Regional Conference on Risks and Solutions: Adaptation Frameworks for Water Resources Planning, Development and Management in South Asia

Hilton Hotel, Colombo, Sri Lanka

Preliminary Summary of Findings[1]

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South Asia's water resources

The management and development of surface waters and groundwater is a critical issue in the South Asian Region (SAR) where 25% of the world's population but only 5% of global water resources are located. SAR's climate is highly variable. Great seasonal, inter-annual and spatial differences determine water resource availability and the frequency and intensity of extreme events, especially floods and droughts. Population growth, urbanization and expanding economies are placing an ever-increasing demand on the resource for the production of food and energy, to support industry, mining, and livestock, and to supply the drinking water and sanitation needs of expanding cities and rural communities. Increasing demand for consumptive and non-consumptive uses of water is also impacting water availability for freshwater ecosystems and the communities dependent on them. By 2030, demand for water in SAR countries is projected to be twice the available supply.

Water availability is determined by supply and demand. The monsoons and a dramatic rise in water withdrawals for irrigation are key factors in determining the supply-demand balance. The contribution of glacier and snowmelt to the total flow of most Himalayan Rivers is small, with the exception of the Indus Basin where it reaches 35-40%. The Deccan Rivers, coastal rivers and rivers of inland drainage basins are largely fed by Summer and Winter monsoons. About 80% of rainfall occurs between June and September, making built storage (dams, reservoirs and tanks) and natural storage (aquifers, wetlands, lakes and floodplains) critical for the provision of reliable water supplies. However, the region's overall built storage capacity is only around 20% of levels typical in Middle Income Countries (MIC), and natural storage assets, such as aquifers, are insufficiently understood, appreciated, protected and managed. Climate variability has both immediate and longer-term economic implications that will shape future patterns of demand and, therefore, how states, societies and regional institutions will respond to specific policy and practical challenges.

Most major rivers in South Asia are shared by nations or by states and provinces within nations. The largest rivers – the Indus, Ganges and Brahmaputra – originating in the Hindu Kush Himalayan (HKH) mountains are each shared by a number of countries. While there are treaties governing water sharing on the Indus (between two of the four riparians, India and Pakistan), between India and Bangladesh on the Ganges, and between India and Nepal on the Koshi, many other transboundary rivers have no formal frameworks and institutional mechanisms for management or for coordinating responses to water-related events such as floods and droughts. Even existing treaties have largely focused on water sharing mechanisms and have no or limited

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provisions for coordinated responses to disaster risk management, for example flood early warning systems or coordinated planning and management in the event of floods and droughts.

Attention to the protection and management of surface water and groundwater has, to date, not been accorded sufficient priority in South Asia. As a consequence, unsustainable water use, allocation and development practices could continue, with serious implications for future adaptation capacity and economic development:

- Water resources regulatory institutions are generally weak or non existent, promoting inequitable or unsustainable uses of water;
- Degradation in surface water quality from point and non-point sources is widespread, sometimes locally severe, and increasing in many places;
- The ecological health of rivers in the region (including the Indus and the Ganges) has deteriorated under the impact of both increasing pollution loads and inadequate environmental flows;
- Many South Asian rivers carry high sediment loads making these high-energy rivers very difficult to manage during floods, and creating major challenges for hydropower operation, the maintenance of major and minor water storage (due to high siltation rates), and river transport;
- Groundwater is the primary source of drinking and irrigation water in India, Pakistan, Bangladesh, and Sri Lanka. The growing dependence of irrigation on groundwater and proliferation of tube wells with inadequate regulation, protection and management has contributed to severe overdraft in parts of region, affecting domestic supplies, increasing energy costs and reducing agricultural productivity. In addition, groundwater contamination from rural and urban wastewater, industrial discharge and irrigation drainage is also growing. These are additional challenges to the naturally-occurring arsenic, and fluoride contamination in India, Bangladesh, Nepal, and Pakistan.

Water and climate risks

Much of the region is highly vulnerable to water-related disasters. In the last two decades floods and droughts have affected nearly half of the region's population causing signifiant loss of life and damaging local livelihoods and economic development. The last two consecutive years of El-Nino-related drought have affected 330 million people in India alone.

These extreme events are likely to become more frequent and even more damaging as global warming increases and climate patterns change. The IPCC Fifth Assessment Report (2013) identifies key South Asian risks as: (a) increased riverine, coastal and urban flooding, leading to widespread damage to infrastructure, livelihoods and settlements; (b) heat-related mortality; and (c) increased risk of drought-related water and food shortages causing malnutrition. Other climate change risks include: (d) mudslides and sedimentation problems; (e) sea level rise inducing saltwater intrusion of coastal aquifers; and (f) changes to the cryosphere of the Hindu-Kush Himalayas (the so-called 'third pole') with impacts downstream on the hydrology of major rivers including the Ganges-Brahmaputra and the Indus. Figure 1 shows the combination of climate-related hazards (floods, droughts, extreme rainfall, heat waves and sea-level rise) and hot spots in South Asia.

COP 21 in Paris underscored the central role water resources management and development plays in addressing future climate risks. Adaptation in the water sector will require improved management of existing water resources, investments in additional infrastructure, mobilization of government institutions and communities (as well as individuals) and improved knowledge about the impact of climate change on the region's water resources. Groundwater, in particular, is likely to come under additional pressure as a result of climate change and will require significantly improved management.

Objectives

This South Asia Water Initiative-supported technical assistance (TA) has the objective of collaboratively building knowledge, tools and capacity across the region to assist governments in adapting to emerging climate change threats in the water sector through developing effective policy frameworks as well as practical planning, development and management actions that promote effective adaptation responses. The TA will be implemented in two phases. The first phase, being implemented jointly by the International Water Management Institute and the World Bank, consists of rapid, diagnostic reviews of: a) current knowledge on water resources in the region, and climate change science and modeling work; b) existing water and climate change policies, strategies and plans and climate change national adaptation plans and related documents; and c) the potential economic impacts of climate change and the effectiveness of current financing mechanisms and institutional structures in supporting adaptation to change. These reviews, written as three linked papers, are summarized here and will be presented at a regional conference in Colombo from July 12-13, 2016.

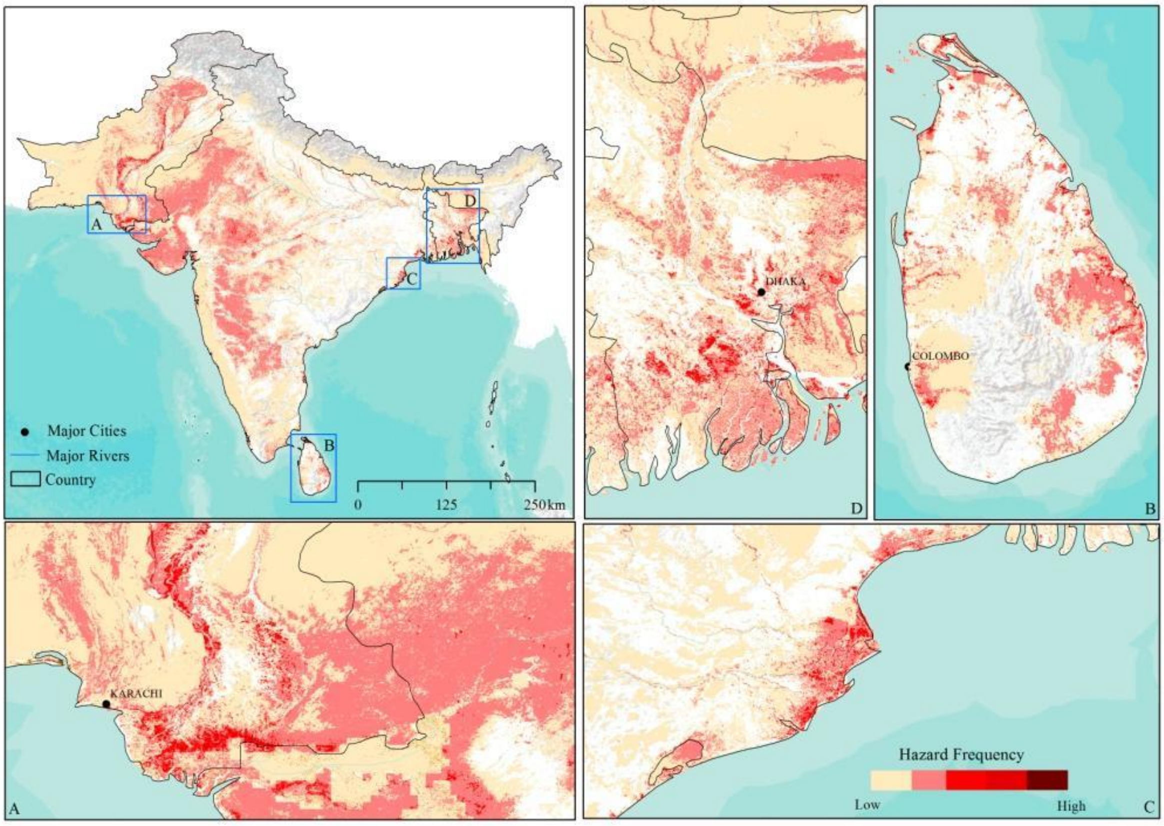

Figure 1. Overall climate-hazard map showing the combination of climate-related hazards (floods, droughts, extreme rainfall, heat waves and sea-level rise) and the hot spots in South Asia. The latter includes part of Bangladesh, Sri Lanka, drought and floods impacts in Pakistan, north-western India and coastal areas in eastern India (Giriraj et al., 2016).

All three reports were conducted as desk studies drawing on existing sources of information. The three reports suggest potential priority areas for more detailed investigation in Phase 2 to help build adaptive capacity in the water sector.

The challenge of climate change

The challenge of climate change in South Asia is such that there is need for substantial improvement in water resources information, governance, development, planning and management. Shah and Lele (2011), in their report from an IWMI/GWP workshop on adapting to climate change in the water sector in South Asia, concluded that "climate change adaptation does not call for a different way of managing water resources; we need to simply do a far better job of planning and managing our water resources than we have done so far" (p14). In particular, we will need to combine interventions of sufficient flexibility to deliver benefits under a range of potential conditions (Lacombe and Chinnasamy, 2016). While adapting to climate change is primarily a matter of instituting flexible, efficient and equitable water resources management using methods that are well known, there are two new topics that need to be integrated into traditional water management concerns – coastal aquifers will need protection from salinization as sea level rises are accompanied by severe storm surges, and monitoring and forecasting capabilities will need to be expanded to take account of changes in climate parameters as a result of global warming.

Table 1 describes the major water-related impacts from climate change and potential options as part of a framework for adapting to these impacts. The adaptation framework builds on earlier work in the SADC region and Zimbabwe and comprises the dimensions of: water resources information, governance, infrastructure, planning and management and communications/participation and education. The table also illustrates the relationship between the three papers prepared in phase 1.

The primary and secondary water-related risks arising from climate change (listed in the first column) are analyzed in Paper 1. Primary risks arise from changes in meteorological and marine parameters as a result of global warming – changes in precipitation, sea-level and temperature. These primary changes then give rise to a number of secondary risks to human activities and livelihoods – including floods, droughts, and changes to groundwater recharge. Access to monitoring data and the use of scientific models for prediction and understanding are central to informed decision making. Paper 1 analyses the adequacy of the existing information base and modeling capability and identifies areas where improvement is needed. It also looks at the extent to which this information is accessible to decision makers.

Paper 2 examines the extent to which various adaptation options, grouped under the five dimensions of knowledge, governance, infrastructure, planning and management, and communications/education and participation, are incorporated and promoted by government water and climate instruments (policies, strategies, plans and legislation). These options include actions advocated by Integrated Water Resources Management (IWRM), an approach to water management that is already widely accepted in South Asia's water policy environment but which has yet to be widely implemented.

Paper 3 then analyses the adequacy of the mechanisms for financing adaptation actions and the structure of water and climate institutions responsible for implementing these actions across multiple scales – local, state, national and transboundary. The paper examines the capacity of these institutions to undertake the actions needed for successful climate change adaptation. The key challenge, as Paper 3 notes, lies in moving from principles contained in policies to the practicalities of establishing effective institutions and implementing actions on the ground.

Table 1. Climate-Related Risks to Water Resources and Potential Adaptation Actions					
Climate Risks	**Adaptation Dimensions**				
	Knowledge	***Governance***	***Infrastructure***	***Planning/management***	***Communications / Education / Participation***
1. Primary risks					
a) Changes in precipitation (especially monsoon)	Research; weather monitoring	Coordination between meteorological, water and agriculture agencies	Dams; inter-basin transfers; groundwater recharge (including artificial options)	Flexible irrigation management systems; inter-sector responses to assist adaptation	WUAs and FOs involvement; capacity development; communication to farmers and other stakeholders
b) Sea-level rise	Monitoring; research	Coordination between water agencies, agriculture and other water using sectors, and coastal authorities	Embankments; sub-surface groundwater barriers, maintaining and restoring natural shorelines	Groundwater use plans; controls over groundwater use;	Involvement of coastal communities; capacity development
c) Temperature extremes	Research; monitoring	Coordination between water, energy and productive sectors	Soil and water conservation; improved water supply infrastructure	Mapping trends and designing for peak demands	Prevention of risk through public information and information sharing
2. Secondary risks					
a) Floods	Monitoring and early warning systems	Coordination (inter-agency, government-public)	Embankments; Dams; flood refuges	Flood management plans; restrict development on floodplains; flood mapping; flood insurance	Public awareness of flood risk areas; capacity strengthening
b) Droughts	Weather prediction and early warning communications; research; monitoring	Allocation priorities and planning mechanisms; coordination between agriculture / power / water resources / water supply; local institutional capacities to manage scarce water resources and improvise	Dams; inter-basin transfers; groundwater development	Water allocation plans; conjunctive use; demand management including pricing; water efficiency technologies; irrigation and urban water management; recycling and reuse	Involvement and sharing local solutions; capacity development
c) Reduction in groundwater recharge	Monitoring and characterization of aquifers; research into groundwater; database on groundwater-related information,	Coordination between agriculture, domestic water supply, industrial water use, water resources; public ownership of groundwater	Check dams, recharge ponds, managed aquifer recharge development	Groundwater use plans; controls over groundwater use including indirect regulation; artificial recharge; conjunctive use	Awareness of groundwater limitations; capacity development
c) Increased erosion, landslides and sedimentation	Research into soil management and protection	Coordination between land, water, energy and other agencies	Sedimentation dams	Land management; riparian management; soil conservation	Awareness of soil loss; participation and local solutions; capacity development
d) Reduced water quality (surface and groundwater)	Monitoring; research into water quality treatment	Coordination between water resource and industry / water supply and sanitation agencies	Wastewater treatment and pollution treatment plants	Water quality standards and enforcement; wastewater and pollution treatment including through incentives and disincentives; recycling and reuse	Awareness on pollution risks and prevention measures, polluter pays principle
e) Glacial Lake Outburst Floods (GLOF)	Research; monitoring and early-warning systems	Coordination between departments working on disaster management, geology, hydro-meteorology	Artificial lowering of lake levels	Hazard and risk management protocols, planning for natural disaster management	Public awareness of flood risk areas; opportunities to effectively participate in local infrastructure development and their O&M; capacity strengthening

Findings

There is generally both a high level of appreciation of the impacts of climate change within the water sector instruments together with a clear understanding that the water sector is key to climate change adaptation within climate change documents. IWRM is formally adopted as a set of guiding principles in almost all countries in both water resources and climate change instruments. While there is little argument about IWRM being the correct approach to water management, its actual implementation is limited, incremental and, in most cases, in its infancy.

Water Resources Knowledge

The need for improved monitoring networks for surface and groundwater volume and quality is one of the most consistently-voiced actions across South Asian water resources and climate change documents. Improved monitoring will be central to the development of surface storage and the management of natural (including aquifer) storage to buffer against increased climate variability. Three countries – Bangladesh, Bhutan and India – advocate that these data be held in a central repository to be made available when needed. A number of countries recognize the importance of specific disaster monitoring systems, such as monitoring of GLOFs in Bhutan and Nepal.

There is also a wide acceptance of the need to invest in research, including modelling the hydrological effects of climate change, and understanding the linkages between surface and groundwater in the Indo-Gangetic plain if planned conjunctive use is to be effective. In Pakistan's Punjab, it is necessary to increase the number of monitoring wells to accurately survey the temporal and spatial variations in groundwater levels and better understand their connections with surface water bodies. Hydrological and groundwater modelling should help forecasting variations in groundwater and surface water availability under different aquifer conditions and climatic scenarios.

While there is a considerable body of scientific information available on efficient water application techniques, this information is neither uniformly developed nor widely available to or used by irrigators.

Countries recognize the importance of mapping flood-prone areas in order to limit settlements in these exposed areas, and for flood forecasting and early warning to allow exposed populations to prepare for these events. Both flood mapping and forecasting as well as early warning systems should account for the expected impact of climate change on rainfall patterns and associated flow regimes.

More broadly, South Asian countries need to take a regional approach to climate change adaptation, not only to tackle regional issues such as large-scale flooding but also to promote data sharing, early warning systems, research and development as well as capacity building of national institutions. Many countries recognize this in their climate change documents. Thus, improved flood mapping and forecasting, taking account of climate change, will require joint development of early warning systems and sharing of data and information, especially in border areas. There is also substantial scope to do more to share and assist in the uptake of best practice across the region, from modeling change to agreeing and implementing appropriate responses.

Satellites are dramatically changing the overall picture available to decision makers and, to some extent, overcoming ground-level data limitations. This is by enabling the measurement of regional masses of water (including surface and groundwater and soil moisture) and monitoring how amounts change over time. It is therefore important to investigate this wide range of new capacities in order to quantify and anticipate water resource changes in areas where ground measurements are unavailable and/or difficult to implement.

Paper 1 also examines different methods for assessing a project's sensitivity to climate change compared to other risks. The Decision Tree Method shows promise as a practical tool for assessing a project's robustness against the potential effects of climate change; though apart from an initial application to the Upper Arun Hydropower Project (in Nepal) there has been little experience of its application within the region.

Water Resources Governance

Probably the biggest gap in water instruments is the absence of agreed water policies and legislation in three countries – Nepal, Pakistan and Sri Lanka. Consequently, these countries lack a coherent response to water problems and are reliant on sub-sector instruments or the policies of water-related sectors such as environment, energy and/or agriculture. Two countries – Afghanistan and Bhutan – do not have a national climate change policy or strategy although they have various reports to UNFCCC that provide some guidance on implementing adaptation actions. Four of the seven South Asian countries (Afghanistan, Bangladesh, Bhutan and India) clearly recognize and incorporate climate change impacts in their water instruments while two others (Pakistan and Sri Lanka) mention climate change.

A key institutional feature of IWRM, namely coordination across water-dependent sectors, is recognized as important in the water instruments of all South Asian countries. All countries have established coordinating institutions although the composition, authority and capacities of these bodies varies considerably. However, another important institutional feature, the separation of water resources regulatory and operational functions, has yet to be widely recognized or implemented.

South Asian governments have created institutions to deal with climate change issues, either through the formation of inter-ministerial coordinating bodies, or through assigning the responsibility to tackle climate-related issue to specific sector ministries. However, the climate change instruments, while detailing many aspects of water management, pay little attention to either the need for regulating water use or cross-sectoral coordination of water-dependent institutions. The climate change inter-ministerial coordination bodies often do not function well, constrained by current institutional set ups and lack of capacity, both in terms of budget and staffing.

The mechanisms for financing climate change adaptation are not harmonized and are scattered resulting in, not only inaccurate estimates of adaptation costs related to specific climate risks, but also uncoordinated funds channeled for climate adaptation across different sectors and levels.

Managing groundwater will assume an even greater significance than it already does because of climate change. Climate change will not only affect groundwater supply in diverse and hard to predict ways but will also lead to an increase in demand for groundwater. Groundwater's unique characteristics (large natural storage, a long detention period, and slow aquifer response) plus the negligible losses due to evaporation make groundwater a more effective buffer against climate change if the resource is managed well. Yet not only is groundwater managed poorly but the links between groundwater and climate change have not been explored in detail in South Asia. Nor are opportunities to conjunctively use and manage surface water and groundwater understood, explored or developed effectively.

Most countries recognize the importance of mainstreaming adaptation. India already includes mainstreamed activities in their accounting for adaptation.

The importance of regional cooperation and coordination is reflected in the transboundary nature of many of the impacts on water resources anticipated under climate change scenarios. Water shortages could intensify existing tensions and create new conflicts over sharing transboundary rivers, whether within or between countries. Some countries – India in particular – are pivotal in developing future transboundary cooperation. The South Asian Association for Regional Cooperation (SAARC) can play a leading role in supporting such cooperation. The recently-held South Asia Groundwater Forum provided an important opportunity to share knowledge on critical aspects of groundwater use and governance in general, including opportunities for adaptation to climate change.

Water Resources Infrastructure
All countries, except possibly Bangladesh, have plans to develop additional water storage but this will only provide additional flexibility to respond to increased climate variability if such storage incorporates in its design the anticipated effects of climate change. The need for additional water storage will be greatest in arid and semi-arid areas and also where groundwater is depleted and worsening in quality (e.g. the Lower Indus Basin) as a result of climate change. This means not only constructing more storage but also reducing sediment loads in rivers to prolong the life of existing storage.

Both existing and new infrastructure will be needed taking account of the effects of climate change and other concurrent environmental changes such as land-use. Thus catchment yields will need to be recalculated to account for changes in annual runoff and storage operating rules will need to incorporate any fluctuations in extreme flows.

Groundwater can also be used more actively as an alternative to surface water storage through the wider use of managed aquifer recharge.

Water Resources Planning and Management
Afghanistan, Bhutan, India and Nepal have adopted basin-level water planning and management. Bangladesh points out that basin water planning and management means that the Ganges should be managed as a single system. Pakistan does not include basin-level water management in its water instruments, presumably because the Indus River is already the focus of its management attention, including under the Indus Water Treaty.

Most countries see improved water-use efficiencies through technical methods as providing the primary response to the threat of increased frequency and severity of droughts because of climate change. Non-technical methods, including demand management and improved management of main canal systems, can be just as effective and are often cheaper although also administratively difficult. Conjunctive use and reuse of treated wastewater are also proposed to augment irrigation water supply, although the latter carries considerable health risks unless currently weak regulatory capacity is improved across South Asia.

Communications, Education and Participation
All countries support community-level participation in adaptation activities within their climate instruments. However, across the seven countries, local communities continue to be positioned as recipients of (nationally-defined) adaptation programs, rather than as actors capable of shaping their own adaption measures. At the same time, local communities remain on the

frontline of change and continue to cope with climate variability directly and show capacity to deal with the additional impacts from climate change. Harnessing and sharing this local knowledge – and better understanding how communities are responding – can enable more effective adaptation across a range of environments.

The irrigation sector, the largest water-using sector, has the greatest experience in devolving responsibility to local water user associations. While there is little evidence that self-management of irrigation districts improves agricultural productivity, participatory management may help improve adaptive behaviors in the face of a changing climate. Currently, ongoing policy discussions on climate adaptation in general, and IWRM in particular, fail to put local communities and marginalized groups into the overall shaping of adaptation strategies.

There is widespread agreement in both water resources and climate change instruments about the importance of building an understanding of climate change and its implications for water resources amongst the general public as well as amongst sectoral groups and decision makers.

Recommendations for Phase II

The three papers propose a number of topics arising from these findings that may assist South Asian countries in building their capacity to adapt to climate change in the water sector. The workshop will consider these and other topics to help develop a shortlist of studies for more in-depth analysis in Phase 2 of this project. The suggested priority topics have headings in bold/underlined below.

Water Resources Knowledge

1. Droughts and floods can be monitored in near real-time using remotely-sensed water-related indices. Can the capacity of South Asian countries be improved such that these technologies can be applied more widely?
2. **A Jointly-Developed Flood Early Warning System Initiative**: A pilot study of a flood early-warning system could be undertaken to examine both the technology required and the means of disseminating possible flood conditions to potentially-affected communities. This would integrate existing national systems and support a region-wide network.
3. Achieving improved water-use efficiencies will require better dissemination of knowledge from research institutions and agricultural extension services to farmers, and the development of capacities to implement these efficiency measures. Can good practice examples be identified and used as models for disseminating scientific understanding to irrigators more widely?
4. **A Data Sharing Initiative**: A number of countries have proposed sharing water data across transboundary river basins and aquifers. Can opportunities for developing shared early warning systems for flood forecasting be taken up through design of an online method for collating and reconciling data collected through different protocols across countries? Are there administrative issues that require further study for both surface and groundwater? How would this be integrated with SAARC initiatives?
5. If community-level adaptation is to become a successful part of the response to climate change, how can community-level monitoring and data sharing be organized and funded so that it can also contribute to higher levels of management? Protocols for data collection, training and capacity development, etc. will be needed. Nepal may provide a useful case study.
6. **Regional Knowledge-Into-Use Initiative**: To what extent is the growing understanding of scientific climate change impacts in the water sector being passed to, and understood

by, decision makers? Is scientific information actually influencing the different adaptation responses needed in different South Asian countries? An analysis of potential bottlenecks in the uptake of scientific information and actions to reduce any bottlenecks would be timely. Training in the use of techniques such as Decision Tree analysis and integrated river basin planning would help decision makers appreciate the sensitivity of proposed projects to climate impacts and the role of river basin plans to inform future development, operational and management decisions, respectively.

Water Resources Governance

1. What are successful models for effective coordination between highly water-dependent sectors and also between water agencies and institutions responsible for climate change in each country? Are water agencies, environmental agencies, or independent coordinating committees, more successful?
2. How well do water managers understand the impacts of climate change and how well do they understand that the IWRM model (even if difficult to implement) provides an adaptation response to climate change?
3. **A Non-Water Governance Initiative**: What is required to effectively mainstream climate change adaptation across water-dependent sectors? Education of officials in water related Ministries? Coordination with agencies responsible for climate change? How can adaptation activities be properly defined and tagged within Ministry budgets without incurring excessive overheads?
4. In federal systems (India and Pakistan) a significant proportion of the adaptation budget is directed through State/Provincial agencies. How well is this coordinated with the national effort and, also, with local adaptation activities? What can be done to improve this coordination?
5. **A Climate Adaptation and Groundwater Initiative**: The impacts of climate change on groundwater needs greater attention in both policy and practice and in financing. The best way to control groundwater use in different hydro-geological and socioeconomic settings needs to be better understood.
6. The inability of the current institutional and financial set up to address climate change challenges through an integrative cross-sectoral approach suggests that the development of water-sector specific adaptation measures may be more successful. Institutionally, such measures could be developed involving not only relevant ministries working in water issues, but also those responsible for land management and energy planning.
7. While ministries in charge of local government are included in central decision making bodies, what is lacking is an explicit mechanism to reflect adaptation needs from the ground upwards. This would enable planning, allocation and tracking of climate funding to support priority needs more effectively and efficiently, and to ensure accountability in the conversion of funds into results. These center-local linkages are key not only for identifying context-specific adaptation strategies, but also for highlighting the centrality of water resources management in climate adaptation.

Water Resources Infrastructure

1. Most infrastructure plans focus on major structures for storage. But is it more effective to revive small, local structures, including traditional storage mechanisms or make more use of local groundwater storage (including Managed Aquifer Recharge and sand dams)?
2. **A Climate Adaptation/Infrastructure Management and Development Initiative**: Major infrastructure will only provide adaptation to climate change if it is designed and operated taking account of climate change. How can design standards and operating

rules be developed that take account of climate change. Bangladesh, in their 2nd Communication to UNFCCC, state that they will establish design standards for flood embankments that take account of climate change. Is this a useful case study and example?

3. The design of new storage infrastructure will require greater attention to issues of erosion and siltation because of the frequency and intensity of major storms anticipated under climate change. Do design standards take account of these potential impacts? Are there adequate monitoring and reporting arrangements for tracking erosion and siltation?

Water Resources Planning and Management

1. Coordinating across national boundaries to develop water-sharing plans under the influence of climate change is a major requirement. Are there preliminary studies that would build confidence and tackle some technical issues to help pave the way for transboundary water planning?
2. **A Regional Basin Planning for Climate Change Initiative**: Introducing basin-level planning and management is a major challenge. Are there lessons to be learnt from pilot studies in Nepal, Pakistan and elsewhere about how to do this?
3. How can water-related adaptation measures be designed to benefit the poor and disadvantaged? How can more gender-responsive approaches be designed into current and future adaptation approaches?
4. Saltwater contamination of coastal aquifers will affect Bangladesh, India, Pakistan and Sri Lanka. However, it receives relatively little attention in climate changes strategies. Is it inevitable? Are there protective mechanisms that are cost effective? Would a pilot study help define the steps to be taken to deal with saltwater intrusion into urban and rural water supplies?
5. An integrated pilot study of drought resilience could be undertaken using a combination of actions – demand management, regulation, water efficiency improvement, MAR, and monitoring.

Communication, Education and Participation

1. What are the identifiers of successful community engagement in adaptation actions? Case studies in Bangladesh or Nepal would be timely. Nepal now has 200 NAPAs in progress – how well do they work? What are the lessons? How should they be organized to provide nationally-coherent responses while still retaining local control? How should they be financed and provided with skills that may not be available locally? How can their lessons be disseminated?
2. **A Regional Educational Initiative on Climate Adaptation and Water Management**: What is the best way to raise general understanding of climate change impacts? Sri Lanka says that generic media campaigns are not effective and that targeted approaches through selected on-ground implementation agencies and small groups are more effective. Is this true more widely across South Asia? How should the targeting be done in different countries?
3. Groundwater is likely to play an increasingly important role in climate change adaptation. How well do groundwater users understand the nature of the communal resource? Can the tragedy of the commons be avoided through education and technical knowledge about shared water resources? Is there need to build this understanding in groundwater-dependent communities?
4. If community-level adaptation is to be a major component of adaptation activities, how can existing community and local institutions, including local government, be utilized? What guidelines, regulations, education and technical support are needed to help them

become involved? How can the strategies of government agencies in climate adaptation be better linked with local community strategies to cope with climate change. Climate-smart villages, in which researchers document local villagers' adaptation strategies in agricultural development and water use, can be considered a starting point from which to build up this linkage. How can ideas of 'water-smart agriculture' be developed and shared across the region – combining efficiency, effectiveness and productivity in use of scarce water resources.