



## ROUND TABLE CONFERENCE REPORT

# Water, Livelihood and Adaptation to Climate Change in South Asia

November 05-06, 2009  
New Delhi

Organized by **India Water Partnership (IWP)**  
at **Institute for Studies in Industrial Development (ISID)**



Supported by





*Report of the Round Table Conference*  
*on*  
**Water, Livelihood and Adaptation  
to Climate Change in South Asia**

**November 05–06, 2009**

*edited by*  
**Dr Veena Khanduri**

*conference organized by*  
**India Water Partnership**

*at Host Institution*  
**Institute for Studies in Industrial Development**  
4, Institutional Area, Vasant Kunj, New Delhi – 110 070 (India)  
*Telephone: +91 11 2689 1111; Fax: +91 11 2612 2448*

*with the support of*  
**Global Water Partnership-South Asia**

*Cover Design & Page Layout:* ISID Media Centre

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## *Acknowledgement*

We take this opportunity to express our sincere thanks and immense gratitude to all those who made this Conference a great success. We wish to thank all the presenters for contributing their papers/presentations, chairpersons for moderating the sessions and the participants for enriching the discussions.

We are thankful to Global Water Partnership (GWP) and GWP-South Asia (GWP-SAS) for providing both financial and technical support to the Conference. We also thank Prof. S.K. Goyal, Vice-Chairman, Institute for Studies in Industrial Development (ISID), the host institution of India Water Partnership for his continuous support and valued guidance which made the Conference a grand success. The staff of ISID has helped us in various capacities for the smooth conduct of this Conference, for which we are grateful to them.





# Preface

Promoting Integrated Water Resource Management (IWRM) for sustainable livelihoods has been one of the prominent agenda of Global Water Partnership-South Asia (GWP-SAS). Of late, it has been realized by the GWP-SAS that there is need to have a holistic approach to adapt with the various ill effects of climate change and mitigate them substantially. To begin with, GWP-SAS included this burning subject in its strategy for 2009-13 under Goal-2 that addresses critical development challenges and focuses on contributing to and advocating solutions for critical challenges to the water security such as climate, growing urbanization and food production, resource related conflict and other challenges as they emerge, making mandatory for all the Country Water Partnerships to play a more pro-active role vigorously towards climate change adaptation and its mitigation.

Towards this endeavour, Institute for Studies in Industrial Development (ISID), New Delhi, the Host Institution of India Water Partnership (IWP) with the support of GWP-SAS organized a Round Table Conference on *Water, Livelihood and Adaptation to Climate Change in South Asia* on November 05–06, 2009 at New Delhi in which more than 60 participants comprising of climate change experts/ eminent scientists and scholars from South Asian countries namely; Pakistan, India, Sri Lanka, Nepal, Bangladesh, Bhutan, Global Water Partnership Office (GWPO), Sweden made their valuable contributions through powerpoint and paper presentations.

I convey my sincere gratitude to all the participants of this conference for their valuable contributions towards the thoughtful interactions that led into the production of this report. This report contains useful information to respond appropriately to the needs of the climate change—vulnerable communities in the South Asia. I hope that researchers, policy makers and natural resource experts would identify the priority areas for adaptation efforts in the region. I also hope that our GWP-SAS partners, scientists, policy makers, climate change experts would find the recommendations of this report worthy of their attention.

I acknowledge and place on record the whole-hearted support and cooperation of Mr Suresh Prabhu, Chairman, GWP-SAS, Mr Martin Walshe, Dy Secretary, GWPO, Dr Mercy Dikito Wachtmeister, GWP Network Officer, South-East Asia, South Asia & Caribbean, Presidents of all the Country Water Partnerships, all the Country Coordinators and Regional Council Members of GWP-SAS.

I am grateful to Prof. Y.K. Alagh, Chairman, IRMA & Former Minister of Power and Science & Technology, Government of India who despite his busy schedule, spared his valuable time and graced the Conference with his key note address. I am also thankful to Prof.

S.K. Goyal, Vice Chairman and founder Director of ISID for extending full support and valuable guidance in organizing this conference. My thanks also go to Dr Veena Khanduri, Adviser, IWP for her painstaking efforts in coordinating the RTC and preparing this report. I sincerely hope that we have done justice to capture the excellent contributions of all who made their presentations.

I express my sincere thanks to Prof. M.R. Murthy, Jt Director, ISID & General Secretary, IWP for providing his wholehearted support for smooth conduct of this Conference.

Finally, I am thankful to Vice-Chancellor of Sharda University, NOIDA, Uttar Pradesh, the staff of ISID and the IWP Secretariat who have helped to make the conference a grand success.

S.R. Hashim  
*Chairman*  
India Water Partnership

## *Abbreviations*

ADB	Asian Development Bank
AFPRO	Action for Food Production
BWP	Bangladesh Water Partnership
CC	Climate Change
CIMMYT	International Maize and Wheat Improvement Centre
CWC	Central Water Commission
CWP	Country Water Partnership
DA	Development Alternatives
DHM	Department of Hydrology and Meteorology
GCC	Global Climatic Change
GDP	Gross Domestic Product
GWP	Global Water Partnership
GWPO	Global Water Partnership Office
GWP-SAS	Global Water Partnership–South Asia
IARI	Indian Agricultural Research Institute
ICID	International Commission on Irrigation and Drainage
ICT	Intercontinental Consultants and Technocrats
IDS	Institute of Development Studies
IPCC	Intergovernmental Panel on Climate Change
IRMA	Institute of Rural Management Anand
ISID	Institute for Studies in Industrial Development
IWP	India Water Partnership
IWRM	Integrated Water Resource Management
KALYANI	Kalyani Institute for Study Planning and Action for Rural Change

MoU	Memorandum of Understanding
NAPA	National Adaptation Plans of Action
NAPCC	National Action Plan on Climate Change
NARS	National Agricultural Research Systems
NCAWP	Nara Canal Area Water Partnership
NREGS	National Rural Employment Guarantee Scheme
NWP	Nepal Water Partnership
PARC	Pakistan Agricultural Research Centre
PWP	Pakistan Water Partnership
RTC	Round Table Conference
SLWP	Sri Lanka Water Partnership
SRI	System of Rice Intensification
TAER	Takshashila Academia of Economic Research
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNWFP	United Nations World Food Programme
WAPCOS	Water & Power Consultancy Services
WB	World Bank
WMO	World Metrological Organization

## *Key Recommendations*

- ❏ The developing countries need to spend its energy on promoting adaptation to climate change by engaging communities through participatory management to be better informed and responsive to adapting climate change measures.
- ❏ Policy debates addressing around climate change impacts are occurring at the Government level of all South Asian countries. Civil societies, however, needs to be engaged equally at the policy level. Global Water Partnership, a network based organization provides the platform for civil societies. However, mainstreaming adaptation into development practices is very hard at the national level and even more challenging at the regional level.
- ❏ South Asian Region is obliged to face the dilemma of twin distinctly different pressures. Also, the types of water and land use decisions are to impact one or more aspects in context of South Asia as macro economy and familial poverty. In such circumstances, the suggested strategy focus on bringing more lands under agriculture, enabling best practices to enhance productivity.
- ❏ Preparation for climate change should be utilized as an opportunity to set right all the discords in water resources management and planning which require regions and states to work in unison to cater to the whole country's need. National movement is required to confront effectively with the hazards of climate change.
- ❏ Adaptation must be integrated into national economy and development plans. The policies and actions should be given priority to promote synergies between adaptation, food security, poverty reduction and environmental protection. The adaptation measures should include both soft and hard solutions.
- ❏ Future requirements of food grains and water have to be met through vertical growth by intensification, resource conservation, mechanization and introduction of new genotypes for sustaining the growth of food production in the region.
- ❏ Climate change is likely to reduce yields of more crops in long term. In long term, better adopted varieties are needed to adapt to multiple stresses linked with climate change. In short term, several options relating to technology transfer, its adoption, appropriate policies and land & water management are available which can help minimize negative impacts.
- ❏ In agricultural sector people's ability to cope with stresses induced by climate change depend on their access to knowledge, training, credit, technologies and other agricultural resources.
- ❏ Developing countries will require resources to improve capacity, undertake specific adaptation measures and cope with impacts as they occur.

- ❏ There is a need to build inter and intra departmental cooperation to address the challenges of climate change in an integrated manner.
- ❏ There is no single adaptive solution. Effective and sustainable adaptation depends or requires resources to improve capacity and a combination of measures that must be implemented at multiple levels (national, regional, local and community).
- ❏ The way forward approach for preparedness of climate change hazards considers possible solutions by promoting Integrated Water Resources Management approach for river basins development, flood water utilization through Master Plan studies, reworking of reservoir operation schedules, future planning of reservoirs. Innovative approaches for accommodating rare floods and drought events, approaches for drought and flood proofing measures for agricultural production, development of appropriate crop stains for sustaining over and under stress of water conditions. It is the time to draw short term and long term implementation plans and work out financial implications for the mitigation measures.
- ❏ South Asian region is rated poorly in global ranking on ensuring food security. Securing water for food production stood relegated in status unfortunately and this needs reversal. Assured water for agriculture can also combat poverty reduction and ensure rural livelihood; resist the migrational tendencies and avoid more and more cities turning into large scale slums with problems of different dimensions.
- ❏ Adoption of precision land leveling system to just two million hectare of area under rice-wheat system could save 1.5 million hectare meter of irrigation water and improve crop yields amounting to US \$ 500 million in three years.
- ❏ As the water cycle represents the medium through which climate change will largely be experienced, (especially through floods and droughts), society's adaptation strategies to climate change needs to relate to improved water resources management and livelihood issues.
- ❏ The key message in response to drought and flood affected areas stress upon capacity building of local government and PRIs in the technical and planning disciplines to understand potential climate impacts and devising response strategies in a judicious manner, institutional strengthening, technology and financial resources. While adaptation must be integrated across existing institutions, focal points are needed at the local levels to garner expertise, develop, coordinate and implement comprehensive projects/ programmes.

## *Introduction*

Climate change is arguably the most severe long term threat to development facing present and future generations across the globe. The past 50 years have witnessed unprecedented changes in the eco-system. Eco-system changes on global and regional scales have already affected natural resource base in diverse conditions and environments. It adversely affects not only the living conditions of people who depend upon these eco-systems for their livelihood but also influences the whole socio-economic system at the macro level.

The natural resource base, including land and water, that support and sustain the livelihoods of masses is degrading at accelerated rates. Melting Himalayan glaciers pose a direct threat to the water and food security of 1.6 billion people in South Asia region as per recent estimates of Asian Development Bank (ADB). The situation is likely to worsen in the water scarce regions in terms of severe drought and floods. Such conditions are likely to disrupt the balance in the pattern of water supply and demand for water across agriculture, domestic and industry sectors. This will lead to reduction in the choice of crops and cropping system, posing threats to food security and increasing frequency of water induced disasters. The recent estimates of World Bank (WB) also indicate that the global warming of two degree Celsius above pre-industrial temperature—the minimum the World is likely to experience—could result in permanent reduction in Gross Domestic Product (GDP) of four to five per cent for South Asian region. Hence, region's vulnerability to climate change has extremely serious implications in general and for agriculture in particular in rain fed conditions. In such emerging situation how are the livelihood opportunities going to be affected in the region? Keeping this in view, it is essential to understand the implication of changes at both micro and macro levels and find out the possible solutions which would help in policy formulation for adaptation to climate change in context of water.

In order to cope-up with these challenges, it is necessary to take a different perspective on water resource management to make multiple gains in ensuring food security, reducing poverty, creating opportunity for livelihood diversification, conserving eco-system integrity and creating resilience to climate change.

## *Round Table Conference (RTC): A Brief*

To deal with the crisis of climate change; various initiatives are being taken at community as well as state level to enhance the viability of social and economic activities and to

reduce their vulnerability to climate, including its current variability and extreme events and longer-term climate change. These initiatives may be institutional reform, choice of options, and adoption of innovative technology in managing water resource in a sustainable manner.

Realizing these challenges which are already a priority subject in Global Water Partnership-South Asia (GWP-SAS) Strategy 2009-13 under Goal-2 that addresses critical development challenges and focuses on contributing to and advocating solutions for critical challenges to the water security such as climate, growing urbanization and food production, resource related conflict and other challenges as they emerge, the theme concept of the Conference was formulated.

In this background, India Water Partnership (IWP) in collaboration with Global Water Partnership, South Asia (GWP-SAS) organized a 2-day RTC on *Water, Livelihood and Adaptation to Climate Change in South Asia* on November 05–06, 2009 at Institute of Studies in Industrial Development (ISID), New Delhi which is the Host Institution of IWP.

RTC envisaged sharing the rich experiences from different parts of the South Asian Region with a view to:

- ✎ Identifying diverse nature of priority areas in each country;
- ✎ Bringing out the socio-economic-politico constraints in handling the challenges thrown up by the experience of each South Asian country;
- ✎ Highlighting the success and failure stories in taking up the adaptation measures to the poor in diverse settings and providing lessons from these experiments;
- ✎ Drawing attention to the fact that every implementation strategy would demand certain level of investment, private as well as public. How are we going to mobilize these resources, particularly for maintaining food security in the Region?;
- ✎ Highlighting that the sharing of river water/basins is as critical within the country as between the countries. What is the mode to enhance cooperation at different levels under the federal and non-federal structures? and,
- ✎ Focusing attention on the dire necessity for developing and seeking consensus on the means and measures to move ahead with the adaptation strategy which accommodates divergent interest groups and takes the Region ahead. What kind of minimum common strategy is needed that incorporates technical and financial inputs and also enlists community and state support? What are the common priorities in the adaptation strategy acceptable to all the countries in the Region? How do we go about it to make it functional?



- ✦ In this context, the need for RTC assumes high significance where concerns relating to the adverse impact of climate change on the livelihoods of the poor in general and livelihood security in South Asia was discussed in detail.

## *Proceedings of the RTC*

The conference commenced with the Welcome Address by Prof. S.R. Hashim, Chair, IWP. Prof. Hashim formally welcomed the participants to the ISID and Conference. In his Welcome Address, he expressed his gratitude to Prof. Y.K. Alagh, Chairman, Institute of Rural Management Anand (IRMA) & Former Minister of Power and Science & Technology, Government of India for sparing his valuable time for the RTC. He also expressed thanks to Mr Suresh Prabhu, Chair, GWP-SAS for his participation in the Conference.



*Prof. S.R. Hashim, Chair-IWP, welcoming the participants of RTC*

Speaking on the occasion, Prof. Hashim also appreciated and extended his sincere thanks to Prof. S.K. Goyal, Vice-Chairman of ISID for hosting this South Asian Round Table Conference in ISID which is one of the premier national-level policy research organization in the public domain and is affiliated to the Indian Council of Social Science Research (ICSSR).



*Dr Veena Khaduri, Adviser, IWP; Prof. S.K. Goyal, Vice-Chairman, ISID; and Dr R.P. Singh, Vice-Chancellor, Sharda University in the Inaugural Session*

In the Welcome Address, Prof. Hashim said that South Asian countries are burdened with high population density and high incidence of poverty and also a high level of vulnerability to water related distress. The region is also vulnerable to the occurrence of extreme hydrological events. Prof. Hashim said that most of the present day problems of high carbon emission, global warming

and water scarcity have their roots in a large population and high levels of consumption. Economic and technological development which fuels higher levels of consumption and growth is also the only proven remedy of population control. Malthusian prediction of food supplies running short of population growth did not come true because he did not foresee the technological development and industrial revolution, and population went on growing. But when certain countries achieved high levels of income and consumptions, the growth rate of population started falling reaching just the replacement rate of growth or these about. Today most of the developed countries have reached a stage where population growth is around replacement rate of growth, and even less than replacement rate in some of them like Russia, Germany, Japan. Even in the developing countries, as the income is growing, growth rate of population is declining fast reaching a rate of fall which could not be achieved by persuasive campaigns or coercive methods. Hence, development itself is the biggest contraceptive. Development also leads to development of technology and its adaptation. Technology is important for mitigation of adverse consequences of climate change and adaptation. We need to strike a balance.

It is necessary to ensure that the links between water, development and climate change are not only understood by all but also appropriate responses are identified, developed and implemented. Expressing his satisfaction with the theme and purpose of the Conference, Prof. Hashim said that it would give an opportunity to all key stakeholders and actors to work vigorously towards adaptation with respect to water resources.

The Welcome Address was followed by the Keynote Address by Prof. Y.K. Alagh. The Key Note address raised the issue of new paradigms in water sector in the context of India. The key note address raised the questions that most of the received facts and so called solutions to India's water problems (big dams, small projects, irrigation schemes, conjunctive use, etc.) are quoted as recent developments. However, they are incomplete and do not address the crisis which India is facing today in water and agriculture sector.



*Prof. Y.K. Alagh, Chairman, IRMA delivering the Keynote Address*

The address focused on certain recent developments generally ignored both by policy makers and the quantitative analysts and analyzed consequences of these developments. Addressing the issue of new paradigm in water sector, Prof. Alagh said that there is an

intimate relationship between cropping intensity, land use and water management. Irrigation permits the possibility of multiple cropping by bringing additional land under cultivation and the same land to be used more than once. He further added that whereas in the Nineties, arable area had stopped growing and so the land constraint was far more severe, but later on growth was seen increasing by adopting double cropping system. This fundamental relationship was used to project the intensive resource base of the economy. It was projected that by the end of decade, India would have used up most of its balance water reserves. With the irrigated area reaching around 114 million ha by 2010, projection for 2020 was a requirement for irrigation of 122 million ha which clearly indicates that the balance ground water reserves are now very limited. Hence efforts will be needed to harvest and carefully use the available water.

Highlighting Tushar Shah's report on ground water in which Mr Shah has mentioned that there are 100 districts which account for over 60 per cent of India's critical and over exploited blocks, Prof. Alagh said these also happen to have the highest concentration of dug wells in the country. Ironically, here is where falling of water tables have the most disastrous impact on drying up wells and forcing farmers to revert to rainfed farming. Outside the Punjab, most recent farmers suicides are reported from these districts and ground water stress is an important source of agrarian distress in these districts. Much of these distresses can be alleviated and at a relatively low cost to the society by mounting a well designed programme of ground water recharge. For achieving this, Mr Shah believes that working models with stakeholder groups and Panchayati Raj agencies need much greater attention. Land scarcity is going to be perhaps the single greatest constraints to India's development. Hence the economic interest in land and water had to be at the heart of any reform process.

The Inaugural Session was Chaired by Mr Suresh Prabhu, Chair, GWP-SAS. Delivering Chair's remarks, Mr Suresh Prabhu emphasized that IWP and GWP-SAS are discussing the area of high importance in the context of South-Asia as South-Asian region is the



*Mr Suresh Prabhu, Chair, GWP-SAS delivering his speech in the Inaugural Session*

most affected region with regard to pressing water resources in relation to climate change. South Asia with 25 per cent of world population has only 9 per cent of world water and uses over 90 per cent of its water for irrigation. This is a region with abundant water during the monsoon when quite often devastating flood occurs and at the same time this region faces water scarcity and

droughts during dry periods. Being an agrarian society, agriculture suffers most due to natural disasters. We, therefore, need to focus on water resources management, capacity building, institutional support and infrastructure. Water managers who often seem to be mainly interested in assessing short-term risks and reducing vulnerability, should be encouraged to take climate variability and change more seriously. Adaptation must be taken as an on-going process evolving with increasing knowledge, awareness and capacity building.

This two-day RTC was well attended with due participation of climate change experts/ eminent scientists and scholars from South Asian countries namely; Pakistan, India, Sri Lanka, Nepal, Bangladesh & Bhutan. Besides this, officials of Global Water Partnership Office (GWPO), Sweden were also present during the deliberations. In all, there were 60 participants in the Conference.

The Conference was divided into five Technical Sessions as under. Summary and Proceedings of those Sessions were recorded accordingly.

Technical Session – I	Climate Change and Impact on Water Resources: South Asian Perspective
Technical Session – II	Adaptation to Climate Change: Agriculture I (Food Security)
Technical Session – III	Adaptation to Climate Change: Agriculture II (Innovative Low Cost Water Saving Technologies)
Technical Session – IV	Adaptation to Climate Change: Role of Institutions
Technical Session – V	The Way Forward

## ***Climate Change and Impact on Water Resources: South Asian Perspective***

The First Technical Session was devoted to *Climate Change and Impact on Water Resources: South Asian Perspective*. This Session was Chaired by Sardar Muhammad Tariq, Chairman, Pakistan Water Partnership and the Rapporteur was Dr Karuna Onta, RC Member, NWP. The presentations made during this Session were:

- ❖ Scientific Evidence of Impact of Climate Change in South Asia and Bangladesh in Particular by Dr Giasuddin Ahmed Choudhury, Executive Director, Centre for Environmental & Geographic Information Service, Bangladesh;
- ❖ Nairobi Statement on Adaptation to Climate Change for Land and Water Resources and those in South Asia Context by Ms Reba Paul, Bangladesh Water Partnership;

- ✘ Global Climatic Change (GCC) and its Impact on Water Resources in Diverse Situations-Emerging Challenges in Adaptation by Mr M. Gopalkrishan, Secretary General, International Commission on Irrigation & Drainage (ICID), New Delhi;
- ✘ Climate Change: Trends and Impacts on Livelihood of People in Nepal by Dr Keshav Prasad Sharma, Nepal Water Partnership; and
- ✘ An Approach to Preparedness for Climate Change Hazards by Mr P.L. Diwan, Former CMD WAPCOS, Head of Water Resources Department & former RC-Member, GWP-SAS.

**Dr Giasuddin Ahmed Choudhury** in his presentation on *Scientific Evidence of Impact of Climate Change in South Asia and Bangladesh in Particular*, said that climate change was a reality and had been happening with or without our knowing from time immemorial. However, of late, the impacts of climate change has been manifested in form of rising temperature, glacier melts, floods, landslides, drought, scanty rainfall, rise in sea levels, threatening floods and water intensity, epidemics and their effects on the eco-systems. Flood disasters and other vulnerabilities occurring in South Asia particularly in Bangladesh have demonstrated irreversible climate change.

*Flood Disaster in South Asia  
Socio-Economic Damages caused due to Flood Events in South Asian Countries (1960-2008)*

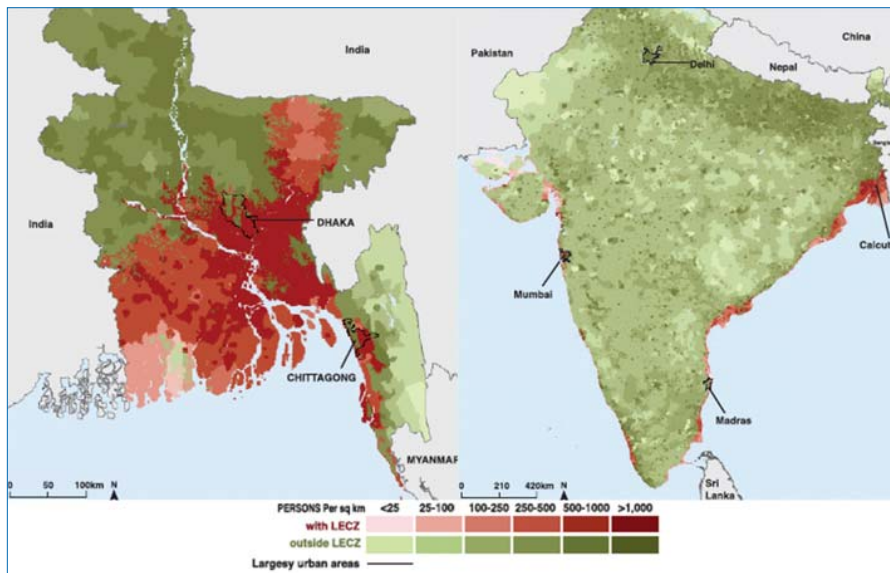
<i>Damages</i>	<i>Bangladesh</i>	<i>India</i>	<i>Nepal</i>	<i>Pakistan</i>	<i>Srilanka</i>
Deaths	52033	55656	5637	8877	1050
Effected	304628928	763986965	2977703	37687043	7957127
Homeless	4219724	13210000	84925	4234415	2746601
Injured	102390	1561	1072	1981	1002
Total Effected	308951042	777198526	3063700	41923439	10704730
Estimated Cost (US\$ '000)	12038400	29417188	977213	2865178	374364

Stressing on flood disaster and other vulnerabilities occurring in South Asia, particularly in Bangladesh, Dr Choudhary mentioned that these diverse effects posed great challenge to networks like GWP-SAS to position water at a centre of all climate change debates taking place at sub-national/International and global level without which we will not be able to unite and prepare ourselves with adequate responses to understand and address the impact of climate change. Hence networking to understand the behavior of climate change impacts such as floods and drought has become important.

Dr Choudhary also mentioned that there is an urgent need to link the “science” behind climate change and how it impacts the lives of poor vulnerable and socially excluded populations. Experience shows that there are communities which have been using indigenous practices to adapt to climate change impacts. This knowledge needs to

be recorded, and widely shared. While the developed countries are more responsible for negatively influencing the eco-system, the developing countries have to bear the negative impacts. At the moment, the developing countries need to spend their energy on promoting adaptation to climate change by engaging communities to be better informed and responsive to adapting climate change measures.

*Population Density within and outside 10 m Low Elevation Coastal Zone (BLUE ALERT, Green Peace, March 2008)*



*Summary of key observed Past and Present Climate Trends and Variability (IPCC, 2007)*

Country	Change in Temperature	Change in Precipitation
India	0.68°C increase per century, increasing annual mean temperature	Increased extreme rains in north-west in recent decades, lower number of rainy days along east coast
Nepal	0.09°C rise per year in Himalaya, and 0.04°C in Terai region, more in winter	No distinct long term trends in precipitation records for 1948-1994
Pakistan	0.6°C-1°C rise in mean temperature in coastal areas	10-14 % decrease in coastal belt and hyper arid plains, increase during summer and winter over last 40 years in Northern Pakistan
Bangladesh	Increasing trend of about 1°C in May and 0.5°C in November during 1985-98	Decadal rain anomalies above long term averages since 1960s
Sri Lanka	0.016°C increase per year between 1961-90 over entire country, 2°C increase per year in central highlands	Increasing trend in February and decreasing trend in June

**Ms Reba Paul** presented the extract of *Nairobi Statement on Adaptation to Climate Change for Land and Water Resources*, and how it can be linked to South Asian Context. Guiding principles for adaptation to climate change adopted in Nairobi Statement included (a) sustainable development; (b) resilience; (c) governance; (d) knowledge sharing and information; and (e) economics and financing.

*Guiding Principles for Adaptation to Climate Change Adopted in Nairobi*

1. Sustainable Development	Adaptation must be addressed in a broader development context, recognizing climate change as an added challenge to reducing poverty, hunger, diseases and environmental degradation
2. Resilience	Building resilience to ongoing and future climate change calls for adaptation to start now by addressing existing problems in land and water management
3. Governance	Strengthening institutions for land and water management is crucial for effective adaptation and should build on the principles of participation of civil society, Gender equality, subsidiarity and decentralization
4. Information	Information and knowledge for local adaptation must be improved, and must be considered a public good to be shared at all levels
5. Economics and Financing	The cost of inaction, and the economic and social benefits of adaptation actions, calls for increased and innovative investment and financing

Implementation of Guiding Principles will be strengthened through the establishment of partnerships that enable the combining of strengths, mandates and institutional capacities. Also, forging partnerships and working through networks will create the diversity and creativity necessary to support land and water management for adaptation to climate change. While, policy debates around addressing climate change impacts are occurring at the Government level of all South Asian countries. However, mainstreaming adaptation into development processes is very hard at the national level and even more challenging at the regional level.

While citing the comprehensive approach discussed during the Nairobi dialogue, presenter highlighted:

- ❏ A comprehensive and integrated framework is needed for effective adaptation for land and water management and such framework should follow a bottom up approach from community based adaptation to basin, national and trans-boundary levels;
- ❏ Adaptation must be integrated into national economy and development plans;
- ❏ The policies and actions should be given priority to promote synergies between adaptation, food security, poverty reduction and environmental protection;

- ✘ The adaptation measures should include both soft and hard solutions; and
- ✘ Adaptation planning and implementation should consider other significant drivers of change (e.g. food, energy, finance, markets).

**Mr M. Gopalakrishnan** in his presentation on *Global Climatic Change(GCC)and its Impact on Water Resources in Diverse Situations— Emerging Challenges in Adaptation*, described the compulsions in managing water as a key to face the challenges due to climate change and also highlighted role of International Cooperation

with special reference to South Asia. He said that the South Asia Region is obligated to face the dilemma of twin distinctly different pressures. Also, the type of water and land use decisions are to impact one or more aspect in context of South Asia such as macro economy and familial poverty; high technology and local knowledge; enhanced productivity and lesser water use; national policies & State priorities and programmes. The presentation also highlighted that countries in South Asian region are rated poorly in global ranking on ensuring food security. Securing water for food production stood relegated in status unfortunately and this needs reversal. Assured water for agriculture can also combat poverty reduction and ensure rural livelihood; resist the migrational tendencies and avoid more and more cities turning into large scale slums with problems of another dimensions.

Build upon the intrinsic connectivity of the Great Rivers of Himalaya

- How can we optimize the development and use of water resources in the region?
- How can transportation on land & water be improved for exchange of goods & services?
- Can regional cooperation be founded on good benefit sharing, in a larger context?

The presentation also highlighted that South Asia perspective on water and food for eradicating poverty and hunger received attention during Fifth Water Forum at Istanbul. The suggested strategy focus on bringing more lands under agriculture, enabling best practices to enhance productivity and associated land consolidation are deserved actions for the future food security of India.

The presentation stressed and posed questions that:

- How can we best assess and monitor significant environmental changes in the region, jointly?
- Can water be the driver for trust, cooperation and partnership, following successes elsewhere?
- What additional mechanisms can enhance the propensity to share the data in the region?

The paper elaborates lastly that if large scale, long distance water transfers can enhance overall regional benefits , how to examine them boldly by joint efforts, which would help



to enhance environmental quality, green energy, more food and thus prepare nations to face the impacts of GCC on water. World over and India in SA region in particular may have to aim doubling the production for increased needs. Failure to do so will expose the already vulnerable and poor from increased threats.

**Dr Keshav Prasad Sharma** in his presentation on *Climate Change: Trends and Impacts on Livelihood of People in Nepal*, indicated that the agrarian society living primarily in the rural areas of Nepal has the strongest bond with the ecosystems, which are sensitive to the climatic changes. Besides agriculture, the livelihood of rural population has close links with forest, another climate sensitive sector. More than 86 percent of energy needs of the population are met by fuel wood, agriculture residue and animal wastes. Majority of the population (30 percent are below national poverty line) are living in marginal conditions. Hence, any adverse impact as result of climatic changes can become disasters for the population living below the poverty line in particular and to the national economy in general. Besides agriculture, the anticipated losses resulting from increased intensities of weather related hazards, epidemics, and diseases are likely to add to the sufferings of the population with overall damage to the national infrastructure.

In Nepal, melting Himalayas have been the most highlighted issues of climatic changes. Its impacts on water resources are a concern not only in Nepal but also in South Asia and Southeast Asia. Major rivers of the region, such as the Ganga, Brahmaputra, Indus, Irrawadi, Salween and Yangtze originate from the Himalayas.



*View of the Melting Himalayas*

People in Nepal are already facing the impacts of dwindling water sources, recurrent floods and prolonged droughts. Because of high dependence on agriculture, high population growth rate and marginalized economy, the existing hardship is likely to lead towards disastrous consequences in the scenarios of projected climatic changes in the region. Reducing vulnerabilities, developing coping mechanisms, and implementing adaptive measures are the only solution to the problem of climatic changes as climate change mitigation is not an option for several years to come.

Hence, there is an urgent need to implement water plan approved by the government of Nepal with additional consideration of new findings and policies regarding climate change. Thus, the role of the Water and Energy Commission becomes important in this respect.

Besides providing information on past climate, Department of Hydrology and Meteorology (DHM) is the only agency capable to monitor climate in future and assess future scenarios. Government should give special consideration for strengthening DHM with support for establishing benchmark stations for reliable climate assessment and for developing climatic and hydrological modeling facilities.

Due to fragile environment and high level of poverty, Nepal urgently needs capability to assess climate related vulnerabilities and develop appropriate strategies for adaptive measures. Besides, the farmers need to be oriented about crop diversification, development of micro-irrigation schemes, appropriate technologies for land and water management. Wider application of such strategies can contribute to ameliorate the adverse impacts of climate change in Nepal.

**Mr P.L. Diwan** made a presentation on *An Approach to Preparedness for Climate Change Hazards*. Referring the climate change futuristic models, he indicated that by doubling of Co<sub>2</sub> concentration increase the air temperature by 4.90° - 6.10°C thereby globally effecting the precipitation changes with wide variation of -35% to +50%. It is also stated that the combined effect of climate change may trigger into numerous impacts altering precipitation pattern, surface flows and water balance, evaporation, evapo-transpiration, growing seasons, adversely affecting the environment for agricultural production thereby threatening food security, spreading pest and diseases and adversely affecting the economic status and livelihood.

With these aspects in view, the author dwells on the water management issues which are going to be very critical in the coming years and suggests way forward approach for preparedness for mitigation measures specifically for sustaining agricultural production.

For way forward approach, he opined that for preparedness of climate change hazards, the possible solutions may be interlinking of irrigation projects, Integrated Water Resources Management approach for river basins development, flood water utilization through Master Plain studies, reworking of reservoir operation schedules, future planning of reservoirs. Innovative approaches for accommodating rare floods and drought events, approaches for drought and flood proofing measures for agricultural production, development of appropriate crop strains for sustaining over and under stress of water conditions, reduction of paddy cultivation and social acceptance of coarse cereals, a change in food habits, grafting techniques, adaptive measures, etc.

The climate changes and fear of drastic consequences in the availability of water resources affecting human life, its habitat, flora and fauna shall be considered as a national challenge and an opportunity for both to unite together and rise above petty politics' and thereafter search for technical options. The situation is already alarming in water sector and all round efforts shall be channelized for mitigation measures otherwise mankind is at the threshold for catastrophic changes.

Mr Diwan further said that relevance of interlinking of rivers and development of large reservoirs are now more relevant for combating the vagaries of climate change. Reservoirs shall serve for both drought and flood proofing to ensure food, water and land security. Innovative techniques of building reservoirs in unfavorable topography could be equally contemplated rather than locating such structures in the mountains. Re-engineering be administered in each state to interlink the irrigation projects in the same state for withstanding vagaries of climate change. Climate proofing cannot be confined in a river reach within one state boundary rather it can be achieved in the whole basin which could be located in several states. River Basin planning and preparation of Master Plan studies on holistic approach is essential both for flood utilization and optimal water resources utilization. Pollution abatement of human activities shall be part of the Master Plan studies.

Preparation for the climate change should be utilized as an opportunity to set right all the discords in water resources management and planning which require regions and states to work in unison to cater to the whole country's need. National movement is required to confront effectively with the hazards of climate change.

## ***Adaptation to Climate Change: Agriculture I (Food Security)***

The Second Technical Session was devoted to *Adaptation to Climate Change focusing on Agriculture and Food Security*. Md. Shahidul Hassan, Chairman, BWP was the Chairperson of this session. The Rapporteur to this session was Mr Karamat Ali, PWP. Three very important and thought provoking presentations were made by the eminent water/ agriculture experts which were:

- ✕ Conservation Agriculture: An Opportunity to Address Water Crisis by Dr Raj K. Gupta, Facilitator, CIMMYT, NASC Complex, Pusa New Delhi;
- ✕ Benefits of System of Rice Intensification (SRI): Pro-poor Option for Household Food Security and Resource Conservation by Dr B.C. Barah, Director, National Centre for Agriculture Economics and Policy Research (NCAP), Pusa, New Delhi; and,
- ✕ Adapting Indian Agriculture to Global Climate Change by Dr P.K. Aggarwal, Professor, Indian Agricultural Research Institute (IARI), Pusa, New Delhi.

All the above three presentations focused on better water management through technology intervention which would be essential if communities have to adapt successfully to climate induced changes in their water resources.

**Dr Raj K. Gupta** in his presentation on *Conservation Agriculture: An Opportunity to Address Water Crisis*, said that Green Revolution in India was fueled by irrigation, groundwater and infrastructure development. However, areas benefited most by Green Revolution technologies now suffer with receding water tables in fresh water aquifer zones. This grave situation poses the question as to what

are the opportunities to save water for sustainable agriculture. It was explained that the future requirements of food grains and water have to be met through vertical growth by intensification, resource conservation, mechanization and introduction of new genotypes for sustaining the growth of food production in the region. The presentation cited the example of rice-wheat systems of the Indo-Gangetic plains wherein Rice-Wheat Consortium in collaboration with its NARS partners is working on several water saving technologies for water-short irrigation environments. One such technology is laser-assisted precision land leveling which saves irrigation water, nutrients and agro chemicals. It also enhances environmental quality and crop yields. The presentation also highlighted that adoption of precision land leveling system to just two million hectare of area under rice-wheat system could save 1.5 million hectare meter of irrigation water and improve crop yields amounting to US \$ 500 million in three years.

**Dr B.C. Barah** made presentation on *Benefits of System of Rice Intensification (SRI): Pro-poor Option for Household Food Security and Resource Conservation*. Explaining the importance of rice for the food basket, Dr Barah said that rice is a staple food of 2.4 billion people worldwide, which is expected to reach 4.6 billion by 2050 requiring 70 % growth of production by 2025. Decline in per capita availability of rice will have implication on food and nutrition security. A key challenge is

to orient ourselves for alternative cultivation practices to enhance productivity and ensure sustainable production. One such innovative technique is SRI. The presenter

- Water lost from the aquifers is lost from the region for all times. Estimated losses: 13.2 – 17.7±4.5 km<sup>3</sup>/yr.
- Bunds 22cm in height can save >95% of the “Rainfall Excess”.
- Timely seeding of rice in leveled fields can use most of the rainwater and result in high total system productivity. Late planting in eastern Gangetic Plains result in rainwater use to just 40-60%.

SRI offers opportunities to:

- Increase in production. The possibility of even doubling or tripling yield averaging about 8t/ha, which can change the rice availability globally, with less land, water and other inputs.
- Raise factor productivity.
- The property of being invariant to variety and reducing chemicals and excessive use of other inputs make SRI accessible to the poor (a pro-poor option), while being environmentally friendly.

also highlighted SRI adoption, gains of SRI, farmers' perception on usefulness, SRI governance in India and pathways of SRI.

**Dr P.K. Aggarwal** made presentation on *Adapting Indian Agriculture to Global Climate Change*. Defining the aspects of climate change scenario for India with implications for agriculture, Dr Aggarwal narrated that the climate change adaptation in agriculture is a continuous process. Referring the results of controlled environment facilities at Indian Agricultural Research Institute (IARI) used for evaluating model performance in future climate change scenarios, Dr Aggarwal indicated that climate change is likely to reduce yields of most crops in long term. In long term, better adapted varieties are needed to adapt to multiple stresses linked with climate change.

Dr Aggarwal projected the impacts of climate change on agriculture which are: (a) Increase in CO<sub>2</sub> to 550 ppm increases yields of rice, wheat, legumes and oilseeds by 10-20%; (b) A 1°C increase in temperature may reduce yields of wheat, soybean, mustard, groundnut, and potato by 3-7%; (c) Productivity of most crops to decrease marginally by 2020 and



*Controlled Environment facilities at IARI used for Evaluating Model performance in Future Climate Change Scenarios*

10- 40% by 2100. Increased droughts, floods and heat waves will increase production variability; (d) Length of growing period in rainfed areas is likely to reduce, especially in peninsular regions and southern India; (e) Considerable effect on microbes, pathogens, and insects; (f) Possibly some improvement in yields of chickpea, rabi maize, sorghum and millets; and (g) Less loss in potato, mustard and vegetables in north-western India due to reduced frost damage. He also concluded that costs of adaptation are less understood but likely to be high. However, costs of inaction could be even higher. Adaptation practices take time to become effective. This is the time to act.

## ***Adaptation to Climate Change: Agriculture II (Innovative Low Cost Water Saving Technologies)***

The Third Technical Session dealt with *Adaptation to Climate Change focusing on agriculture and innovative low cost water saving technologies*. The session was chaired by Mr S.B. Niyangoda, Chairman, SLWP and the Rapporteur was Ms Reba Paul, BWP. The presentations made in this Session are as under:

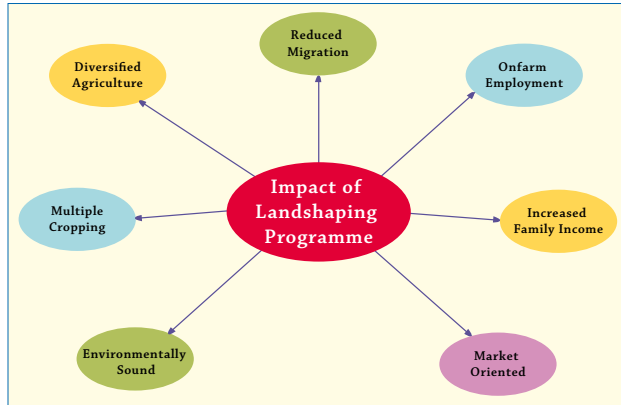
- ✘ Water, Climate Change and Livelihoods: Experiences from Bundelkhand, (Central India) by Dr K. Vijaya Laxmi of Development Alternatives, New Delhi;
- ✘ Water and Climate Change—Low Cost Water Saving Technologies: Lessons From Eastern India by Prof. Sudhin K Mukhopadhyay of (KINSPARC, Kalyani, West Bengal);
- ✘ Local Wisdom for Water Harvesting and Synergy in Water-Centric Programs: Lessons from Hill Areas by Ms Arti Gupta (PRAKRITI, Shimla) & Prof. Prem S. Vashishtha, Sharda University, Noida;
- ✘ Up-Scaling Grassroots Interventions to National and International Levels: Nara Canal Area Water Partnership by Dr M. Akhtar Bhatti, PWP; and
- ✘ Combating Climatic Change through Technological Interventions—Case Study on Drip Irrigation by Dr Santosh K. Deshmukh of Jain Irrigation System Limited, Jalgaon, Maharashtra.

This Session focused on impacts of impending climate change which need a different and innovative response. In this session five presenters shared their field experiences in response to water management challenges which are as old as civilizations, but in new environmental circumstances (drought & flood) needs innovation and fresh thinking.

**Dr K. Vijaya Laxmi** in her presentation on *Water, Climate Change and Livelihoods: Experiences from Bundelkhand, (Central India)*, shared her experience on Bundelkhand (Uttar Pradesh) where Development Alternative, a leading NGO is working for adaptation and mitigation of climate change impacts through community mobilization and capacity building of communities on planning and management of water resources through innovative technologies which can save energy and water. The technologies include use of Tara filter for purification of water, use of renewable energy and eco-building services. The adaptation mitigation strategy of Bundelkhand is totally society driven and the case advises that any adaptation or mitigation strategy of climate change should be society driven. By continuing this strategy, the organization has formed green social enterprise under which three grass-root cluster groups namely; (i) Women energy clusters; (ii) Farmer adaptation clusters; and (iii) artisans clusters together called community carbon cluster, are using energy efficient low emission technologies, eco-material production for buildings and involved in regeneration of resource base by reducing carbon foot prints.

**Prof. Sudhin K. Mukhopadhyay** in his presentation on *Water and Climate Change—Low Cost Water Saving Technologies: Lessons from Eastern India*, highlighted the case of Eastern India which has abundant water (both surface and ground water) and at the same time faces water scarcity. The withdrawal of excessive groundwater has caused declining of groundwater table in the area during dry seasons which has affected soil, agricultural productivity and income of the farmers. In order to deal with this problem, immediate

### Impact of Landshaping Programme



application of appropriate eco-friendly low cost technologies and management practices for saving water at national, regional and community and household level is an imperative need. Various such technologies have been designed to cope-up with the water crises. For example; Land shaping technology which is followed in Sundarban area of West Bengal is an improved agro technology. The benefits of this technology are; (a) three dimensional (land, water, air) crops; (b) Option for integration of agriculture; (c) Aquaculture with duck rearing; (d) Introduction of double and triple crops; (e) Additional crop in pond & land embankment; (f) Harvested water utilized in 2<sup>nd</sup> and 3<sup>rd</sup> crops; (g) Conservation of ground water; and (h) Energy saving module. In Gangetic plains of Eastern India, moisture conservation technology has been used to enhance and sustain farm production. The other technology is Micro Level Water Resource Development through Tank-cum-Well Technology designed by Water Technology Centre, Bhubaneswar. The technology involves a system of tanks and dug wells in sequence. While tanks store run-off water which is recycled for irrigation, the open dug wells harvest water seeped in from tanks. In Delta region of West Bengal, bunds which used to demarcate plots are raised and broadened and used for vegetable cultivation. The presentation also indicated that various technologies are available but to promote the success of these technologies, very intensive work is required at the grass-root level to improve the water management situation in the area.

**Ms Arti Gupta and Prof. Prem S. Vashishtha** made presentation on *Local Wisdom for Water Harvesting and Synergy in Water-Centric Programs: Lessons from Hill Areas*, wherein they presented one case study on Hamirpur district of Himachal Pradesh (North India) which highlighted as to how the local wisdom of water harvesting helped a small village to come out of the existing water problems in the area. The presentation made was based on the National Rural Employment Guarantee Scheme (NREGS), a Government of India program, which has helped revival of traditional water sources involving the local community to identify, building and maintaining water harvesting structures and sources (check dams/Khads/Nallas). The presentation also raised questions as to how the reshaping of public programmes with water centric components can help bring

prosperity to village life and create synergy between the positive effects of local wisdom and public programmes.

**Dr M. Akhtar Bhatti** made a presentation on *Up-Scaling Grassroots Interventions to National and International Levels: Nara Canal Area Water Partnership (NCAWP)*, which is located in rural areas of Sindh province of Pakistan. The presentation focused on up-scaling grass-root interventions at National and International level. Nara Canal AWP was established in 2001. The partnership include active partners from Government Departments, Non Governmental Organizations, Community Based Organizations, Local Counselors, etc. to address the water related issues in the area through facilitating integrated use of water resources, gender sensitization and training. Nara Canal AWP has collaborated with Pakistan Agricultural Research Centre (PARC) to evolve synergies among the NCAWP and PARC that are complimentary to each other for improved use of natural resources especially the water resources in Sindh. Recently PARC, Government of Pakistan and Agriculture Ministry of People’s Republic of China signed a MoU to assist NCAWP in providing technology and hybrid seeds for increasing agricultural productivity.

**Dr Santosh K. Deshmukh** made presentation on *Combating Climatic Change through Technological Interventions: Case Study on Drip Irrigation*, wherein a case study on drip irrigation to combat climate change was presented. Dr Deshmukh illustrated the difference between conventional use of water for irrigation and drip irrigation for different crops. For example; the percentage yield of Banana crop using conventional method would be 57.5 MT/ha, while by using drip irrigation, it will be 87.5 MT/ha resulting an increase of 52% yield and water saving to the tune of 45%. The presentation also indicated that adoption of drip irrigation will solve the problems of energy security, water security, food security and rural to urban migration in global change and population resource imbalance scenario.

*Benefits of Drip Irrigation over Conventional Use of Water for Irrigation*

<i>Crop</i>	<i>Conventional (Yield/MT(ha))</i>	<i>Drip (Yield/MT(ha))</i>	<i>% yield increase</i>	<i>Water savings (%)</i>	<i>Increase in water use efficiency (%)</i>
Banana	57.5	87.5	52	45	176
Grapes	26.4	32.5	23	48	136
Sweet Lime	100	150.0	50	61	289
Pomegranate	56.0	109.0	98	45	167
Tomato	32.0	48.0	50	31	119
Watermelon	24.0	45.0	88	36	196
Chilly	4.2	6.1	44	63	291
Sugarcane	128.0	170.0	33	56	204



## *Adaptation to Climate Change: Role of Institutions*

The Fourth Session highlighted the role of institutions for *Adaptation to Climate Change to achieve water security in the region*, which needs infrastructure to store and transport water as well as to build the institutions that are equipped with the information and capacity to predict, plan for and cope with climate variability. Prof. V.S. Vyas, Member, Economic Advisory Council to the Prime Minister, Government of India, chaired this session and Rapporteur was Mr Som Nath Poudel, NWP. Five presentations were made during the Session:

- ✘ Institutional Response to Climatic Change in India: Role of Water Demand Management Institutions by Prof. R. Maria Saleth, Director, Madras Institute of Development Studies (MIDS), Chennai;
- ✘ Documentation of Success Story on Ground Water Conservation & Prospects to ensure Sustainable Water Supply in Dargah Premises of Ajmer Sharif by Dr Veena Khanduri, Adviser, IWP and RC Member of GWP-SAS;
- ✘ Institutional Response to Climatic Change at National Level by Mr Rajesh Kumar, Chief Engineer, Central Water Commission, New Delhi;
- ✘ Adaptation to too much and too little Water by Dr Anish Chatterjee, Action for Food Production (AFPRO), New Delhi; and,
- ✘ Groundwater Markets, Institutional Mechanism and Poverty in Diverse Conditions by Dr Dalbir Singh, IWP, New Delhi

The first presentation of this session was made by **Prof. R. Maria Saleth** on *Institutional Response to Climatic Change in India: Role of Water Demand Management Institutions*, which largely focused on physical impacts, science & technology and economic needs. The presenter indicated that already 80.0 per cent of basins with 60.0 per cent of the farm area are facing physical water scarcity. Projecting the food demand in 2050 at 400 million tonnes requires an additional irrigation of 60 Mha, and this would create livelihood opportunities but will also demands huge investment initiatives. In the present context, the presenter stressed that the approach for CC adaptation should be through promotion of National and local institutions, integrating IWRM, focusing on supply management-infrastructure, demand management-institutions, etc. However, the present institutions, management system, and infrastructure are inadequate to deal with the exigencies of climatic change. Thus, in addressing potential water shortages, as much attention should be given to managing demands as to increasing supply, by introducing more efficient technologies as well as simply promoting a culture of conservation. He also mentioned that there are institutional linkages among the various institutions which can be strategically exploited. The presentation underlined that current water crises calls for major reforms in water institutions and climate change only

adds to the urgency. In this context, the core water strategy for climate change should be the creation of Demand Management Institutions within the IWRM framework.

**Dr Veena Khanduri** made a presentation on *Documentation of Success Story on Ground Water Conservation & Prospects to ensure Sustainable Water Supply in Dargah Premises of Ajmer Sharif*. During the presentation, a documentary film on the same was also shown to the participants. The presentation highlighted that a community-based action is required for the efficient use of water resources in scarce conditions through making the effective functioning of informal institutions. The presentation and film clearly explained the role of public institutions and community participation in ensuring water supply in the holy Dargah of Ajmer Sherif.

Explaining about the Water problem in Dargah Ajmer Sherif, which is visited by more than 35.00 lakh pilgrims during Annual Urs and Mini Urs in Muharrum requires 17.00 crores litres of water in a year. Against the requirement, only 23.00 lakh litres of water was supplied by the Public Health Engineering Department (PHED), Government of

Religious and pilgrim places have huge tracts of land and other natural resources, which at places are in degraded conditions. In some religious places pilgrims do free labour to develop land, plant trees, clean up the premises etc. Though government is striving to provide facilities to pilgrims, community action will go a long way to bring about sustainability to the solutions.

Rajasthan, leaving a huge gap between Demand and Supply. For years together, this gap was met by a groundwater reservoir which lies in southern part of the Dargah premises popularly known as Jhalra. However, this historically and spiritually attached water body dried in July, 2007.

To meet the gap in demand and supply of water, Dargah Committee took up the noble initiative for reclaiming the dried Jhalra through community participation and commenced the work. By December 31, 2008, water level in the Jhalra

If leadership in big religious places plays an important role in conserving and developing the huge natural resources they possess, the natural resources development agenda will get a big boost in the country.

reached 40 feet, making available 63 lakh litres of water per day. An average of 4.75 lakh litres of triple/double filtered water is supplied to the Dargah premises, meeting nearly 99.0 percent of the demand. This five minute documentary film prepared by IWP partner NGO, namely; Institute for Development Initiatives with the support of India Water Partnership exhibits not only a record of historical natural resources restoration effort but also act as a motivational tool for other religions/historical places to play a catalytic role in other parts of South Asia to revive such water bodies. This is an experimental evidence of how community participation can play the pro-active role in restoration of the traditional water harvesting structure.

Highlighting *Institutional Response to Climate Change at National Level*, **Mr Rajesh Kumar** said that National Action Plan on Climate Change (NAPCC) had been launched by the Hon'ble Prime Minister of India on 30<sup>th</sup> June 2008. NAPCC has laid down the principles and identified the approach to be adopted to meet the challenges of impacts of climate change through eight National Missions. Five goals have been identified by the NAPCC viz; (i) Comprehensive water data base in public domain and assessment of the impact of climate change on water resource; (ii) Promotion of citizen and state actions for water conservation, augmentation and preservation; (iii) Focused attention on over-exploited areas; (iv) Increasing water use efficiency by 20%; and (v) Promotion of basin level integrated water resources management. The NAPCC requires an additional fund of Rs. 21626 crores to achieve its goal under XI Plan. NAPCC also stresses on some important issues in water sector such as involvement of many Ministries and Departments and their key role in implementation on various cross-cutting issues.

**Dr Anish Chatterjee** made presentation on *Adaptation to too much and too little Water*. Dr Chatterjee in his presentation mentioned that activities carried out by Delhi based NGO namely, Action for Food Production (AFPRO) bring the perspective of community in response to climate change. The key message in response to drought and flood affected areas stress upon capacity building of local government and PRIs in the technical and planning disciplines to understand potential climate impacts and devising response strategies in a judicious manner, institutional strengthening, technology and financial resources. Emphasizing that, while adaptation must be integrated across existing institutions, focal points are needed at the local levels to garner expertise, develop, coordinate and implement comprehensive programmes. With reference to assessment of vulnerability of the livestock's associated livelihoods due to climate change, adaptation strategies in Rajasthan focus on identification of traditional adaptation practices, mapping of pasture land and fodder availability and adaptation framework for livestock management.

The last presentation of this session was made by **Dr Dalbir Singh** on *Groundwater Markets, Institutional Mechanism and Poverty in Diverse Conditions*, which pointed out the role of institutions in the functioning of water markets. Rights on groundwater belong to land owner that governed by the tenancy laws of the state. In such a legal framework, landless and tribes are left out due to absence of ownership rights. As a result, access to this resource is privy to well to do farmers and beyond the reach of poor farmers. The only option left with these farmers is water markets. The presenter indicated that institutional arrangements made to regulate the over-exploitation of groundwater have proved to be ineffective. Generally, such measures are undertaken when situation becomes alarming. Existing institutional set-up both formal and informal behaves in adverse manner in scarce regions and need to strengthen its potential. Unrestricted access makes the situation more complicated by converting common property into open access resources.

## *The Way Forward*

The last session on panel discussion was chaired by Prof. V.S. Vyas, Member, Economic Advisory Council to the Prime Minister, Government of India. The outcome of the discussion in the form of way forward presented by Dr Mercy Dikito Wachtmeister is as follows:



*Dr Mercy Dikito Wachtmeister, Network Officer, South-East Asia, South Asia & Caribbean Addressing the participants*

As the water cycle represents the medium through which climate change will largely be experienced, (especially through floods and droughts), society's adaptation strategies to climate change

needs to relate to improved water resources management, and livelihood issues. The special focus areas include floods and drought. The issue of climate change adaptation highlighted in the presentations indicate that the way forward necessitates that climate change adaptation strategies address a range of issues at various levels.

As this workshop focused on South Asia, the strategies should focus on regional, national and sub national/area water partnerships levels. The key regional and national level strategies include the following:

### *Key Regional Strategies*

- ❏ addressing regional priorities regarding climate change adaptation;
- ❏ ensuring that regional priorities are linked to climate change interventions at national level; and
- ❏ ensuring that regional priorities are addressed in global processes.

### *National Level Strategies*

- ❏ harmonizing IWRM and other water resource management activities with national economic development plans, national adaptation strategies (e.g, the National Adaptation Plans of Action (NAPA) in LDCs), and National Disaster Management Plans;

- ❏ harmonizing their implementation, where these integrate climate information into IWRM and development planning frameworks;
- ❏ ensuring that the climate information being made available supports the needs of water managers as well as energy, industry, farmers, environmentalists, and other stakeholders in water use and allocation;
- ❏ develop a programme on integrated drought management together with WMO and through input of other knowledge partners;
- ❏ promote activities that strengthen the ability of institutions responsible for water resource management to cope better with the additional challenges to be posed by climate change;
- ❏ develop links with climate information service providers at national, regional and global level to provide detailed information relevant to water resources management;
- ❏ integrate climate risk management approaches into water-related programmes and projects; ensure that adaptation funds are linked with the financing of water resources management on both conceptual and practical levels and work with international organizations such as the ADB, UNEP, UNDP, WB, etc.;
- ❏ advocacy and awareness raising on climate change and climate change adaptation including the sub national level; and
- ❏ also come up with a simple medium of disseminating information so as to ensure that we carry along communities and other stakeholders.



*RTC participants during Inaugural & Technical Sessions*

## List of Participants

SNo	Participant	Country/Institution	e-Mail & Telephone
1	Dr Giasuddin Ahmed Choudhury	Bangladesh (BWP)	gchdhury@cegisbd.com; +88 02 881 6010; 258 7361
2	Mr Khondaker Azharul Haq	- do -	kahaq@dhaka.net
3	Mr Md Shahidul Hassan	- do -	bwp@dhaka.net; +88 02 912 4027
4	Ms Reba Paul	- do -	bwp@dhaka.net; +88 02 811 6668
5	Dr Lam Dorji	Bhutan (BhWP)	ldorji@rspnbhutan.org
6	Ms Roseleen Gurung	- do -	roseleengurung@gmail.com; +975 1 771 1738
7	Dr Anish Chatterjee	India (AFPRO, New Delhi)	achatterjee@afpro.org; +91 97183 49433
8	Mr S.C. Jain	- do -	scjain@afpro.org; +91 98686 07509
9	Prof. Y.K. Alagh	India (Chairman, IRMA & Former Minister of Power and Science & Technology, Government of India)	alagh@icenet.net
10	Dr Raj K. Gupta	India (CIMMYT, New Delhi)	rajgupta@cgar.org; +91 97110 09365
11	Mr Rajesh Kumar	India (CWC, New Delhi)	rajeshkumar.cwc@hotmail.com; +91 93507 04061
12	Dr K. Vijaya Lakshmi	India (Development Alternatives, New Delhi)	kvijayalakshmi@devalt.org; +91 98714 39649
13	Dr A. Perumal	India (GWP-SAS)	coordinator@gwpsas.org; +91 80 2218 5097
14	Mr S.P. Prabhu	- do -	spprabhu1@gmail.com; +91 22 2649 6040
15	Mr Mangesh Gupte	India (HCC Ltd, Mumbai)	mangesh.gupte@hccindia.com; +91 97696 03383
16	Dr P.K. Aggarwal	India (IARI, Pusa)	pkaggarwal.iari@gmail.com; +91 11 2581 1112
17	Mr M. Gopalakrishnan	India (ICID)	icid@icid.org; mgopalakrishnan@hotmail.com; +91 98113 01279
18	Mr P.L. Diwan	India (ICT Pvt. Ltd, New Delhi)	pldiwan@ictonline.com; +91 96545 21121
19	Dr Surjit Singh	India (IDS, Jaipur)	surjit07@gmail.com; +91 141 2705 348
20	Dr Jesim Pais	India (ISID, New Delhi)	jesim_pais@yahoo.com; +91 11 2689 1111
21	Dr K.V.K. Ranganathan	- do -	kvkranga@yahoo.co.in; +91 11 2689 1111

<i>SNo</i>	<i>Participant</i>	<i>Country/Institution</i>	<i>e-Mail &amp; Telephone</i>
22	Dr Mahua Paul	India (ISID, New Delhi)	mahuapaul@yahoo.com; +91 11 2689 1111
23	Dr P.P. Sahu	- do -	ppsahu@isid.org.in; +91 11 2689 1111
24	Dr T.P. Bhat	- do -	tpbhat@isid.org.in; +91-011-2689 1111
25	Dr T.S. Papola	- do -	papola@isid.org.in; +91 11 2689 1111
26	Prof. K.S. Chalapati Rao	- do -	chalapatirao@yahoo.co.in; +91 11 2689 1111
27	Prof. M.R. Murthy	- do -	murthy.maddipati@gmail.com; +91 99682 90770
28	Prof. S.K. Goyal	- do -	skg@isid.org.in; +91 11 2689 1111
29	Prof. Seema Goyal Papola	- do -	seema@isid.org.in; +91 11 2689 1111
30	Shri Bhupesh Garg	- do -	garg@isid.org.in; +91 11 2689 1111
31	Dr Dalbir Singh	India (IWP)	+91 11 2689 1111
32	Dr Veena Khanduri	- do -	iwpneer@gmail.com; +91 98911 95806
33	Prof. S.R. Hashim	- do -	drsrrhashim@hotmail.com; +91 98182 33038
34	Dr K.S. Deshmukh	India (Jain Irrigations, Jalgaon)	deshmukh.santosh@jains.com; +91 94030 80103
35	Mr Sudhin K. Mukhopadhyay	India (KINSPARC, Kalyani)	mukhopadhyay_sk@hotmail.com; +91 98312 27404
36	Prof. V.S. Vyas	India (Member, Economic Advisory Council to the Prime Minister, Government of India)	vsvyas@mac.com
37	Mr R. Maria Saleth	India (MIDS, Chennai)	rsaleth@gmail.com; +91 98840 59455
38	Dr B.C. Barah	India (NCAP, New Delhi)	barah48@yahoo.com; +91 98711 60387
39	Mr Arti Gupta	India (Prakrti, Shilma)	guptaarti@gmail.com; +91 94183 42479
40	Dr Anita R. Gainta	India (Sharda University, Noida)	-
41	Dr Shalini Sharma	- do -	shalini.p1@gmail.com; +91 92132 77122
42	Mr Rajneesh Kher	- do -	rajneesh-kher@hotmail.com
43	Prof. Prem S. Vashishtha	- do -	premsv08@gmail.com; +91-098 99 15 99 92
44	Shri Prakash	- do -	shriprakaash@bimtech.ac.in; +91 92137 87320

<i>SNo</i>	<i>Participant</i>	<i>Country/Institution</i>	<i>e-Mail &amp; Telephone</i>
45	Dr R.P. Singh	India (Sharda University, Noida)	singhravip@gmail.com; vicechancellor.sgi@gmail.com
46	Ms Ritu Gupte	India (TAER, New Delhi)	ritugup@gmail.com; +91 96541 25186
47	Mr P. Paithankar	India (UNWFP, New Delhi)	pradyna.paithankar@wfp.org; +91 11 2615 0000
48	Dr (Mrs) Karuna Onta	Nepal (NWP)	karuna@carenepal.org; +977 1 422 9582
49	Dr Keshav Pd. Sharma	- do -	kpspoudel@gmail.com; +977 1 424 8808
50	Mr S.N. Upadhyaya	- do -	surya@upd.wlink.com.np; +977 1 441 4241
51	Mr Som Nath Poudel	- do -	alek@wlink.com.np; +977 1 245 228
52	Dr Muhammad Akthar Bhatti	Pakistan (PWP)	mbhatti@isdb.org; +92 51 922 2249, +92 333 516 2081
53	Mr Karamat Ali	- do -	pwp@pwp.org.pk; karamat.ali.pwp@gmail.com; +92 51 285 6250
54	Mr Sardar Muhammad Tariq	- do -	smtariq@pwp.org.pk; +92 51 285 6250
55	Mrs Hamida Masood Shah	- do -	hamidamasood@hotmail.com; +92 300 271 1271
56	Mr Ranjith Ratnayake	Sri Lanka (SLWP)	r.ratnayake@cgjar.org; +94 11 278 7404 ex(3303)
57	Mr S.B. Niyangoda	- do -	s.niyangoda@cgjar.org; +94 11 278 7404 ex(3303)
58	Ms Mallika R. Samaranayake	- do -	ipidc@panlanka.net; +94 11 236 5521
59	Dr Mercy Dikito-Wachtmeister	Sweden (GWPO)	mercy.dikito-wachtmeister@gwpforum.org; +46 8 522 126 48; +46 73 914 26 48 / +46 73 714 89 86
60	Mr Martin Walshe	- do -	martin.walshe@gwpforum.org; +46 8 522 126 73



## *Climate Change Mitigation Initiative in the ISID Campus (Post-RTC Activity)*



On completion of the RTC, Prof. S.K. Goyal, Vice-Chairman, ISID requested the South-Asian participants to join Tree Plantation Drive in the campus, which is already following eco-friendly practices having effective ground water recharge system for conservation of water and varieties of flowering trees and plants in its surroundings. Prof. Goyal further said that there is no time to wait, let us begin the noble initiative to mitigate the adverse effects of climate change from now onwards.



## *India Water Partnership*

India Water Partnership (IWP) is the Country Water Partnership functioning under the overall framework of Global Water Partnership (GWP) headquartered at Stockholm, Sweden.

IWP became a legal entity on November 28, 2001 with its Memorandum of Association registered in the State of Haryana under the Societies Act, 1860. It was first hosted by Water and Power Consultancy Services Ltd. (WAPCOS), New Delhi. Institute for Studies in Industrial Development (ISID), New Delhi is the present host institution of IWP.

IWP has been active in promotion of Integrated Water Resource Management (IWRM) principles and practices through IWP network partners to support national development priorities. Some of the core priority areas are: promoting IWRM approach effectively through workshops and consultations to address adaptation to climate change with the support of zonal water partners across the country; encouraging use of innovative low cost water saving technologies by the farming communities; sustainable natural resource management; integrated domestic water management; promoting Area Water Partnership (AWP) for river basin management; conflict resolution on water sharing; inter-state trans-boundary water sharing issues, gender mainstreaming, etc.

IWP prepared “India Water Vision—2025” during 1999 based on the projections for country’s water demand in 2025 on the initiatives of GWP and South Asia Technical Advisory Committee. The Vision Document was prepared after a series of four regional consultations with the senior government officials from Central and State Governments, policy makers, academicians, water experts, donor agencies, UNICEF, World Bank, NGOs and industry representatives.

IWP pioneered the concept of Zonal Water Partnerships (ZWP). Both IWP and ZWP work closely with the relevant water institutions, universities, CBOs/NGOs and other stakeholders at national, state and local level. IWP with the support of ZWPs in India is addressing the water centric issues through Panchayati Raj Institutions (PRIs)/Urban Local Bodies (ULBs) which have constitutional authority in the chain of civil authority structure.

*Contact*

*Dr Veena Khanduri, Adviser*

**India Water Partnership Secretariat**

**Institute for Studies in Industrial Development (ISID)**

4, Institutional Area, Vasant Kunj, New Delhi – 110 070 INDIA

*Tele: +91 11 2689 1111; Fax: +91 11 2612 2448*

*Mob: +91 98911 95806*

*E-mail: [iwpneer@gmail.com](mailto:iwpneer@gmail.com); Website: [cwp-india.org](http://cwp-india.org)*