

Workshop Report on “Improving Flood and Drought Governance: Applying EPIC Response Framework”

Organized by:

The World Bank,
World Meteorological Organization (WMO),
Deltares (Netherlands) &
Global Water Partnership (GWP)

In Collaboration with:

India Water Partnership (GWP-India) &
WAPCOS Limited



**An EPIC
Response:**

**Innovative Governance
for Flood and Drought
Risk Management**



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Layout

WAPCOS Limited

Disclaimer

This Report is based on a workshop on Improving Flood and Drought Governance Applying EPIC Framework” organized by the World Bank, WMO, Deltares (Netherlands) and GWP on 28th April, 2023 at New Delhi with the support of IWP and WAPCOS Limited. The Report contains knowledge gathered during various sessions and a Panel Discussion of Distinguished Experts. The Report full or in parts, can be freely referred, cited, translated and reproduced for any academic and non-commercial purpose, with appropriate citation.

The Report can be downloaded from <https://cwp-india.org>

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Acronyms

AIRBM	:	Assam Integrated River Basin Management
APFM	:	Associated Program on Flood Management
API	:	Application Programming Interface
ARG	:	Automated Rain Gauges
ASDMA	:	Assam State Disaster Management Authority
AWS	:	Automated Weather Station
CWC	:	Central Water Commission
DRM	:	Disaster Risk Management
DSS	:	Decision Support System
EPIC	:	Enable, Plan, Invest and Control
ERAM	:	EPIC Response Assessment Methodology
Flood-MAR	:	Flood Managed Aquifer Recharge
FREMAA	:	Flood Erosion Management Authority of Assam
GP	:	Gram Panchayat
GWP	:	Global Water Partnership
HydroSoS	:	Hydrological Status and Outlook Status
IARI	:	India Agricultural Research Institute
ICAR	:	Indian Council of Agricultural Research
ICID	:	International Commission on Irrigation & Drainage
IDMP	:	Integrated Drought Management Program
IITM	:	Indian Institute of Tropical Meteorology
IMD	:	Indian Metrological Department
INCOIS	:	Indian National Centre for Ocean Information Services
IWMI	:	International Water Management institute
IWRM	:	Integrated Water Resources Management
NAP	:	National Development Plan
NbS	:	Nature based Solutions
NCMRWF	:	National Center for Medium Range Weather Forecasting
NDVI	:	Landsat Normalized Difference Vegetation Index
NDWI	:	Normalized Difference Water Index
NESAC	:	North Eastern Space application Center
NIDM	:	National Institute of Disaster Management
NIH	:	National Institute of Hydrology
Q & A	:	Question & Answer
SADMS	:	South Asia Drought Monitoring System
SOP	:	Standard Operating Procedure
WMO	:	World Meteorological Organization
WRA	:	Water Resource Agency
WRM	:	Water Resources Management
WTC	:	Water Technology Centre

Acknowledgement

We express our sincere thanks to the World Bank and Global Water Partnership (GWP) for reposing confidence in India Water Partnership (GWP-India) and WAPCOS Limited for facilitating and supporting in organizing a Workshop on **“Improving Flood and Drought Governance: Applying the EPIC Response Framework”** on 28th April, 2023 at New Delhi.

We gratefully acknowledge the support received from Mr. A C Tyagi, Vice-President, India Water Partnership; Mr. A B Pandya & Smt. Preeti Madan, I.E.S., Regional Council Members, GWP-South Asia; Dr. A K Sikka, India Representative, IWMI, New Delhi; Dr. Partha J Das, Aaryanak, Assam and Mr. Lal Indurwage, Regional Coordinator, GWP-South Asia, Sri Lanka for sparing their valuable time and participating in a series of pre-workshop online meetings with Mr. Greg Browder, World Bank, USA; Mr. Valentin Aich, GWP; and Ms. Ana Nunez Sanchez, The Netherlands in planning for the workshop and setting the key questions.

Our deepest gratitude go to Mr. Kushivinder Vohra, Chairman, Central Water Commission, Ministry of Jal Shakti, Government of India for gracing the inaugural session and delivering the keynote address and sharing his views on flood and drought management challenges in India and the mechanism in place to respond.

We are greatly thankful for the constant guidance and support received from Mr. R K Agrawal, President, India Water Partnership & Chairman-cum-Managing Director, WAPCOS Limited for convening the workshop successfully.

We convey our sincere thanks to key speakers from overseas; Government of India and the State Government representatives of Assam, Bihar, Karnataka, Kerala and Odisha for their insightful discussions and presentations on the flood and drought governance challenges and management at National and State level. We also express our heartfelt appreciations to the distinguished panel of experts for having in-depth discussion on the applicability of EPIC Response Framework in the Indian context.

We immensely thank Ms. Urmila Chatterjee, Senior Economist & Mr. Jai Mansukhani, Senior Program Associate, World Bank, New Delhi, senior officials of WAPCOS Limited and Mr. Mangla Rai, Project Associate & Mr. Neeraj, Accounts-cum-Admn. Officer, India Water Partnership for their cooperation and support.

We hope that key leanings and recommendations emerged from the workshop deliberations would help for undertaking necessary steps for managing flood and drought in India.

Dr. Veena Khanduri,
Executive Secretary-cum-Country Coordinator,
India Water Partnership (GWP-India)

Workshop Report on
"Improving Flood and Drought Governance: Applying the EPIC Response Framework"
organized on April 28, 2023 at New Delhi (INDIA)

Overview

Experts from India, the World Bank, Global Water Partnership (GWP) and Deltares, the Netherlands participated in a one day workshop on "Improving Flood and Drought Governance: Applying the EPIC Response Framework" on April 28, 2023 at New Delhi, India to discuss the applicability of EPIC Response Framework which was jointly prepared by the World Bank and Deltares (Netherlands) with support from the GWP and World Meteorological Organization (WMO) to manage flood and drought together as part of the same hydro-climatic spectrum. Mr. Kushvinder Vohra, Chairman, Central Water Commission, Ministry of Jal Shakti, Government of India was Chief Guest on the occasion who addressed the audience with the Keynote Address.

The workshop witnessed 60 participants in-person and around 40 persons joined on-line from India and overseas. The speakers/presenters/panellists and participants were from the World Bank; Central Water Commission; National Institute of Hydrology; Indian Meteorological Department; International Commission on Irrigation & Drainage; National Institute of Disaster Management; Indian Agricultural Research Institute; International Water Management Institute, Colombo & New Delhi; Global Water Partnership; Global Water Partnership-South Asia; Deltares (The Netherlands); World Meteorological Organization; Flood Erosion Management Authority of Assam (FREMAA); Representatives from State Disaster Management Authorities (Bihar, Karnataka, Kerala & Odisha); WAPCOS Limited; India Water Partnership and Civil Society Organizations.

In the inaugural session the experts spoke on the effects of flood and drought, mechanism in place in India for managing both of them followed by some lucid presentations on flood and drought management and the EPIC Response Framework. In the afternoon session, governance challenges on flood and drought management from the National and State perspectives were discussed and the experts presented flood and drought scenario, data collection & sharing and early warning systems in place and what are the governance systems in the States for managing the flood and drought in their respective States.

In the evening session a Panel Discussion comprising of six distinguished experts was organized to discuss how the EPIC Response Framework fits into Indian context and how it will help India and its States to respond and manage flood and droughts together.

The workshop report has come-up with some key messages and recommendations for managing flood and drought together.

Proceedings of the workshop are elaborated in the following pages.

Background

Floods and droughts are some of the most tangible and devastating consequences of the climate crisis. They increasingly affect communities across the planet. The toll in human suffering and in economic costs is staggering. It is crucial that societies adapt and that governments prioritize, accelerate, and scale up their response mechanisms in the coming decade.

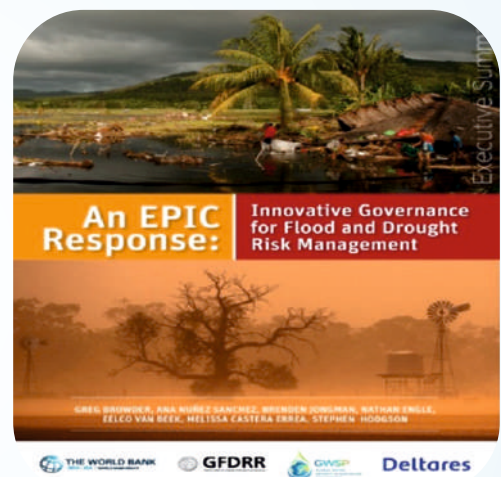
Societies have long struggled to prepare for and respond to floods and droughts - two hydrological extremes that can happen to the same country and at the same time. Climate change is driving more moisture into the atmosphere, resulting in 'hyper-charged' storms, heavy rains, and more intense dry spells. In many parts of the world, these changes to the hydrological cycle mean stronger and longer flood and drought periods, and in other areas, individuals are experiencing these hazards to a significant degree for the first time in living memory. Worldwide, it is difficult to point to a region or country that will not face more challenges in managing these extremes in the years to come.

Countries can harness the power of water for development while avoiding the human suffering, economic losses, and ecological degradation that is associated with the hydrological cycle on overdrive and societies can learn how to embrace the inevitability of floods and droughts, and the drastic alternations between them. This requires innovative governance and risk management approaches that navigate uncertainty, protect communities, economies, and ecosystems, reduce duplication, and improve efficiency of public resource use.

EPIC Response Report was jointly prepared by the World Bank and Deltares (Netherlands) with support from the GWP and WMO. In addition, it highlights the importance of managing floods and drought together as part of same hydro-climatic spectrum. Link of the report is:

<https://www.worldbank.org/en/topic/water/publication/an-epic-response-innovative-governance-for-flood-and-drought-risk-management>

To demonstrate the applicability of the EPIC Response Framework in the Indian context, the World Bank, WMO, Deltares (Netherlands) and GWP organized a workshop on **“Improving Flood and Drought Governance: Applying the EPIC Response Framework”** in collaboration with India Water Partnership (GWP-India) and WAPCOS Limited in hybrid mode at New Delhi, India on 28th April, 2023.



Objectives of the Workshop

- To disseminate the World Bank's flagship report on hydro-climatic risk management: “An EPIC Response: Innovative Governance for Flood and Drought Risk Management”;
- Share the EPIC Response Assessment Methodology and its application (Piloted in Assam);
- To present the Global Water Partnership/World Meteorological Organization's Integrated Drought Management Program (IDMP) and Associated Program on Flood Management (APFM); and,
- Explore governance challenges & generate recommendations for improving flood and drought risk management at the national and State levels in India; and come-up with recommendations for improving flood and drought governance.

Scope of the Workshop

- Presenting the EPIC Response Report;
- Demonstrating the application of the EPIC Response Framework;
- Examining flood governance challenges and opportunities at the national and state level;
- Examining drought governance challenges and opportunities at the national and state level; and,
- Expert Panel discussion on recommendations for improving flood and drought governance.

Inaugural Session and Presentations (Forenoon)

Welcome Remarks by Dr Veena Khanduri, Executive Secretary-cum-Country Coordinator, India Water Partnership (GWP-India)

Welcoming experts and the officials present on the dais, Mr Kushvinder Vohra; Chairman, Central Water Commission (CWC), Ministry of Jal Shakti, Government of India; Ms Sumila Gulyani, South Asia Water Practice Manager, World Bank, New Delhi; Mr Anupam Mishra, Director, Commercial & HRD, WAPCOS Limited; Mr A B Pandya, Regional Council Member GWP-South Asia & Secretary General International Commission on Irrigation and Drainage (ICID); Mr. Greg Browder, Lead WRM Specialist, World Bank, USA; Dr. Veena Khanduri said that the EPIC Response Framework workshop has provided the opportunity to meet in-person with so many experts after COVID pandemic. She also expressed her concern that in India, the National and State Governments are dealing with floods and droughts as per specific context without encompassing the inter-linkages between these two extreme climate induced events.



On the dais (From left to right): Mr. A B Pandya, Ms. Sumila Gulyani, Mr. Kushvinder Vohra, Mr. Greg Browder & Mr. Anupam Mishra

Today's workshop will provide an opportunity to understand the EPIC (Enable, Plan, Invest and Control) Response Framework for managing flood and drought together as part of same hydro-climatic spectrum. She also shared that sharing of knowledge from National and State Government officials from the concerned Departments will provide the real challenges and opportunities to gauge the effectiveness of the EPIC Response Framework in the Indian context. With these words she invited Mr Anupam Mishra, Director, Commercial & HRD, WAPCOS, Limited for the Welcome Address.

Welcome Address by Mr. Anupam Mishra, Director, Commercial & HRD, WAPCOS Limited

At the outset Mr. Mishra greeted the officials from Central Water Commission (CWC); State Governments; The World Bank; Global Water Partnership (GWP); Global Water Partnership- South Asia; Indian Agricultural Research Institute (IARI); International Commission on Irrigation and Drainage (ICID); National Institute of Disaster Management (NIDM); State Disaster Management Authorities (Representing Bihar, Karnataka, Kerala & Odisha); Indian Meteorological Department (IMD); FREMAA, National Institute of Hydrology (NIH); International Water Management institute (IWMI- Colombo & New Delhi), WAPCOS Limited; and the participants. He highlighted that the occurrence of disasters have increased substantially in the recent past with high intensity and rapidly increasing in the subsequent years, which have devastating effects on the mankind, livestock, shelters and food security. Keeping this in view, WAPCOS Limited as a commercial organization has taken a number of steps to examine and address climate related challenges in their projects in the irrigation, hydro power, water supply and



sanitation, drainage and water management, etc. He expressed that EPIC Response Framework will provide sharing of knowledge and experiences in managing floods and droughts together and also how the EPIC Response Framework can help to meet governance challenges and its operations in India.



Welcome Remarks by Ms Sumila Gulyani, South Asia Water Practice Manager, World Bank, New Delhi

Ms. Sumila Gulyani welcoming the audience highlighted that the World Bank in India runs nearly \$ 20 Billion of projects and also bringing Knowledge. Due to climate change, floods and droughts intensity and variations are increasing which creates problems to the whole society. To tackle this, it demands multi-sector approach which is not easy. Citing an example of Tamil Nadu State on the occurrence of flood and drought in sequence in Tamil Nadu and Chennai city, she shared how the World Bank collaborated with Chennai city partnership project with the State Government to manage flood and drought simultaneously.

She also touched upon the Assam Integrated River Basin Management (AIRBM) project wherein flood and drought management is a key important component. She emphasized that in the AIRBM project, integration of EPIC Response Framework and its application through EPIC Response Assessment Methodology (ERAM) tool will provide the applicability of the EPIC in context of the Assam. Concluding her remarks she said today's workshop is timely discussion in presenting multi sector tool in tackling floods and droughts to have the fruitful dialogue.

Context Setting by Mr. A B Pandya, Regional Council Member, GWP-South Asia and Secretary General International Commission on Irrigation and Drainage (ICID)

Setting the context, Mr A B Pandya shared that droughts and floods are part of hydrological system since time immemorial and he took the audience to 150 years back history of Ganga canal which was built in order to get rid of famine of 1858 to face the drought in Indian history. On the flood management, the first thing done by the first independent Indian Government was setting-up of Damodar and Hirakud River Valley projects for power generation along with water supply and irrigation (Hirakud) which improved the ways for flood control in the flood prone States such as Bihar and West Bengal. He also brought examples of the impacts of impoundments on flood experience of the downstream communities who faced disparity of flows. New challenges such as flash floods, drainage management which are leading to urban floods are to be managed properly. He also shared that in India in terms of flood and drought management a lot of progress has taken place but still there is a lot of scope for further advancement. He suggested that this exercise can be taken up to assess the existing systems in place by applying the EPIC Response Framework and how EPIC Response tool can be further helpful for managing the flood and drought simultaneously or separately.





Keynote Address by Mr. Kushvinder Vohra, Chairman, Central Water Commission (CWC), Ministry of Jal Shakti, Government of India

Welcoming dignitaries and participants, Mr. Kushvinder Vohra stated that flood and drought are one of the most pressing issues of the time, it is mostly due to climate change but human activities also worsen the situations which ultimately impact the livelihood of masses across the World. From the national perspective, India is facing numerous challenges in water resources sector due to rapidly increasing population, depleting groundwater level and water quality challenges. India is having 18% of human population and 15% of livestock and only 4% of the fresh water resources of the World. He further added that India has typical monsoon climate and therefore availability of water is variable throughout the year as most of the rainfall actually falls within 3-4 months during monsoon season and that is why India is continuously facing flood and droughts in this season. Climate change will

increase water availability by the end of the century, but the challenge is that its spatial and temporal variability is not necessarily favorable. 40% of the country is flood prone, and hence it is essential to develop climate resilience structural and non-structural solutions.

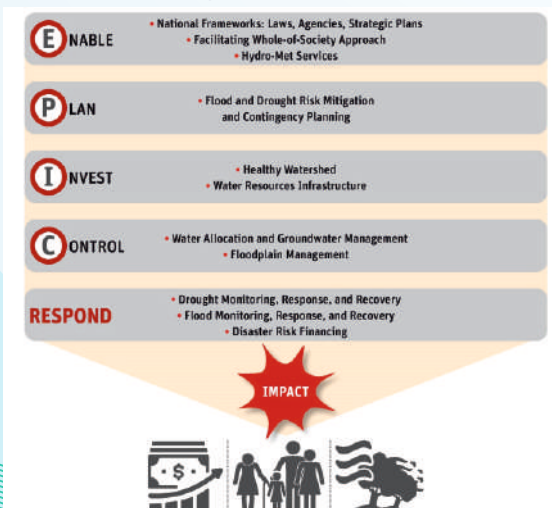
Flood forecasting is identified as the most effective measure to live with the flood and CWC is doing 5 days advance flood forecasting in the country which is 95% accurate around the country. It is important to have a comprehensive plan against drought given its profound effect on the economy. Drought resilient crops and water storage at different levels (e.g., household, rainwater harvesting, groundwater recharge, etc.) are among adaptation measures. Stream forecast is extremely important in predicting drought (as was for flooding). Open data and hydro-meteorological modeling are the important parts of managing hydro-climatological challenges. He expressed that EPIC Response Framework will be helpful to know our own water index and reassessment of water resources for devising innovative solutions for effective water governance.

Presentation by Mr. Greg Browder, Lead WRM Specialist, World Bank, USA on “EPIC Response Framework”

Mr. Greg Browder shared that the motivation behind EPIC Response Framework was that the days of financing flood and drought risk separately are coming to an end and we have to take multi-sectoral integrated perspective, and this is a framework to cater for that demand and the audience (National and State agencies) present today, are in the forefront for addressing flood and drought within a unified hydro-climatic risk management.



EPIC Response Framework Program Areas



Elaborating about the EPIC Response Framework, he shared the core principles of the approach are; 1) joined-up governance, 2) whole of society approach, 3) addressing the hydro-climatic risks as a whole, i.e., drought and flood are either side of the same spectrum and need to be managed within the same governance system. Every level of programs in the cascading programs of EPIC Response Framework helps improve the downward steps systematically, and in their totality, help reduce the impact. He also shared that EPIC Response Framework has covered comprehensive collection of drought and flood policies across the globe. He later invited Ana Nunez Sanchez, Deltares to share the EPIC Response Assessment Methodology (ERAM) tool.

Presentation on EPIC Response Assessment Methodology (ERAM) Tool and its Application by Ana Nunez Sanchez, Expert Advisor, Resilience Department, Deltares, The Netherland (Online)

Ana Nunez Sanchez presented the ERAM prototype that can be used by agencies or 3rd parties to assess the governance preparedness in combined management of hydro climatic hazards and risks. She also presented quick overview of the ERAM and its application. Ana also highlighted that ERAM is versatile and can be tailored to the specific assessment needs.

She also presented the application of innovative ERAM in the State of Assam piloted in the World Bank supported AIRBMP in 2023 and projections of future expectations beyond in the project in 2033. The AIRBMP consists of 3 Phases aimed at reducing the vulnerability of people to hydro climatic risks and improving Integrated Water Resources Management (IWRM). The Water Resource Agency (WRA) and Disaster Risk Management (DRM) Agency both ensure capable programme related to flood forecasting, river basin planning, water resources investment and infrastructure safety. AIRBMP is promoting inter-agency cooperation by involving both Water Resources Department (WRD), Assam & Assam State Disaster Management Authority (ASDMA) and facilitating synergies through Food Risk Management Plan and Flood Forecasting Early Warning and dissemination. She also shared that ERAM can be best used periodically accompanied by a continuous institutional strengthening process. It is at present a prototype level and through continuous use it will further improve.



Open Discussion (Q & A)

On the dais: Ms. Sumila Gulyani, Mr. A B Pandya, Mr. Kushvinder Vohra, Mr. Greg Browder and Mr. Anupam Mishra

Dr Veena Khanduri, Executive Secretary-cum Country Coordinator, IWP and Hila Cohn Mizrav, World Bank invited participants both in-person and online to raise the questions. Following questions were taken up.

- ➔ How does the EPIC Response Framework incorporate Nature based Solutions (NbS) and eco- system based adaptation while integrating the Green Infrastructure?
- ➔ How the framework is integrating Hydro climatic spectrum in planning process which has a lot of cascading impacts and complexity?
- ➔ How the Government can be shaken up to take-up steps about the two water extreme climatic hazard events and how the EPIC Response Framework can be taken- up in implementation?

Mr. Greg Browder explained that in the EPIC Response Framework report, various programs within EPIC response address about green infrastructure such as maintaining forest cover, wetlands and coastal zones, watershed and floodplains in the most natural condition.

Mr. Kushvinder Vohra explaining about the integration said that generally, whenever integration is needed, it is there, but not addressed completely. To bring flood and drought silos together, there are thoughts about integration, e.g., the data is open and accessible to all. The days are over that people do not work together, and there is transparency at all levels. The Government of India is working very hard to address most of these issues not in silos but as a whole by involving multi-sector participation. There are various technical issues involved but for planning purpose the governance is utmost priority.

Adding to Mr. Vohra's statement, Mr. Greg Browder said, some countries do periodic assessments of the entire response systems across various sectors as a mechanism to keep-up with the changes associated to environmental and climatic change as a never ending process.

Presentation by Mr. Valentine Aich, Senior Water & Climate Specialist, Network Specialist for Central Asia and Caucasus, GWP on “Managing Flood and Drought together-An Overview on Practical Approaches” (Online)

Mr. Valentine Aich presented the joint programme on Integrated Drought Management Programme (IDMP) of GWP & Associated Programme on Flood Management (APFM) of WMO. While APFM focuses on flood risk management, land use & water management, the drought management relies on monitoring and early warning, risk & impact assessment and risk mitigation preparedness and response. Integration is the heart of flood and drought management. He presented the WMO helpdesk for integrated flood and drought management programs for the students, researchers and Government agencies. WMO is also very much focused on the integration of flood and drought management.

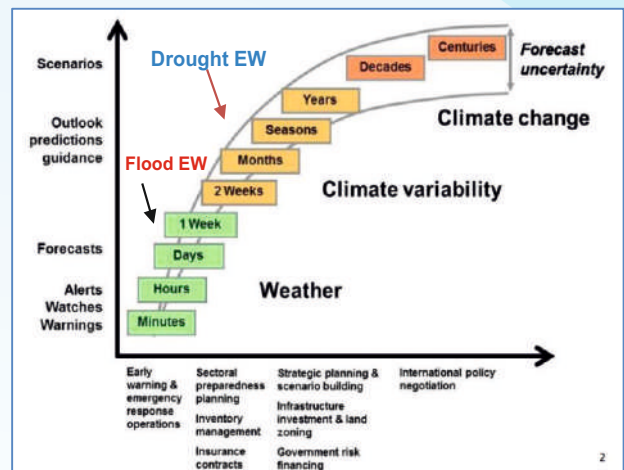


Image showing time taken for flood and drought early warning

Flood as a fast onset event needs real time forecast, while drought has a mid-to long term onset and needs a longer-term preparations in terms of agriculture and water storage management. The difference is perhaps the key to the fact that in many countries these are not addressed together. 79% of the WMO countries have riverine forecasting in place and this is even worse (53%) for drought. He also listed a number of prevention and preparedness and awareness programs (e.g., Flood Managed Aquifer Recharge (Flood-MAR), Nature based Solutions (NbS)). The image above shows that it takes very less time for flood forecasting whereas it takes much more time for drought forecasting. Summarizing the presentation, he presented to adopt a common risk management framework and recommended the importance of taking a strategic or proactive approaches to reduce both drought & floods at the basin and sub basin scales (across administrative boundaries) and related benefits at local level.



Experience sharing on Integrated Drought & Flood Risk Management based on States Perspective by Mr. Giriraj Amarnath, IWMI Colombo and Dr. Alok Sikka, IWMI, New Delhi

Mr. Giriraj Amarnath discussing the combined management of flood and drought elaborated on the existing programs (in Bihar, Orissa, Assam & Uttar Pradesh) in preparing, mitigating, and recovering from flood. Further he presented how drought is approached in South Asia (e.g., drought prediction, contingency and recovery plans) citing the example of Sri Lanka. To bundle flood and drought services, integration of collaborative platform across institutions, scales, sectors and real time data for climate risk preparedness, the rapid response is important. There is a need to develop systematic process of identifying, assessing, mitigating and adaptation interventions including multi-level, multi-institutional coordination for integrating climate adaptation strategies.

He also shared about South Asia Drought Monitoring System (SADMS), which is cloud based integrated drought management portal providing information needed to forecast, monitor and manage the drought. Mr. Amarnath also shared about the National Development Plan (NAP) under Ministry of Environment, Sri Lanka which is focusing on to unlock the investment in adaptation and resilience through adaptation finance mobilization.

Interactive session (Q&A)

Question: Prior preparing framework for drought, have you evaluated the frameworks already in existence at National or State level and accordingly suggested new features?

Question: What is the level of accuracy and reliability of forecasting drought in terms of time scale?

Question: As SADMS has gone through various phases and evolved now to Decision Support System (DSS), Is it all automated and input variables which has to go in DSS are automated or it is being managed through the Monitoring Cell of the Ministry of Agriculture?

Answers: Replying to the question, Mr. Amaranth asked? Is it about policy or activity or about Institutional framework? Dr. A K Sikka clarified that it is in the context of institutional mechanism. Further it was shared that IWMI has signed a MoU with Government of Sri Lanka for series of activities (nine month preparatory activities) such as Regional, National and community level programme consultation for launch of new programme. Through consultative process only, the programme design has been prepared.

With regard to accuracy of forecasting, the dependency is on existing data sets provided by Indian Institute of Tropical Meteorology (IITM), Pune for seasonal or sub-seasonal frequency of data. Hence data accuracy is specialization of the other agency.

With regards to SADMS, it was stated that SADMS is 95% fully automated and managed through cloud technology. It is also under consideration to migrate the SADMS to Indian Council of Agricultural Research (ICAR) for a Drought Krishi Portal (Drought Agriculture Portal).

Session on Governance Challenges on Flood and Drought Management in India: National & State Perspectives

(Afternoon)

Mr. Rajendra Ratnoo, I.A.S, Executive Director, National Institute of Disaster Management (NIDM), Ministry of Home Affairs, Government of India addressing the audience on “**Governance Challenges on Flood & Drought Management in India from National perspective**” shared that quality data availability is identified as the main challenge. Drought is not only about rainfall but about a multitude of parameters. The country is far from a country-wide coverage of real time data. Even rainfall monitoring stations are not all operating all the times. When it comes to flood and drought, there are plenty of departments responsible and the measures are not effectively coordinated. Very often, plans are developed by Engineers independent of the local community perspectives, which often results in wrong assumptions resulting in weak mitigation/adaptation plans preparation. To mitigate drought in the long term, it involves not only the agriculture, but also the basin and sub-basins management in a complex manner. Furthermore, the eating habits of the people are also relevant. This demands a movement from mono-culture farming to multi-culture farming, since mono-culture depletes the soil quality, especially in the areas where groundwater extraction has been dominant. Mr. Ratnoo emphasized that NIDM is keen to adopt and mainstream recently developed tools (e.g., EPIC) to bridge the knowledge gaps in the Government bodies.





Kerala Flood Management Perspective by Dr. Sekhar Lukose Kuriakose, Member Secretary, Kerala State Disaster Management Authority (KSDMA) - (Online)

Dr. Sekhar shared his experiences and challenges in terms of governance faced in Kerala through the 10 points (i) The blue line and red line - concept for managing flood through building rules need to be adopted; (ii) Organically developed urban spaces-vs-planned urban spaces have to be given priority for managing the urban and rural spaces; (iii) As Aspiring Rural areas are increasing in the urban sprawl and pressure is on susceptible lands (grazing land, forest land and wetlands), this

needs to be managed very carefully; (iv) Vertical development and preservation of natural sponges (such as wetlands) need to be incentivized for lesser carbon foot print; (v) Availability of terrain data at 1 in 1m resolution for at least Pan India for Disaster Management planning to be made available; (vi) Facilitation of Application Programming Interface (API) based integration of Central Water Commission (CWC) observational data with State's DSS for forecasting is needed; (vii) Facilitation of API based integration of IMD, CWC, Indian National Centre for Ocean Information Services (INCOIS) forecast data with state's DSS need to be made available; (viii) Trans-boundary reservoirs (neighboring States such as Tamil Nadu, Karnataka etc.) catering to the nearby States require protocols guidelines online with flood management guidelines; (ix) Risk transfer - have to be taken into account while planning for huge investment primarily in housing, communication, infrastructure and transportation; and (x) Behavioral change - the big question of respecting water - our traditional respect to water and water bodies have lost and it need to be enacted.

Karnataka Flood Management Perspective by Dr Manoj Rajan, I.F.S, Special Secretary, Food Processing & Harvest Technology, Government of Karnataka and Commissioner, Karnataka State Disaster Management Authority - (Online)

Dr. Rajan shared his views on flood management and governance challenges in context of Karnataka State. Citing the numbers, he shared that in last five years, 54.32 lakh hectare of agriculture and horticulture land have been damaged, around 2.62 lakhs houses were damaged. In terms of infrastructure destruction, around one and a half lakh kilometer roads were damaged, so one can imagine the loss of livelihood and infrastructure. Now the challenge is how to restructure and reconstruct again, how to make resilient infrastructure for combating flood, how to make contingency plans to overcome the drought and how to dovetail Government schemes like MANREGA for planning like natural resource management, catch the rain, check dams, ponds construction, gully plugging and afforestation etc. For flood management, planning for low lying areas, selection of agriculture crops post flooding, identification of vulnerability areas and population and strategic planning for rescue and rehabilitation.

Dr. Rajan informed that it is to be appreciated that Karnataka has identified 2400 vulnerable Gram Panchayats (GPs) and these GP's have been provided training to prepare the contingency plans at the district level. He suggested that it is very pertinent that how different departments come together to handle the disaster risk reduction activities as per their Departmental priorities.





Assam Flood Management Perspective by Mr. Bhaskar Jyoti Das, Chief Technical Officer, FREMAA, Water Resources Department, Government of Assam

Mr. Das sharing flood and erosion management in Assam talked about two major basins of Brahmaputra and Barak having very dynamic river morphology horizontally and vertically (aggradation). The area occupied by Brahmaputra River has risen by 50% in the last 100 years. Flood discharge of Brahmaputra River is the 9th highest one and annual sediment transport is about 700 million metric tons. Flood makes large parts of the land uncultivable. The Flood and River Erosion

Management Agency of Assam (FREMAA) has taken various structural measures to manage flood and erosion risks, encroachment of riverine area, etc. The State challenges are fragmented governance, climate change, integrating flood with other activities, resource allocation, etc.

He also elaborated on the Assam Integrated River Basin Management Programme (AIRBMP) under World Bank funding in three phases (2023-2033) with Water Resources Department of Assam and other related departments. The State has focused on hybrid approaches with co-benefit taking engineering and ecosystem based (e.g., using vegetation as a buffer for flood management) solutions.



Village level civic bodies in India are called Gram Panchayats (GPs)

Government of Assam is also developing a Hydro Informatics Unit (HIU) under Water Resources Department (WRD), Assam, which will interface with systems located in other agencies like North Eastern Space application Center (NESAC), Indian Meteorological Department (IMD), National Center for Medium Range Weather Forecasting (NCMRWF), Assam State Disaster Management Authority (ASDMA), Central Water Commission (CWC) and Department of Environment and Forest, etc. to draw data to support its activities.

Bihar Flood Management Perspective by Mr. Pravin Kumar, Project Officer (Natural Disaster), Bihar State Disaster Management Authority (BSDMA)

Mr. Kumar cited that in most of the cases along the Ganga River when there is no flood, there is drought. He also explained on the paradigm shift taken in disaster relief to disaster management by Bihar State Disaster Management Authority (BSDMA). Some of the mitigation measures are Standard Operating Procedure (SOP) for flood, drinking water, crisis management, preparedness and response, procedures for National Disaster Relief Funds, intense monitoring, etc. Mr. Kumar shared that for Bihar the major challenges are; 73% area flood prone, major rivers come from Nepal with large sediment load and thus humanitarian issues, loss of livelihoods, and environmental loss. The State Government has taken up technology based initiative by establishing flood forecasting stations and providing early warning system to the communities. State Government of Bihar has also established a Flood Management Information Center and provided capacity building training to community youths and Panchyati Raj Institutions, as the first responder.



Flood prone Districts of Bihar

Districts marked in dark blue are high flood risk and districts marked in light blue are moderate to low flood risk



In response to questions: About using the tool for drought in Bihar and flood in Assam, Mr. Kumar said that Bihar addresses drought purely based on rainfall data and Mr. Bhasker Joyti Das shared that Assam use CWC data (Stream flow) for flood mapping. Mr. Das also informed that with the setting-up of Hydro Informatics Unit in Assam in collaboration with North Eastern Space Application Center (NESAC), it would be easy to manage the floods in Assam.

Karnataka Drought Management Perspective by Dr. V S Prakash, Former Special Director, Karnataka State Natural Disaster Monitoring Centre (KSNDMC) & Former Director, Drought Monitoring Cell, Karnataka

Dr. Prakash highlighted the challenges of incompatible data, data discrepancy, and data sharing policies. He flagged that surface water bodies are drying up largely all over India including Karnataka State. As per recent Government of India's Report, around 20,000 water bodies in Karnataka have dried up and 4000 water bodies have dried up in Jharkhand and groundwater is depleting day by day. For flood mitigation management, we are still holding on learning's of five decade back and as per emergence of new learning and new technologies, it is not suitable. Citing the example of extreme event in 20-30 years' time period and constructing the bridges with 50% probability design standard will not work. Why we are not handling issues with caution? He also flagged that it is very important to understand where do we stand, what need to be done and how to move forward.



Dr. Prakash shared that EPIC Response Framework Report really provide very good suggestions depending on objectives and looking at the core issues. For example as per EPIC Response Framework, enabling environment of policy, law, and plans depends on information and information depends on data. He explained in detail about turning water data into water wisdom by citing data, knowledge, and information leads to wisdom. He stressed that just to improve the data; our country needs investment around INR 40,000/- crore and this is the budget outlay for only one year. If we are not ready to invest for data, then organizing conferences are not going to help us. The whole of society approach calls for more engaged participation from all stakeholders.



Odhisa Drought Management Perspective by Mr. Sabyasachi Hota, Chief General Manager, Odisha State Disaster Management Authority (OSDMA)

Mr. Sabyasachi Hota first shared about drought declaration indicators and ground trothing methods. He also explained the governance challenges in Odisha on the issues in data sourcing like meteorological data/groundwater level data/satellite data (NDVI, NDWI) that leads to incorrect assessment of indicators. Beside this, integration with natural resources and climate change adaptation policies is required.

He also shared that Odisha is working on establishing wider network of weather monitoring systems, i.e. installation of Automated Weather Station (AWS) and Automated Rain Gauges (ARG) throughout the State. Development of integrated and inter- departmental database system and facilitation of data sharing will help to strengthen the decision support system.



National Perspective on Meteorological Drought by Mr. Rahul Saxena, Scientist "F", Indian Meteorological Department (IMD), Government of India

Mr. Saxena said every forecasting system has its own limitations. Seasonal/monsoonal rainfall both in amount and distribution results in droughts or floods over South Asia. He explained on the meteorological background of drought development which begins when precipitation is below the normal or an extended period of time. Meteorological information from IMD is used in several ways for disaster risk

reduction; for example: hazard monitoring & assessment, early warning & mitigation, technical support in vulnerability analysis, mapping & risk assessment, preparedness and planning. Droughts are becoming more regional and showing a general shift to agriculturally important coastal region of South India, Central Maharashtra & Indo- Gangetic plains indicating higher food insecurity and socio-economic vulnerabilities. Data sharing is still an issue in improving the early warning systems.

He shared that in 2020, IMD in collaboration with WMO operationalized South Asia Flash Flood Guidance System which provides guidance on flash floods at the watershed level to regional partner countries of South Asia (Bangladesh, Bhutan, Nepal, Sri Lanka & India).

The other development is HydroSoS (Hydrological Status and Outlook Status) which is an initiative of WMO in collaboration with IMD (Ministry of Earth Science, Government of India) to establish a framework for providing a viable solution to water security issues in India and the neighboring countries to prepare for the occurrence of the floods due to intense monsoon rainfall or excess inflows from upstream. The initiative is in its initial stage and as hydrological data is managed by CWC, the discussion with CWC is under progress. Summarizing the key points, he stated that robust, quality assured observational network systems and user specific customized products are critical for successful drought/flood management Services.

Panel Discussion of Distinguished Experts: Applying EPIC Framework in India

(Evening Session)

The Panel Discussion comprised of 5 distinguished experts namely (i) Mr. A B Pandya, Regional Council Member, GWP-South Asia & Secretary General, ICID; (ii) Dr. Ravinder Kaur, Principal Scientist, Water Technology Centre (WTC), IARI; (iii) Dr. R P Pandey, Scientist "G", NIH, Roorkee; (iv) Mr. Shashikant Chopde, Senior Associate, ISET-International, USA, and (v) Mr. Anup Karanth, Senior DRM Specialist, World Bank, New Delhi, India.

Dr. Partha J Das, Head, Climate Change Hazards Division, Aaryanak, Guwahati, Assam moderated the Panel Discussion.

The key questions asked by the Moderator and the answers given by the Panellists are elaborated below:

Key question: What is your opinion about the relevance and applicability of the EPIC Response being introduced by the World Bank for a Country as a whole and for specific States?

On the pros & cons of EPIC Response Framework, Mr. A B Pandya emphasized that depending on the status of a country, each country is at different level of EPIC assessment. As far as India's case is concerned, we are in better category. We need to coordinate more amongst various agencies at the sub-regional and regional level and develop the views at basin centric approach rather than political or administrative boundary centric approach. For this, additional mechanism is required that needs to be put in place. EPIC Response tool serves as a good benchmark to assess the readiness of a country to handle the drought and flood management simultaneously. He further emphasized that scientific and administrative agencies coordination also needs to be strengthened.

Dr. R P Pandey stated that as drought is driven by regional climatic parameters, it should also be managed regionally (e.g., Western to Eastern States).

Dr. Ravinder Kaur described EPIC Response Framework as a tool to examine governance system in response to flood or drought, and not as a tool about technological development in studying the drought or flood. It is a very useful tool for a Government to identify and access the progress of various activities/programmes in operation (by the various State Governments as per established node (Enable, Plan, Invest and Control- EPIC). It is a very good tool for a country/state for self-assessment.

Mr. Shahikant Chopde going through the flagship report found that it a very thorough analysis of the range of topics required to be addressed in hydro climatic risk management. However, when it comes to implementation, the question is how to translate this to the ground and elaborated further on the challenges of capacity building, coordination and multi sector partnership. He said that how climate data can be used for future and how do we integrate the available information for further 30 years planning is important. Hence the EPIC Response tool is very helpful for planning to manage drought and flood together.

From Mr. Anup Karanth perspective, the tool works perfectly from an assessment perspective. The tool also offers freedom to maneuver or use this for specific purpose and interact with multi- institutions and multi-actors.



**View of Panel Discussion (From left to right):
Mr. Anup Karanth, Dr. R P Pandey, Dr. Partha J Das,
Mr. A B Pandya, Dr. Ravinder Kaur & Mr. Shahikant Chopde**

Key question: How do you foresee challenges in operationalizing the EPIC Response Framework approach?

Mr. A B Pandya stated that EPIC Response Framework component implementation for sub-continent size country like India, has to use the multiple approaches (bottom up and a top-down approach). There are top-down approaches at the central level, but at the ground level, there are fragmented approaches and EPIC Response Framework attempts to address integration of these approaches. A national view about water resources management is necessary that is missing. Because of that, some of the manageable disasters hit with larger impact than expected. Therefore, there is a strong need to use EPIC Response Framework as a benchmark tool at the sub national level or at regional level.

Furthermore, he said that infrastructure plays an important role and it is a crucial aspect of drought and flood management. For smart infrastructure development, strategic investment for water infrastructure is needed.

Dr. R P Pandey said most of the speakers addressed that there should be a regular drought monitoring system but there is no single agency that is responsible for centrally aggregating data across the India. He suggested through EPIC Response tool, States can assess vulnerability of various areas, but there is a need for region specific mitigation plans. There is an essential requirement to integrate various efforts for decision making planning.

Key question: What are the gaps in the state of technology in the country? How technologies can be helpful for EPIC Response Framework?

On this question Dr. Ravinder Kaur said that the role of technology is very important but there is no single Standard Operating Procedure (SOP) for flood or drought and various States follow different procedures for data. She suggested: 1) finalize SOPs (flood and drought) for management of data; 2) standard modes for data collection and processing across India, 3) capacity building of the flood and drought State's authorities can only take place, if centralized procedures are in place and constant evaluation of those procedures for monitoring of drought & flood protocols are carried-out.

Key question: Improved management of floods and droughts entails developing resilience of communities and ecosystem vulnerable to the calamities and how we can achieve collateral development?

Mr. Anup Karanth explained that most of the Disaster Risk Management (DRM) operators work a lot on flood but not on drought. Most of the State risk assessments even in multi-hazard assessment do not address drought as a hazard. It is important to bring sufficient tools to assess drought. Citing the SANDAI Framework, he shared that Disaster Preparedness Plan for flood at national, sub-national level and even at village level has been prepared by the States but in context of drought the information has not been very substantive. It is not providing measures for alternate strategy. So for the better governance requirement at the planning stage, concerned institutions has to be accountable and ready to work on further improvising the plans by collating the various institutions inputs.

Key question: What is the level of uptake in Disaster Risk Management (DRM) in terms of technology at the policy level?

Mr. Shahikant Chopde in response to the question said, EPIC Response Framework is about feeding inputs but how these inputs are leading to put in place for resilience assessment? Can we link this to lives saved, infrastructures saved, etc.? Hence input data is a key in this assessment. Also the focus is on low frequency high impact disasters and not on low impact high frequency disasters. The latter could act as a measure to examine resilience. There is lot of data on climate projections but very less information to design infrastructure in terms of adaptive mechanism. There are areas that the EPIC Response Framework can be elaborated to be adoptable. Another area of interest is private sector participation for adaptive infrastructure investment. Are there resilient procurement plans in place? These are the areas where in EPIC Response Framework can be applied to check the progress in terms of DRM.

Assam can serve as a very good check for EPIC Response Framework and to also further see what can be done at the next levels.

Interactive Session

Dr. Partha J Das invited audience to discussion. Dr. V S Prakash stated that EPIC Response Framework has done its EPIC job and now the thrust should be to how it can be operationalized at State level or agro-climatic zone wise level? He also suggested can we think of EPIC version-II? Replying to this Mr. A B Pandya said in that context, we have to look at our own priorities vis-a-vis ideal EPIC Response Framework and tailor ourselves accordingly.

Dr. Ravinder Kaur suggested before venturing into EPIC-II version, EPIC should be tried and tested across the sectors so that limitations and gaps can be checked and verified and accordingly version II can be planned. Mr. Anup Karanth indicated that as NIDM is involved in capacity building of stakeholders who are working on drought and flood management, it is a good idea to introduce the tool to the stakeholders across the States with the support of NIDM.

Dr. Veena Khanduri highlighted that the recent launch of AIRBMP Assam Project (2023-2033) under the World Bank funding can serve as a very good check for EPIC Response Framework to also further see what can be done in the next levels. She also emphasized that as it is a Framework and the applicability of the tool will depend on the Water Resources Department, Government of Assam and other stakeholders to operationalize it in their own context (in terms of indicators and scores or matrix). The learning's from the different phases of the AIRBMP will provide the guidance for EPIC Response Framework for implementation in other States of India.

Mr. Anupam Mishra raised as drought and floods are the characteristic of river basins so to operationalize the EPIC Response Framework, instead of taking State-wise why not to follow a basin-wide approach?

In response to this, Mr. A B Pandya said some basins are trans-boundary such as Brahmaputra basin (flood and disaster prone State, Assam is part of this basin). In Ganga basin, North bank of Ganga is highly flood prone (Bihar & Uttar Pradesh) whereas south bank of Ganga basin is drought prone. We have no such forum wherein we can invite States to discuss the issues as water is a State subject in India and hence there are some limitations. Only through diplomatic efforts at the Government level, the neighboring countries associated with the basins can be involved to pilot the EPIC Response Framework tool. National Level Water Council/Forum/Network for hydro climatic disaster management where the States can come together for exchange of information, knowledge and ideas are required.

Major outcomes of the Panel Discussion

The eminent panellists highlighted various aspects of flood and drought management in India focusing mainly on scientific, technological, administrative, legislative, policy, and institutional dimensions. The panel delved deep into the question of the relevance of the EPIC Response approach for India. It concluded that the EPIC Response Framework would be highly useful in the Indian context for improving the management of hydro-climatological hazards.

The panel also underlined the need for policy and institutional reforms to create a proper governance ecosystem that will enable such innovative approaches to disaster risk management to be operationalized effectively. This will need integration of the framework with the sustainable development goals. Moreover, at the State and local level, environmental and social characteristics and community participation will be the crucial factors to be considered for the successful implementation of such a governance assessment tool.

Key Messages

- EPIC Response tool serves as a good benchmark to assess the readiness of a country to handle the drought and flood management simultaneously.
- The EPIC Response Framework would be highly useful in the Indian context for improving the management of hydro-climatological hazards.
- EPIC Response Framework as a governance tool is a very useful tool for a Government to identify and access the progress of various activities/programmes in operation (by the various State Governments as per established node (Enable, Plan, Invest and Control- EPIC).It is a very good tool for a country/state for self-assessment.
- The EPIC Response Framework would be highly useful in the Indian context for improving the management of hydro-climatological hazards.
- The EPIC Response tool works perfectly from an assessment perspective. The tool also offers freedom to maneuver or use this for specific purpose and interact with multi-institutions and multi-actors.
- EPIC Response Framework component implementation for sub-continent size country like India has to use the multiple approaches (bottom up and a top-down approach). There are top-down approaches at the central level, but at the ground level, there are fragmented approaches and EPIC Response Framework attempts to address integration of these approaches. A national view about water resources management is necessary that is missing. Because of that, some of the manageable disasters hit with larger impact than expected. Therefore, there is a strong need to use EPIC Response Framework as a benchmark tool at the sub national level or at regional level.
- The EPIC Response Report is found to be a very thorough analysis of the range of topics required to be addressed in hydro climatic risk management.
- Through the EPIC Response tool, the Indian States can assess vulnerability of various areas, but there is a need for region specific mitigation plans.
- With respect to India, NIDM is involved in capacity building of stakeholders who are working on drought and flood management; it is a good idea to introduce the tool to the stakeholders across the States with the support of NIDM.
- Need for integration of the EPIC Response Framework with the sustainable development goals.
- At the State and local level, environmental and social characteristics and community participation will be the crucial factors to be considered for the successful implementation of such a governance assessment tool.

Key Recommendations

- Flood and drought need a joined up government response.
- Flood and drought need to be dealt as a whole of society effort.
- Many synergies can be used when floods and droughts are managed together.
- The EPIC Response Methodology is a very well suited to support India's work towards more resilience to flood and drought.
- There is need for policy and institutional reforms to create the proper governance ecosystem that will enable such innovative approaches to disaster risk management to be operationalized effectively.

Closing Remarks & Vote of Thanks

Mr. Greg Browder extended thanks to all the key speakers, presenters, panellists and the participants for having a fruitful discussion on the EPIC Response Framework and hoped that the outcomes and recommendations that will emerge from the deliberations would help in refining the EPIC Response Framework for better flood and drought management in India and the globe.

He also expressed his sincere thanks to the World Bank, New Delhi, India Water Partnership (GWP-India) and the WAPCOS Limited for conduct of the workshop successfully.

Online Workshop Proceedings Dissemination through Social Media

Some of the on-line Workshop proceedings dissemination through social media by India Water Partnership (GWP-India) is given below:



Workshop Agenda

Time	Sessions	Speaker/Presenter
09:30 - 10:00 am	Registration and Coffee	
10:00 - 10:05 am	Welcome Address	Mr. Anupam Mishra, Director, Commercial & HRD WAPCOS Limited
10:05 - 10:10 am	Welcome Remarks	Ms. Sumila Gulyani, South Asia Water Practice Manager, World Bank, New Delhi
10:10 - 10:15 am	Context Setting	Mr. A B Pandya, Secretary General, International Commission on Irrigation & Drainage (ICID), New Delhi
10:15 - 10:25 am	Keynote Address	Mr. K Vohra, Chairman, Central Water Commission, Ministry of Jal Shakti, Government of India
10:25 - 10:45 am	Presentation of EPIC Response Framework	Mr. Greg Browder, Lead WRMSpecialist, World Bank
10:45 - 11:00 am	Presentation on EPIC Response Assessment Methodology (ERAM Tool)	Ms. Ana Nunez Sanchez, Expert Advisor, Resilience and Planning Department, Deltares, The Netherlands
11:00 - 11:30 am	Open Discussion	
11:30 - 11:45 am	Coffee Break	
11:45 – 12:00 pm	Presentation on WMO/GWP Integrated Drought Management Program (IDMP) and Associated Program on Flood Management (APFM) Publications and Tools	Mr. Valentin Aich, Senior Water & Climate Specialist, <i>Network Specialist for Central Asia and Caucasus, GWP</i>
12:00- 12:30 pm	Experience sharing on Integrated Drought & Flood Risk Management based on States perspective	Dr. Alok K Sikka, IWMI Representative India, New Delhi; and Dr. Giriraj Amarnath, Representative, International Water Management Institute (IWMI), Colombo, Sri Lanka
12:30 – 13:00 pm	Open Discussion	
13:00 - 14:00 pm	Lunch Break	
14:00 - 14:15 pm	Governance Challenges on Flood & Drought Management in India: National Perspectives	Mr. Rajendra Ratnoo, I.A.S., Executive Director, National Institute of Disaster Management (NIDM), Ministry of Home Affairs, Government of India

Time	Sessions	Speaker/Presenter
14:15 - 15:00 pm	Governance Challenges on Flood Management in India : National and State Perspectives	<ol style="list-style-type: none"> Mr. Bhaskar Jyoti Das, Chief Technical Officer, FREMAA, Water Resources Department, Government of Assam: Assam Perspective Dr. Sekhar Lukose Kuriakose, Member Secretary, Kerala State Disaster Management Authority: Kerala Perspective Dr. Manoj Rajan, I.F.S., Special Secretary, Food Processing & Harvest Technology, Government of Karnataka and Commissioner, Karnataka State Disaster Management Authority: Karnataka Perspective Mr. Pravin Kumar, Project Officer (Natural Disaster), Bihar State Disaster Management Authority : Bihar Perspective
15:00 – 15:45 pm	Governance Challenges on Drought Management in India: National and State Perspectives	<ol style="list-style-type: none"> Dr. V S Prakash, Former Director, Drought Monitoring Cell, Government of Karnataka: Karnataka perspective Mr. Sabya Sachi Hota, Chief General Manager, Odisha State Disaster Management Authority: Odisha perspective Mr. Rahul Saxena, Scientist “F”, Indian Meteorological Department (IMD), Government of India: National Perspective on Meteorological Drought
15:45 – 16:00 pm	Coffee Break	
16:00 – 17:00 pm	Panel Discussion of Distinguished Experts:Applying EPIC Framework in India	<p>Panelists:</p> <ol style="list-style-type: none"> Mr. A B Pandya, Secretary General, International Commission on Irrigation & Drainage Dr. Ravinder Kaur, Principal Scientist, WTC, IARI, Govt. of India Prof. R P Pandey, Scientist “G”, National Institute of Hydrology, Roorkee Mr. Shashikant Chopde, Senior Associate, ISET-International, USA Mr. Anup Karanth, Senior DRM Specialist, World Bank, India <p>Moderator:</p> <p>Dr. Partha Jyoti Das, Head, Climate Change Hazards Division, Aaryanak, Guwahati, Assam</p>
17:00 – 17:05 pm	Closing Remarks	Mr. Greg Browder , Lead WRM Specialist, World Bank

Annex-B: List of Participants

Workshop on "Improving Flood and Drought Governance : Applying The EPIC Response Framework, 28th April,2023, The World Bank , Hindustan Times Building , New Delhi, India

A. In-Person Participants

S.No.	ORGANIZATION	NAME OF PARTICIPANT	DESIGNATION
1	THE WORLD BANK	Mr. Greg Browder	Lead Water Resources Management Specialist
2		Ms. Hila Cohen Mizrav	Consultant, World Bank, USA, & EPIC Program Coordinator
3		Ms. Urmila Chatterjee	Senior Water Economist
4		Ms. Sumila Gulyani	South Asia Water Practice Manager
5		Mr. Anup Karanth	Senior Disaster Risk Management Specialist
6		Mr. Jai Mansukhani	Senior Program Associate
7		Mr. Parth Gupta	Consultant
8	DELTARES, THE NETHERLANDS	Dr. Sepehr Eslami Arab	Senior Researcher/ Advisor
9	CENTRAL WATER COMMISSION, MINISTRY OF JAL SHAKTI, GOVT. OF INDIA	Mr. Kushvinder Vohra	Chairman
10		Mr. Rishi Srivastava	Chief Engineer, BPMO
11		Mr. Vimal Kumar	Director, WM DTE.
12		Ms. Chetna	Deputy Director Hyd (S) Dte
13		Ms. Cini Menosh	Deputy Director, FM Dte
14		Mr. Pranav Shukla	Deputy Director, FCA-I DTE
15		Mr. Rakesh Kumar Gupta	Deputy Director, FMP Dte
16		Ms. Kritika Lila	Deputy Director, RO Dte
17	NATIONAL INSTITUTE OF HYDROLOGY, INDIA	Dr. R.P. Pandey	Scientist G & Head, Environmental Hydrology Division and Member-Secretary, Indian National Committee on Climate Change
18		Dr. Pankaj Mani	Scientist G , Flood
19		Dr. Ravi Galkate	Scientist F & Head
20	INDIAN AGRICULTURAL RESEARCH INSTITUTE, MINISTRY OF AGRICUTURE, GOVT. OF INDIA	Dr. Vijay Kumar Prajapati	Scientist, Water Technology Centre
21		Dr. Ravindra Kaur	Principal Scientist, Water Technology Centre, Indian Agricultural Research Institute (IARI), Government of India
22	FLOOD AND RIVER EROSION MANAGEMENT AGENCY OF ASSAM (FREMAA), WATER RESOURCES DEPTT., GOVT. OF ASSAM, INDIA	Mr. Bhaskar Jyoti Das	Chief Technical Officer, FREMAA cum Director Planning, WR Department, Govt. of Assam
23		Mr. Pranab Baruah	Assistant Engineer, Water Resources Department
24	INDIAN METEOROLOGICAL DEPARTMENT (IMD), MINISTRY OF EARTH SCIENCE, GOVT. OF INDIA	Mr. Rahul Saxena	Scientist F, Hydrometeorology Division, IMD
25	INTERNATIONAL WATER MANAGEMENT INSTITUTE (IWMI) - NEW DELHI, INDIA & COLOMBO, SRI LANKA	Dr. Alok Sikka	India Representative, New Delhi
26		Dr. Giriraj Amarnath	Research Group Leader – Water Risk to Development and Resilience, Colombo, Sri Lanka

27	NATIONAL INSTITUTE OF DISASTER MANAGEMENT (NIDM), MINISTRY OF HOME AFFAIRES, GOVT. OF INDIA	Mr. Rajendra Ratnoo, IAS	Executive Director
28	BIHAR STATE DISASTER MANAGEMENT AUTHORITY (BSDMA), GOVT. OF BIHAR, INDIA	Mr. Pravin Kumar	Project Officer (Natural Disaster)
29	BIHAR STATE DISASTER MANAGEMENT AUTHORITY (BSDMA), GOVT. OF BIHAR, INDIA	Dr. V S Prakash	Former Founder and Special Director, Karnataka State Natural Disasters Monitoring Centre (KSNDMC), Director, Karnataka Drought Monitoring Cell
30	ODISHA STATE DISASTER MANAGEMENT AUTHORITY (OSDMA), GOVT. OF ODISHA, INDIA	Mr. Sabya Sachi Hota	Chief General Management
31	AARYANAK, GUWAHATI, ASSAM, INDIA	Dr. Partha Jyoti Das	Head, 'Water, Climate & Hazard Division'
32	WAPCOS LIMITED, GURUGRAM, HARYANA, INDIA	Mr. Anupam Mishra	Director (Commercial & HRD)
33		Mr. Sarbjit Singh Walia	Chief Manager Level-I
34		Mr. Vimal Chander	Chief Manager Level-I
35		Mr. Rahul Saraswat	Dy. Manager (Liaison)
36		Mr. Rohit Chidwal	Junior Assistant
37		Ms. Anshul M Deol	Additional Chief Engineer, Environment & Construction Management
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40		Ms. P Sumana	Senior General Manager (Hydro Power), Dam & Reservoir Engineering and Hydro Power Division
41		Mr. Kishore Sarma	Chief Engineer Level-II , Dam & Reservoir Engineering and Hydro Power Division
42		Mr. Rajeev Singh	Additional Chief Engineer, Dam & Reservoir Engineering and Hydro Power Division
43		Ms. Neha Bansal	Senior Engineer, Dam & Reservoir Engineering and Hydro Power Division
44		Mr. Vinodh Kumar	Dy. Chief Engineer, INFS-IV Division
45		Mr. Krishna Yadav	Senior Engineer, INFS-IV Division
46		Mr. Gaurav Malhotra	Chief Engineer, Level-I, WRD Division
47		Mr. Rakesh Dhapola	Chief Engineer, Level-II, WRD Division
48		Mr. Harish Gangwar	Senior Engineer, WRD Division
49	Mr. Deepak Lakhanpal	Chief Engineer, Level-I, INFS-II Division	
50	Mr. Manish Kumar	Senior Engineer, INFS-I Division	
51	Mr. Mehul Kumar	Engineer, INFS-I Division	
52	INTERNATIONAL COMMISSION ON IRRIGATION AND DRAINAGE (ICID), NEW DELHI, INDIA	Mr. A B Pandya	Regional Council Member, GWP-South Asia, Secretary General, ICID, & Former Chairman, Central Water Commission
53		Mr. H.K. Varma	Executive Director

54	PRAGYA, GURUGRAM, HARYANA, INDIA	Ms. Sejuti Basu	Senior Manager -Research & Advocacy Team
55	TARU LEADING EDGE, NEW DELHI, INDIA	Mr. Jay A Shah	Senior Consultant
56	INDIA WATER PARTNERSHIP, GURUGRAM, HARYANA, INDIA	Dr. Veena Khanduri	Executive Secretary-cum-Country Coordinator
57		Mr. Mangla Rai	Project officer
58		Mr. Neeraj	Accounts-cum-admin officer
59		Mr. Nipun Kaushik	Social Media Consultant

B. Online Participants List

S.No.	ORGANIZATION	NAME OF PARTICIPANT	DESIGNATION
60	THE WORLD BANK	Mr. Chabungam Rajagopal Singh	Senior Water Resources Management Specialist
61		Mr. Shunong Hu	Senior Water Engineer
62		Ms. Sona Thakur	Senior External Affairs Officer
63		Ms. Arushi Sood	Financial Management Specialist
64		Ms. Mariappa Kullappa	Senior Water Supply and Sanitation Specialist
65		Ms. Eisse Wijma	Consultant
66		Ms. Anju Gaur	Senior Water Resources Management Specialist
67		Ms. Hiromi Yamaguchi	Consultant
68		Ms. Vinita Daryani	External Affairs Associate
69		Ms. Neha Vyas	Senior Environmental Specialist
70		Mr. G Srihari	Senior Social Development Specialist
71		Mr. Avijit Ghosh	Senior Environmental Specialist
72		Mr. Satyanarayan Panda	Water Resources Specialist
73		Mr. Basharat Ahmed Saeed	Senior Procurement Specialist
74	GLOBAL WATER PARTNERSHIP, STOCKHOM, SWEDEN	Mr. Valentin Aich	Senior Water & Climate Specialist, Network Specialist for Central Asia and Caucasus, GWP
75	GLOBAL WATER PARTNERSHIP –SOUTH ASIA, COLOMBO, SRI LANKA	Ms. Kusum Athukorala	Chair
76		Mr. Lal Induruwage	Regional Coordinator
77		Ms. Diluka Piyasena	Regional Communication Coordinator
78	DELTARES, THE NEITHERLANDS	Ms. Ana Nunez Sanchez	Expert Advisor, Resilience and Planning Department
79		Isten Tamba	Jr. Advisor on Marine and Coastal System
80		Eva Costa de Barros	Governance and Climate Change Adaptation Specialist
81	INTERNATIONAL WATER MANAGEMENT INSTITUTE (IWMI), COLOMBO, SRI LANKA	Mr. Matthew McCartney	Research Group Leader - Sustainable Water Infrastructure & Ecosystems
82	KARNATAKA STATE DISASTER MANAGEMENT AUTHORITY	Dr. Manoj Rajan,	I.F.S Special Secretary, Food Processing & Harvest Technology, Government of Karnataka and Commissioner, KSDMA
83	KERALA STATE DISASTER MANAGEMENT AUTHORITY (KSDMA), GOVT. OF KARNATAKA, INDIA	Dr. Sekhar Lukose Kuriakose	Member Secretary
84	FLOOD AND RIVER EROSION MANAGEMENT AGENCY OF ASSAM (FREMAA), WRD, ASSAM, INDIA	Dr. Jeevan B, I.A.S	Chief Executive Officer

85	INDIA WATER PARTNERSHIP, GURUGRAM, HARYANA, INDIA	Mr. A.C. Tyagi	Vice- President & Former Secretary General, International Commission on Irrigation & Drainage
86		Ms. Preeti Madan, I.E.S	Regional Council Member, GWP-South Asia & Former Principal Economic Advisor, Department of Industrial Policy & Promotion, Government of India
87	NATIONAL INSTITUTE OF HYDROLOGY, ROORKEE, UTTARAKHAND, INDIA	Dr. S.K. Jain	Former Director, National Institute of Hydrology, Roorkee
88	KSCSTE-CENTRE FOR WATER RESOURCES DEVELOPMENT AND MANAGEMENT, INDIA	Dr. Sarathjith M C	Scientist B, Land and Water Management Research Group
89		Ms. Sharannya TM	Scientist B, Hydrology and Climatology Research Group
90	INDIAN INSTITUTE OF TECHNOLOGY (IIT), ROORKEE, INDIA	Prof. Mahua Mukherjee	Head, Department of Architecture & Planning
91	YUVA GRAM VIKAS MANDAL, BEED, MAHARASHTRA	Mr. Santosh Repe	Administrative Officer
92	NAVDEEP, INDORE, MADHYA PRADESH	Mr. Ravindra Shukla	Chairman
93	RURAL INTEGRATED AND SOCIAL EDUCATION SOCIETY (RISES), ANDHRA PRADESH	Mr. A.Narayana Reddy	Director
94	SAFE WATER NETWORK INDIA, NEW DELHI, INDIA	Ms. Reena Kumari	Research Manager
95	JANHIT FOUNDATION, MEERUT, UTTAR PRADESH, INDIA	Ms. Anita Rana	Director
96	HUMANITY, JHARKHAND, INDIA	Mr. Ajay Kumar	Chief Functionary
97	UDYAMA, BHUBANESHWAR, ODISHA, INDIA	Mr. Pradeep Mohapatra	Team Leader
98	JS ENERGY LIFE CO., GURUGRAM, HARYANA, INDIA	Ms. Michi Suniya	Deputy Manager (R&D and Technical Support)
99	ORGANIZATION NAME NOT KNOWN	Mr. Varun Shankar	Designation not known
100	ORGANIZATION NAME NOT KNOWN	Dr. Mohammad	Designation not known

**Workshop on
“Improving Flood and Drought Governance: Applying the EPIC Response Framework”
organized on April 28, 2023 at New Delhi, India**

S.No.	Title of Presentation	Name of Presenter
Inaugural Session (Morning)		
1.	Presentation on EPIC Response Framework	Mr. Greg Browder, Lead WRM Specialist, USA
2.	EPIC Response Assessment Methodology (ERAM) Tool and its Application	Ms. Ana Nunez Sanchez, Expert Advisor, Resilience Department, Deltares, The Netherland (Online)
3.	Managing Flood and Drought together- An Overview on Practical Approaches	Mr. Valentine Aich, Senior Water & Climate Specialist, Network Specialist for Central Asia and Caucasus, GWP (Online)
4.	Experience sharing on Integrated Drought & Flood Risk Management based on States Perspective	Mr. Giriraj Amarnath , IWMI Colombo and Dr. Alok Sikka IWMI, New Delhi
Session on Governance Challenges on Flood and Drought Management in India: National & State Perspectives (Afternoon)		
5.	Flood and Erosion Management in Assam	Mr. Bhaskar Jyoti Das, Chief Technical Officer, FREMAA, Water Resources Department, Government of Assam
6.	Improving Flood and Drought Governance: Applying the EPIC Response Framework	Mr. Pravin Kumar, Project Officer (Natural Disaster), Bihar State Disaster Management Authority (BSDMA)
7.	Improving Flood and Drought Governance: Applying Epic Response Framework	Dr. V S Prakash, Former Special Director, Karnataka State Natural Disasters Monitoring Centre (KSNDMC) & Former Director, Drought Monitoring Cell, Karnataka
8.	Drought Risk Assessment: Odisha	Mr. Sabyasachi Hota, Chief General Manager, Odisha State Disaster Management Authority (OSDMA)
9.	Improving Flood and Drought Governance : National Perspective on Meteorological Drought	Mr. Rahul Saxena, Scientist “F”, Indian Meteorological Department (IMD), Government of India





About the Organizers

The World Bank

The World Bank is an international development organization owned by 187 countries. Its role is to reduce poverty by lending money to the governments of its poorer members to improve their economies and to improve the standard of living of their people.

World Meteorological Organization (WMO)

The World Meteorological Organization (WMO) is a specialized agency of the United Nations responsible for promoting international cooperation on atmospheric science, climatology, hydrology and geophysics.

Deltares, Netherlands

Deltares is an independent institute for applied research in the field of water and subsurface. Throughout the World the Deltares work on smart solutions, innovations and applications for people, environment and society.

Global Water Partnership

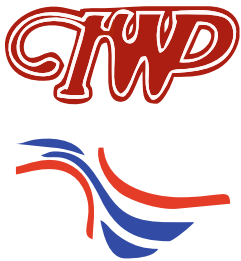
The Global Water Partnership or GWP is a global action network with over 3,000 Partner organizations in 179 countries. The network has 77 accredited Country Water Partnerships and 13 Regional Water Partnerships including GWP South Asia. The partnership provides opportunities to leverage the knowledge and expertise of GWP and allows development of collaborative programmes and resource mobilization.

India Water Partnership (IWP)

India Water Partnership (IWP) is a non-profit organization with the goal of promoting and supporting Integrated Water Resources Management (IWRM) in India. The IWP has also been accredited by the Global Water Partnership (GWP) as Country Water Partnership of GWP, thus, also known as GWP-India. IWP works on water security in India. IWP carries out dispassionate analysis of various water related issues and steers the policy discourse on social, economic, ecological on the scientific basis.

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