechanisms for those rights, can help. There is considerable experience with alternative rights and pricing systems for dealing with water shortages in drought-prone areas such as the American West.

While privatization of international water development is not a panacea, the participation of private economic actors in a framework of explicit rights and contracts, can facilitate international negotiations. Explicit economic valuation enables a simpler, more open assessment of an international exchange than is possible with traditional diplomatic barter. Once that step has been taken, other possibilities, including the involvement of private financial institutions, are opened up.

VI Conclusion

Three kinds of obstacle have constrained intergovernmental negotiations over water in the past, and contributed to the rise of significant tensions between states. Firstly, the strict practice of bilateral negotiation has put blinkers on the discussants, exaggerating the importance of past disagreements, limiting discussants' ability to evaluate the regional potential for cooperation, and encouraging the rise of myths about the malevolent roles and limited needs of neighboring states. Secondly, the construction of grand national plans for river development has tended to crowd out plans with benefits for other nations or for the whole region. Thirdly, the limits of bilateral diplomacy have been confined

further by the restrictions of barter exchange. Transactions are only possible, in this type of exchange, when each government has what the other government wants.

The expansion of diplomacy in ways prefigured by the agreements of 1996 and 1997 could overcome these obstacles of bilateralism, grand nationalism and barter diplomacy. Could negotiations about flood mitigation be taken out of diplomatic barter and transferred to negotiations among private and public-private agencies? This transfer would require the design and unfolding of a suitable regulatory framework. That framework could embody the concerns of sovereignty which currently limit the topic to interactions among states. It could also clarify property rights in water, and incorporate the latest thinking on unresolved environmental questions, such as those relating to falling groundwater aquifers. With an appropriate regulatory framework, cross-border transactions involving water services could be a significant source of employment, economic growth and livelihood security. Perhaps the design of a regulatory framework is a topic that could be taken up by SAARC.

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Table 1
Potential International Transactions in South Asia²⁰

Potential parties	Good or service (Exchange: † occurring to some extent, * discussed, Ω suggested)	Type of exchange anticipated
Nepal to India	Supply of hydro-electric power *	Monetized
	Supply of water storage benefits ²¹ *	Barter exchange
India to Nepal	Navigation and transit †*	Barter exchange
	Provision of finance for construction *	Monetized
	Provision of engineering expertise *	Probably monetized
India to Bangladesh	Supply of water storage benefits *	Barter exchange
	Granting secure expectations of minimum flow *	Barter exchange
Bangladesh to India	Navigation and transit rights *	Barter exchange
	Transfer of water from Brahmaputra to Ganges Ω	Barter exchange
Bangladesh to Nepal	Navigation and transit rights Ω	Barter exchange
Nepal to Bangladesh	Supply of hydro-electric power Ω	Monetized
	Supply of water storage benefits Ω	Barter exchange
Bhutan to India	Supply of hydro-electric power †	Monetized
	Supply of water storage benefits Ω	Barter exchange
India to Bhutan	Navigation and transit †	Barter exchange
	Provision of finance and engineering for construction †	Partly monetized

Pictures



1988 Floods in Bangladesh (photo: crow)



Country boat in Bangladesh (photo: Crow)



Tubewell pumping water (photo: Crow)



Hillside terracing in Kathmandu valley, Nepal (Photo: Crow).

Endnotes

¹ This paper builds on Crow and Singh (2000). It extends that paper to focus on floods and incorporates some recent developments.

² By one estimate there are more poor people in the Ganges-Brahmaputra basin than in all sub-Saharan Africa: Rogers et al (1994).

³ The topography of these rivers is, briefly, as follows. The Indus and its tributaries begin in the Himalayas and their foothills, then flow west and southwest through Kashmir and (Indian and Pakistani) Punjab, and finally southwest to the Arabian Sea through Sindh in Pakistan. The Ganges has its headwaters in the Himalayas of Nepal, China and India. It flows south from the Himalayas, before turning east to dominate the geography of North India as it flows through the states of the Ganges plain (Uttar Pradesh, Bihar, West Bengal) and into Bangladesh, where it turns south as it joins the Brahmaputra before emptying into the Bay of Bengal. The Brahmaputra flows west to east through much of the length of the Tibet region of China (where it is called the Tsangpo), before falling 7,500 ft from the Himalayas to the plains of Assam, and turning through almost 180 degrees to flow east to west, then it turns south into Bangladesh, where it joins the Ganges.

⁴ For example: Verghese (1990), Gyawali and Dixit (eds) (1994), Ahmad, et al (1994), Verghese and Iyer (eds.) (1993), Ahmad et al (1993), Thapa, et al (eds.) (1995).

⁵ See Verghese (1990).

⁶ For example, one player in the prisoner's dilemma may assign a small probability to the possibility that the opponent simply plays "tit-for-tat".

⁷ The "lemons problem" arises when one party in a transaction does not have complete information about the value of the trade. For example, a potential buyer may be uncertain about the quality of a good being sold. If the buyer uses average quality as a basis for making offers, high quality goods are withdrawn from the market, leaving only "lemons". Mutually beneficial trades then fail to be consummated.

⁸ This discussion is based on conversations of the second author with Indian officials of the Indus Waters Commission.

⁹ Joseph V. Montville, a former U.S Foreign Service officer, apparently introduced the term Track Two Diplomacy in 1982 (Montville, 1982). In his words, Track II Diplomacy signifies "unofficial, nonstructured interaction between members of adversarial groups or nations that is directed toward conflict resolution through addressing psychological factors." (Montville, 1987).

¹⁰ See Haddad (1996).

¹¹ See, for example, Bavly (1999).

¹² The existence of conflict over the rivers, and the absence of coordination of development has made international agencies, such as the World Bank, unwilling to fund river development projects on these rivers.

¹³ One successful, if limited, bilateral negotiation, culminated in the Indus Waters Treaty of 1960 between India and Pakistan. See Crow and Singh (1999).

¹⁴ Interviews with the first author.

¹⁵ Ohlsson (1995). We will return to this 'zero-sum' issue in Sections III and IV.

¹⁶ A more detailed description of these histories can be found in Crow and Singh (2000).

¹⁷ Formally, the four agreements are these:

i) **The India-Nepal power trade agreement** (Agreement between His Majesty's Government of Nepal and the Government of India concerning the Electric Power Trade, February 17th 1996)

ii) **The Mahakali Treaty** (Treaty between His Majesty's Government of Nepal and the Government of India concerning the Integrated development of the Mahakali River including Sarada Barrage, Tanakpur Barrage and Pancheshwar Project, January 29th 1996).

iii) **The India-Bangladesh Treaty on Sharing the Ganges:** The 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 Waters at Farakka, 12th December 1996. The text of this Treaty is published in *The Independent*, Dhaka, December 14 1996.

iv) **Agreement for the Tala Hydel Project** signed by representatives of India and Bhutan in March 1996 ('Bhutan and India sign Tala Hydel Project' *Kuensel* 3/9/96 p1, 12).

Crow (1998) also considers these agreements. Iyer (1999) discusses the Mahakali and Ganges Treaties, along with the older Indus Treaty.

¹⁸ Problems with the Kosi extend to the nature of downstream solutions also. Flood mitigation embankments built in northern Bihar state have contributed to permanent waterlogging. Natural flooding has perhaps been replaced with a worse outcome (Sharma, 1999). The problem here is not transboundary spillovers, but simply one of neglecting the knowledge and interests of local experts and residents. In this sense, one can argue that a multi-track approach is warranted as well for purely internal flood mitigation issues.

¹⁹ A parallel suggestion to 'think basin wide and act locally' is made in Falkenmark and Lundquist (1995).

²⁰ Based on Crow, et al, 1995, Table 18, Ch 8.

²¹ Including water storage for dry season irrigation and monsoon flood mitigation.