SYNTHESIS OF WORKSHOP DISCUSSIONS

Climate Change, Food and Water Security in South Asia: Critical Issues and Cooperative Strategies in an Age of Increased Risk and Uncertainty

A Global Water Partnership (GWP) and International Water Management Institute (IWMI) Workshop, 23-25 February 2011, Colombo, Sri Lanka

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Foreword

Our aim in this workshop was to promote discussion on how the South Asian region can best address the threats and opportunities latent in the the nexus between climate change, water security and food security. Increasingly, these three issues are tightly interconnected in ways that extend well beyond national borders. Their associated shocks and vulnerabilities are truly global and regional, even if their impacts and the responses to them vary locally. We will not solve these problems by addressing them one by one, country by country or basin by basin. At this critical juncture, if we are to meet future challenges with effective solutions and sufficient levels of preparedness, we need to improve the understanding of these issues at regional level and to develop more coordinated responses.

The workshop organised by the Global Water Partnership (GWP) and the International Water Management Institute (IWMI) was successful in highlighting some of the best thinking in the region on these issues and in identifying several key areas for action. One of the most promising outcomes for the region was an agreement between members of the Planning Commissions of India and Pakistan and Global Water Partnership South Asia to develop a collaborative work plan and seek financial support to set it in motion. The first proposed collaborative event was a farmers' colloquium with participation of farmers from all South Asian states. The event also included the announcement of the establishment of a regional platform on integrated flood/drought management. We hope that this is only the beginning. I am convinced that South Asia has the potential to lead the way in taking a more strategic and integrated approach to these issues.

I would like to thank IWMI, International Development Research Center (IDRC), the GWP Global Secretariat, GWP South Asia and GWP Sri Lanka for making the workshop possible. Thanks to all of the participants for contributing their thinking and their enthusiasm.

A special note of appreciation is due to Uma Lele and Tushaar Shah, members of the GWP Technical Committee, for leading the preparatory work and writing this synthesis of the main points and arguments that emerged from the presentations and discussions at the workshop.

Mohamed Ait-Kadi
Chair, GWP Technical Committee

1. Water and food insecurity in South Asia

Unlike in East and Southeast Asia, economic growth has not been matched by significant improvements in social indicators in South Asia, with the exception of Sri Lanka. In 2005, South Asia was home to 44 percent of the world's nearly 1.4 billion poorest people (World Bank, Chen and Ravallion 2008)[1] and contained the largest number of the world's hungry – nearly 350 million (FAO, 2011)[2]. The food and financial crises of 2007 and 2008 have increased these numbers. Also, unlike during the Green Revolution in the 1970s, agriculture no longer contributes as greatly to income. Agriculture now accounts for less than a fifth of the gross domestic product (GDP) in South Asian countries, yet it still contains more than half of their labour force.

The region faces some of the greatest population pressure on the land in the world. This has resulted in unprecedented stress on natural resources and ecosystems, causing sustained degradation of forest, soils, wetlands, rivers and aquifers. With a three-fold increase in human population since 1950, South Asia's per capita water availability is down to one fifth of what it was 60 years ago. Likewise, the availability of arable land for those dependent on agriculture has declined from over 1 hectare per person at the beginning of the 20th century to less than 0.1 ha today.

As a region, Asia is also very vulnerable to earthquakes and flooding. Typhoons, cyclones, floods and other water-related disasters are on the rise, according to a recent World Bank evaluation, increasing by as much as five times in 2010 alone, with tremendous loss of life, livelihoods and property. Severe flooding in 2007 along the Ganges and Brahmaputra rivers affected over 13 million people in Bangladesh; flooding in Pakistan in 2010 severely affected 20 million people. India has likewise suffered numerous events of extreme rainfall, flooding and droughts. The economic cost of the 2007 floods in Bangladesh was over US$1 billion; in Pakistan it was nearly US$10 billion. The degree of human suffering has been immeasurable. Millions of tons of food lost to crop and land damage have added unknown numbers of food security-related deaths to the thousands of deaths due to the actual flooding and its consequences, including disease.

Risk and uncertainty are increasing in the region due to climate change, greater frequency of extreme events, warmer temperatures and increased incidence of temperature-influenced diseases and pests. Thus, nowhere is sound land and water resources management needed more urgently than in South Asia. Among the key challenges are achieving food and water security for a region that has the largest prevalence of both child and adult under-nutrition in the world.

[1] Chen, Shaohua, and Martin Ravallion. 2008. The developing world is poorer than we thought, but no less successful in the fight against poverty. Policy Research Working Paper. Development Research Group. Washington, D.C.: World Bank. August 2008.
[2] www.fao.org/hunger/en/

2. Purpose of the workshop

Against this backdrop, the Global Water Partnership (GWP) and the International Water Management Institute (IWMI) held a workshop of policymakers and international and regional experts working on the South Asian region in Colombo, Sri Lanka, 23–24 February to explore new ways of promoting 'out-of-the box' thinking about the region's food and water security issues. The specific objectives of the workshop were fivefold:

- To understand the current state of knowledge related to climate change, food security and water security
- To distil lessons from past
- To identify means of effective dissemination of existing knowledge
- To explore and plan a collaborative platform/network/community of practice among GWP's South Asia regional partnership (GWP SAS), the GWP Technical Committee, IWMI, and national and regional players
- To map out how such a collaboration would work in practice, including organisational arrangements, a shared 5-year work plan and fundraising strategy, areas for research and analysis, periodic expert meetings, training, and publication and dissemination.

GWP SAS and various country-level partnerships offer a network of stakeholders with outreach and potential policy influence in the region. IWMI, which is headquartered in Sri Lanka and has a history of strong water policy research throughout the subcontinent, was an ideal co-convener of the workshop. Underlying the design of the workshop was the expectation that it could serve as the foundation for a regional initiative to provide strong evidence-based and innovative thinking on water and food security and climate change in South Asia with greater synergetic cooperation among South Asian countries than exists today.

The Sri Lankan Minister of Agriculture, in a special message conveyed by Kusum Atukorala, Chair of GWP Sri Lanka, extended support and good wishes to the workshop participants. Sardar Tariq, Chair of South Asia Regional Water Partnership, shared his confidence that the GWP network would be able to take the cooperation among the countries to a higher level than in the past. In her message, Letitia Obeng, the chair of GWP, stressed the need for knowledge generation and sharing around the water and food security–climate change nexus. For Ania Grobicki, the GWP Executive Secretary, it is important to focus on the interface between knowledge and decision-making and the link through to action with the stakeholders on the ground. In his opening remarks, Mohamed Ait-Kadi, the chair of the GWP Technical Committee, outlined how difficult the challenges of water and food security facing the region are and why it is critical for countries in the region to cooperate for a secure future. Welcoming the participants to IWMI headquarters, IWMI's Director General Colin Charters, suggested that GWP and IWMI should work together to foster such cooperation on a science-based agenda.

The two-day workshop featured rich discussions centred around various clusters of presentations (see Annex 1, Part 2 for the programme). Of the 30 presentations, three focused on India, four on Pakistan, two on Sri Lanka and one each on Bangladesh and Nepal; five presentations focused on the region as a whole, and six had a global perspective. While the workshop presentations focused on critical issues, some key issues that had initially been proposed, such as whether and how national- and state-level policy and planning is affected by analysis of climate change issues, were not covered because certain invited key speakers were unable to participate. Therefore, there is a need to continue exploring these issues in subsequent gatherings. This report presents a synthesis of the presentations and discussions they generated.

To set the stage for the workshop, Uma Lele, member of GWP Technical Committee, began by reviewing essential concepts in food and water security.[3] She outlined South Asia's formidable food and water security challenges. In 1981, China had 44 percent of the world's poor people. By 2005, this fell to 15 percent but South Asia's share increased from 29 percent to 44 percent. Stressing the interdependent nature of some of the MDGs, Lele highlighted several puzzling trends.

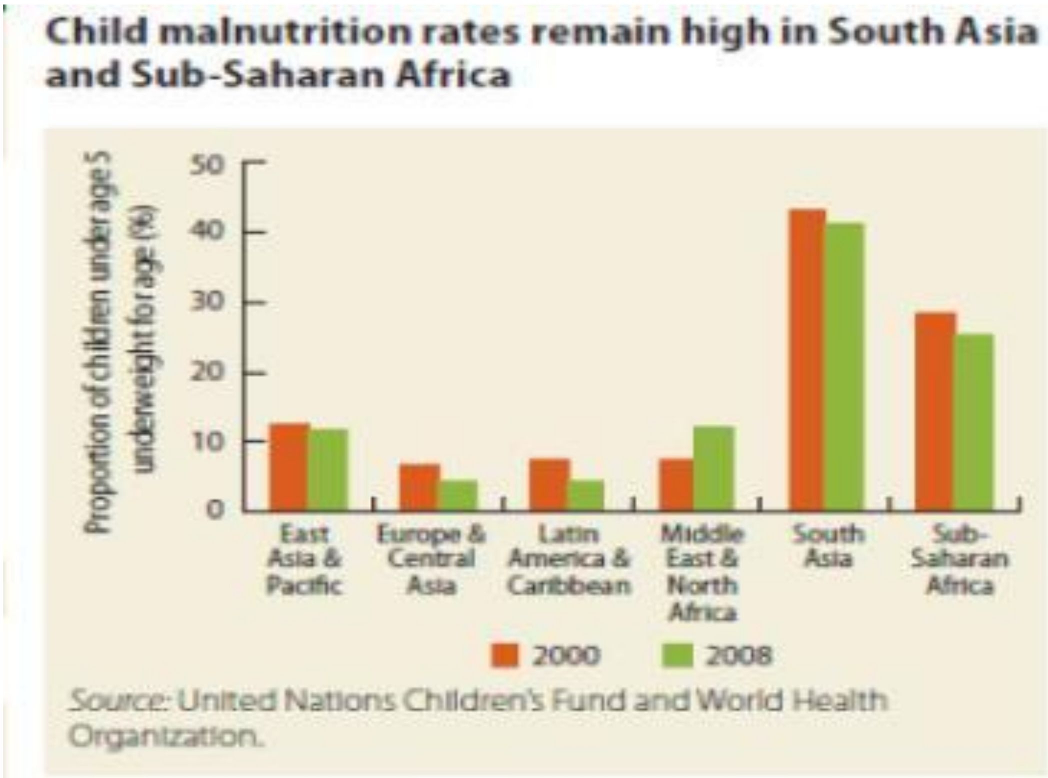
For example, data suggest that South Asia is reducing levels of poverty faster than it is reducing hunger; it is also improving water access faster than access to basic sanitation.

Figure 1: Geographic distribution of the world's hungry and undernourished people

[3] FAO defines food security as "all people, at all times, having physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life". There is no current internationally accepted definition of water security. But Gray and Sadoff define water security as insuring "the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable limit of water-related risks to people, environment and economies."

Despite economic growth, South Asia's rate of child malnutrition remains the highest in the world – even compared to sub-Saharan Africa and even after taking into account the gains made in the last decade.

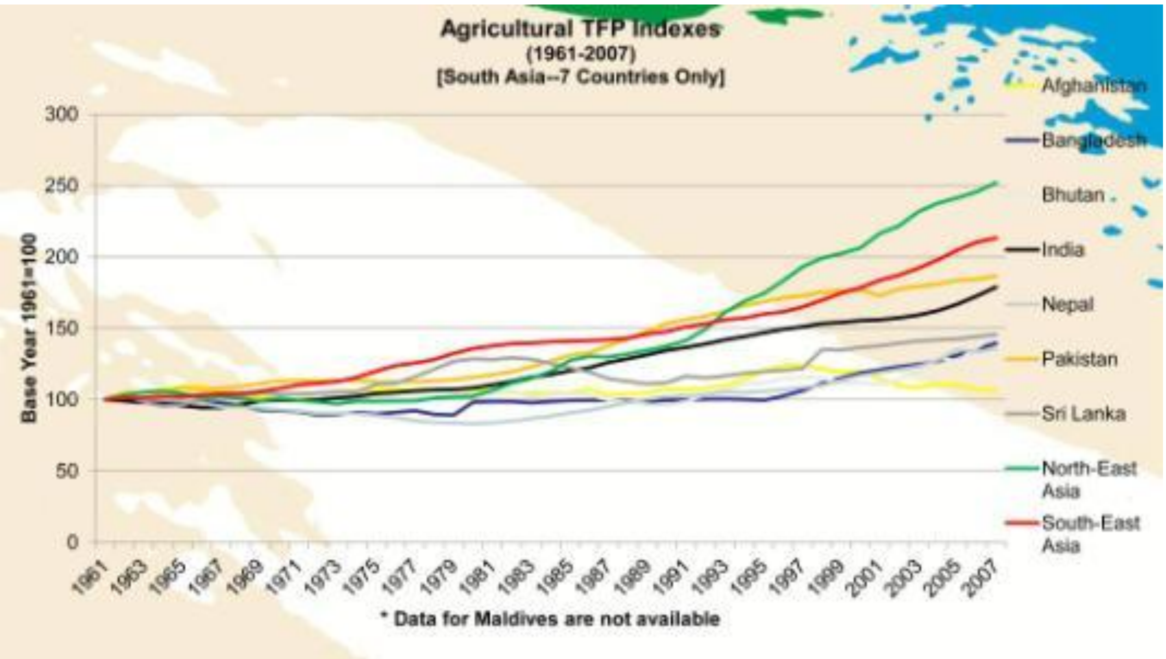
Figure 2: Child malnutrition rates by region



Of course, there are differences both between and within countries. Bangladesh has done better on many social indicators as compared to India.[4] While the agricultural population is projected to drop in the rest of the world, both agricultural and urban populations are projected to increase in South Asia, due in part to the fact that neither agriculture nor manufacturing are creating as many jobs in South Asia as in Southeast and East Asian countries. Recent analysis also suggests that growth in total agricultural factor productivity in South Asia is slower than in the neighbouring countries in Southeast and East Asia, and is insufficient to compensate for the rising population pressure and the rapidly changing patterns in food demand (towards a preference for more resource-intensive foods) in the face of poor regional economic integration.

[4] Amarty Sen has attributed Bangladesh's greater progress on social indicators to educating women. Within India too there are huge differences among states in economic growth and food insecurity.

Figure 3: Agricultural TFP indexes by region



Source: Keith O. Fuglie, Total Factor Productivity in the Global Total Factor Productivity in the Global Agricultural Economy. http://www.card.iastate.edu/books/shifting_patterns/pdfs/chapter4.pdf

3. The challenge of climate change

Presentations and discussions in the workshop traversed the local-to-global and particular-to-general concerns. The need to adapt to the varied impacts of global warming and climate change was the constant refrain. There was general agreement that climate change – to which South Asia is particularly vulnerable – will only make the region’s complex water challenges even more daunting. There was also general agreement that there was little that South Asia could do in the immediate future in the way of mitigation to improve its prospects; its core challenge is one of adaptation.

As Uma Lele recounted, the past two decades have already witnessed 750 million people affected by natural disasters and extreme events in the region, resulting in 230,000 deaths and US$45 billion in damage. Melting glaciers in the Himalayas will increase the frequency of flood events and their intensity in sub-Himalayan areas, leaving these vast plains with permanently reduced river flows in 30–50 years. Sea level rise is already affecting cities with large populations. Rising temperatures are raising irrigation requirements for crops, and increasing rainfall variability will place rainfed agriculture at severe risk. Some models project that India’s GDP may suffer a 2 percent loss because of climate change; Bangladesh, Maldives, Nepal, Pakistan and Sri Lanka may suffer even more. Lele pointed out that South Asia will thus need to face the full implications of the increasingly strong interconnections between water insecurity, food insecurity, climate change and regional integration. Flows of international aid to the South Asian region have already declined as share of GDP and investment. Thus, the region's policy makers will have to brace up to meet this triple challenge by making the right investment choices, creating appropriate institutions and policies, and by effectively addressing questions of productivity, equity and sustainability as a collective.

Expanding on the notion of the increasing frequency of water-related disasters in Asia, Mike Muller, member of GWP Technical Committee, suggested later in the workshop that water security is different from food security and energy security in that it "also captures destructive aspects of water, floods and droughts as well as effects on water quality" besides incorporating "broader environmental and biodiversity goals." Muller argued that achieving water security will be a complex business and will involve resolute action in three areas:

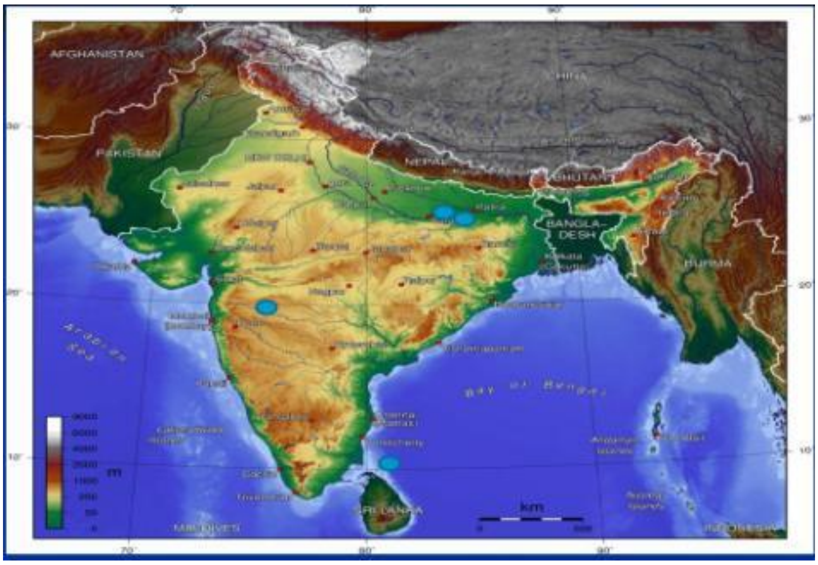
- Making good investments in *infrastructure* to store and transport water, and treat and reuse waste water
- Crafting robust *institutions* that are able to take and implement decisions
- Gathering, analysing and using *information* and the capacity to predict, plan and cope.

Emerging literature is going beyond coping to focus on the importance of disaster preparedness through systematic planning and implementation. Pursuing that same theme, Muller noted that whether water security is a useful paradigm will be judged by a dual test:

- Does water security help us to address the broader developmental challenges of poverty and social inclusion?
- Does water security guide us as to the structure of the institutions that we may choose to use to achieve it?

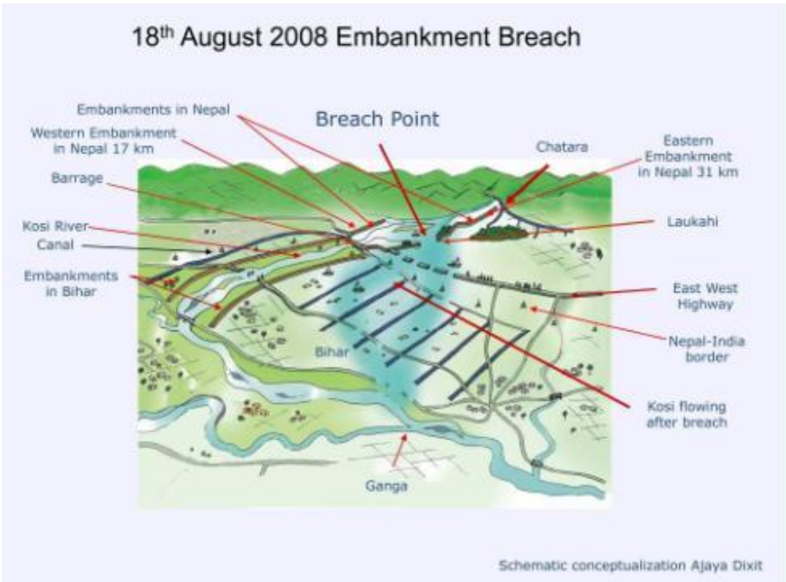
Detailed country-level assessments of climate risks were presented to explore these issues. Ghazanfar Ali, Pakistan's leading glaciologist, drew participants' attention to rising climate-related risks in South Asia. According to him, two thirds of disasters – cyclones, floods, drought, Glacier Lake Outburst Floods (GLOFs) and desertification – are climate related, and there has been a phenomenal increase in their frequency and severity.

Figure 4: A Region with multiple climate hotspots



Like all island states, Sri Lanka's charged climate change discussions consisted of its future vulnerability to extreme events as well as sea level rise. Eriyagama Nishadi and Vladimir Smakhtin, water experts from IWMI, reviewed a large corpus of studies to show that the country may gain in mean annual water availability but will suffer increased temporal and spatial variability. In particular, areas of north-eastern and eastern dry zones of Sri Lanka are likely to become even drier. Overall, agriculture will be affected adversely; improving irrigation may help to arrest this decline. Dipak Gyawali, from the Nepal Water Conservation Foundation, explored the risks posed by climate change to Himalayan states such as Bhutan and Nepal, from increasing frequency and intensity of flash floods and their impact on hill agriculture and livelihoods.

Figure 5: Flood events along the Nepal-India border, 2008



Nasir Gilani, Pakistan's national water planner, explored climate change's impact on Himalayan ecology on the plains of Pakistan Punjab and Sindh. He argued that the increasing intensity of flood events is Pakistan's major threat. The 2010 flood in the Indus was an example of what Pakistan needs to prepare for in adapting to disasters. Participants watched a short but powerful film on the flood's devastating effect. The negative impact of floods on Pakistan's economy, which has averaged six billion dollars per year during recent years, is four times greater than a century ago. Gilani cited an Intergovernmental Panel on Climate Change (IPCC) report predicting that the Indus Basin is destined to face higher frequency, severity and coverage of extreme events like floods and droughts. The main thrust of the Pakistan presentations was the need for increased investments in dams and canal lining as the response to climate change.

While climate change will likely bring more floods in Pakistan, it will also be the cause of deepening water scarcity. The Indus system, the mainstay of Pakistan's agriculture, will experience far-reaching changes due to climate change. Ali showed that the Indus system depends on glacier melt for an unparalleled 45 percent of its flow, as compared to 9.1 percent for the Ganges, 12.3 percent for the Brahmaputra and 6.6 percent for the Mekong. The Tarim basin in China is the only other comparable Asian basin: it depends on glacier melt for 40 percent of its flow. While China also has Yangtze and Yellow rivers, which depend for only 18.5 percent and 1.3 percent respectively of their flow on glacier melt, Pakistan has only the Indus. According to Ali, once the glaciers are finished melting in the coming three decades or so, no country in the region will suffer as much water stress from the Himalayan impact of climate change as Pakistan.

Other sources support this concern. IPCC (2007)[5] has contended that increased snowmelt will contribute to growing river flows and flooding for the coming 2–3 decades, after which river flows will decrease as glaciers recede. The World Bank (2006) reported a similar conclusion, suggesting that river flows will increase for 50 years, followed by a 30–40 percent decline over the course of the subsequent 50 years. For Pakistan, predicted decline in rainfall is an additional risk that may cause severe water stress in arid and semi-arid areas. Rising mean temperature and depletion of soil moisture will create new vulnerabilities for Pakistan's agriculture and food security, and declining river flows will adversely affect its coastal ecology and, in conjunction with reduced precipitation, may result in expansion of its desert areas.

How glacier melt in the Himalayas will respond to climate change is, however, a subject of some controversy among scientists. While some glaciers are receding, others are actually growing. Ali, who has followed Himalayan glaciers in the Hunza basin in the Karakoram Range of Himalayas, found that five out seven glaciers whose volumes have been monitored during 1979–2000 have gained significantly in volume, while only two have declined. This discrepancy between predictions and the experience on the ground in some areas illustrates the hazy state of our current knowledge and understanding about precisely how climate change will affect snowmelt contribution to Himalayan river systems.

Tushaar Shah, member of GWP Technical Committee, summarised the findings of the work of Indian scientists. India's hydro-climatic regime is expected to alter significantly over the course of the 21st century. Quite aside from the snowmelt impacts, parts of the Indo-Gangetic basin may also receive less rain than in the past. However, the rest of India, like much of Sri Lanka, is likely to benefit from greater – but more variable – annual precipitation. According to IPCC (2001)[6], most Indian landmass below the Ganges plain is likely to experience a 0.5–1 degree rise in average temperatures during 2020–2029 and a 3.5–4.5 degree rise during 2090–2099. Many parts of peninsular India, especially Western Ghats, are likely to experience a 5–10 percent increase in total precipitation (IPCC 2001); however, this increase is likely to be accompanied by greater temporal variability.

Throughout the subcontinent, it is expected that 'very wet days' are likely to contribute more and more to total precipitation, suggesting that more of India's precipitation may be received in fewer than 100 hours of storms – and half in less than 30 hours – as has been the case during recent decades. A combination of higher precipitation intensity, larger number of dry days in a year and increased frequency of extremely wet rainy seasons will also mean increased runoff. According to some scientists, compared to 1900–1970, most of India is likely to experience a 5–20 percent increase in annual runoff during 2041–2060. All in all, if the predictions prove true, the entire subcontinent will have to adjust to receiving

[5] IPCC (2007): The Fourth Assessment Report
[6] IPPC (2001): The Third Assessment Report

more of its water through rain than through snowmelt, to snowmelt occurring faster and earlier, and to less soil moisture in summer and higher crop evapotranspiration demand as a consequence.

The hydro-climatic change will then mean:

- Kharif (monsoon) season crops will be subject to heightened risk of floods and droughts
- Rabi (winter) and especially summer crops will experience increased evapotranspiration and thus will need larger, more frequent doses of irrigation
- Surface water storage – large and small – will benefit from increased runoff but will also suffer increased evaporation from large open surfaces of reservoirs and open canal networks as a result of higher mean temperature
- Irrigating the same area through canals will necessitate larger reservoir storage; more frequent droughts will also mean greater need for multi-year reservoir storage capacity, of which South Asia currently has very little.

From these points of view as well as others, managing groundwater storage will acquire greater significance for the plains of South Asia than ever before. In addition to affecting groundwater demand, climate change is expected to have an impact on groundwater supply in direct and myriad ways. Links between climate change and groundwater have received little attention in the literature or policy so far. Given that the region has come to depend heavily on groundwater irrigation, greater analysis and sound policy on groundwater are critical for South Asia's agricultural future.

For example, to the extent that climate change results in spatial and temporal changes in precipitation, it will significantly influence natural recharge. Moreover, since a good deal of natural recharge occurs in areas with vegetative cover, such as forests, changing evapotranspiration rates resulting from rising temperatures may reduce infiltration rates from natural precipitation and thus reduce recharge. Recharge responds strongly to the temporal pattern of precipitation as well as soil cover and soil properties.

In the African context, scientists have shown that replacing natural vegetation by crops can increase natural recharge by up to a factor of 10. If climate change results in changes in natural vegetation in forests or savannah, these too may influence natural recharge; however, the direction of net effect will depend upon the pattern of changes in the vegetative cover. Simulation models developed by Australian scientists have shown that changes in temperatures and rainfall influence growth rates and leaf size of plants and that these parameters in turn affect groundwater recharge. The direction of change is conditioned by the context: in some areas, the vegetation response to climate change would cause the average recharge to decrease, but in other areas, recharge to groundwater would more than double. Changing river flows in response to changing mean precipitation and rainfall variability, rising sea levels and changing temperatures will all influence natural recharge rates.

All available evidence suggests that groundwater recharge through natural infiltration occurs only beyond a threshold level of rainfall; however, it also suggests not only that runoff increases with rainfall but also the runoff coefficient (i.e. runoff/precipitation) itself increases with increased rainfall intensity (or precipitation per rainfall event). Higher variability in precipitation may thus negatively impact natural recharge in general. What will be the net impact on a given location will depend upon the change in both the total precipitation and the variability of that precipitation.

The Indo-Gangetic aquifer system has been getting heavy recharge from the Himalayan snowmelt. As snowmelt-based runoff increases during the coming decades, its contribution to potential recharge may increase; however, in the Ganga-Meghana-Brahmaputra system, a great deal of this runoff may end up as 'rejected recharge', and thus enhance river flows and intensify the flood-proneness of eastern India and Bangladesh. As the snowmelt-based runoff begins declining, one should expect declines in runoff as well as groundwater recharge in this vast basin.

A major interplay of climate change and groundwater will be witnessed in coastal areas. Using over 40 years records of coastal tide gauges in the north Indian Ocean, Indian scientists have estimated sea level rise between 1.06–1.75 mm per year, consistent with 1–2 mm per year global sea level rise estimates of the IPCC. Rising sea levels will threaten coastal aquifers. Many of South Asia's coastal aquifers are already experiencing salinity ingress. This problem is particularly acute in the aquifers along the Saurashtra coast in Gujarat and in the Minjur aquifer in Tamil Nadu. In coastal West Bengal, Sundarbans (mangrove forests) are threatened by saline intrusion overland, affecting its aquifers. Coastal Bangladesh is experiencing similar problems. The precarious balance between freshwater aquifers and seawater will come under growing threat as sea levels rise. Coastal aquifers are thus likely to face serious threats from climate change induced sea level rise.

Some scientists suggest that climate change may alter physical characteristics of aquifers themselves. Higher CO_2 concentrations in the atmosphere, they argue, may influence carbonate dissolution and promote the formation of karst, which in turn may negatively affect infiltration properties of topsoil. Others have argued the opposite. From experimental data, some scientists have claimed that elevated atmospheric CO_2 levels may affect plants, the vadose zone and groundwater in ways that may hasten infiltration from precipitation by up to 119 percent in a Mediterranean climate to up to 500 percent in a sub-tropical climate.

There is growing interest among climate scientists in carbon capture and storage (CCS) and geological sequestration. New uses of aquifers as carbon storehouses may compete with existing uses of aquifers as water storage in ways that are not clearly understood. However, if geological sequestration takes off in a big way, it may significantly affect agriculture through groundwater irrigation.

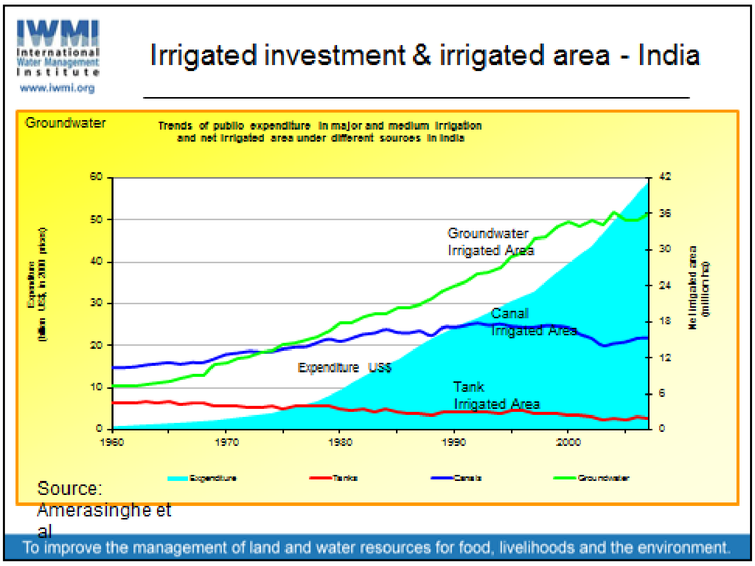
4. Water resources planning: Need for a paradigm shift

How best can South Asia adapt to these myriad impacts of climate change? The common refrain in the workshop discussions was 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.

The keynote address by Mihir Shah, member of India's Planning Commission which is responsible for water resource management, set out how India can achieve this. Shah's presentation explored some of the fundamental accumulated issues in water resource planning and management. Shah began with the dictum that **we need to move beyond the "complacency of denial mode"**. We cannot manage – nor properly budget for – what we do not measure. He argued that the basic national water budget for India, which has been treated as a holy cow ever since the country became independent and on which mega water development projects have been planned and executed for billions of dollars, has increasingly come into question from independent scholars.

All along, India's water planning has worked on the assumption of total available water resource of 1,123 billion cubic metres against a current demand of 634 billion cubic metres, which is slated to rise to 1,180 billion cubic metres in 2050. Shah cited new research to show that the water resource actually available to India is much smaller than assumed and the country may already have developed all its water resources, with little scope for more development. He explored the causes of the deepening water crisis in India, namely reduced efficiency of major and medium irrigation systems due to implementation failures; the absence or ineffectiveness of water users associations (WUAs) and the low technical and managerial capacity of irrigation department staff; failure of cost recovery; and failure to expand surface irrigated areas despite substantial investments.

Figure 6: Irrigated investments in India



He argued that the era of further water development might be over. From now on, the only way India can improve its water security is by focusing squarely on improving the management of water resources for which the country has already built the infrastructure.

In this direction, Shah outlined **a 10-point agenda for India's 12th Five-Year Plan**, which is to be implemented during 2013–2017. These would include: a total reform of Government of India's multi-billion dollar Accelerated Irrigation Benefits Program (AIBP); restructuring of irrigation bureaucracies and broadening their competency base to include community social skills; renewed emphasis on watershed management in rainfed areas; proactive groundwater management through aquifer mapping; introduction of river basin planning and management; deep reforms in water laws and policies; and a new thrust towards urban water management.

Shah outlined a reform programme based on active involvement of a broader range of stakeholders, including the Indian and external scientific community, civil society and farmers' organisations. He also proposed creating water regulators in each of the Indian states after the encouraging experience of Maharashtra. His recommendations also included the formation of a new National Water Commission to act as a coordinator of the national water strategy and to resolve the competing interests of stakeholders driven by narrow self-interests, representing different sectors, and endowed with incomplete information, unequal power and voice.

Most issues Shah identified in his discussion of India resonated with the thinking of the participants from other South Asian countries. A core concern was the poor performance of public systems in irrigation, urban and rural water supply and sanitation, as well as in environment management. From a water and food security viewpoint, however, the most urgent is the need to revitalise public irrigation systems by addressing the myriad administrative, technical, social and political constraints Shah outlined in his presentation. There was also some evidence that other regions of the world facing water resource management challenges may be progressing more rapidly in reforming systems of top-down paternalistic administrations inherited from the colonial period than are South Asian bureaucracies.

5. Improving performance of public irrigation systems

Shah stressed that public irrigation systems in South Asia are notorious for their under-performance. Gyawali's discussion of the evolution and performance of the Kosi project in Nepal and India reflected **a concern throughout South Asia of persistent failure of public systems, and the planning and management of large water projects**. Designed to irrigate over 670,000 ha, the project seldom managed more than 55,000 ha. It was designed to flood-proof 214,000 ha; yet post-project, 415,000 ha has been under a permanent state of flooding. It was designed for a sediment yield of 700 m^3/km^2/year; however during 1981–1994, its average sediment yield was 12,000 m^3/km^2/year – seventeen times the designed value. The project is able to generate only a small fraction of the 20 MW of power it was designed for.

Gyawali wondered if the Kosi project and other mega water projects in the region really leave the people better off in net terms. He argued that instead of integrating its ancient indigenous knowledge and practice with modern ideas, South Asia has taken wholesale to modern engineering and dumped its ancient wisdom. Kosi would perhaps have been less lethal and destructive than it was before the project if only the planning of the Kosi project had factored in the key role that was played by numerous ponds upstream in the ecosystem of the river by taking a 'toad's eye view'. Ponds stabilised landslide and gullies, preserved green water and increased maize production.

Gyawali's concerns were echoed by Thierry Facon and Aditi Mukherji, water experts from FAO and IWMI respectively, who presented results of rapid appraisal of performance of 30 Asian irrigation systems. Their conclusion: "equity not achieved reliability dubious, flexibility very low". According to Facon and Mukherji, stagnation and decline are the dominant characteristics of the systems they studied. Low flow rates and poor irrigation services have driven South Asian farmers to groundwater irrigation. It is this informal, atomistic pump irrigation economy that has helped the much-needed intensification of smallholder farming in the region.

Facon and Mukherji found that of the 30 systems they studied, all except two were multiple-use systems; and the crop water productivity was but a small portion of their aggregate water productivity. Poor water delivery service at all levels was the bane of all these systems; and system managers had a systemic tendency to over-estimate the level of service they actually delivered.

The conclusion of Facon and Mukherji's studies was that the greatest scope for delivering better service in South Asian public irrigation systems lies in improving the management of the main canal system. Irrigation managers keep bemoaning lack of resources at their command for poor service delivery. Facon and Mukherji, however, found that a large budget helps but is by no means sufficient for improving services. What helps more is tighter, more accountable system management. Among the 30 systems studied, Facon and Mukherji found massive variation in water productivity ranging from 0.073 US$/m^3 to 0.18 US$/m^3. Counter-intuitively, however, strong WUAs play little role in improving service as well as water productivity. Equally counter-intuitively, Facon and Mukherji found that the fewer the employees per hectare, better the irrigation service. In their analysis, tightly run irrigation agencies that focus on better employee management through incentives, empowerment, supervision and capacity building play a big role in improving irrigation service to farmers. Canal lining, which guzzles billions of dollars and eats up about 40 percent of the project cost, contributes little to improving service quality.

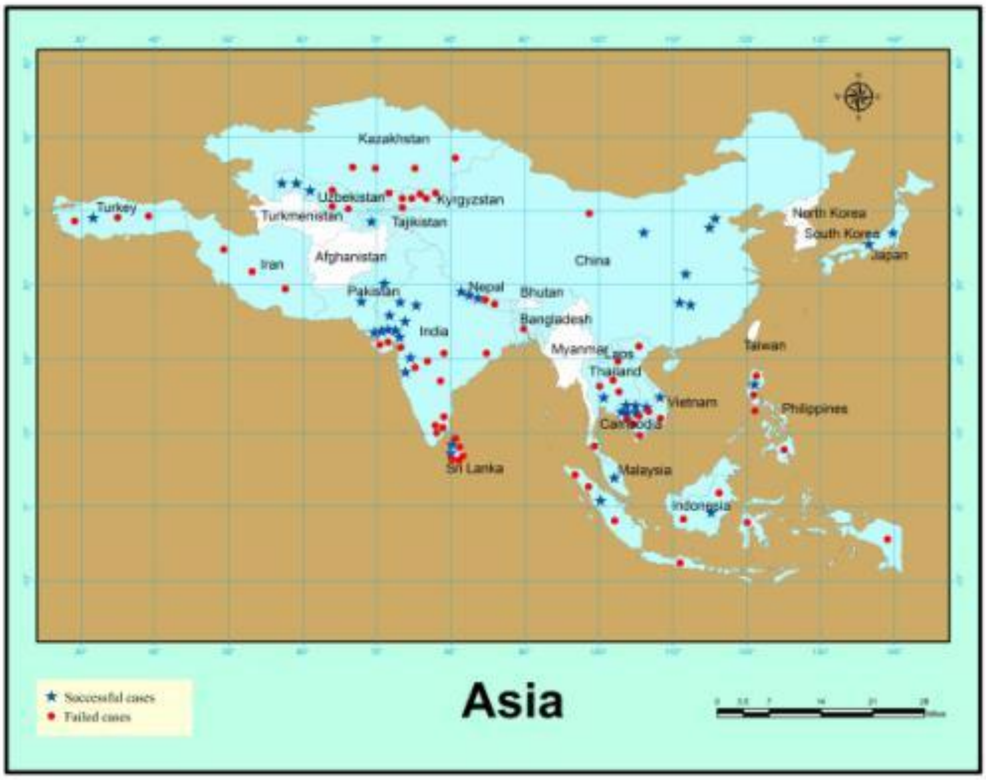
While it is true that seepage losses account for 10–40 percent of diverted water, these persist even after canal lining; and in many areas, these seepage losses support a vibrant irrigation economy based on conjunctive use of surface and groundwater. To address the current water, energy and food crisis, Facon and Mukherji argued, existing large-scale systems need to move towards greater complementarities and convergence with small-scale and atomistic irrigation systems.

The upshot of Facon and Mukherji's studies was that South Asian public irrigation can improve by focusing more on software than on the hardware of irrigation management. An organisational change programme in irrigation bureaucracies needs to inculcate a new development ethos, correct the top-down bias of bureaucratic management, promote accountability and control political clientelism. It needs to overcome path dependency and rigidity and bring about a new era of public systems management reform.

Irrigation reform has indeed been much in the air in South Asian discussions over the past 30 years. However, the dominant thinking is all is well with the main system and the bureaucracy – what needs reform are the farmers. As a result, institutional reforms are firmly driven below outlet – on reforming the farmer. Participatory irrigation management (PIM) through WUAs has emerged as a silver bullet to improve the functioning of surface irrigation throughout South Asia, and indeed, the whole developing world.

In his talk, Madar Samad of IWMI synthesised years of IWMI research in this field to ask a key question: do schemes transferred to WUAs perform better than those under agency management? Reporting from a worldwide IWMI study of 118 cases, Samad found no striking conclusive results. The IWMI study showed that PIM works slightly better in pump schemes than in gravity flow schemes; marginally better in small schemes than large schemes; and in schemes serving fewer members somewhat better than in schemes serving large number of members. It also showed that PIM did marginally better in simple schemes than complex schemes; in non-paddy schemes better than in paddy irrigation systems; and in rehabilitated systems better than in non-rehabilitated ones. PIM works better when O&M is fully transferred and it works much less well when implemented by government than when implemented by non-governmental organisations (NGOs). None of the differences, however, were large enough to lead to firm policy conclusions about how to make PIM work on a large scale.

Figure 7: Distribution of successful and failed cases of PIM according to a comprehensive review of 108 documented cases of PIM in Asia by IWMI



PIM is not a silver bullet. The question Samad then raised was: is the PIM concept to blame for the lack of success or is it the half-hearted, shoddy implementation that is the problem? He argued that it is probably the latter. In most situations institutional reforms are focused only at the lowest level, while the irrigation agency continues in a business-as-usual mode. The neglect of improvements in main system management is the principal reason for poor performance of PIM.

Poor performance in large dam and canal irrigation projects managed by government bureaucracies was a concern shared by many participants. As an alternative, some might suggest reverting to traditional modes of local water management. This radical view, aired by Gyawali in discussing the Kosi project, would advocate **combining large-scale water projects with decentralised local initiatives.**

For Pakistan, however, dams are far more important than the rest of the South Asia. Even as he despaired about corruption and poor performance in the irrigation bureaucracy of his country, Pervaiz Amir of Asianics Agro-Dev International argued that Pakistan's experience with dams has been somewhat better than elsewhere in the region. Dam projects in South Asia seldom produce the benefits that were touted during the planning stage. However, Pakistan's Tarbela dam produced more benefits than were projected. It generates 3,000

MW of power – only 2,400 MW was planned for; it irrigated 17.5 million ha against the planned 15 million ha; and it reduced flood damages from US$43 billion to US$10 billion. According to Amir, **for Pakistan, dams have proven to be very effective in addressing issues of food and energy security and would be even more important in the context of climate change, even though, as in other countries in the region, mismanagement, governance and corruption are very serious issues in the water sector**.

Amir argued that **Pakistan badly needs more storage as its principal defence against climate change and food insecurity**. It needs more dams, but it is not building them fast enough. At present, the country can store only 30 days' worth of its water requirement. While India has built 245 million acre-feet (MAF) of storage against a water resource of 750 MAF (i.e., >30 percent), Pakistan has built only 12.35 MAF for the total water resources of 145 MAF (i.e., <10 percent). Dams are also important for addressing Pakistan's power shortage, which is of the order of 5,000 MW. The alternative to hydropower for Pakistan is thermal power, which is far more expensive. The power deficit is not only robbing Pakistan of some 5 percent GDP growth annually but is also a major cause of popular discontent, political turmoil and social disharmony, and potentially of transboundary disputes.

Mukuteswara Gopalakrishnan, Secretary General of the International Commission for Irrigation and Drainage (ICID), argued that **dams and canal systems should be given credit for the 'spill-over' benefits they produce**. In this vein, he argued for the need to reconsider prevailing notions of irrigation efficiency. He showed that over 60 percent of the water passing through surface irrigation systems is lost through seepage (49.2 percent) and evaporation (12.3 percent). It is these losses that make surface irrigation systems appear highly inefficient. Some 35 percent of the total water conveyed in an irrigation system is lost to seepage below the distributaries and is recoverable by conjunctive use as it recharges groundwater. With South Asia's vast network of irrigation wells, this conjunctive use of canal irrigation return flows gives a major boost to the basin-level efficiency of canal irrigation systems. **The groundwater boom experienced by South Asia creates an uncommon opportunity to enhance the value of canal irrigation through proactive conjunctive management of ground and surface water**.

To exploit this opportunity, Gopalakrishnan stressed **the need for a major effort to revitalise and modernise South Asia's irrigation systems**. In support of his argument, he advanced the example of China, where such an initiative was launched on 402 large irrigation systems covering 56 million ha between 1998 and 2005. China invested 18.9 billion RMB to modernise 255 systems to generate major improvement in irrigated area, food production and agriculture productivity. **As important as the investment, however, are institutional reforms**. Irrigation staff was reduced by a quarter; and irrigated area managed by WUAs was increased from 9 percent to 36 percent. In the face of climate change, he argued that **there is no alternative to building more storage and to improving management of large irrigation projects**. Even without climate change, other global drivers – such as soaring oil prices, volatile food markets and the deepening financial crisis – will heighten the need to tighten the management of water infrastructure in times to come.

In many ways, to bring order to its chaotic water economy **South Asia needs to learn from China**. This was evident from the presentation of Zhanyi Gao of the China Institute of Water Resources and Hydropower Research. China faces many of the same challenges as South Asia, yet it has been able to make considerable progress in combating the water and food security–climate change nexus. In China, 44.4 percent of farming areas are irrigated and these contribute 75 percent of its food grain output. Increasing food grain demand is putting strain on China's land and water. The crisis deepens because available land and water for food grain production has been declining rapidly. China's irrigated areas are under pressure to compensate for this decline through ever increasing land and water productivity. China has also been facing more frequent occurrence of droughts. Between 1950 and 1990, only 25 percent were drought years; this proportion has increased to 40 percent between 1991 and 2007.

China's response to this crisis has been its own model of integrated water resources management (IWRM) at different scales. **China has been investing around US$60 billion per year in improving its water management sector performance. This is probably less than what South Asia invests every year. However, China is getting much more out of its investment**. A good deal of its public investment is devoted to upgrading water distribution below the main canals as well as on farm-level irrigation infrastructure. Also, China seems to be doing better in reforming irrigation institutions, in particular in achieving the functional division of management roles between irrigation district bureaus, which manage the main systems, and the WUAs, which manage lateral and sub-lateral canals. China has also successfully created 10 basin areas, each with its own basin authority. Some of these, especially in the Yellow river basin, have already begun to perform the critical role of allocating basin water among different areas and between different users. Clearly, given the very different political systems between China and South Asian countries, there are no obvious immediate transferable lessons and yet **there is urgent need for systematic examination of the Chinese experience to explore what lessons South Asian countries can learn.**

6. Groundwater over-exploitation in the West and South

Tushaar Shah noted that, while improving the functioning of South Asia's public irrigation systems is difficult, the challenge of governing the region's massive, anarchic and pervasive groundwater irrigation economy is proving even harder. With 25–27 million irrigation wells, groundwater irrigators of South Asia abstract over 300 billion m^3 of groundwater every year. This water provides supplemental irrigation to 70–75 million ha of land. **In South Asia, private investments in groundwater wells have increased irrigated area more in the past 40 years than public investments in dams and canals have in the 200 years before.** A booming groundwater irrigation economy is a unique aspect of South Asia's waterscape.

China too has a booming groundwater economy; but this is confined to the semi-arid North China plains. Humid South China has little groundwater use in agriculture. In South Asia, in contrast, the groundwater revolution is pervasive. It is understandable that semi-arid western India and all of Pakistan are large groundwater users in agriculture. What is not so easy to understand is that even in humid Assam, Bangladesh, Coastal Orissa, Eastern Uttar Pradesh, North Bihar, West Bengal and the terai areas of Nepal, **groundwater has emerged as the mainstay of agriculture**. We can understand the intensive use of groundwater in the deep alluvial aquifer areas of the Indo-Gangetic basin, which are underlain by one of the world's most abundant aquifer systems. What is hard to understand is that hard rock peninsular India and northern and eastern Sri Lanka, with aquifer systems which elsewhere would be considered unworthy of development, have witnessed rapid expansion in groundwater irrigation.

The groundwater economy has become so central to South Asia's food security and agrarian livelihoods that its governments cannot afford to dismantle it. On the other hand, the **environmental impacts are potentially so devastating that they cannot afford to allow the groundwater boom to keep running amok as it has in recent decades**.

This dilemma was captured in the presentation by Stephen Foster, Director of the World Bank GW-MATE and one of the world's best-known groundwater scientists. Foster highlighted the potential threat posed by groundwater overdevelopment in arid alluvial plains of the west as well as in hard rock aquifer systems of India's southern peninsula. Some of these threats – such as rising pumping costs, declining well yields and reduced base flow – are reversible. Amelioration of phreatophytic vegetation stress, aquifer compaction and transmissivity reduction may or may not be reversible and need more research. However, some threats of groundwater overdevelopment, such as saline water intrusion, pollution of aquifers and land subsidence, are decidedly irreversible in short to medium term.

According to Foster, **the hydro-geological setting of an aquifer system both frames the resource problem as well as constrains the management solution.** In working towards a resource management strategy, it is critical to factor in unique features of the hydrogeology of the subcontinent. In the vast and fertile Indo-Gangetic plain with huge aquifer storage, the groundwater–surface water linkages are critical. In the Indian Punjab, growing dominance of tubewells irrigation has turned the Bhakra irrigation system into an aquifer recharge system, albeit an imperfect one: groundwater levels have been continuously declining at 0.5–0.8 m per year.

In the Indo-Gangetic basin, what is needed most is planned conjunctive use of surface and groundwater, especially by increasing groundwater use in upstream areas and improving surface water availability downstream. Such conjunctive management is even more important in Pakistan's Punjab, where surface water supplies can potentially be an answer not only to declining groundwater levels but also to secondary salinisation. In hard rock peninsular India and northern and eastern Sri Lanka, aquifer storage is small, the flow is local and sluggish, and natural recharge is limited. Groundwater regimes here impose an element of self-regulation on users because beyond a point, aquifer systems can no longer be squeezed for more water. As a result, these shallow-circulating groundwater systems pose a problem more of equitable allocation than of secular decline. **The need in this vast region is to move from destructive competition for dwindling groundwater storage reserves to constructive dialogue on productive and equitable use of available average recharge**. Foster highlighted some exciting experiments in Andhra Pradesh (Andhra Pradesh Farmer Managed Groundwater Systems) and Maharashtra (Hivre Bazaar) in which NGOs and local leaders were able to mobilise farmers for creating a more sustainable and equitable regime for groundwater resource management.

To create a sustainable groundwater regime in South Asia, governments need to act at several levels by combining the understanding of hydro-geological settings with sensitivity to socio-economic situations. Governments are likely to more easily resort to quick fixes such as enhanced aquifer recharge or promotion of micro-irrigation as easy solutions to the groundwater crisis. The underlying core issue, however, is one of reducing consumptive water use. One window of opportunity lies in agriculture policies; for example, restricting alfalfa irrigation in arid areas can curtail groundwater use, just as can reducing rice areas in the Punjab and sugarcane cultivation in semi-arid areas. The Punjab Government's effort to defer rice transplantation after the monsoon rains is a practical measure in this direction.

A particularly pernicious driver of groundwater over-exploitation, especially in India, is power subsidies offered to farmers under flat and free power tariff regimes. Given that canal irrigation is heavily subsidised everywhere in South Asia, there is perhaps some ground for energy subsidies for irrigation. **The prevailing power pricing regimes in many Indian states create perverse incentives that provide encouragement, even legitimacy, to over-exploitation of aquifers. More rational energy subsidies are offered by the Government of Bangladesh, which provides a consumption-linked subsidy on diesel as well as electricity to bore well irrigators**. While such subsidies alter farmer incentives and may reduce the efficiency of energy and water use, it leaves the internal dynamic of the energy economy undisturbed – unlike the Indian power subsidies. All these complications illustrate **how important it is to examine energy subsidies in conjunction with the issues of food and water security to reconcile the complex trade-offs between efficiency, equity and environmental sustainability at the level of the society as a whole rather than within a sector.**

Foster's formula for taming the groundwater anarchy – which involves reducing consumptive use of groundwater and not resorting to quick fixes like aquifer recharge or micro-irrigation – resonates with the thinking of all but the policy makers (especially politicians). Reducing consumptive use of water by farmers in agriculture has proved hard even in a highly industrialised agriculture such as California's, where its relative livelihood and economic significance is minuscule. Reducing consumption on a significant scale in South Asian context might prove a Herculean task. The daunting nature of this task highlights the challenges institutions such as the South Asia GWP network face in turning policy around. It will take more effective and persistent outreach to overcome these challenges. Indeed, reforming perverse incentives that encourage rice cultivation in Punjab and sugar cane in Maharashtra has proved difficult, just as correcting perverse power subsidies to groundwater pumping has been throughout India. It is not that curtailing power subsidies has not been tried, but many chief ministers who did try were driven into political oblivion. In such a milieu, **politicians will throw their weight only behind politically feasible policies, even if second-best, that will contain or resolve a problem in ways that poses no threat to their political fortunes**.

Tushaar Shah's presentation shared the experience of precisely such **second-best policies that the Indian state of Gujarat** experimented with in turning around a perverse energy–groundwater nexus into a benign one over the last decade. Between 1990 and 2000, Gujarat's 700,000 private electric tubewells virtually bankrupted the state's electricity utility by increasing the farm power subsidy burden. During that time, groundwater withdrawals in the state steadily rose at around 12–15 percent per year, turning North Gujarat, Kutch and Saurashtra into serious groundwater 'hotspots'. Rising fluoride concentrations in groundwater, which is the main source of drinking water supply, has emerged as a serious public health threat.

A new government in Gujarat looked for innovative win-win strategies to engage the state's farming communities in resolving this multi-dimensional crisis. As a first measure, the government consolidated and supported a growing mass movement for rainwater harvesting and groundwater recharge in hard rock areas of Saurashtra and Kutch. It supported farmer communities to construct over 300,000 decentralised recharge structures such as check dams, percolation ponds, bori-bands and sub-surface dykes across river beds. This massive recharge movement probably enhanced groundwater availability by all of 1–2 billion m^3 – about 3–5 percent of the state's total water resources. However this small increase made all the difference to the farmers of Saurashtra and Kutch because it ensured the security of the main kharif crop by making available life-saving irrigation during a mid-monsoon or terminal dry spell. To curtail farm power subsidies, Gujarat invested US$250 million on a scheme called *Jyotigram* ('lighted village'). Under this scheme, all irrigation tubewells were linked to exclusive agricultural electricity feeders. This done, farmers were offered a daily ration of 8 hours of uninterrupted full voltage power supply along a strictly scheduled roster, as opposed to the earlier situation of longer hours of frequently interrupted, variable voltage power at unpredictable times, mostly at night.

These innovative approaches have not fully resolved Gujarat's problems but they seem to have turned the tide. Studies indicate that, helped by a succession of good monsoons, the groundwater levels throughout Gujarat have not only stabilised but are recovering. Consumption of electricity in pumping groundwater has declined as have farm power subsidies and aggregate groundwater draft. To top it all off, semi-arid Gujarat has emerged as the fastest growing agricultural economy among all Indian states, growing its agricultural GDP at 9.6 percent per annum in real terms during 2000–2008. Tushaar Shah's presentation led to an animated discussion of the extent to which the Gujarat experience can be considered an example of IWRM in practice.

Asad Qureshi, a water expert from IWMI, brought to the workshop a groundwater perspective from Pakistan. Pakistan's Punjab and Sindh provinces are home to the Indus

Basin Irrigation System (IBIS), the world's largest continuous irrigation system serving 16.5 million ha. In the 19th century, IBIS was the world's 'canal irrigation laboratory', a fertile ground for developing innovations in canal design, engineering and management. Yet, groundwater use in agriculture has today become an increasingly critical aspect of agriculture in the IBIS and for Pakistan as a whole.

Nasir Gilani observed that **a cubic metre of groundwater irrigation adds 2.5 times more to Pakistan's GDP than a cubic metre of canal irrigation**. Pakistan has 1.2 million groundwater structures, of which two-thirds are in Punjab alone. Groundwater irrigation has increased Punjab's cropping intensity by 70–150 percent and crop yields by 150–200 percent. Groundwater irrigation has proved a bulwark against droughts and emerged as the main source of drinking water. Forty percent of Pakistan's irrigation water today is delivered by groundwater wells. Like elsewhere in South Asia, in Pakistan too, uncontrolled groundwater development has led to twin problems of resource depletion and quality deterioration. Canal irrigation return flows are the key source of groundwater recharge in Pakistan Punjab and Sindh, making conjunctive use of surface and groundwater a critical management challenge for Pakistan's irrigation managers. **According to Qureshi, throughout the Indus basin, water tables have been falling at a rate of 1.5 m per year. In Baluchistan, the pace of decline is even faster.**

For Pakistan, however**, the biggest threat is salinisation**. Irrigation adds 1 tonne of salts per hectare every year. As a result 22 percent of Punjab and 78 percent of Sindh have highly saline groundwater. Climate change, in all likelihood, will worsen the situation for Pakistan as surface water flows decline and groundwater dependence increases.

While effective control of anarchic groundwater development through controlling consumptive use remains a pipe dream, **Pakistan's big opportunity lies in improving the management of its surface water.** In doing this, Qureshi echoed Pervaiz Amir's viewpoint earlier that building more surface storage is critical. Pakistan can store only 15 percent of its river flows today, and a third of its existing storage will be lost to siltation by 2025. As snowmelt becomes less reliable, Pakistan will become increasingly dependent on rainfall at higher altitudes. Rainfall constitutes 59 percent of Indus flows, and 85 percent of this is received during the monsoon, making storage a critical priority.

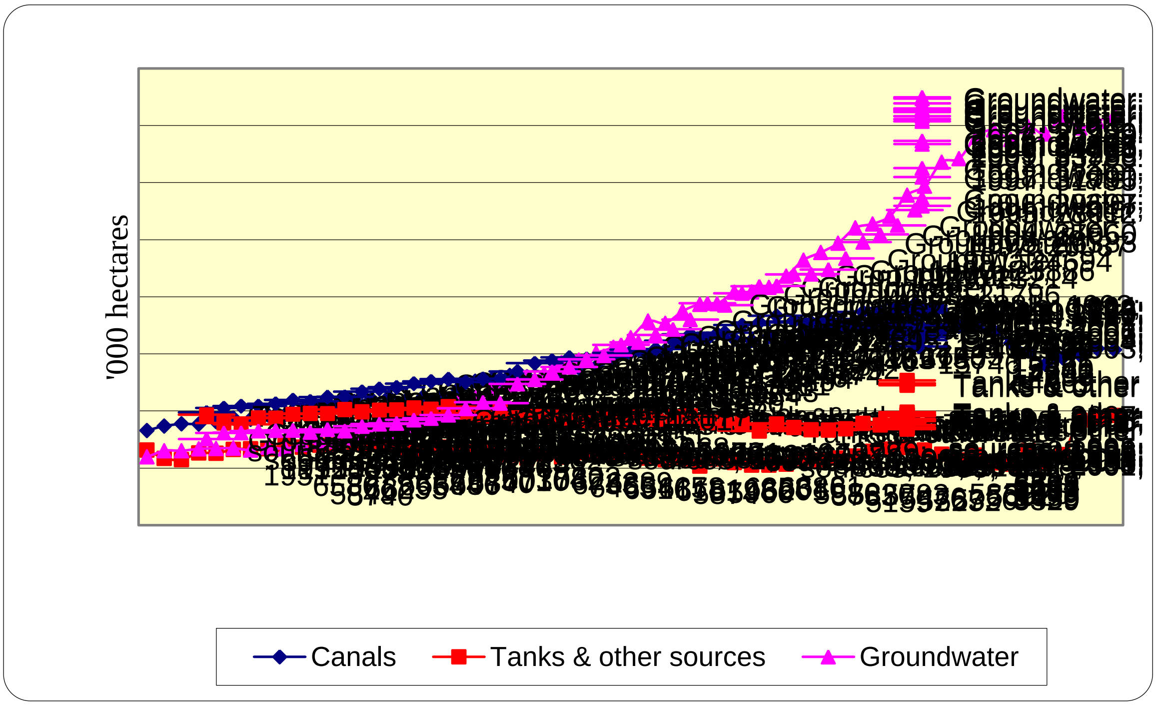
Managing system losses is a critical part of husbanding surface waters better. Of its total canal water diversions of 128.8 billion cubic metres (BCM), 83 BCM constitute system losses in canals (27 BCM), watercourses (40.7 BCM) and field application (15.3 BCM). Minimising the evaporation component of these losses and spreading seepage losses evenly over the canal command can help improve conjunctive management in Pakistan and alleviate many of its groundwater-related problems. Today, farmers in the head reach of the IBIS corner the bulk of surface water supplies; mid-reach farmers receive some 20 percent less surface water than the head reach farmers; and tail-end farmers get 20 percent less than the mid-reach farmers. This spatial bias in canal water delivery needs to be evened out, if not reversed, to maximise the benefits of conjunctive use of surface and groundwater in

Pakistan. The current strategy is to increase canal supplies to tail-end farmers by lining the canal network; but this might reduce groundwater recharge in non-saline areas. Improved main system management can be as effective in improving spatial distribution of canal waters.

7. Groundwater and livelihoods in the East

While Gujarat's small-scale farmers have enjoyed a groundwater-supported agrarian prosperity, Aditi Mukherji lamented that West Bengal agriculture has stagnated, growing at just around 1 percent per year, despite the fact that, against Gujarat's depleted aquifers, much of West Bengal is underlain by one of the world's most abundant alluvial aquifer systems. Mukherji argued that West Bengal's small-scale agriculture is stifled by the urban bias of its political leadership and a *Bhadra-Lok* (elitist bordering on snobbish) mentality of state administration that has imposed all manners of restrictions on agricultural groundwater use. Mukherji's research, amply supported by econometric analysis of panel data, showed that **the Ganges 'water machine hypothesis' that gained currency during the 1970's works pretty well in the case of West Bengal.**

Figure 8: The changing face of India's irrigation sector, 1951-2007



For every metre of pre-monsoon drawdown in groundwater levels by irrigators, there is 0.85 m of monsoonal recovery. Groundwater development can reduce rejected recharge, lower flood intensity and turn aquifers into cost-effective, highly efficient storage systems. **If there is a case for farm power subsidies anywhere in South Asia, it is in eastern parts of the region, where groundwater development can not only spur agricultural growth but can**

also reduce the intensity of floods. Yet, West Bengal is the first state in India to have abolished electricity subsidies, metered all its tubewells and imposed a time-of-day metered tariff on farm power consumption**.**

An impact study by Mukherji showed that this apparently 'first-best' solution improved the finances of the electricity utility and benefited owners of electric tubewells, but it had an adverse impact on over a million marginal farmers and share croppers who depended on local, informal groundwater markets for accessing water to irrigate their crops. Her studies showed that, after the change, electric pump owners now sold less water and charged 30–50 percent higher prices. Mukherji argued that, if a perverse energy–groundwater nexus can create a socio-ecological crisis in western states, a benign form of this nexus could become a powerful tool to accelerate smallholder agriculture growth, food security and poverty reduction in Eastern India and Bangladesh. According to her, investment in rapid agricultural electrification can catalyse competitive groundwater markets in states like Bihar. An ICT-enabled diesel subsidy voucher scheme, *à la* Bangladesh, can also help the poor in Eastern India and the Nepal Terai. She also made a case for relaxing restrictions on new shallow tube well installations and even argued for a capital cost subsidy targeted to small and marginal farmers. But then what about excessive groundwater exploitation?

In West Bengal, Bangladesh and elsewhere in Eastern parts of South Asia, if the groundwater revolution has proved a boon for a segment of smallholder farming and propagation of hand-pump water from drinking water tubewells has emerged as a bane for public health. Growing occurrence of arsenic in hand-pump water has created a massive public health hazard in these regions.

The presentation of Khondaker Azharul Haq, member of the Regional Council, provided an overview of this health hazard in Bangladesh. Twenty percent of Bangladesh's drinking water wells, around 8,000 of its 87,000 villages, and some 30 million out of 160 million Bangladeshis (those living mostly in North Western parts) are at risk from arsenic-related health hazards. Arsenic is a geogenic contaminant and its occurrence and sources are still not fully understood. What is known is that shallow aquifers are more at-risk than deep aquifers. It is also clear that neither irrigation tubewells nor fertilizer application is implicated in arsenic contamination of groundwater. Policy makers and public opinion, prone to knee-jerk reactions, however, have already begun to hold groundwater irrigation responsible for the arsenic crisis. According to Mukherji, this association may well be the reason for the groundwater-restrictive policies of the West Bengal Government. According to Haq, arsenic in groundwater may be a much larger regional problem encompassing a vast area starting in the east from Shanxi Province in China, covering Bengal, Jammu and Kashmir, Myanmar and Nepal, going up to Xinjiang Province in China.

Some 40,000 Bangladeshis are already showing symptoms of arsenicosis, which include lesions, hardening of skin and dark spots on palms and feet. The disease has a long gestation period of up to 20 years, but intense exposure can lead to cancers of the skin, lungs, bladder and kidney. Arsenic exposure also impairs cognitive development in children. Like fluorosis, resulting from high fluoride concentration in drinking and cooking water, arsenicosis is a disease of the poor: malnourished people are twice at risk compared to well-nourished people. Like fluorosis, arsenicosis is also a social condition and its severity can deepen the social ostracising of and prejudice against victims. In rural Bangladesh, arsenicosis is popularly viewed as a curse and a contagion. Women suffering from arsenicosis have trouble getting married, children find it difficult to get accepted and young patients have trouble finding employment. Given the impossibility of removing arsenic from geological formations, governments are doing what is possible, which is spreading awareness and education about the threat and creating sources of arsenic-free drinking water. Bangladesh, in a campaign mode, painted its contaminated tubewells red and safe tubewells green. It also promoted a variety of arsenic filters, in addition to creating arsenic free drinking water sources. **Results have begun to show: arsenic awareness has improved dramatically, households carefully source their drinking water from safe tubewells, rainwater and surface water have been promoted aggressively for drinking and cooking, and the social trauma of those affected has begun to ease.**

Arsenic impact on food security may eventually turn out to be a trickier problem for Bangladeshis (and other countries if the problem also exists there) to manage. Under groundwater irrigation, arsenic enters the food chain, degrades soil and reduces crop yields. Out of Bangladesh's 4 million ha of irrigated land, 2.4 million ha depend on shallow tubewells and are thus at the risk of introducing arsenic in food chain. Bangladesh's rice has 1.8 ppm of arsenic, compared to 0.5 ppm in rice grown in Europe and USA. Borewell-irrigated leafy vegetables such as spinach and cabbage can have more than twice the arsenic content compared to rice. While arsenic in drinking water may be resolvable in the short to medium term, arsenic in the food chain may eventually become a much more serious food security issue that may need an aggressive response of the scientific community and all governments of regions/states/countries whose populations are potential victims of the arsenic. This response must be multi-dimensional and include agronomic research as well as genetic engineering. Mobilising this sort of response is precisely the type of a regional challenge that could benefit from the convening power of organisations such as GWP-SAS and IWMI.

8. Bracing to cope with climate change

The workshop brought to light many ideas on how South Asian society might break the nexus between water insecurity, food insecurity and climate change. According to Gyawali, this nexus presents a class of wicked problems with 'nested layers of troubles that won't go away anytime soon'. In his view, such **problems can be resolved only by the uncomfortable knowledge arising from a 'toad's eye view'**. Gyawali suggested that real adaptation is likely to occur at the household level rather than through macro-level adaptation programming, and that South Asia tends to resolve serious problems through seemingly 'clumsy' solutions innovated by its people, informal market responses and the engagements of civil society. In

Himalayan ecologies, Gyawali advocated greater wisdom in blending the modern with the ancient, in technologies as well as institutions.

Participants from Pakistan, on the other hand, considered storage as the key adaptive response. As Amir argued, no country in the region will be hit as hard by climate-induced water stress as Pakistan, and thus the main response needed is ramping up its storage by around 25 MAF. To achieve its goal, **Pakistan needs to change the business of building dams. Its policy makers need to realise that delays in indecision are costly; that benefits have to be equitably shared; that environmental concerns need to be addressed rather than bypassed; and that mismanagement, corruption and poor governance have to be tackled forthwith.**

Holger Hoff of the Potsdam Institute for Climate Change Impact argued that for all states sharing the Indo-Gangetic basin, a big answer may lie in better use of 'green water' (water stored in the soil profile) rather than focusing all energies on blue water (water from aquifers and surface bodies). In a nine-basin study by Hoff and colleagues, the Ganges and Indus river basins emerged as having the lowest availability of green and blue water in per capita terms. The only other large basin comparable to these is the Yellow River basin. However, the Yellow has more green water and less blue water; Ganges and Indus in contrast, have the opposite mix. According to Hoff, **moisture recycling can potentially be an important element in climate change adaptation strategy in the Indus and Ganges basins.**

ICID's Secretary General Gopalakrishnan had different thoughts about improving food security. He suggested that optimisation of farmholdings through land consolidation, which could undo the malaise of land sub-division and fragmentation in South Asia, could be one component of the strategy to improve food security in Asia. Also important, according to him, is to increase collateral inputs – improved seeds, fertilizers, pesticides and extension services – to improve land and water productivity in agriculture. But this calls for the creation of much more off-farm employment to release the population pressure on the land – something China and South East Asian countries have achieved, but which South Asia has struggled with.

Particularly for South Asia, with its vast area and large populations sharing rivers and aquifers, GWP Technical Committee member Patricia Wouters highlighted **the role of improved transboundary water management as a potentially powerful adaptation strategy against climate change**. Wouters explored the notion of water security in a transboundary context. She suggested that operationalising shared management of transboundary waters principally has to do with three aspects of benefit sharing: availability issues, access issues and issues related to conflicts of use. All the relevant factors considered together, she argued that the formula for successful shared management is the equitable and reasonable use of transboundary water.

Humberto Peña, another member of GWP Technical Committee, emphasised the role of social equity in climate change adaptation strategies. He asserted **equity considerations as**

central to any IWRM strategy and emphasised that they should inform all decision processes involving sharing of direct and indirect benefits related to water in private common-pool as well as public regimes; he also argued for explicit factoring in of trade-offs between efficiency and social equity. Much discussion arose around social equity issues. Sara Ahmed of **IDRC forcefully argued for explicit treatment of gender, caste and class issues as part of social equity.**

There was a general agreement that climate adaptation does not require us 'to do different things but to do things differently'; it simply demands that we elevate the game of water resources management. In this direction, Nayana Mawilmada from the Sri Lanka National Climate Change Adaptation Strategy (NCCAS) Project explored how government and civil society in Sri Lanka are bracing up to do just this, by developing a comprehensive national climate change adaptation strategy. This Sri Lanka-Asian Development Bank (ADB) collaboration is notable less for its final outcome – which only time will tell – but for the six-step process it followed: [i] develop sector vulnerability profiles for key sectors, [ii] map climate change vulnerabilities, [iii] understand climate change perceptions and communication needs, [iv] establish strategic priorities, [v] formulate the strategy, and [vi] develop adaptation initiatives.

On how to improve food security not only for South Asia but also for the world as a whole, Jan Lundquist from the Stockholm International Water Institute (SIWI) had an altogether different take. While everyone else was focusing on ways of increasing production and productivity, Lundqvist asked the critical question "is increasing production the best and the only action to achieve food security?" His answer was an emphatic 'no': we already producing enough food to overcome world hunger if we can reduce the current global losses and waste of food by 50 percent.

Lundqvist showed that dramatic increase in food production in the past 15 years has been unable to reduce hunger and malnourishment; and there is no reason why it will do so in future. Between 1995–1996 and 2008–2009, world food production increased from 1.7 billion to 2.3 billion metric tons; yet the number of malnourished people increased from 830 million people to over a billion people. The biggest paradox we face is that while a billion people are malnourished, 1.4 billion are overweight and 400 million are outright obese. According to Lundqvist, **while the plan A to provide global food security is to keep increasing food production; our plan B should: [i] focus on post-harvest logistics, reduce losses, improve storage, transport and marketing of food; [ii] pay attention to food intake and nutrition balance; and [iii] call an end to food waste, which in 27 EU countries was an astronomical 179 kg per capita in 2010**. The food that EU wastes every year may well be enough to end malnourishment in South Asia.

9. From piecemeal problem-solving to IWRM

The workshop effectively demonstrated that Bangladesh's strategy of painting borewells 'red' and 'green', Gujarat's separation of agricultural from non-agricultural electricity feeders, Pakistani participants' arguments in support of ramping up its reservoir storage to 25 BCM and its investments in lining canals (the effectiveness of which other presentations in the workshop questioned), and India's thrust on watershed programmes in rainfed areas are all symptom-oriented, piecemeal approaches to problem solving.

The workshop also illustrated that the South Asian governments have not systematically evaluated the effectiveness of their own quite sizeable public investment programmes, broadly disseminated the lessons of experiences, or learned from them for future public investment strategies. They have mostly sought supply-side solutions heavily influenced by public sector water managers, generally avoided demand-management through reducing consumptive water use and defined 'problem-sheds' to resolve problems within them. They have rarely effectively engaged other key stakeholders, including in particular policy makers in related sectors, farmers and consumers. A contrasting philosophy is offered by IWRM, which suggests more holistic approaches to problem solving.

There is hardly any disagreement with the IWRM philosophy. The problem, many policy makers in developing countries argue, is in its implementation. **There is a great need for examples that demonstrate how to apply the IWRM philosophy to find comprehensive solutions to pressing water sector issues faced by countries, but an approach that some, such as the state of Gujarat, have embarked on implementing albeit partially and without a systematic guide to the design and implementation of such an approach.**

Wouter Arriens of the ADB, a member of GWP Technical Committee, attacked this 'implementation difficulty' by outlining the ADB's experience in promoting IWRM in Asia. He argued that operationalising IWRM becomes easy if IWRM is construed not as a *plan* but as a *process* to be unleashed in river basins. ADB has used the IWRM process in finding keys for success in adaptive management in the face of changing conditions. In ADB's work, the IWRM process has pursued a triple bottom line of benefits – economic, social and environmental – to optimise stakeholder satisfaction and to increase the stock of 'basin capital'. In Arriens' view, the IWRM process involves transforming *stakeholders* into *stockholders*. Arriens described ADB's guiding vision of water security in a kind of *panch-sheel* (five ethical tenets): including all households, creating productive economies, building liveable cities, creating healthy rivers and sustaining resilient communities.

To Arriens, the IWRM process means promoting new thinking beyond the industrial edge; it involves new ways of explaining the reality and transforming it through new mental models. ADB's IWRM work in Asia has made encouraging progress, produced promising results and created new leadership examples. Arriens reviewed ADB's partnering successes in creating coalitions for change. He argued for the **need to work across boundaries by transforming**

people and organisations, by driving innovation and by solving problems. Doing this, in his view, however demands boundary-spanning leadership.

ADB's integrated approach was illustrated by Arnaud Cauchois, ADB Water Resources Specialist, who outlined the Bank's efforts to work with South Asian countries as they prepare to adapt to climate change. ADB's climate change programme is built on three pillars of finance, knowledge and partnership. The programme addresses five priorities: [i] scaling up clean energy; [ii] sustainable transport and urban development; [iii] land use and forest for carbon sequestration; [iv] climate-resilient development; and [v] strengthening policies, governance and capacities. ADB has sought to sharpen its focus on water security by promoting regional dialogue, through technical assistance projects and by financing infrastructure. Its approach to water security in the face of climate change is focused on information, impact assessment and investments in adaptation strategies.

Opportunities to explore more multi-sector approaches may be found in the new mega-research programme on '**Water, Land and Ecosystems'** taking shape in the Consultative Group on International Agricultural Research (CGIAR) as outlined by David Molden, IWMI's Deputy Director General. The programme will bring together the expertise of the CGIAR centres around the world in forestry, fisheries, plant breeding, food policy, dryland and tropical agriculture, and various crops. The **CGIAR Research Program (CRP) is taking shape under IWMI's leadership. When approved, this programme will transform the way IWMI functions, making it possible to involve numerous national and local partners in the research programme instead of focusing research in a 'water silo', and shift the view of water resources management as an integral part of a larger framework of natural resource and environment management.**

In particular, however, the Water, Land and Ecosystems CRP will focus on three global challenges: water scarcity, land degradation and loss of ecosystem services. A distinctive aspect of this CRP proposal is its emphasis on practical solutions, outcomes and impacts. The goal is to improve the livelihoods of 200 million people over 20 years. The practical and result-oriented nature of the programme will make it a fertile ground for collaboration for the GWP network. Clearly, one way the CRP can achieve this ambitious impact on lives of millions of people is by effectively engaging national and local partners in its design and implementation to address the kinds of challenges identified during this workshop. The GWP-IWMI platform can help foster such partnerships while also broadening the membership of GWP-SAS to be more inclusive of all relevant stakeholders.

10. Conclusion and outcomes

In his opening remarks, Mohamed Ait-Kadi, chair of GWP Technical Committee and the inspiration behind the Colombo workshop, expressed his hope that the event would produce a concrete outcome. In his own words,

> "There is still vast, unexploited scope to pool knowledge and understanding of interconnected challenges and to design collaborative regional strategies. For this

> purpose, it is important to have a neutral and creative space where multiple stakeholders can come together in an atmosphere of trust. The Global Water Partnership's proposed regional platform is meant to be such a space.'

The Colombo workshop produced three concrete outcomes. The original idea was to use the workshop to create a common ground and generate ideas for a proposal for a platform. During the workshop, Suresh Prabhu, former chair of GWP South Asia, made an eloquent and compelling case for GWP country partnerships to announce the creation of a South Asia platform. **In a side meeting facilitated by the chairs of country and local water partnerships, members of the Planning Commissions of India and Pakistan and former and sitting chairs of GWP South Asia resolved to develop a collaborative work plan, seek financial support to set it in motion**. The first proposed collaborative event is a farmers' colloquium, with participation of farmers from all South Asian states.

The second concrete outcome was **GWP's decision to use the Colombo workshop as a model to organise a similar meeting in sub-Saharan Africa in mid-2011**. The hallmark of the Colombo workshop was the analytical richness of the material presented and diversity of thematic and social concerns captured by it. Given the sterling quality of the IWMI-GWP Colombo workshop, GWP Technical Committee felt confident that a similar workshop in sub-Saharan Africa can be an equally valuable vehicle to further GWP's vision of a water secure world.

The third concrete outcome was a **set of products that capture the rich analyses and insights presented in the Colombo workshop** – this synthesis paper and the collection of presentations given at the workshop. The possibility of putting together a book of selected papers based on presentations made in the workshop is also being explored.

At the end of the workshop the Chair of GWP South Asia, Sardar Tariq, noted that it provided a boost to the functioning of the South Asia network in several ways: it pointed to the need for a more inclusive network of key stakeholders; broader dissemination of existing knowledge; generation of new knowledge; possibly some systematic piloting, monitoring and evaluation of the suggested 'outside the box' approaches to learn lessons for scaling up; and longer term, more consistent exchange of ideas and targeted messaging to key stakeholders while increasing mutual trust and confidence among members of the network in a region, where the deficit of trust in the past has inhibited strong regional cooperation.

Annex 1: Concept note

By Uma Lele and Tushaar Shah

I. Context and justification

South Asia, together with sub-Saharan Africa, is among the areas expected to be hardest hit by climate change. It will likely have profound effects on food and water security. Greater frequency of extreme events, warmer temperatures, increased incidence of temperature-influenced diseases and pests, and increased risks and uncertainty are already evident. Severe flooding in 2007 along the Ganges and Brahmaputra rivers affected over 13 million people in Bangladesh; flooding in Pakistan in 2010 severely affected 20 million people. India has likewise suffered numerous events of extreme rainfall, flooding and droughts. In addition, the rise of sea level is a real threat to low lying areas in Bangladesh and Sri Lanka. The economic cost of the 2007 floods in Bangladesh was over $1 billion; in Pakistan it was nearly $10 billion.

The human suffering has been immeasurable. Millions of tons of food production have been lost in the process, adding unknown numbers of food security-related deaths to the thousands of deaths directly related to the flooding and its aftermath, including the spread of disease.

Climate science and the projections of its various impacts are at an early stage of development in the region. Yet South Asia is among the most data-rich regions of the developing world and is well endowed with considerable analytical capacity for providing policy inputs – a capacity that has yet to be fully mobilised for effective policy and institutional responses.

The strategic geopolitical implications of the recent climate events also cannot be overstated when observed in the context of one of the most densely populated and economically dynamic regions of the world. South Asia contains a third of the global population but three quarters of the world's one billion poor. A recent report by the Institute of Defense Studies in India on water security illustrates the increasing attention to water issues within a broader geopolitical context.[7] While reviewing India's bilateral water relations with neighbouring countries, country by country, the report notes that if not managed well, riparian issues will lead to increased conflicts. It calls for a paradigm shift from the historical supply-side considerations in domestic and international agreements, and past investments focused on water sharing among competing interests, to one that focuses on benefit sharing. It stresses that rivers can no longer be viewed as a 'soft component' of a country's foreign policy. Rather they must be seen as intricately linked to development goals and domestic needs impacting bilateral relations.

The report goes on to say that while it is important to adopt sensible riparian policies and 'healthy rivers' schemes, there is a need to re-evaluate existing treaties and reframe them based on current hydrological knowledge and future mutual needs. India's geographical contours place multiple upper, middle and lower riparian systems within its borders – thus placing it at the epicentre of riparian politics. Therefore collaborative riparian management will be crucial for settling many of the water-induced conflicts in the region; greater 'hydro-diplomacy' – both internally and across national borders – will need to balance the region's growing water needs with larger security concerns.[8]

Good international-geopolitical management, however, is only possible when countries successfully manage their myriad domestic water challenges. Complex national-level issues of food, water and energy tend to be addressed in a cylindrical fashion by sector-focused ministries, when cross-sectoral analysis and solutions are urgently needed.[9]

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[7] Institute for Defense Studies and Analyses (IDSA) (2010) *Water Security for India: The External Dynamics*, New Delhi: IDSA.
[8] *Ibid*.
[9] Yu, W.; Alam, M.; Hassan, A.; Khan, A.S.; Ruane, A.; Rosenzweig, C.; Major, D.; and Thurlow, J.

Water sharing across state boundaries has been complicated by the fact that water is often a state issue.[10] Rapid economic growth, population growth and urbanisation add to pressures from the growing urban and industrial demand for water. Per capita water availability has already plummeted to one fifth of the level of 1947, the year that many of the countries of the region became independent. In many circumstances, availability is already less than the minimum required for a healthy life.

Agriculture sits at the centre of these challenges. An overwhelming 80 percent of total water use goes towards agricultural needs. Agriculture is also an extremely inefficient user of water; water productivity, measured as 'crop per drop', is one of the lowest in the world. Furthermore, the region has been shifting away from a historical dependence on surface irrigation towards groundwater exploitation, which accounts for an increasing share of food and agricultural production. India and Pakistan were the first to witness this structural change in arid-alluvial canal commands of the Indo-Gangetic basin during the 1960's and 70's. Since then, groundwater irrigation has gradually expanded to include even the hard-rock areas of peninsular India, Pakistan's Baluchistan region, and northern and eastern Sri Lanka.[11]

Within the context of climate change, South Asia's groundwater hotspots are the Indus basin in the north-west and almost all of peninsular India, where groundwater levels have dropped dramatically. Dependence on groundwater is also increasing South Asian agriculture's energy-intensiveness. Groundwater pumping with electricity and diesel now accounts for an estimated 16–25 million MTs of carbon emissions, 4-6 percent of the region's total. Around the world, humid areas with plentiful surface water have seldom adopted groundwater irrigation strategies – South Asia being the exception. Bangladesh and the Nepal Terai have among the world's highest surface water flows per km^2. Yet they too find their agriculture increasingly dependent on the shallow tube wells that are the mainstay of smallholders. Groundwater use in agriculture elsewhere in the world is commonly the result of water scarcity; in South Asia it seems to be the outcome of extreme land – as well as water – scarcity.

Some have ascribed this decline in gravity flow irrigation and the rise of the 'water-scavenging' irrigation economy (through millions of small, private tube wells) as a way of avoiding the challenging organisational structures that accompany service-water irrigation schemes[12]; others have explained it in terms of the absence of groundwater management.[13] Not surprisingly, groundwater is rapidly reaching unsustainable levels of exploitation, i.e., levels beyond the normal recharge. Considering the region's growing reliance on aquifers as storages in place of surface reservoirs, South Asia needs to evolve its own methods of aquifer management, and transition from surface storages to 'managed aquifer storage' as a central element of its water strategy. In doing this, South Asia must examine the experiences of other countries (such as Australia, the United States and China, that have many years of experience in managed aquifer recharge) and develop technologies to suit the unique South Asian context.

(2010) *Climate Change risks and food security in Bangladesh*, London: Earthscan.

[10] Iyer, R.R. (ed) (2009) *Water and the Laws in India*, New Delhi: SAGE Publications India Pvt Ltd.

[11] Amir, P. (2008) "Climate Change and Emerging Opportunities in Agriculture", Powerpoint presentation, August 30.

[12] Chartres, C. (2010) "Colin's STRAIGHT talk: Revitalising Asia's Irrigation", http://www.iwmi.cgiar.org/Colins STRAIGHT talk/

[13] Shah, T. (2009) *Taming the Anarchy: Groundwater Governance in South Asia*, Washington, DC: Resources for the Future.

While the international arena offers many worthy strategies to combat the issues described above, practitioners and policy makers should be wary of 'out of the box' solutions. The successive 'silver bullet' approaches of water pricing, community or participatory water management, investment in dams followed by a movement to no dams, and then a return to dams have had mixed impact; there is little independent evaluative evidence on their successes or failures, as noted by the World Bank in their review of water and development.[14] Evidence also indicates that governments and donors alike are better at investing in hardware, but poor on the 'soft side' – building institutional capacity, human capital, changing the rules of the game and devising incentives that work beyond formulaic solutions. South Asia must scrutinise the lessons learned at the global level, adapt them where relevant, and provide local solutions to the unique contexts across the region.

There are also lessons to be learned and applied within countries. India, for example, depends on the western half of the country for a significant share of its food production, a region less endowed with water than its eastern counterpart, where water is abundant but productivity per unit of land and water is far lower than the national average. With increased climate-related risks and uncertainty, it makes sense to secure production in areas less susceptible to variability. Yet increasing water and food productivity in the eastern states is not only hindered by insufficient infrastructure and ineffective institutions; the current energy and food pricing, procurement, and distribution issues are also imbalanced in their provision of a level playing field for inter-regional competition. Western states are better endowed and better managed in each of these respects as compared to the eastern states, where more than 80 percent of the population lives below the poverty line.[15]

In this challenging and rapidly evolving situation, however, there are examples of successful water management that are at once more efficient, sustainable and equitable, e.g., in Gujarat. Yet the factors underlying their success are not translated into policy and implementation across states, slowing the prospect of replication and 'scaling up'. These successful examples present key opportunities for stronger advocacy, more active knowledge and information sharing and, where necessary, further location-specific analyses of constraints and solutions.

The long term effects of climate change are not yet known, but in all likelihood they will compound the problems posed by increasing and competing demands for water. Climate change will amplify the criticality of groundwater for reducing drought risks to agriculture, while simultaneously heightening the threat to the groundwater resource itself. The likely effects include the abandonment of cultivable areas, changes in cropping patterns and in the locations of production, greater variability, greater food imports and most likely, greater vulnerability of the poorest households – which consist largely of women and children – to climatic and related impacts on food, water and other forms of security. At the same time, declining snowmelt in Himalayan rivers and growing variability in monsoon precipitation will intensify the unreliability of irrigating from surface reservoirs.

These above-mentioned effects will likely increase the social, economic, political and environmental vulnerability of the countries. Hence the concept of *security* is seen in multiple dimensions and has acquired

[14] Independent Evaluation Group (IEG) of the World Bank (2010) *Water and Development: An Evaluation of World Bank Support, 1997 – 2007, Volume 1*, Washington, DC: the World Bank.

[15] Saxena, N.C. (2010) Personal Communication with Uma Lele.

renewed urgency. Letitia Obeng, Chair of GWP, noted in her 2009 Chatham House address that "water security is the gossamer that links together food, energy, climate, economic growth and human security challenges".[16] South Asia will have to face these and other unforeseen insecurities unless water issues are addressed on a long-term basis in the context of rapid overall economic and social development. As a recent McKinsey report noted, some solutions may require potentially unpopular policy changes and the adoption of water-saving techniques and technologies by millions of farmers.[17]

The conversation needed among stakeholders, then, is about:

[i] clearly defining water and food security and their roles in the South Asian context
[ii] individual countries' economic and social priorities to achieve those goals, and
[iii] the challenges of highest priority needing to be addressed.

What value can a single workshop add when numerous workshops on water take place in the region? To determine the potential value-added of a GWP-IMWI initiative, experts in the region were consulted, leading to the goal of this proposal: the creation of a shared platform over a sustained period that will promote an informed conversation around the challenges and help stakeholders develop a shared understanding of the issues, leading to quicker and more effective actions.

The aims of this initiative are fivefold:

1. To bring together knowledgeable professionals and experts specialising in regional, cross-sectoral work to identify the current state of knowledge: *what we know and need to know to address the complex challenges* – country by country and across the South Asia region – *related to water and food security and climate change*
2. To *distil lessons from the existing knowledge* to share with policy makers in the region
3. To *identify means of effective dissemination of the existing knowledge* pertinent to the regional issues, including the outcome of the workshop to all stakeholders
4. To *plan for the establishment of a long-term virtual platform of professionals that will comprise a South Asian Climate Change, Food and Water Security Platform as part of the GWP SAS network*
5. To *find means of operationalising the platform,* including agreeing on organisational arrangements with national, regional and international partners in support of a 5-year work plan and fundraising strategy that will delineate areas for immediate action, further research, analysis, periodic expert meetings around specific issues, training, publications and dissemination strategies – country by country and cross-country.

II. Considerations related to the establishment of a platform

South Asian stakeholders stress that water-related workshops and conferences abound. Therefore people will participate in this platform only to the extent that they perceive the benefit from networking on this platform to be greater than the cost of participation. The cost can be recovered only to the extent

[16] Obeng, L. (2009) "Water Security – Food Security – Climate Change Nexus", Food Security 2009: Achieving long-term solutions, Session Six: Use of Resources, http://www.gwp.org/Global/Activities/News/091116_ChathamHouse.pdf

[17] 2030 Water Resources Group (2009) *Charting Our Water Future: Economic frameworks to inform decision-making*, The Barilla Group, The Coca-Cola Company, The International Finance Corporation, McKinsey & Company, Nestlé S.A., New Holland Agriculture, SABMiller plc and Standard Chartered Bank.

that it results in the establishment of a platform which generates benefits over time and reaches an optimum size. GWP South Asia (GWP-SAS) network experience suggests that too small a group or too many sub-groups increase the overhead costs of operating such a platform without the commensurate benefits. Too big a platform, on the other hand, can result in a lack of selectivity and priorities, increasing perceived costs by participating members relative to the benefit they believe they can derive. There is thus a challenge in managing the private and social costs and benefits, as well as issues of economies of scale and scope which would need to be addressed.

This Initiative envisions a platform with an active work programme. GWP has invested in this venture with an expectation of realising its potential benefits. These would be well worth monitoring and evaluating if the platform is established and becomes operational.

III. Proximate objective

The proposed GWP-IWMI initiative will bring together practitioners, policy makers, researchers, activists and other experts – from both South Asia and abroad – for a 2-day discussion around the pressing food and water issues affecting the entire region. Topics will include the current state of analysis of climate change issues and their impacts on food and water policy and planning, the implications of climate change for looking at the old issues of dams, trans-boundary water management, surface and groundwater management and irrigation, all as they relate to South Asia's shared concerns about water resources for food security. The outputs of the workshop will contribute to operationalising the strategic element on 'achieving food security' in GWP's 2009–2013 Strategy, where it is stated that *"…GWP will work with the CGIAR system, particularly with the International Water Management Institute (IWMI) to facilitate adoption of the recommendations emerging from the Comprehensive Assessment of Water Management in Agriculture and the Challenge Programme on Water and Food."*

This Initiative differs from other water-related conferences in that it seeks to *initiate an enduring collaboration among South Asian countries to cooperatively improve their knowledge of agricultural water resource management for [i] greater food security, [ii] sustainable livelihoods, and [iii] preservation of natural resources against the threats created by climate change*.

This collaboration will be encouraged and supported by the existing GWP South Asia network through work on *water and food security and climate change* that will *[i]* mobilise existing knowledge and bring it to practitioners, *[ii]* stimulate new research, *[iii]* identify research, training and communication needs, and [iv] link researchers, activists, operational types and advocates from within the region and outside through periodic conferences.

IV. Key outputs

[i] The provision of a platform for sharing ideas, experiences and challenges across the region, with the goal of improving interactions among professionals working in the cross-cutting areas of climate change, water resource management and food security;

[ii] A series of 'thought pieces' as well as well-researched issue papers that can underpin the design and development of a 5-year programme of collaborative policy research, dialogue, information dissemination and advocacy among South Asian water policy makers and stakeholders; these papers will be compiled and published as a book post-workshop;

[iii] The foundation of a longer term collaboration through strengthening of the GWP-SAS network to move the ball forward on best practice adoption by promoting virtual and periodic face-to-face meetings, coordinating successive workshops and commissioning papers on issues identified as lacking in readily available research; and actively advocating policy and institutional solutions.

Annex 1, Part 2: Agenda

Date/Location: *24–25 February, 2011, IWMI Yellow River Auditorium, Colombo, Sri Lanka*

Thursday 24 February: Food and water security risks and uncertainty in a changing climate

9:00 – 9:30 **Opening remarks and welcome**

Colin Chartres (International Water Management Institute, Director General)

Ania Grobicki (Executive Secretary, Global Water Partnership)

Sardar Tariq (Global Water Partnership Chair, South Asia)

Kusum Atukorala (GWP Sri Lanka, Chair)

Mohamed Ait-Kadi (Global Water Partnership, Technical Committee Chair)

9:30 – 9:45 **Purposes of the workshop**

Tushaar Shah and *Uma Lele* (Technical Committee Members, GWP)

9:45 – 10:30 **Keynote speech**: "What does climate change mean to South Asia's water and food security?" 12th Five-year plan approach and beyond

Mihir Shah (Member, Planning Commission, India)

Brief introduction of central paper: "Interaction between food security and water security in South Asia: A statistical perspective"
Uma Lele (Technical Committee Member, GWP), *Manmohan Agwarwal and Sambudha Goswami*

This presentation will provide an overview of the concepts of food and water security in each country, focusing specifically on the interplay between productivity growth, domestic supply and the state-of-play on inter-regional trade.

10:30 – 11:00 **Tea/coffee break**

11:00 – 11:45 **Modelling, climate change and policy making**
Khalid Mohtadullah, Chair (GWP Senior Advisor and Country Director, IWMI Pakistan)

This session will review the current state of climate change modelling in the South Asia region, scope for learning from global and country-by-country methods, impacts on policy planning and areas for future inter-regional/regional-global cooperation in analysis and policy impacts.

- Impact of climate change on water resources and agriculture in Sri Lanka
  Eriyagama Nishadi and Smakhtin Vladimir (IWMI)
- Planning for climate change adaptation – Lessons from Sri Lanka
  Nayana Mawilmada (NCC Adaptation Strategy Project, Team Leader)
- Climate change and South Asia's water security
  Dipak Gyawali (Nepal Water Conservation Foundation, Nepal)

11:45 – 12:15 **Discussion 1**

12:15 – 1:45 **Lunch break**

1:45 – 2:45 **Modelling, climate change and policy making** (Cont'd)

- Climate change and national planning in Bangladesh
  Rashid Faruqee (World Bank)
- Climate change and Pakistan's strategy
  Ghazanfar Ali (Head of Water Resources and Group Leader, Glaciology, GCISC)
- Flood and drought synergies
  Naseer A. Gillani (Chief, Water Planning Commission, Pakistan)
- Climate change and South Asia's water security
  Arnaud Cauchois (Senior Water Resources Specialist, Asian Development Bank)

2:45 – 3:15 **Discussion**
3:15 – 3:45 **Tea/coffee break**

3:45 – 4:45 **Old challenges in a new context: Responses to modelling results from multiple perspectives**

Claudia Sadoff (Technical Committee Member, GWP)

This session will establish the current country perspectives on these issues and will ask whether and how climate change has influenced and/or should influence future work in these areas.

- Transboundary issues from an international perspective
  Patricia Wouters (Technical Committee Member, GWP)
- How climate change can foster transboundary cooperation?
  Suresh Prabhu (GWP Ambassador)
- Dams and development: A perspective from Pakistan
  *Pervaiz Amir (*Asianics Agro-Dev International)
- Disaster management in the context of climate change
  Santosh Kumar (National Institute of Disaster Management, India)

4:45 – 5:15 **Discussion**

Friday 25 February: Can old questions remain unaddressed given the realities of climate change?

9:00 – 10:15 **Learning from irrigation system management experience in South Asia**

Vadim Sokolov (Coordinator GWP Central Asia and Caucasus)

Focusing particularly on surface water management, this session will review the current state of information and knowledge, the performance of the surface water schemes and what can realistically be expected from the performance of surface water supply going forward in the context of climate change.

- Model-based analysis of green and blue water productivity, scarcity and trade
  Holger Hoff (Potsdam Institute for Climate Change Impact, Germany)
- The ICID response to the water food security and climate change challenges
  M. Gopalakrishnan (Secretary General of ICID, India)

- Improving the management of public irrigation in South Asia
  Thierry Facon (Regional Office for Asia and Pacific, FAO)
- Unlocking value in South Asia's public irrigation
  David Molden (Deputy Director, IWMI)
- Reforming irrigation institutions in Andhra Pradesh
  Samad Madar (IWMI/ICRISAT, India)

10:15 – 10:45 **Discussion**

10:45 – 11:15 **Coffee break**

11:15 – 12:30 **Groundwater management**

Dipak Gyawali (Nepal Water Conservation Foundation) and *Naseer A. Gillani* (Chief, Water Planning Commission, Pakistan), Chairs

This session will provide an overview of the current state of groundwater exploitation in the country, its interaction with productivity and food security and implications for policy and implementation going forward.

- Sustainable groundwater irrigation – GW-MATE vision on resource use and management approaches
  Stephen Foster (Director, World Bank GW-MATE)
- Groundwater, agriculture and energy: Lessons from Gujarat
  Tushaar Shah (Technical Committee Member, GWP)
- Paradox of poverty amid plenty of groundwater
  Aditi Mukherji (IWMI, Eastern India)
- Groundwater management in Pakistan
  Asad Qureshi (IWMI Senior Water Management Specialist, Pakistan)
- Groundwater quality – Arsenic contamination in Bangladesh
  Khondakar Azharul Haq (Regional Council Member, Bangladesh)

12:30 – 1:00 **Discussion**

1:00 – 2:00 **Lunch break**

2:00 – 2:45 **Using an integrated water resources management (IWRM) approach in South Asia**

Sardar Tariq, Chair (GWP Chair, South Asia)

This session will critically examine the extent to which IWRM is being practiced in South Asia and China.

- 15 years of IWRM in Asia: A balance sheet
  Wouter T. Lincklaen Arriens (Technical Committee Member, GWP)
- Integrated water resource management in China
  Gao Zhanyi (GWP, China)
- IWRM and equity
  Humberto Pena (Technical Committee Member, GWP)

2:45 – 3:15 **Discussion**

3:15 – 4:30 **Looking to the future**

Pasquale Steduto (Deputy Director NRL, FAO Headquarters) *and John Metzger* (Head of Network Operations, GWP), Chairs

This session will begin to draw lessons for learning from within the region and from other regions, with the scope for application of global best practices.

- A 'Plan B' for food security – The water variability connection
  Jan Lundqvist (Stockholm International Water Institute)
- Land, water and ecosystems, CGIAR CRP5
  David Molden (Deputy Director, IWMI)
- Integrated drought management: Lessons from Australia
  Dasarath Jayasuriya (Bureau of Meteorology, Australia)
- Recent experiences of ESCAP in promoting green growth and developing stronger partnership with GWP
  Salmah Zakaria (UNESCAP, Thailand)
- Reflections on water security and application for future work
  Mike Muller (Technical Committee Member, GWP)

4:30 – 5:00 **Discussion**

5:00 – 5:30 **Coffee break**

5:30 – 6:30 **Implications and going forward**

Mohamed Ait-Kadi (Technical Committee Chair, GWP) and *Suresh Prabhu* (GWP Ambassador), Chairs; *Torkil Jønch Clausen* (GWP Senior Advisor), Facilitator

Synthesis, review and future activities
Uma Lele and *Tushaar Shah* (Technical Committee Members, GWP)

This session will focus on steps needed to increase inter-regional cooperation in developing a knowledge base, learning from each other based on existing knowledge, areas needing action and the need and the scope for a 5-year regional network.

Conclusions and way forward with inputs from South Asia regional participants
Ania Grobicki (Executive Secretary, GWP), Chair

Annex 2: List of participants

Surname	Name	Affiliation/Organisation	E-mail contact
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