SAARC

Disaster Management Centre (IU)

Technical Proceedings of Workshop on **Building Resilient Cities: Strategies for Effective Urban Flood Management**

Contents

Introduction

Urban flooding in the SAARC region is an escalating threat, driven by a combination of climate change, rapid urbanization, and inadequate infrastructure and governance. As cities continue to expand, informal settlements often develop in flood-prone areas, lacking proper drainage systems, flood protection, and effective urban planning. Combined with extreme weather, such as heavy rainfall and rising sea levels, urban flooding is now a major issue in cities across the SAARC member states. In 2024, more than 50 million people were affected in all of these member states.

The impacts of urban flooding in the SAARC region are devastating, with widespread loss of life, displacement of populations and destruction of homes, infrastructure and essential services like water supply, sanitation and healthcare. The projections show that climate change could increase the economic cost of urban floods in South Asia by up to $23 billion annually by 2050. Vulnerable communities, particularly those living in informal settlements in flood-prone areas, are the most affected, often suffering from poor recovery due to limited resources. In addition, floods result in significant environmental damage, eroding soil, polluting rivers and lakes and destroying vital wetlands that naturally help mitigate flooding. The contamination of water sources also increases the risk of waterborne diseases, exacerbating the public health crisis.

Despite these challenges, many cities in the SAARC region and globally are making strides in reducing urban flood risks and building resilience. These cities are adopting innovative solutions such as nature-based approaches, including green infrastructure (e.g., parks, wetlands, and permeable surfaces), improved urban planning and upgraded drainage systems. This workshop will serve as a platform to learn from these successful practices, share experiences and explore strategies to enhance urban flood resilience. By raising awareness of effective flood management techniques and fostering regional collaboration, the workshop will equip participants with the knowledge and tools necessary to build more resilient cities through both technological and nature-based solutions.

Aim

The aim of the Training Workshop on Building Resilient Cities: Strategies for Effective Urban Flood Management for the SAARC Region is to equip participants with the knowledge, tools and strategies necessary to address urban flooding challenges in rapidly growing cities. The workshop will focus on practical approaches to reduce urban flood risks, build resilience and integrate sustainable solutions, including nature-based strategies, in urban planning and disaster risk management.

Objectives

1. Raise awareness about the growing threat of urban flooding in SAARC cities, its impacts and the urgent need for effective flood management strategies to ensure urban resilience.
2. Share successful case studies and good practices from cities in the SAARC region and globally that have effectively reduced flood risks and built resilience through innovative solutions, including green infrastructure, improved drainage systems and urban planning.
3. Highlight the role of nature-based solutions, such as wetlands, green roofs, permeable surfaces, etc. in managing storm water and enhancing urban flood resilience.
4. Create a platform for participants to collaborate, share experiences and discuss the challenges and opportunities in urban flood management across the SAARC region.

Enhance the capacity of participants to design and implement flood risk management plans and urban resilience strategies that integrate both technological solutions and nature-based approaches

Workshop Overview

The SAARC Disaster Management Centre (IU) organized the virtual workshop on '**Building Resilient Cities: Strategies for Effective Urban Flood Management**' during 27-29 January 2025 for the SAARC Member States.

The workshop brought together 43 officials from five SAARC Member States: India, Maldives, Nepal, Pakistan and Sri Lanka. Participants represented various departments within their respective countries, including National Disaster Management Authorities, Response Forces, Ministries of Home and Foreign Affairs, Local Government, Urban Development & Housing Departments., etc.

The three-day virtual workshop featured a comprehensive blend of technical sessions and case studies presented by experts in their respective fields. The sessions provided valuable insights into urban flood management strategies, innovative solutions and good practices. On the final day, each participating country delivered detailed presentations highlighting their successful initiatives, good practices and the challenges they face in managing urban floods. They also shared practical solutions and mitigation strategies adopted to address these pressing issues.

This report provides a detailed account of the workshop proceedings, capturing key discussions, expert insights and country presentations. For further reference, the complete workshop agenda and the list of participants are included as Annexure 1 and Annexure 2, respectively.

Proceedings of the Sessions

Inaugural Session

Mr. Nisarg Dave, I/c Specialist, SDMC (IU) welcomed all the participants to the three-day virtual workshop on '**Building Resilient Cities: Strategies for Effective Urban Flood Management** 'from 27-29 January 2025.

Dr. Rajiv Kumar Gupta IAS (Retd.), Director, SDMC (IU) addressed the delegates and highlighted the need of effective urban flood management in South Asian Region. He emphasized the devastating impacts of urban floods, including the displacement of communities, damage to infrastructure and contamination of water supplies, which left millions vulnerable to health and livelihood risks. He stressed the urgent need for a shift from reactive responses to proactive, sustainable solutions. These include flood-resilient infrastructure, integrated urban management plans, IoT-based early warning systems, rainwater harvesting, and nature-based approaches like the "sponge city" model.

He highlighted the importance of public-private partnerships (PPP) and collaborative regional efforts to tackle urban flooding comprehensively. The workshop, he noted, would explore regional risks, innovative techniques and case studies while fostering dialogue on building resilient urban infrastructure and long-term recovery.

In conclusion, the speaker urged participants to move from awareness to action and use this workshop as a platform for shared learning and innovation, contributing to the achievement of key Sustainable Development Goals

The inaugural session concluded with a group photo as mentioned below:

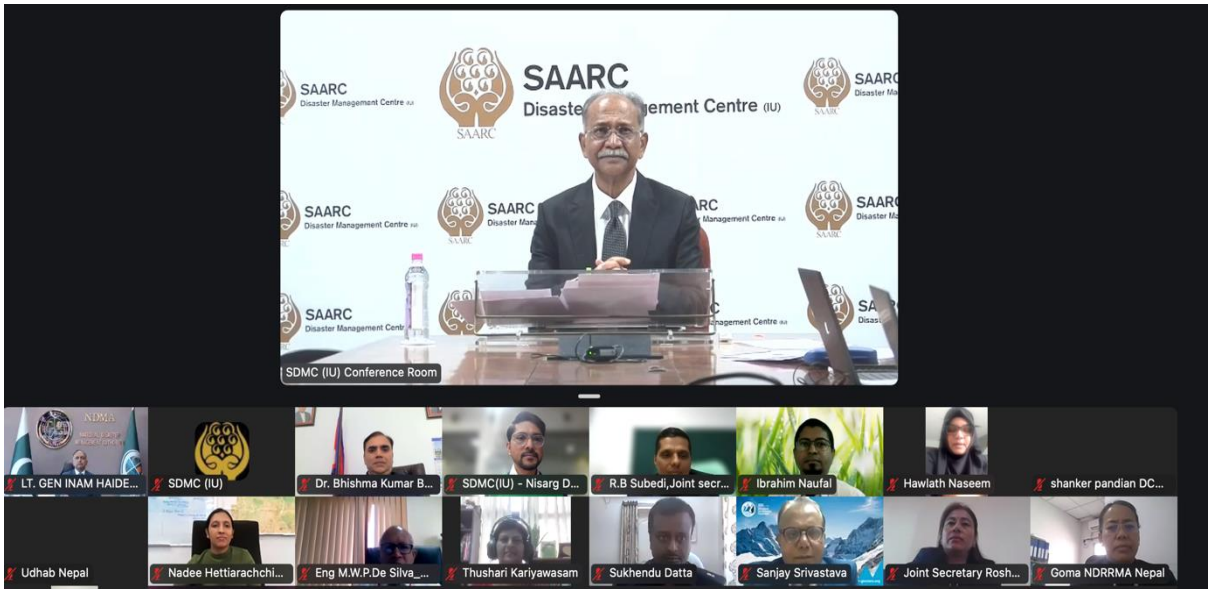


Figure 1 Director, SDMC (IU) and delegates from SAARC Member States during the group photo. Dated on 27th January 2025

Technical Sessions

1. Extreme Weather Events and Urban Floods: Risks and Opportunities in the SAARC Region

Dr. Sanjay Srivastava, Chief of Disaster Risk Reduction, UNESCAP

Dr. Srivastava delivered a comprehensive session on the economic losses caused by extreme weather events and outlined actionable strategies for countries in the region. Drawing from the findings of the UNESCAP Disaster Report for South and South West Asia 2024, he highlighted that over the past five decades, approximately 3 billion people were affected, and 1 million fatalities were recorded. Economic damages amounted to $485 billion, accounting for 17% of total disaster-related losses in the Asia-Pacific region.

He identified several multi-hazard risk hotspots across South Asia, including:

- Hindu Kush Himalaya Region: Prone to glacial lake outburst floods (GLOF), earthquakes and avalanches
- Indus River Basin: Vulnerable to floods and droughts
- Ganga-Brahmaputra-Meghna River Basin: Affected by floods and droughts
- Indian Ocean Region: Susceptible to tsunamis

In these densely populated areas, risks are escalating due to urbanization, population growth, limited resources and unplanned development. Alarmingly, more than 50% of the population in South Asia is projected to reside in 26 cities classified as extreme high-risk zones.

Dr. Srivastava emphasized the need for increased investments in adaptation, noting that current investments are insufficient and not risk-informed compared to the Average Annual Losses (AAL). He further stressed the adverse impact of disasters and climate risks on key Sustainable Development Goals (SDGs), particularly SDG 13 (Climate Action), SDG 1 (No Poverty), SDG 11 (Sustainable Cities and Communities) and SDG 15 (Life on Land).

To address these challenges, he recommended:

- Investing in Early Warning Systems for All: Including sector-specific early warnings
- Nature-based Solutions (NbS): For environmental restoration
- Comprehensive Disaster and Climate Risk Management: Leveraging opportunities for better preparedness
- Technology Clusters: Promoting science-based technologies for climate, agriculture, and health, alongside innovative technologies for infrastructure and energy
- Data Science and Geospatial Technology: For risk assessment and decision-making

Dr. Srivastava also encouraged participants to utilize the UNESCAP Risk and Resilience Portal for supporting risk-informed adaptation and resilience strategies. Citing the 2004 Tsunami as an example, he underscored the importance of regional cooperation in disaster preparedness and response.

2. Smart Cities and Floods: Innovative Techniques for Urban Flood Reduction
Mr. Kamlesh Yagnik, Chief Resilience Officer, Surat

The session highlighted Surat's transformation into a model for urban flood management and climate resilience in India. As the eighth-largest and fourth-fastest-growing city, Surat has faced recurring floods, with the 2006 flood being one of the most devastating. Post the construction of the Ukai Dam, flooding patterns changed, prompting the city to adopt a comprehensive, multi-pronged approach to flood mitigation.

Key initiatives undertaken by the city include:

- Infrastructure Improvements: Construction of embankments, flood retention walls and an upgraded stormwater drainage system.
- Proactive Measures: Removal of encroachments along riverbanks, establishment of an early warning system and the development of disaster management plans at both city and ward levels.
- Technology Integration: Use of advanced rainfall forecast models, such as the Multi-Model Ensemble Model (IMD), Weather Research and Forecasting Model (European sources), and Global Forecast System (NASA), to generate inflow forecasts for the Ukai Dam and assess flood scenarios across wards.
- Risk Communication: Implementation of an innovative color-coded pole system to communicate flood risk to the public.
- Slum Relocation: Resettlement of communities to EWS housing, ensuring better safety and living conditions.

To further enhance climate resilience, Surat has installed automatic weather stations and participates in the Asian Cities Climate Change Resilience Network. Collaboration with national agencies, including the Indian Meteorological Department (IMD), IIT Delhi, and the Narmada Water Resources & Water Supply Department, Government of Gujarat plays a crucial role in risk assessment, reservoir management, and early warning systems.

The city updates its Disaster Management Plans annually in coordination with Gujarat State Disaster management authority (GSDMA), and each zone maintains its own Zone Disaster Management Plan (ZDMP) with regular training on flood management for local teams.

During the interactive session, delegates from Nepal and Pakistan inquired about community reactions to the relocation process and associated challenges. The speaker highlighted the importance of community engagement and long-term stakeholder consultations in facilitating smooth relocations and establishing necessary social infrastructure. The insights shared underscored Surat's commitment to continuous improvement and building a more resilient and adaptive urban environment.

3. Community Engagement and Citizen Participation in Flood Risk Reduction

Dr. Sumedha Dua, Sustainable Environment and Ecological Development Society (SEEDS)

Dr. Dua presented an insightful session on the critical role of community engagement and the application of technology in flood risk reduction in India. Highlighting the country's vulnerability, she noted that India ranks second in disaster risk according to the World Risk Index 2022, with floods causing widespread loss of life and severe economic disruptions.

To address these challenges, SEEDS has leveraged technology for improved risk assessment using AI and machine learning models. Key initiatives include:

- Localized Impact Assessments: AI models generate hyper-local assessments to identify vulnerabilities and predict flood impacts.
- Cyclone Fani Case Study: High-resolution satellite imagery was used to identify building roof types. With assistance from Microsoft scientists, a training dataset of 50,000 roofs was developed to inform disaster preparedness.
- AI for Resilient Cities Model: This model follows a structured four-step process:
    - Developing a cluster-wise hazard risk register
    - Creating a risk scoring matrix
    - Conducting hyper-local assessments
    - Generating outputs, including risk reports, dashboards, and geospatial data categorized by roof types

The model has been successfully scaled to address multiple hazards, such as heatwaves, earthquakes and floods. During Cyclone Nivar, the AI model identified over 30 vulnerable areas in Chennai, enabling advisories and targeted preparedness efforts. Volunteers played a vital role in assisting community groups during Cyclones Nisarga (2020) and Tauktae (2021) as well.

Dr. Dua underscored the significant benefits of AI-driven risk assessments, including:

- Enhanced Community Resilience: By facilitating timely evacuations and issuing actionable advisories
- Economic Protection: Minimizing household asset losses, safeguarding livelihoods and reducing debt burdens
- Health and Sanitation Improvements: Ensuring secure drinking water and reducing waterborne disease risks

- Government Collaboration: Partnering with government agencies for surveys, awareness campaigns and workshops

In conclusion, Dr. Dua emphasized that AI-led hyper-local assessments empower communities, increase accountability and strengthen resilience against disasters.

4. Building Resilient Urban Infrastructure and Services
Dr. Umamaheshwaran Rajsekhar, Coalition of Disaster Resilient Infrastructure (CDRI)

Dr. Rajsekhar provided a comprehensive overview of the Coalition for Disaster Resilient Infrastructure (CDRI), a global partnership that brings together national governments, UN agencies, multilateral development banks, the private sector and knowledge institutions. The coalition's primary goal is to enhance the resilience of infrastructure systems against climate and disaster risks, contributing to sustainable development.

Key Discussion Highlights:

- Impact of Hazards on Infrastructure: Dr. Rajsekhar highlighted the vulnerability of critical urban sectors, such as mobility, buildings, energy and water, to climate-related hazards.
- Urban Infrastructure Resilience Program (UIRP): This initiative aims to improve urban livability in low- and middle-income countries through resilient infrastructure planning and data-driven decision-making to manage urban shocks and stresses.
- Urban Planning Solutions: Dr. Rajsekhar emphasized the importance of network-based planning over traditional Land Use and Land Cover (LULC) approaches.

Case Studies and Innovative Solutions:

- Nature-Based Solutions (NbS): Examples included the Green Pedestrian Axis in Tokyo, East Kolkata Wetlands Management, Adyar River Restoration in Chennai and Mangrove Management in Mumbai.
- Engineering Solutions: Notable examples included flood barriers at The Maeslantkering in Rotterdam and The Thames Barrier in London; advanced storm water management at the Floodwater Diversion Facility in Tokyo, Storm water Storage Scheme in Hong Kong, and the Chicago Deep Tunnel; and rainwater harvesting initiatives at both community and building levels, such as Parkroyal Collection Pickering in Singapore.
- Hybrid Solutions: Good practices included the Wetland Restoration Project in Dhaka and the Chulalongkorn University Centenary Park.

Policy Solutions: Dr. Rajsekhar emphasized the need for comprehensive flood management strategies, including:

- Land use planning and building regulations to prevent development in flood-prone areas
- Storm water harvesting ordinances and flood risk maps
- Flood risk assets registers and awareness programs for community preparedness
- Emergency response plans and technical guidance through a code of practice
- Financial mechanisms, including revenue sources, subsidies, and incentives

Dr. Rajsekhar emphasized the critical need for developing state-of-the-art urban infrastructure to enhance resilience against disasters. He highlighted the importance of establishing dedicated city disaster management cells to coordinate preparedness and response efforts effectively. Additionally, he stressed the need for maintaining comprehensive repositories of floodplain maps to guide urban planning and risk assessment. Implementing advanced dam management systems was identified as a key measure to control water flow during extreme weather events. Strengthening early warning mechanisms to ensure timely alerts and proactive measures was also underscored as a crucial component for safeguarding urban communities. He concluded by emphasizing that urban resilience requires a collaborative approach involving government agencies, community stakeholders, and technological innovations to build safer, more sustainable cities.

5. Integrating Nature-Based Solutions into Urban Flood Management

Dr. M. B. Joshi, Consultant, Gujarat Institute of Disaster Management

Dr. Joshi highlighted the multifaceted challenges associated with urban flood management, emphasizing the impact of rapid urbanization, climate change and aging infrastructure. He explained how urbanization exerts pressure on natural watercourses, increasing flood risks as impervious surfaces such as roads and buildings limit water infiltration and heighten runoff volumes. Climate change compounds this issue by altering precipitation patterns, leading to more frequent and intense rainfall events, thereby increasing both the frequency and severity of urban floods. Additionally, aging flood infrastructure in many urban areas lacks the capacity to manage rising runoff volumes and remains prone to failures.

To address these challenges, Dr. Joshi outlined several flood conveyance strategies, including channel improvements, floodplain restoration, and the construction of bypass channels. He shared examples of effective flood management practices from various regions in India, such as the innovative flood mitigation measures at Khambhati Khuva and the Ukai Dam in Surat, Gujarat, as well as traditional water management systems at Jaigarh Fort in Rajasthan.

He also presented case studies around the world, such as Water-Sensitive Urban Design in Rotterdam, Netherlands; Green Infrastructure initiatives in Chicago, USA; Cloudburst Management in Copenhagen, Denmark; and Comprehensive Flood Management practices in Singapore. These examples illustrated a range of innovative approaches that have successfully addressed flood risks while enhancing urban resilience.

Dr. Joshi concluded by critically addressing the gap between theoretical frameworks and their real-world applications. He emphasized the need for customized solutions tailored to the unique challenges of different urban areas, stressing that a one-size-fits-all approach is inadequate. With over two-thirds of the global population expected to reside in urban areas by 2050, he underscored the immense long-term value of investing in well-planned and resilient cities.

He further recommended that stormwater drainage planning incorporate climate resilience measures using Representative Concentration Pathway (RCP) 8.5 or higher scenarios. While acknowledging significant progress in urban planning and infrastructure development, Dr. Joshi emphasized the importance of continuous knowledge sharing and collaborative efforts to drive sustainable and effective urban flood management solutions for the future.

Case Studies

Case Study1: Innovative Approaches to Urban Flood Risk Reduction (South Korea)

Mr. Sanjaya Bhatia, Head, UNDRR GETI ONEA

Mr. Sanjaya Bhatia introduced the Making Cities Resilient (MCR2030) initiative and provided valuable insights into its role as a city network for knowledge sharing on urban resilience. He highlighted that the initiative offers a self-assessment tool to assist local governments in adopting people- and nature-centered, multi-hazard approaches to early warning systems.

As a case study, Mr. Bhatia presented the Disaster Resilience Scorecard Application for Flood Risk Reduction in Ulsan Metropolitan City, South Korea. Ulsan has been conducting annual scorecard assessment workshops led by the Ulsan Research Institute since 2018. The outcomes of these assessments inform policy enhancements and the development of new urban resilience strategies. Under MCR2030, Ulsan is creating a comprehensive Urban Master Plan based on risk analysis, integrating disaster risk prevention into urban management strategies and ensuring risk assessments for development projects. Notable efforts include the development of an ecological city around the Taehwa River and the preservation of a 40km bamboo forest, which functions as a natural disaster buffer and vital habitat for migratory

birds. Additionally, Ulsan is collaborating with the National Disaster Management Research Institute to strengthen disaster preparedness.

The speaker highlighted the Leading City Project under MCR2030, which emphasizes green infrastructure through water circulation strategies. Key disaster mitigation measures include the seismic reinforcement of public facilities and bolstering the resilience of lifelines and public services.

Beyond Ulsan, Mr. Bhatia presented other notable initiatives. He mentioned Korea Safe Net, a unified broadcast system designed for rapid emergency responses, and Jakarta's Smart Emergency Response System, which integrates multiple crowdsourced platforms into a centralized control room for real-time flood forecasting and emergency management. In the context of transboundary risk management, the Central Asian Flood Early Warning System (CAFEWS) was highlighted as a shared virtual platform for data exchange, weather monitoring and flood forecasting, serving countries such as Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, Uzbekistan and Afghanistan. This initiative enhances regional disaster preparedness by delivering accurate hydrometeorological information.

Mr. Bhatia also emphasized the importance of multipurpose infrastructure projects, citing the Kuala Lumpur Stormwater Management and Road Tunnel (SMART) as a global best practice. This innovative tunnel diverts floodwater from the city's financial district while serving as a roadway. Its dual-function design ensures a high safety margin essential for critical infrastructure. Since its inception, the SMART tunnel has been activated 114 times, successfully preventing at least seven major flash floods and saving hundreds of millions in potential economic losses.

Concluding the session, Mr. Bhatia referenced the catastrophic Dubai floods of 2024, urging delegates to acknowledge the increasing intensity of natural hazards and the unprecedented scale of losses and damages. He emphasized the urgent need for proactive disaster risk reduction measures and global collaboration to build resilient urban environments.

Case Study 2: Rebuilding Resilience: Lessons learned from recent floods to improve long term recovery
Dr. Sekhar L. Kuriakose, Kerala State Disaster Management Authority

Kerala has been recognized for its proactive disaster management efforts, emphasizing human resource development, institutional strengthening at both state and district levels and the decentralization of disaster management to Local Self-Governments (LSGs). The state has also prioritized climate change awareness and disaster risk reduction through resilient housing initiatives.

In 2018, Kerala experienced catastrophic floods that affected all 14 districts and submerged 687 sq. km of land. Additionally, a multi-hazard scenario unfolded as landslides impacted 1,260 villages, further exacerbating the crisis. In response, the 2019 Local Government Disaster Management Plans (LGDMPs) marked a paradigm shift by empowering LSGs as frontline entities with the necessary authority, funds, and resources to implement disaster resilience measures effectively. This initiative has focused on downscaling spatial risk information for localized planning, ensuring comprehensive disaster management plans for all LSGs, and addressing climate change impacts at the grassroots level.

To enhance disaster communication, the CAP-integrated Location-Based Public Messaging System, developed by CDoT with funding from NDMA, has been operational in Kerala since 2018. Furthermore, KaWaCHaM, an advanced disaster warning system integrating alerts, sirens, and global weather models, has significantly improved the state's early disaster preparedness and public safety.

Key initiatives undertaken include Operation Breakthrough (2019), which addresses pluvial flooding, the construction of resilient housing for indigenous communities, and the integration of social technology alongside technical solutions. These measures reflect Kerala's commitment to an inclusive approach to Disaster Risk Reduction (DRR), emphasizing the empowerment of local governments and communities as the cornerstone of true resilience, rather than relying solely on technological advancements.

The workshop discussions underscored the importance of continued investment in local-level resilience strategies, community participation, and innovative solutions that balance social and technological interventions. These efforts collectively contribute to a more sustainable and adaptive disaster management framework for Kerala and serve as a model for other regions facing similar challenges.

Case Study 3: Lessons learned from Recent Flood: Improving Response and Preparedness

Mr. Piyush Anand IPS, Director General, National Disaster Response Force (NDRF)

Mr. Piyush presented an in-depth overview of India's vulnerability to natural hazards and the critical role of the National Disaster Response Force (NDRF) in flood management. He outlined that India faces a spectrum of disasters, including earthquakes, droughts, floods, cyclones and landslides. The NDRF operates across the country, with its presence established at 68 locations, comprising 16 battalion headquarters, 28 Regional Response Centres and 24 Temporary Placement Locations.

Mr. Piyush highlighted NDRF's deployment in major flood incidents, including the Srinagar Floods (2014), Chennai Floods (2015), Silchar Floods (2022), Delhi Floods (2023), Vadodara Floods (2024) and the most recent Vijayawada Floods (2024).

Addressing the challenges in flood management, he identified issues such as unreliable rainfall forecasting, inadequate stormwater drainage systems and the simultaneous release of reservoir waters that intensify urban flooding. High-density settlements in floodplains, resource shortages, power outages and communication breakdowns further complicate response efforts. Post-flood complications, including health risks, drinking water scarcity, sanitation issues and difficulties in animal evacuation, are compounded by misinformation, media pressure and public panic.

During rescue operations, challenges include evacuation reluctance, prioritization dilemmas, navigation difficulties in narrow lanes and law and order concerns. Life-threatening hazards for responders and coordination difficulties when local officials are unavailable also delay effective relief efforts.

Mr. Piyush highlighted the significant improvements in NDRF's preparedness and response capabilities, driven by lessons learned from past incidents. He emphasized key strategies such as the tactical pre-positioning of NDRF and State Disaster response Force (SDRF) teams in hotspot cities to ensure rapid response during emergencies. Mock exercises and capacity-building initiatives have been pivotal in enhancing operational efficiency and disaster readiness. Strengthened inter-agency coordination, communication redundancies and the adoption of a clear Incident Response System (IRS) were also underlined as critical measures for streamlined disaster management. Community involvement plays a vital role, with local guides and trained first responders, including Aapda Mitras and NYKS volunteers, contributing effectively to response efforts.

Mr. Piyush concluded by stressing the need for continued investment in capacity building, technological advancements and greater community engagement to ensure effective flood risk management and disaster response.

Country Presentations

Innovative Nature-Based Solutions into Urban Flood Management

1. India

Mr. Chandan Singh, Under Secretary (Mitigation), National Disaster Management Authority, India

Mr. Chandan Singh provided valuable insights into India's disaster management initiatives led by the National Disaster Management Authority (NDMA). He outlined NDMA's key responsibilities, including the development of national policies, plans, and

guidelines addressing various hazards, facility-specific measures, and cross-cutting issues. NDMA also plays a pivotal role in formulating disaster preparedness plans for different ministries, securing necessary approvals, and offering technical guidance to states and Union Territories (UTs).

Focusing on the workshop's central theme, Mr. Singh highlighted NDMA's efforts in flood management, including the development of guidelines, standard operating procedures (SOPs), and related protocols. Given India's susceptibility to multiple hazards, he stressed the critical need for proactive disaster risk reduction to safeguard lives and infrastructure.

He detailed several key flood management initiatives outlined in NDMA's guidelines, such as the enactment of Flood Plain Zoning Regulations, the implementation of flash flood forecasting and early warning systems, and the establishment of river basin organizations like the Brahmaputra Board and the Ganga Flood Control Commission (GFCC) to manage floods across various river basins. Additionally, he discussed the Urban Flood Risk Management Program (UFRMP), a comprehensive initiative running from 2021 to 2026 that aims to develop integrated flood management solutions in major cities, including Mumbai, Chennai, Kolkata, Bengaluru, Hyderabad, Ahmedabad, and Pune.

Concluding his presentation, Mr. Singh updated the delegates on the progress of UFRMP and other ongoing initiatives, emphasizing NDMA's commitment to strengthening India's resilience against disasters.

2. Maldives

Mr. Ibrahim Naufal, Contract Management Engineer, Ministry of Construction, Housing, and Infrastructure, Maldives

Mr. Ibrahim Naufal provided an overview of the Maldives, highlighting its geographical characteristics, total area, and vulnerability to climate change and rising sea levels. He explained that flooding in the Maldives primarily results from two types: pluvial flooding, caused by heavy rainfall, and coastal flooding, triggered by swells and storm surges. Due to the country's flat terrain and island-based geography, flood depth is typically less than 1 meter.

According to the Maldives Meteorological Service, the country receives an annual average rainfall of 2,000mm to 2,200mm. To mitigate flooding, the government has implemented various measures, including installing pumping stations, enhancing drainage systems, and designing coastal infrastructure with a 50-year lifespan while factoring in sea level rise.

Concluding his presentation, Mr. Naufal highlighted the significant economic impact of climate-induced disasters, with flood-related damages contributing millions of dollars between 2015 and 2022. He expressed his appreciation to the SDMC (IU) team for organizing the virtual workshop on this critical topic.

3. Nepal

Mr. Bhishma Kumar Bhusal, Joint Secretary, Ministry of Home Affairs, Nepal

Mr. Bhishma Kumar Bhusal emphasized Nepal's high susceptibility to various disasters, including earthquakes, floods and avalanches, ranking it as one of the most disaster-prone countries in the world. Among these hazards, floods account for approximately 40% of annual disasters, followed closely by landslides. He referenced the major floods in July 2024 and a Glacial Lake Outburst Flood (GLOF) in August, underscoring Nepal's ongoing vulnerability.

To enhance disaster preparedness, the National Disaster Risk Reduction and Management Authority (NDRRMA) has been installing multi-hazard Early Warning Systems (EWS) in high-risk areas. The BIPAD information ecosystem, a comprehensive digital platform, includes a web portal, mobile applications, an e-learning system, and a Reconstruction Management Information System (RMIS).

Addressing Nepal's key challenges—unplanned urbanization, damage to water infrastructure, and shifting river courses—he outlined several strategies:

- River protection and management
- Restoration of cultural and historical sites
- Improvement of river water quality and availability
- Capacity-building initiatives

Additionally, he highlighted new urban development projects such as the Valley Ring Road Development, beautification of the Bagmati River, river embankments, and strengthening of sewage treatment plants.

During the Q&A session, Mr. Bhusal addressed concerns about last-mile connectivity for the BIPAD portal, emphasizing its role as a people-centered Multi-Hazard Early Warning System (MHEWS) designed for broad accessibility.

4. Pakistan

Ms. Zahra Hassan, GM, Tech Early Warning, National Disaster Management Authority, Pakistan

Ms. Zahra Hassan provided an in-depth overview of Pakistan's disaster risks and the proactive measures implemented by NDMA, Pakistan. She highlighted the National

Emergency Operation Centre, showcasing graphical representations and real-time data monitoring, which enhance risk communication and outreach across the country.

Key flood management strategies include:

- Advanced forecasting systems
- GIS and Remote Sensing (RS) technologies for exposure assessment
- GIS-based Urban Flood Risk Assessment and HEC-RAS modeling for rivers such as Indus and Kabul and cities like Bahawalpur and Mardan.

She also discussed infrastructure loss assessments, emphasizing Pakistan's first national-level Infrastructure Risk Atlas. This initiative maps high-risk areas based on infrastructure vulnerabilities to floods and earthquakes, utilizing detailed building-type data.

To improve disaster response, NDMA has established material hubs stocked with wooden planks, CGI sheets, bamboo and light-gauge components. These pre-positioned resources ensure immediate reconstruction support for communities affected by disasters.

5. Sri Lanka

Mrs. Asanka Weerasinghe, Sri Lanka Land Development Corporation under Ministry of Urban Development Construction and Hosuing, Sri Lanka

Mrs. Asanka Weerasinghe discussed Sri Lanka's flood management challenges, focusing on its 103 river basins and major waterways, particularly the Kelani River Basin, which spans 2,230 sq. km. She referenced the devastating floods in Colombo in November 2010, which exposed weaknesses in the city's drainage infrastructure, particularly within the Metro Colombo catchment.

Key causes of flooding in Colombo Metropolitan Area include:

- Overflow of the Kelani River
- Canal overtopping due to heavy rainfall
- Rapid urbanization and encroachment
- Loss of wetlands, reducing flood storage capacity

To enhance flood resilience, Sri Lanka has implemented both structural and non-structural interventions:

- Improving canal conveyance capacity
- Enhancing secondary drainage systems
- Preserving wetlands for flood absorption
- Minimizing impervious surfaces to reduce runoff

Implementing an Integrated Flood Management System, featuring:

- SCADA-based flood control monitoring

- Real-time weather and water level tracking
- Early warning systems
- Flood risk assessments

She also expressed concerns about ongoing challenges such as increasing rainfall intensity, rapid urban expansion and insufficient maintenance of drainage infrastructure. She emphasized that addressing these issues requires targeted strategic interventions, enhanced wetland management and comprehensive long-term flood mitigation planning for Metro Colombo.

Closing Session

The workshop concluded with closing remarks delivered by the Director, SDMC (IU). Over the three days, participants explored diverse topics, including technical solutions, policy frameworks and practical strategies to enhance urban flood resilience. Case studies from SAARC nations and other regions provided valuable lessons and actionable insights.

The Director expressed sincere gratitude to the SAARC Secretariat for their coordination and to the member state governments for nominating enthusiastic participants who enriched the discussions. Special appreciation was extended to the distinguished speakers for their insightful presentations and to the participants for their active engagement.

Acknowledging the hard work and dedication of the SDMC (IU) team, the Director highlighted the seamless execution of the event and its significant contributions to knowledge sharing. Concluding on a positive note, the Director expressed hope that the knowledge gained during the workshop would strengthen future efforts in building resilient urban environments and disaster management strategies.

Annexure 1 - Agenda

Day 1: 27th January 2025		
Time	**Session**	**Resource Persons**
10:45 - 11:00	**Welcome and Inaugural Session** • Welcome • Participant introduction • Inauguration and Introduction to the workshop	**Dr. Rajiv Kumar Gupta,** Director SDMC (IU)
11:00 - 11:30	**Session 1: Extreme Weather Events and Urban Floods: Risks and Opportunities in the SAARC Region** • Geographic, climatic and urbanization trends driving urban floods • Historical flood events and lessons learned • Urban Hydrology and Flood Mechanisms • Highlights of urban risks and emerging opportunities	**Mr. Sanjay Srivastava** Chief of DRR, UNESCAP
11:30 - 12:00	**Session 2: Smart Cities and Floods: Innovative Techniques for Urban Risk Reduction** • Flood forecasting and early warning systems • Smart water management technologies and GIS-based solutions • Dynamic Drainage Control Systems • Use of Satellite Imagery and advanced monitoring systems	**Mr. Kamlesh Yagnik** Chief Resilience Officer Surat
12.00 - 12.30	**Session 3: Community Engagement and Citizen Participation in Flood Risk Reduction** • Assessment of Flood hazard, dimensions of vulnerability and risk through inclusive participatory approach • Example of local DRR strategies and action plans	**Dr. Sumedha Dua,** Sustainable Environment And Ecological Development Society (SEEDS)

Day 2: 28th January 2025		
Time	**Session**	**Resource Persons**
10:45 – 11:15	**Session 4: Building Resilient Urban Infrastructure & Services** • Designing flood-resilient infrastructure, Land use and planning • Implementation of National building codes (NBCs) and standards • Retrofitting of existing infrastructure to withstand floods.	**Dr. Umamaheshwaran Rajsekhar** Advisor Urban Resilience Coalition for Disaster Resilient Infrastructure (CDRI)

11:15 – 11:45	**Case Study 1: Innovative Approaches to Urban Flood Risk Reduction (South Korea)**	**Mr. Sanjaya Bhatia** Head, UNDRR GETI ONEA
11:45 – 12:15	**Case Study 2: Rebuilding Resilience: Lessons from Recent Flood to Improve Long-Term Recovery**	**Dr. Sekhar L. Kuriakose** Member Secretary, Kerala State Disaster Management Authority
12.15 – 12.45	**Case Study 3: Lessons Learned from Recent Flood: Improving Response and Preparedness**	**Mr. Piyush Anand** Director General National Disaster Response Force

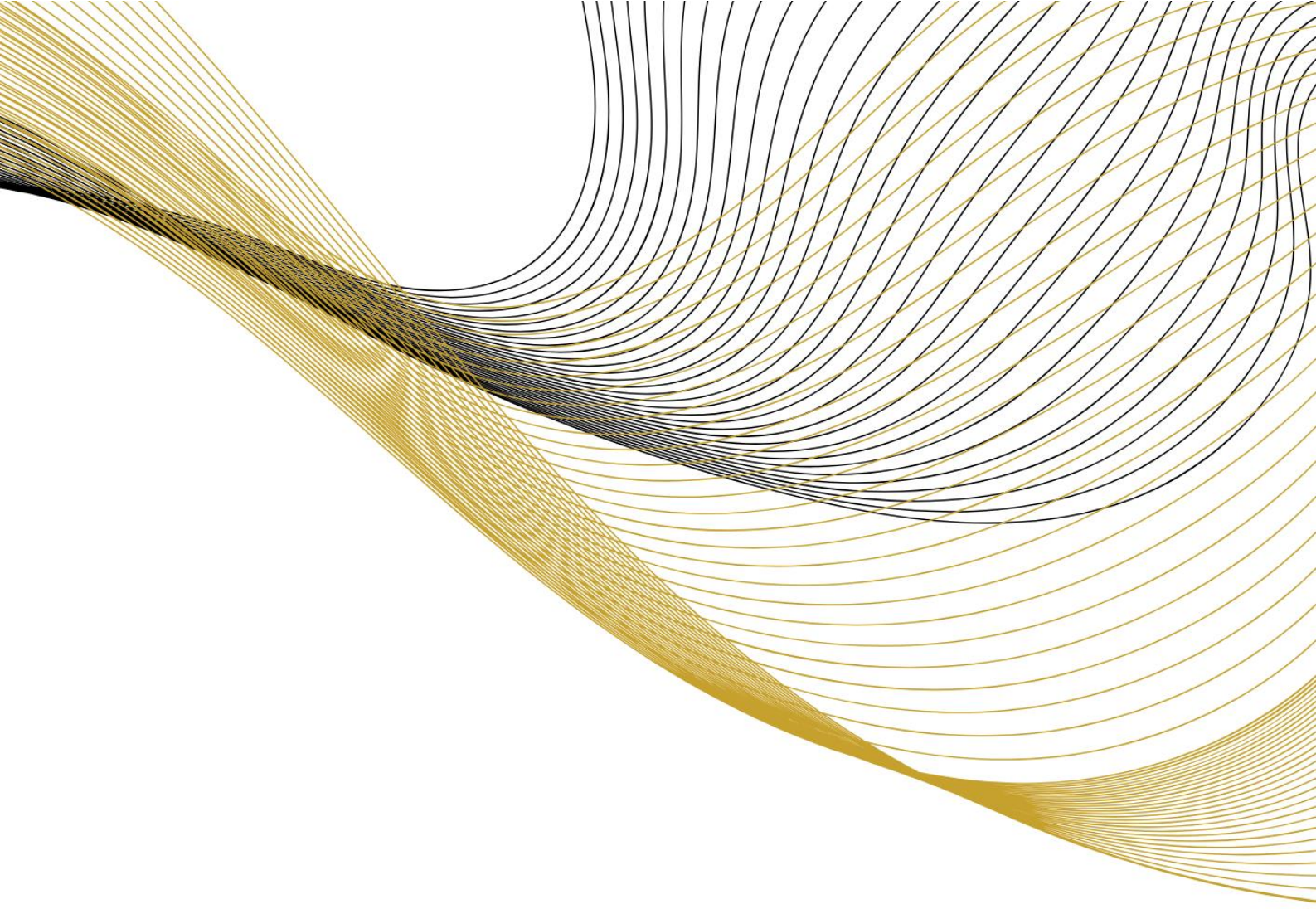
Day 3: 29th January 2025		
Time	Session	Resource Persons
10:45 – 11:15	**Session 5: Integrating Nature-Based Solutions into Urban Flood Management** • Interventions like Flood conveyance; Water retention and detention methods, controlling bank erosions, impact reductions • Examples of Wetland restoration, meander restoration, reviving of old channels, removing water barriers • Implementation, operational challenges and solutions	**Dr. M. B. Joshi** Consultant, GIDM
11.15 - 13.15	**Session 6: Innovative Approaches to Urban Flood Risk Reduction: Lessons from SAARC Member States** (15 min. each)	**Representatives of SAARC Member States**
	1. India	*Mr. Chandan Singh*
	2. Maldives	*Mr. Ibrahim Naufal*
	3. Nepal	*Mr. Bhishma Kumar Bhusal*
	4. Pakistan	*Ms. Zahra Hassan*
	5. Sri Lanka	*Mrs. Asanka Weerashinghe*
13:15 – 13:30	**Closing Ceremony** • Wrap up & Closing remarks	**Dr. Rajiv Kumar Gupta,** Director SDMC (IU)

Annexure 2 - List of Participants

#	Country Name	Flag	Participant's Name	Designation	Department
1	India		Mr. S Shanker Pandian	Deputy Commandant	4th Battalion National Disaster Response Force
2	India		Mr. Sukhendu Datta	Deputy Commandant	10th Battalion National Disaster Response Force
3	India		Mr. Chandan Singh	Under Secretary-Mitigation	National Disaster Management Authority
4	India		Mr. Antony Joh Moothedan	Consultant – Urban Flood	National Disaster Management Authority
5	India		Mr. Amarjeet Kumar	Assistant Professor	National Institute of Disaster Management
6	India		Ms. Avipsha Mohanty	Young Professional	RID Division, National Institute of Disaster Management
7	India		Dr. Vipul Nakum	Manager – DRR	GIFT City, Gujarat
8	India		Dr. Sandeep Pandey	Associate Professor cum Senior Program Manager	Gujarat Institute of Disaster Management
9	India		Ms. Anusha Vyas	Research Associate cum Program Coordinator	Gujarat Institute of Disaster Management
10	Maldives		Mr. Mohamed Rafeeq	Minister of State	Ministry of Cities, Local Government and Public Works
11	Maldives		Mr. Mohamed Ali	Deputy Minister	Ministry of Cities, Local Government and Public Works
12	Maldives		Ms. Aishath Huma	Environmental and Social Safeguard Specialist,	Ministry of Construction, Housing and Infrastructure
13	Maldives		Mr. Ibrahim Naufal	Contract Management Engineer	Ministry of Construction, Housing and Infrastructure

#	Country Name	Flag	Participant's Name	Designation	Department
14	Maldives		Mr. Aman Khaleel	Senior Planning Analyst	Ministry of Finance and Planning
15	Maldives		Ms. Aishath Anha Haisham	Senior Policy Officer	Ministry of Finance and Planning
16	Maldives		Ms. Faroosha Ali Naseer	Director	National Disaster Management Authority
17	Maldives		Ms. Aishath Ilma	Manager	National Disaster Management Authority
18	Maldives		Ms. Aminath Shaufa	Senior Administrative Officer	National Disaster Management Authority
19	Maldives		Ms. Hawlath Naseem	Assistant Director	Ministry of Foreign Affairs
20	Nepal		Mr. Bhisma Kumar Bhusal	Joint Secretary	Ministry of Foreign Affairs
21	Nepal		Ms. Roshni Kumari Shrestha	Joint Secretary	Ministry of Home Affairs
22	Nepal		Mr. Rambandhu Subedi	Joint Secretary	Ministry of Home Affairs
23	Nepal		Mr. Dijan Bhattarai	Under Secretary	Ministry of Home Affairs
24	Nepal		Ms. Hiradevi Paudel	Under Secretary	Ministry of Home Affairs
25	Nepal		Ms. Gomadevi Chemjong	Under Secretary	Ministry of Home Affairs
26	Nepal		Mr. Roshan Shrestha	Deputy Director	General, Department of Urban Development and Building Construction
27	Nepal		Mr. Safal Shrestha	District Commissioner	kathmandu Valley Development Authority
28	Nepal		Mr. Uddhab Nepal	C.D.E.	Ministry of Urban Development
29	Nepal		Mr. Arjun Ghimire	Section Officer	Ministry of Foreign Affairs
30	Pakistan		Ms. Saba Shahzadi	AM Hydrology, Tech EW	National Disaster Management Authority

#	Country Name	Flag	Participant's Name	Designation	Department
31	Pakistan		Mr. Muhammad Umair	DM Hydrology, Tech EW	National Disaster Management Authority
32	Pakistan		Mr. Saleem Malik	Executive Director (Climate & Disaster Risk Financing)	National Disaster Management Authority
33	Pakistan		Mr. Muhammad Razi	Director, Policy-DRR	National Disaster Management Authority
34	Pakistan		Mr. Saleem Raza	Executive Director, IA&PD wing	National Disaster Management Authority
35	Pakistan		Mr. Zohaib Jamal Khan	Manager (Policy), DRR Wing	National Disaster Management Authority
36	Pakistan		Mr. Muhammad Nawaz	Assistant Manager (Infrastructure) IA&PD wing	National Disaster Management Authority
37	Pakistan		Mr. Abdul Latif	Deputy Director, CDRF	National Disaster Management Authority
38	Sri Lanka		Ms. A.A.A.K.K. Seneviratne	Director (Mitigation, Research & Development)	Disaster Management Centre
39	Sri Lanka		Brigadier T.N.K. Perera	Director (Operations)	Disaster Management Centre
40	Sri Lanka		Mrs. Udya Abeysinghe	Assistant Director (Preparedness)	Disaster Management Centre
41	Sri Lanka		Wing Comm. G P Dissanayaka	Assistant Director (Colombo Dist.)	Disaster Management Centre
42	Sri Lanka		Mr. Eng M.W.P.De Silva	Director General (Urban Development)	Ministry of Urban Development, Construction & Housing
43	Sri Lanka		Ms. M G Thushari Kariyawasam	Deputy Director (Landscape Consultancy)	Urban Development Authority



SAARC

Disaster Management Centre (IU)

Gujarat Institute of Disaster Management Campus,
Village-Raysan, Gandhinagar, Gujarat, India
Ph. +91 79 23275804/33 || Email. director@saarc-sdmc.org