

REPORT OF THE NATIONAL ROUND TABLE ON CLIMATE CHANGE AND DISASTER MANAGEMENT

26th November, 2011



Organized by :



India Water Partnership (IWP), New Delhi
in association with



National Institute of Disaster Management (NIDM)
Ministry of Home Affairs, Govt. of India, New Delhi

&



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**REPORT ON
NATIONAL ROUND TABLE ON
“CLIMATE CHANGE AND DISASTER MANAGEMENT”**

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PREFACE

Impacts of disasters have long been considered tragic interruptions to the development processes. Disasters, in the past two decades, in general have spread their wings all across Asia and India in particular. The unique geo-climate conditions of the Indian sub-continent make this region among the most vulnerable to natural disasters in the world. Disasters occur with amazing frequency. While the community at large has adapted itself to these regular occurrences, the economic and social costs continue to mount year after year. Floods, droughts, cyclones, earthquakes and landslides have now become the regular phenomena in India.

The Strategic Goal-2 of GWP envisages using "IWRM approaches effectively to address adaptation to climate change and other emerging challenges at National, Regional and Global levels". Keeping this goal in view, the GWP-India in collaboration of National Institute of Disaster Management (NIDM), Ministry of Home Affairs, Government of India and Institute for Human Development (IHD), New Delhi (the Host Institution of GWP-India) organized a one day National Round Table (NRT) on "Climate Change and Disaster Management" on 26th November, 2012 at NIDM, New Delhi.

In the NRT, eminent experts, policy makers, researchers, academicians, practitioners working on flood and drought management, climate change adaptation and resilience, Integrated Water Resource Management (IWRM), food security and water security participated and made their contributions. Zonal Water Partnership Coordinators of GWP-India, Coordinators of Area Water Partners and GWP-India network partners were the key participants of the NRT. There were 65 participants in the NRT including the speakers and experts.

Our sincere thanks go to Dr. Satendra, I.F.S, Executive Director, NIDM who despite his busy schedule spared his valuable time and made an excellent presentation on the coping mechanisms adopted by the rural community in Bangladesh.

We are also thankful to Mr. A D Mohile, former Chairman, Central Water Commission, Dr. M Gopalakrishnan, Secretary General, ICID, Prof. V K Sharma, IIPA for sparing their precious time and chairing the different technical sessions.

We also express our gratitude to Dr. Alakh N Shamra, Vice-President, GWP-India and Director, IHD for sparing his time and making meaningful contributions.

Our thanks also go to Prof. Santosh Kumar, Head, Policy, Planning & Cross Cutting Issues Division, NIDM for managing the whole event in an excellent manner.

We also convey our sincere gratitude to the panelists and the discussants who accepted our invitation, spared their precious time and enlightened the participants with their valuable contributions.

We also thank all the participants who spared their valuable time and came from the far-flung places and participated actively in the deliberations.

We place on record the efforts of Dr. (Mrs.) Veena Khanduri, Executive Secretary, GWP-India in coordinating the program and preparing this report.

Finally we thank NIDM for providing all the support including the newly constructed Conference Hall.

We hope that the participants would benefit from this NRT and carry forward the key inputs and recommendations of the NRT to their institutions/organizations and at field level to better manage, mitigate, cope and adapt with the impacts of climate change.

S R Hashim
President
India Water Partnership (GWP-India)

ABBREVIATIONS

CWC	Central Water Commission
DRR	Disaster Risk Reduction
EZP	East Zone Water Partnership
FHZ	Flood Hazard Zonation
GDP	Gross Domestic Product
GHGs	Green House Gases
GPS	Global Positioning System
ICID	International Commission on Irrigation and Drainage
IHD	Institute for Human Development
IIPA	Indian Institute of Public Administration
IMD	Indian Meteorological Department
IMR	Infant Mortality Rate
IPCC	Intergovernmental Panel on Climate Change
ISDR	International Strategy for Disaster Reduction
IWP	India Water Partnership
KSNDMC	Karnataka State Natural Disaster Management Centre
MIDS	Madras Institute of Development Studies
MOEF	Ministry of Environment & Forests
MSP	Minimum Support Price
NBCA	Network Based Community Action
NDMA	National Disaster Management Authority
NESAC	North Eastern Space Application Centre
NIDM	National Institute of Disaster Management
NRT	National Round Table
PRA	Public Regulatory Authority
PRIs	Panchayati Raj Institutions
SHGs	Self-Help Groups
UNFCCC	United Nations Framework Convention on Climate Change
VDCs	Village Development Councils

REPORT ON NATIONAL ROUND TABLE ON “CLIMATE CHANGE AND DISASTER MANAGEMENT”

I. Introduction

India Water Partnership (GWP-India) in association with National Institute of Disaster Management (NIDM), Ministry of Home Affairs, Government of India is closely working on sensitization and capacity building of its Zonal Water Partners on “Climate Change, Flood & Drought Mitigation and Management and Disaster Management”. In December 2010, GWP-India organized a sensitization program for Zonal Water Partners on “Flood and Drought Mitigation and Management. This National Round Table on “Climate Change and Disaster Management” had been organized in continuation to GWP-India’s previous efforts in this direction.

II. Context

Impacts of disasters have long been considered tragic interruptions to the development processes. Disasters, in the past two decades, in general have spread their wings all across Asia and India in particular. The unique geo-climate conditions of the Indian sub-continent make this region among the most vulnerable to natural disasters in the world. Disasters occur with amazing frequency. While the community at large has adapted itself to these regular occurrences, the economic and social costs continue to mount year after year. Floods, droughts, cyclones, earthquakes and landslides are regular phenomena in India. Out of the total geographical area of 33 lakh sq. km, about 60% of the landmass is prone to earthquakes of various intensities; over 40 million hectares is prone to floods; about 8% of the total area is prone to cyclones and about 68% of the area is susceptible to drought. Of the 35 States\Union Territories in the country, 22 are disaster prone. During the last two decades of the 19th century (1982-2001), natural disasters in India had claimed a total death toll of 1,07,813 people, on an average more than 5,390 death toll every year. India is getting impacted more by hydro-meteorological disasters than the geological disasters.

Our country is witnessing a serious change in the profile of disasters related to water. If we just refer in the recent a few disasters occurred in the past such as Leh floods (2010) coupled with land slide, Karnataka and Andhra Pradesh Floods (2010), Kolkata Floods (2009 & 2010), and Mumbai floods (2006). It raises many questions regarding its nature, intensity, timings and extremities. We need to examine them in the frame of new climatic conditions of the country. Changing climatic conditions are posing new challenges in terms of high flood, drought and cyclone scenario with increased intensity and frequency. These events also raise a fundamental scientific question regarding climate change phenomenon. Are we really going to be affected by this global phenomenon? Whether India’s rain fall pattern is going to change or remain unaffected? And, is this changing pattern would affect our agriculture and allied activities? If so, how much increase in global temperature would intensify the severity of disasters like floods, cyclone, heat wave, cold wave and other health related issues and the most fundamental question would be of socio-economic impact.

Along with the policy makers and planners, common citizens are now looking at the scientific community and professionals of disaster management, development and climate change specialists for an appropriate answers so that their future strategies may incorporate these changing realities. At this stage probably we do not have the definite answer. Hence, there is a need to have a national discussion on the subject and come up

with integrated strategy. Also, Govt. of India has set up National Panel on Climate Change for making strategies for mitigation and adaptation to reduce climate risks in the country and at the same point of time for Disaster Risk Reduction National Act and National Policy on Disaster Management are being implemented by federal as well as State governments. Hence, it is appropriate to think and act together with all the stakeholders.

II. The National Round Table (NRT)

2.1 In continuation of the sensitization program on Climate Change, Flood & Drought Mitigation and Management and Disaster Management organized in December, 2010, GWP-India and Institute for Human Development, New Delhi in association with NIDM had organized a National Round Table (NRT) on “**Climate Change and Disaster Management**” on 26th November, 2011 at NIDM Conference Hall, New Delhi. Prior to conduct of this NRT, a concept note (*copy enclosed as Annex-I*) was prepared jointly by GWP-India and NIDM containing background and objectives of the NRT and circulated to all the participants.

In the NRT, eminent experts, policy makers, researchers, academicians, practitioners working on flood and drought management, climate change adaptation and resilience, Integrated Water Resource Management (IWRM), food security and water security participated and made their contributions. Zonal Water Partnership Coordinators of GWP-India, Coordinators of Area Water Partners and GWP-India network partners were the key participants of the NRT. The NRT was divided into five sessions viz ; (a) Session I : Inaugural; (b) Session II : Science of Climate Change - The reality Check on its local Impact; (c) Session III : Extreme Weather Events and Water Stress: Case studies of Droughts and Floods; (d) Session IV : Climate Change and Food Security; (e) Session V : Concluding Session.

2.2 The following key issues were addressed in the conference:

- Scientific explanation of increasing extreme events turning into hydro-meteorological disasters in India;
- Risk reduction strategy for changing vulnerability profile of India at the local level;
- Capacity of stakeholders to cope with mitigation, adaptation and risk management;
- Innovation for unconventional strategy for sustainable development;
- Land and water management;
- Inter-relationship between climate change adaptation and disaster risk reduction; and,
- Identification of bridges and avoiding duplicacy – adaptation/vis-à-vis disaster risk reduction.

III. Session I: Inaugural Session

The Inaugural session was chaired by **Mr. Anil D Mohile**, Former Chairman, Central Water Commission, Govt. of India.

Prof. Santosh Kumar, Head, Policy Planning & Cross Cutting Issues, NIDM, enunciating the **key objectives of the National Round Table**, said that indeed it is a great pleasure to be here for the one day NRT on “Climate Change and Disaster Management”. At the outset of the IWP, IHD and NIDM we all came together on one platform to have this workshop thinking that everywhere we are talking issues of climate change actually bothering India leading to disasters. The hydro-meteorological disaster are increasing and with higher intensity. This made us to think how we can combine our mind, our energy and our efforts together so that instead of seeing the climate change and disaster management differently and in isolation with each other , how an integrated approach and the outcomes of this NRT can go as a kind of larger policy framework . How climate change adaptation is

different with disaster risk reduction and how these two are related? Do we need to have common strategy or we need to have separate strategy for each i.e, adaptation and disaster risk reduction? Climate adaptation talks about the vulnerability of the people with extreme climatic events whereas disaster risk reduction has been arguing the similar things since two decades. Hence there is need to think through and also to look at SREX report of Intergovernmental Panel on Climate Change (IPCC) and discuss in the context of several reports on Disaster Risk Reduction (DRR). This is why all the three institutions have partnered. Increasing frequency and intensity of hydro-climate events requires a different strategy and hence the combinations of partners, institutions and stakeholders are now to be redefined. And, this is an appropriate platform where we can discuss and make recommendations for future action. As , I got an opportunity to be the part of the jury as its one of the members on public hearing on climate change and after listening to many cases from the eastern, western and northern part of India, we observed that people at the local level have observed five major changes. Those changes as they defined are : a) extreme high temperature during the summer; b) period of summer months have now extended; c) new insects are coming on the crops and those who were protecting the crops are now disappearing very fast; d) winter time has reduced substantially with extreme weather conditions and; e) rainy season is now not spread to all three months-July to September. In fact they are getting large amount of rains in very small span of time. All these changes are also affecting our lives and livelihood pattern. These examples may be in future to be validated scientifically but it is certain that we cannot ignore in our today's deliberation on climate change and DRR.

Welcoming the participants, Dr. Satendra, IFS, Executive Director, NIDM, invited the attention of the delegates to the close linkage between climate change and disaster management. Affirming that climate change is a reality, Dr Satendra stated that climate change is felt by even the common man. For example, a decade back there was no need for using fans in Dehradun during summer, but now it has become necessary. Droughts, cyclones, floods and other extreme weather events and disasters are increasing. These adversely affect people in rural areas whose livelihoods are directly dependent on weather. He further said that disaster management can be an entry point for climate change risk management.

Dr. Satendra gave a lucid presentation of his experiences on coping mechanisms of the rural community in Bangladesh from a project on livelihood adaptation for climate change in coastal areas where fields are flooded with saline water and livelihood of fishermen is affected by the decrease in fish population.

He elaborated that adaptation approach of the project consisted in assessing current vulnerabilities, promoting institutional and technical capacities, identification of location specific adaptation strategies, etc. The approaches followed by communities include adaptation of indigenous measures such as hanging homestead gardens of creepers and floating gardens in ponds, rice cum fish farming, and houses built on raised platforms. Dr. Satendra said that the climate change adaptation may be a mal adaptation also, for example; in northern region of Bangladesh, diversifying of rice field cultivation to mango orchard was a mal adaptation as labourers who were working in the rice fields became unemployed and hence we have to be scientific in selecting adaptation options so as to guard against mal-adaptation. The criteria for selecting adaptation options are agro-ecological sustainability, increasing resilience against impact of climate hazard, and ensuring that the options do not increase contribution to Green House Gases (GHGs). Dr. Satendra

concluded by emphasizing that the adaptation options which are suitable as per local conditions and economically viable & sustainable can be replicated.

After the presentation of Dr. Satendra, Prof. Santosh Kumar invited the delegates to establish the linkages between climate science and climate change adaptation practices so that we can be on the path of climate proofing on a sure footing. He requested the presenters to be brief, succinctly flagging issues, so that there is time for wide ranging discussions among all the participants.

In his **Inaugural Address, Mr. Anil D Mohile** pointed out that even without climate change, India would have felt water stress due to increase in population, urbanization and ecological demands. Even today a clear linkage between climate change and its effect on water resources has not been established. One thing we are sure about temperature rise but the exact factors that contribute to climate change are not clearly known. Some trends for the future may be seasonal snowfall and snow melts in the Himalayas, slight increase in rainfall intensity, increase in rainfall variability, quick maturing of crops may reduce irrigation needs, increase in number of rainy days leading to soil erosion and sedimentation, rise in sea level leading to land inundation and ground water salinization.

Some of the actions required immediately are improving relevant data base, developing coping and adaptation strategies, changing the way we plan our projects, changing the cropping pattern as per suitability of the area, re-use of water for different purposes, increasing the soil moisture, more water storages (small, medium & large) because of increase in rainfall variability and run-off. He also indicated that these issues are already included in the recommendations of National Water Mission. However, faithful implementation of planned projects is the need of the hour.

In the **Introductory Remarks, Dr. Alakh N Sharma**, Vice President, GWP-India and Director, Institute for Human Development touching upon the disagreements over the extent of climate change occurrences in the scientific community, drew attention to the impacts of climate change on peoples' livelihoods and water availability for drinking and other development needs. Dr. Sharma said that in India, the worst sufferers are tribals, resource poor farmers and people depending on rain-fed agriculture. The usual coping strategy of the poor is migration for employment opportunities. Flood areas are endemic to periodic drought also. He mentioned that GWP-India and IHD in association with NIDM are working closely for awareness generation and capacity building of the community on water and climate change disaster management.

Prof. S. R. Hashim, President, IWP while delivering the **Keynote Address** expressed satisfaction about the good participation of experts and practitioners in the conference from all over India. Prof. Hashim further said that the close collaboration between GWP-India, IHD and NIDM in the core issues of water, climate change and disaster management, which are closely inter-linked problems, gives a central thrust to tackling these issues in a concerted manner. He told that the impacts of climate change are not clearly measurable

and there is no doubt that climate is going to change in an irregular manner in the future. Monsoon may become more erratic and uncertain. However, frequency of climate change induced disasters is going to become more frequent.

He also said that flood is the most frequent disaster in India. Loss of lives due to flood has reduced due to governmental action and there was considerable loss to property and livelihoods. A storehouse of traditional wisdom to adapt to climate change has evolved over centuries. The China's yellow river was tamed through several physical structures like bunding and creating embankments, but these themselves have sometimes caused floods. What is needed is to be better prepared to cope up with floods and other disasters and not to interfere with flood plains and streams. Citing the example, he stated that in Delhi, the Barapulla flyover has almost destroyed the natural flood plain.

Concluding the keynote address, Prof. Hashim said that one of the most serious current disasters is the scarcity of food caused by climate change and strain on availability of water. There is tremendous cost to making water available for various competing purposes like agriculture, urban living and industry. We have neglected the ecological demand of rivers by diverting water, making them virtual drains even for major rivers like the Yamuna. India's current population is 1.22 billion, which is projected to increase to 1.6 billion by 2050 and the food requirement would be 350 million tonnes compared to current availability of 240 million tonnes. If we buy the food items through world trade, that may destabilize world food security situation. We have to produce our own food. Making available food to the needy is a major issue. Therefore we need to have a mechanism to make food available to people in a famine type situation. Even now, though there is enough buffer stock, we are not able to distribute it in an efficient manner.

Dr. Khanduri, Executive Secretary, GWP-India expressed her gratitude and thanks to Mr A D Mohile, former Chairman, Central Water commission, Prof. S R Hashim, President, IWP (GWP- India), Dr. Satendera, Executive Director, NIDM and Dr. A N Sharma, Vice President, IWP & Director, IHD for accepting the invitation and sparing their valuable time and enlightening the participants on the issues relating to climate change and disaster management. She also thanked the distinguished resource persons, Zonal Water Partnership Coordinators and Area Water Partnership Coordinators who came from

different parts of the country to share their enriched experience with the participants on climate change and its associated hazards.

While thanking the participants she said that we are grateful to Prof. Hashim and Prof. Santosh Kumar for their guidance in conceiving the idea of inviting the experts on climate change, disaster management, agriculture, water and food security who are working at grass-root level to come at one platform to discuss the critical issues and challenges posed by the climate change. She further said that the inputs given by the resource persons and participants will help us to draw strategies to fight the menace of climate change. Dr. Khanduri further said that GWP- South Asia with the support of GWP is going to work closely on the climate change management program in near future and these inputs will help us in identifying critical issues and improving the resilience of South Asian countries to withstand impacts of climate change.

IV. Session II: Science of Climate Change: The reality Check on its local Impact

Three lucid presentations were made in this session under the Chairmanship of Dr. Satendra, Executive Director, NIDM.

The first presentation by **Dr. V.S.Prakash, Director, Karnataka State Natural Disaster Management Centre (KSNDMC)**, started with the poser that science without management can become a science for destruction. Accurate measurement of weather events at the micro level, creating relevant data base and making them available in time to the farmers are critical functions that help in managing agriculture and livelihood operations as well as in managing disasters. Citing the reference of Karnataka with regard to coping and adaptation strategy, he explained that there is a well established disaster monitoring system. Floods and droughts during 2010-11 required central assistance of Rs. 27,698 crores, but the actual losses were 2.5 times more than the assistance sought. South west monsoon was delayed and took one week to cover the entire state. In September there was a deficit of 67% in rainfall. Highlighting these instances, he questioned that how much we are investing in practicing science for climate management including adaptation? Hardly any, he said that so far, Karnataka government has invested Rs.40-50 crore for bringing management tools. But still there is a long way to go.

Dr. Prakash also stressed to increase the relevant data base for generating the correct weather information. He said that there is a gap between Indian Meteorological Department (IMD) data and KSNDMC data. On the basis of IMD data, the state declared drought in 70 talukas, by the time it was too late, as IMD failed to capture micro level variations.

In Karnataka, KSNDMC is able to alert farmers through SMS on the current day's situation (early warning, alerts and advisories on Disaster Risk Reduction(DRR). Farmers through the KSNDMC with calls for weather information, as a day's delay in harvesting may lead to heavy losses. Dr. Prakash also suggested that although disasters cannot be predicted accurately, but can be managed properly through availability of current weather information through Global Positioning System (GPS) enabled telemetric rainfall monitoring network. He further said that KSNDMC is providing regular and timely feed-back to the farmers. He also shared that due to access to good quality data on rainfall pattern, forecast is provided to community everyday morning. At last he also quoted that the thing which is not measured properly cannot be managed properly.

Karnataka Initiatives in Weather Forecasting

- GPRS enabled Telemetric rain gauges installed in all 747 hobli centres and 750 Grama panchayaths – being extended to remaining 4203 Grama Panchayats;
- 176 VSAT/GPRS enabled weather monitoring stations established;
- Meso-scale weather forecasting at hobli level taken up in association with CMMACS;
- Auto-mode data analysis and information/alerts, advisories dissemination;
- Supporting Weather based Crop Insurance Scheme;
- Iso-CN maps being generated for surface run-off estimation;
- Capacity building in utilization of information and alerts.

The presentation on “**Climate Change: temperature & rainfall variations**” by **Prof. R.K. Mall of Banaras Hindu University** focused on temperature and rainfall variation projections for different regions of the country based on trends over a century. His presentation showed that mean annual temperature for the country as a whole during 2010 was +0.93°C above the 1961-1990 average, making it the warmest year on record since 1901. Pre-Monsoon season (March-May) in 2010 was the warmest since 1901 with mean temperature being 1.8°C above normal. Unprecedented increase in CO₂ levels was observed through Anthropogenic Emissions. He also said that temperature rise over India is expected to be uniform over most of the country while slightly more warming over North West region is expected. The expected warming by 2100 is likely to be 1.5 to 5° C over most parts of the country.

Region-wise rainfall variations show heavy increases in the north-west region of Gujarat and Rajasthan, North East India, Central North East India. Heavy decreasing trends are seen in peninsular India, West Central India and Northern Hilly regions. This shows a change in regional rainfall pattern. A similar trend is observed in the pattern of long, short, dry and prolonged dry spells. The trend observed for the country is for heavy rain events to increase and moderate & low events to decrease; short & dry spells to increase and long spells to decrease. But the trends are not statistically significant in all zones. A weakening of monsoon circulation may also take place.

Prof. Mall further said that projections for extreme rainfall show overall decrease in the number of rainy days over a major part of the country; decrease is more marked in the Western and Central part of the country (by more than 15 days); in foothills of Himalayas (Uttaranchal) and in North East India. The number of rainy days is found to increase by 5–10 days. The increase in GHG concentrations may lead to an overall increase in the rainfall intensity by 1–4 mm/day. In North West India, the rainfall intensity will decrease by 1 mm/day; increase in the highest 1 mm/day rainfall over a major part of the Indian region up to 20 cm/day will also occur. Extreme rainfall events are likely to increase along the West coast, West Central India and NE region.

Concluding his presentation, Prof. Mall said that the year-to-year variability in monsoon rainfall leads to extreme hydrological events (large-scale droughts and floods) resulting in serious reduction in agricultural output and affecting the vast population and national economy. Hence, variation in seasonal monsoon rainfall may be considered a measure to examine climate variability/change over the Indian monsoon domain in the context of global warming.

Dr. A. K. Gupta of NIDM dealt with the topic “**Climate-change – Adaptation and Disaster Risk Reduction**”. Despite critiques of alarmist views, a close linkage between climate change, natural resources and threat to human life has been established through several rigorous studies. There is the possibility of climate change to feed into disasters through abrupt, pattern less climate/disaster events. This would call for adjustments and un-learning of old styles. He also mentioned that both man-made and natural disasters have shown upward trend between 1970 and 2001. In the total loss of human lives between 1993-and

2002 due to natural disasters, Asia accounted for 42%, Africa for 21% and the America for 20%. In the same period, low human development countries accounted for 66% of loss of human lives. Hydro-meteorological disasters accounted for the bulk of damage in terms of number of people affected and the number of people killed.

Dr. Gupta said that disaster management has now shifted focus from response-centric to mitigation and adaptation centric and further to vulnerability and environment centric.

Climate change impacts can be roughly divided into environmental impacts and socio-economic impacts. **Environmental impacts are comprised of** physiological effects on crops, pasture, forests and livestock (quantity, quality); changes in land, soil and water resources (quantity, quality); increased weed and pest challenges; shifts in spatial and temporal distribution of impacts; sea level rise, changes in ocean salinity; sea temperature rise causing fish to inhabit different ranges. **Socio-economic impacts relate to** decline in yields and production; reduced marginal GDP from agriculture; fluctuations in world market prices; changes in geographical distribution of trade regimes; increased number of people at risk of hunger and food insecurity; and migration and civil unrest

V. Session III: Extreme weather events and Water Stress: Case studies of Droughts and Floods

Three very important and thought provoking presentations were made in this session under the Chairmanship of **Mr. M. Gopalakrishnan, Secretary General, International Commission on Irrigation & Drainage (ICID).**

In his opening remarks, the Chairman posed the question: which climate change event makes maximum impact? He felt that not the receding snow cover or the accentuated monsoons had the maximum impact but the absence of pre-winter rains affect rabi crops adversely. Wheat is the worst affected crop. Water storage is lowest in the North Eastern region, which is a good rainfall region; the highest water storage is in the Krishna-Cauvery basin. After his opening remarks, he invited the speakers to make their presentations.

The first presentation of this session was on **Flood and Erosion in Brahmaputra Basin by Mr. A.K. Mitra**, Former Secretary, Water Resources Deptt. Govt. of Assam. Mr. Mitra said that the North Eastern region has abundant water resources. One third of India's run off flows from North-east through Brahmaputra and its tributaries. This region has unique nexus of water, natural resources and environment. Such nexus also possess potential water related hazard which transforms to disaster.

Mr. Mitra further said that North East India is one of the most disaster prone regions in the country due to its unique geo-environmental settings. The Eastern Himalayas have weak geological formations. There is flooding every year in Brahmaputra and its tributaries, which accelerates erosion and silting. Considering these, and the comparative inaccessibility, the North-eastern region demands special attention to minimize loss of lives, social, private and community losses to ensure sustainable development. Problems of flood, erosion and drainage congestion are associated with the complicated river system of Brahmaputra and its major tributaries, the most dynamic and unique water and sediment transportation pattern. The frequency and intensity of floods has grown over the years, primarily because of the increased encroachment of flood plains.

The Brahmaputra valley had experienced major floods in 1954, 1962, 1966, 1972, 1974, 1978, 1983, 1986, 1988, 1996, 1998, 2000 and 2004. Out of these 1954, 1962, 1988 and 2004 experienced memorable flood havoc. In Assam total flood prone area is 3.15 m.ha (about 9.2 % of the total flood prone area of the country and 40 % of the geographical area of Assam). 80 % of the total flood prone areas are in the Ganga-Brahmaputra-Meghna basin. Floods and riverbank erosion are recurring disasters hampering the development on the flood plains of Assam and downstream.

These trends demand better preparedness at national, provincial and local levels to make sure that appropriate and effective response measures are taken during flood emergency to minimize the loss of lives and properties. It is highly essential to track the various disaster management issues through a more proactive, holistic & integrated approach for strengthening disaster preparedness, mitigation and emergency response.

He added that a sudden decrease in slope near Passighat resulted in a large amount of sediment deposition, giving rise to development of prominent braiding pattern of the river in its flood plain in Assam where the Dihang river enters India. The Brahmaputra River basin in Assam is widening due to morphological changes and landslides in the upper catchments due to frequent tectonic activity. This causes excessive sediment charge in the river. The excessive sediment transported down from uphill are deposited in the flood plains as well as in the river bed causing rise in its bed level. This causes reduction in natural discharge carrying capacity and the river tends to widen by eroding its banks.

Concluding his presentation, Mr. Mitra said that satellite remote sensing technology has made substantial contribution in every aspect of flood disaster management such as preparedness, relief and mitigation. Flood Hazard Zonation (FHZ) is another important measure, which facilitates appropriate regulation, and development of flood plains thereby reducing the flood impact. The recurrent flood events at frequent intervals demand the need for identification of flood hazard prone areas for prioritizing appropriate flood control measures. In this context, satellite remote sensing plays an important role in delineating

such flood hazard zones. Govt. of Assam has entrusted North Eastern Space Application Centre (NESAC) to issue flood forecast for some major tributaries using space technology on experimental basis.

The second presentation was on “ **Is 2011 Flood due to Climate Change or Human Error?**” by **Mr. Tapan K Padhi**, Coordinator, East Zone Water Partnership. Mr. Padhi in his presentation argued that the 2011 Floods in Orissa was basically the result of management failure. There were a series of floods in Odisha in the year 2011, first in the Subernarekha, Budhabalanga system in the north, followed by the Mahanadi system in the first half of September (14 lakh cusec) and immediately after, in Bramhani system. More than 40 lakhs people were affected and the government estimated a loss of Rs. 3000 crores.

Mr. Padhi told that In Mahanadi catchment, it rained 475 mm in Chhattishgarh (accounting for 80% of the catchment of Hirakud reservoir). Hirakud dam authorities opened up 55 sluice gates and released water to the tune of 9-10 lakh cusecs. There was a flow of 14 lakh cusecs in Mahanadi system whereas the storage was designed for only 9 lakh cusec only. The flood in Mahanadi Delta affected 20+ lakh population.

In the Brahmani, there was 195 mm of rainfall in the catchment of Rengali reservoir. Authorities panicked and released a huge amount of water from the reservoir, breaching Bramhani embankments and marooning people for 7 days. The causes were due to high intensity of rainfall and inadequacy of the existing system (Hirakud) to control or moderate it. Climate change had nothing to do with it. The main reason was mismanaged reservoir operation. There was violation of rule curve.

Mr. Padhi further said that in the delta region there was no specific warning for pre-flood evacuation. Flood water did not get released for 4 days in Mahanadi system. In Brahmani delta people were marooned for 7 days, living on roof tops for 3 to 5 days. No communication even by boat, airdropping was not possible for many areas. Many areas were cut off. The State government seemed helpless in the situation. `

Lessons learnt : Orissa Floods 2011

- Climate change might have a role in terms of intensity of rainfall but the flood havoc was the result of poor management such as not following the rule curve in the right spirit. The rule curve needs to be revisited as it is already 30 years old.
- The government could not give timely warnings and when it was given, it was too late to be acted upon at community or administration levels. Warnings need to be based on the practical situation like the strength of the embankments.
- Floods can be controlled if the catchment area in Chhattisgarh is effectively treated.

Mr. G N Kathpalia, President, Alternative Futures, New Delhi making his presentation on **Need for Long Term Perspective Planning** argued for long term development planning for tackling climate change and natural disasters till 2060, when population is expected to stabilize. The main variables that need to be kept in mind in planning are pollution of land and water, reduction of forest cover and loss of agricultural land for industry and urban development, reduced discharge of ground water, minor and major flood hazards, drought, mining and tribal development, poor maintenance of infrastructure. He said that land and water in India cannot be increased except through efficient and multiple use which can only be done through integrated planning.

Mr. Kathpalia stressed that at present careful attention is not being paid to the integrated and planned use of land and water, due to which, rainwater run-off and harmful pollution of water takes place. The flood plains area could be identified on the basis of 1, 5, 10, 25 and 50 year floods and then may be planned for various activities of development, ground water recharge, marine life activity, rituals, sports and tourism, keeping in view the ecological and environmental factors.

Lastly, Mr. Kathpalia said that regulated use of water for actual requirements of agriculture and domestic use, will lead to more sustainable and clean rivers and better river management. In the long run, this will lead to less floods and droughts, of lesser intensity and will help in greater availability of food. It is necessary to ensure that scarce land is put to the most appropriate use for the requirements of the population of 2050 and fertile agricultural land is not taken away for other purposes.

VI. Session IV : Climate Change and Food Security

The Session-IV was chaired by **Prof. V K Sharma** of Indian Institute of Public Administration, New Delhi. Prof. Sharma in his opening remarks said that in the earlier sessions climate change was linked with water, food security and livelihoods which were interesting. He suggested that the recommendations of this NRT should go to the Government ministries/departments like Ministry of Environment & Forests, Department of Science & Technology, Ministry of Agriculture, Ministry of Water Resources, etc. which will help them in taking policy level decisions. He also praised the NIDM and IWP for doing excellent work in joint collaboration as “Water and Climate Change” is the key subject for IWP and “Disaster Management” is the key area of NIDM.

The presentation by **Dr. Rakesh Tewari** on **Climate Change Vulnerabilities to Food Security and Livelihoods in Central India** was based on his study in central India, a semi-arid zone affected by extreme weather conditions, changing rainfall patterns, water scarcity, drought

proneness and inhabited by small holders and marginal farmers. This large tract stretching between Gujarat and Orissa has low irrigation – 10-15 % (wells, pumps, diversion structures); and has lot of tribal population recently exposed to settled modern agriculture and depending on rain fed farming. Water scarcity and low productivity have led to migration which has its adverse effects on children's education.

Dr. Tiwari said that a project was initiated to provide irrigation facilities through small lift irrigation structures, group wells, water conservation structures like check dams, anti - erosion structures and land leveling. This helped farmers to take up orchards, vegetable cultivation, trellis cultivation (multilayer) and agro-forestry. Attention was also given to institutional promotion and market linked collective activities.

He further said that due to expanded irrigation, farmers got wheat yield of 8-10 quintals per acre. In places where there was inadequate irrigation, yield was 4-6 quintals per acre. Animal husbandry got a fillip due to increased fodder availability. Food security and availability of milk led to improved nutrition of children. Migration of entire families with children and women stopped. However, due to water based interventions vulnerable to resource scarcity in arid regions, water availability may be uncertain and there will be suboptimal utilization of infrastructure and even their non-functionality.

In his presentation on **Climate Change, Disasters and Food Security of Rural Poor**, **Dr. Prem S Vashishtha**, Professor at School of Business Studies, Sharda University, NOIDA, touched upon the adverse effects of climate change on food security on large masses of the poor in South Asia. Water is a critical issue in poverty alleviation and there is need for policies promoting water use efficiency and conservation of water resources. Though climate change is going to affect almost every region in the world and adversely affects agriculture across agro-ecological conditions, current knowledge is limited to its effects at the region/country level and robust scientific evidence on small location specific patches is scarce. Expected rise in temperature by 2050 is 2°C for South Asia i.e, is 3.5°C (much more for Central Asia). Dr. Vasishtha told that the greatest effect of climate variability is on the poor.

He further added that natural disasters such as **floods, droughts, storms, earthquake, volcanic eruptions and Tsunamis** lead to loss of life, fall in income, damage to infrastructure and private assets. Women bear much larger brunt of such disasters. More than 50 percent of deaths in the world during 1985-94 caused due to natural disasters occurred in South Asia. Natural disasters adversely impact investment in infrastructure and agricultural

productivity, resulting in increase in rural poverty (e.g., Tsunami in December 2004 led to damage of \$ 2.9 billion and initial reduction in economic activity of \$ 1.5 billion in Indonesia, ADB (2009). Climate change has adverse impact on GDP. The adverse impact on GDP of South-East Asian economies by the end of the century is likely to be in the range of 2.2 to 6.7 percent (World Bank, 2010) but for South Asia, it may be to the extent of 4 to 5 percent.

Dr. Vashishtha hinted that prices of major food grains are likely to rise substantially by the middle of this century due to various factors. Global scenario in food grain trade shows that even without factoring in for climate change effect, South Asia is expected to become net importer of food grains by 2030. The adverse effect of climate change on yield and production of agriculture is likely to make things worse for South Asia in terms of large deficit of food grains.

Inappropriate combination of policies relating to low tariff on power used in extraction of ground water, Minimum Support Price (MSP) favoring paddy and lack of sufficient regulatory mechanism for use of ground water has led to reckless exploitation, especially in North – West zone of India. Recurrence of severe droughts will add to the already desperate situation of falling water table.

The macro level situation is that 98% of world's available fresh water is present in the form of soil moisture and ground water, but the investment priority for this sector is very low, compared to canal irrigation. Efficiency of water usage is very critical in conserving scarce water resources. For example, livestock production consumes more water than crop husbandry. Poultry leads to water pollution. Industries consume a lot of water. We need to have positive policies encouraging water use efficiency and water conservation said Dr. Prem S Vashishtha.

The last presentation of this session was by **Mr. Pradeep Mohapatra**, Team Leader, Udyama, Bhubaneshwar on **Vulnerability Reduction and Community Resilience**. Mr Pradeep argued strongly for building in community based structures that reduce vulnerabilities as the starting point for tackling disasters and climate change. The cost imposed by climate change would be more than the combine effects of the two world wars and the great depression. By 2025 two-thirds of the earth's population will suffer water shortages. A temperature rise of 2°C would dramatically shrink the land available for

growing Robusta coffee in Uganda and restrict it to upland areas. Temperature rise of 2 to 3.5°C in India would reduce farmers' incomes between 9 and 25%.

The cost of tackling the problem, however, could be around 1% of global GDP if mitigation policies are well-designed (Stern Report). United Nations Framework Convention on Climate Change (UNFCCC) puts the costs of adaptation for developing countries between \$28 and \$67 billion in 2030. The effects of climate change on people would reduce agricultural productivity, heightened water insecurity, increased exposure to extreme weather events, rising of sea levels, collapse of ecosystems and increased health risks.

Mr. Mohapatra said that in a 3 degree rise in temperature, 3.1 to 3.5 billion additional persons will be at risk of water shortages and drought, some of whom may be forced to migrate. Future risks include widespread drought in several parts of the world, complete loss of Greenland ice sheet, shift of global forest ecosystems to non – forest ecosystems, extinction of 33 % current species . 180 million people will be at risk of coastal flooding due to sea –level rise. Socio –economic losses will be to the tune of 3- 5 % of GDP. Udyama's strategy is to work with the resource poor through their own Self-Help Groups (SHGs), Village Development Councils (VDCs), Panchayati Raj Institutions (PRIs), distress migrants, artisans and the economically excluded. It enables the community to live with dignity and tackle the development challenges for a lasting solution to livelihood and environmental problems. The key focus is on rejuvenating local livelihoods, strengthening local actions, conserving biodiversity, promoting drought proofing initiatives, building social capital, and enhancing community safety nets. Right based collective actions, community empowerment, livelihoods diversification, and strengthening and complementing government initiatives are the key elements of the approach.

The communities need to develop action plans for Network Based Community Action (NBCA) and adaptation for livelihood resilience.

Mr. Mohapatra highlighted that the key challenges in Odisha are extreme weather conditions that lead to unforeseen floods and drought, monsoon variability, temperature rise, sea level rise and coastal inundation, degrading natural resource base and extremism. Odisha unfortunately is in the pathway of depressions and cyclones formed in the Bay of Bengal during South-West monsoon. With advance in global warming and climate change, if sea storms acquire greater destructive power as is being forecast, the State will be required to bear the brunt of such storms which means all the gains of development will be washed away in flood/storms waters.

VII. Concluding Session

Prof. Vijay Paranjpye, Chairman, Gomukh Environment Trust for Sustainable Development, Pune called for looking at rivers not in terms of the water volumes they provide, but as entities without borders, leaders, religion and politics. The people of the river basin have to be organized at basin level to manage river flows and water resources. The ecosystem will itself provide for livelihoods, food and disaster resilience.

He clearly elaborated this statement by his experience in working with the multi-state Wainganga river basin. The ecosystem of this basin is diverse - high rainfall in Ratnagiri region, drier parts of Maharashtra, Madhya Pradesh and Karnataka. When disasters strike, it is the people in the basin who can tackle the problem first hand rather than the government. 140 villages in the basin, cutting across state boundaries demanded 180 small meteorological stations from their respective state governments to prepare early warning systems and all the governments were persuaded to provide these stations. The people can now predict river behavior and communicate the information among themselves through mobile phones. A distance of 600 kms is covered through this network. They created small ponds for fish rearing. They constructed 3 dams. They took up organic farming, which is the best coping mechanism against climate change.

Prof. Maria R Saleth, Director, Madras Institute of Development Studies, Chennai succinctly summarized the day long deliberations and drew up the overall consensus that emerged. The convergence of opinion was on the key role of water in tackling climate change and disasters. The nexus between water, agriculture and livelihoods was very clear and food security is the urgent agenda that needs to engage the attention of planners, policy makers and civil society.

In his concluding remarks, **Prof. S R Hashim** reminded the participants that we will have to live with the future changes in rainfall pattern, with increased intensity, though total rainfall for the year may remain the same; changes in temperature; the frequent occurrence of drought, flood, cloudbursts, landslides and runoff. There will be lot of uncertainties, for which we have to be prepared. We need to keep discussing and learning more on these issues. We need to adopt crops that consume less water. Change in food habits is possible (ground nut was not in India till the 1930s, but now Gujaratis cannot live without ground nut oil).

VIII. Outcomes of the National Round Table

The major outcome of the round table was the emergence of a consensus on the following:

- (i) There is a need for timely information to farmers through accurate collection of micro-level data so that they can take informed decisions on planting, harvesting etc.;
- (ii) There is a need for further studies on cyclical weather events to get an understanding of future weather patterns;
- (iii) South Asia and the poor therein are bearing the brunt of climate change induced disasters which disturb rural livelihoods;
- (iv) Climate change adaptation and disaster management are closely linked and need to be supported through adequate funding and technology;
- v) There is an urgent need for harnessing the waters in large river basins like Brahmaputra, Mahanadi and Brahmini, which cause flood havocs every year. The havocs were accentuated due to lack of inter-state and trans-boundary cooperation and inadequacy of funds (Brahmaputra) or due to faulty structures like embankments, faulty maintenance of structures and faulty sluice management.
- vi) There is a need for evolving long term perspective plans for the period up to 2050, by which time India's population is expected to stabilize. The factors to be considered in the perspective plans are demographics, urbanization and industrialization, natural resources including forests, surface and ground water, trends in land use pattern, among other things.
- vii) Water is going to be a key factor in all future disasters. The nexus between water, agriculture and livelihoods is very strong and needs to be strengthened. Food security is going to depend on harnessing our water resources and adaptive mechanisms against climate change.
- viii) Disaster Risk reduction framework and policy of the country and adaptation strategies may be looked together and National Disaster Management Authority (NDMA) , NIDM and Ministry of Environment & Forests (MOEF), CWC and other related institutions at the national level may have dialogue for drafting a combined strategy for dealing with climate and disaster risk. We may have to increase our frequency of dialogue between the institutions dealing with climate risk adaptation and disaster risk reduction at all levels.
- ix) Country's capacity development plan for DRR, disaster management plans- national, state district and village may like to consider extreme events as an integral part .
- x) Disaster risk reduction funding and climate risk adaptation financial provisions may like to find the common ground and draft a new strategy for its implementation.

The NRT ended with a vote of thanks by Dr. Veena Khanduri, Executive Secretary of IWP to the eminent panelists, participants, and collaborating institutions.