EFFECTIVE FLOOD MANAGEMENT AND RESPONSES IN CITIES

FINAL REPORT

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Content

Executive Summary

The Roundtable on "Effective Flood Management and Responses in Cities" was held in Kuala Lumpur on 25th and 26th March 2024. The escalating financial impact of floods in both Malaysia and the UK underscore the urgency of addressing the challenge. Climate-related disasters pose significant risks to both countries, and sharing of experiences to delineate pathways for improving flood management is key to building resilience in cities. The primary focus was to capture past, present and future approaches for improving flood awareness in Malaysian cities. A diverse group of stakeholders converged to discuss how to tackle the escalating challenge of floods in cities.

A major concern is the lack of preparedness within communities. Many residents lack the awareness necessary to respond effectively to floods. Additionally, low capacity among local authorities and outdated infrastructure contributes to further devastation. Access to hydrological data on flood risks is a major challenge, hindering efforts to create accurate forecasts and implement preventative measures. The financial burden of flood management was another point of discussion. Limited resources make it difficult to invest in resilient infrastructure and proactive risk mitigation strategies.

Despite these challenges, there is a beacon of hope. Advancements in science and technology were highlighted. The potential of early warning systems, improved forecasting models, and sophisticated risk assessments was discussed. Advancements in forecasting at a more granular city-scale for effective early warning can provide crucial lead time for evacuations, resource allocation, and preventative measures, potentially saving lives and minimizing property damage.

A range of blue-green infrastructure solutions are available for flood management, focusing along rivers and in catchment areas. These are context-specific and area based. Examples include restoring wetlands and planting trees in strategic locations to effectively manage floodwater naturally. State intervention is required to provide a hybrid approach to hard engineering solutions, allocate funding, and scaling up successful pilots. Sustainable infrastructure was recognized as a critical long-term strategy.

Local Authorities in Malaysia need to take a holistic approach to understand the connectivity of issues and implement appropriate institutional arrangements to overcome mandate limitations, and conduct land-use planning that takes into account both natural and administrative boundaries. They should leverage the potential for an adaptation industry mentioned in the National Industrial Plan of Malaysia, in the form of early warning systems, blue-green infrastructure and nature-based solutions.

Innovative financing mechanisms, such as public-private partnerships and risk transfer mechanisms should also be explored to address resource constrains. A spirit of collaboration and openness is a crucial element in the fight against floods. Commitment to ongoing open data sharing and stakeholder engagement is vital for improving transparency, innovation and community action for effective flood management to build resilience in cities.

Introduction

The Roundtable on "Effective Flood Management and Responses in Cities" was held on 25-26 March 2024 in Connexion Conference & Event Centre, Kuala Lumpur, Malaysia. It was organized by the British High Commission Kuala Lumpur with technical support from Universiti Kebangsaan Malaysia's Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM). The inaugural event enabled researchers and practitioners from the United Kingdom and Malaysia to share experiences and identify future pathways to improve flood management in cities.

The event commenced with an overview of the programme by Ms. Poorani Krishnan, Science and Innovation Advisor of the British High Commission Kuala Lumpur. This was followed by welcoming remarks by H.E. Ailsa Terry High Commissioner British High Commission Kuala Lumpur. The launching remarks was delivered by YB Tuan Nga Kor Ming, Minister of Housing and Local Government.

The event comprised four major segments. The first segment on UK Investment in Flood Research commenced with an overview of UK's National Flood Forecasting Framework, and featured three major initiatives implemented in Malaysia that is funded by the UK Government. The second segment on Malaysian Flood Responses comprised a keynote presentation that provided an overview of the status in the country, followed by two panel sessions on strengthening communities' responses and early warning. The third segment focused on finance while the final segment was on sustainable infrastructure including its planning and nature-based solutions. Issues were highlighted through presentations and panel discussions.

UK Investment in Flood Research

Dr. Charlie Pilling, Chief Hydrometeorologist National Flood Forecasting Centre, UK, shared successful flood initiatives in the UK. The National Flood Forecasting initiative aims to provide trusted guidance to protect lives and livelihoods from flooding in England and Wales. It encompasses various components, including the National Flood Risk Forecasting (FFC), Impact-Based Forecasting and Warning, Surface Water/Rapid Flood Forecasting, and the National Severe Weather Warning Service. These elements work together to forecast flood risk, issue warnings, and support planning and response activities.

The forecasted flood risk, categorized for Category 1 and 2 responders, includes Flood Guidance (1-5 days) and Flood Outlook (6-30 Days). It provides planning scenarios for warnings, supports training and exercises, engages users, manages systems and models, and aims to deliver forecasting improvements. The risk of flooding across England and Wales arises from powerful Atlantic storms, convective storms, and various geographical features such as small catchments, managed floodplains, urban areas, coastlines, and areas susceptible to groundwater flooding.

The National Severe Weather Warning Service employs an impact-based methodology to predict not just what the weather will be, but what it will do and how people can act to stay safe. The Flood Emergency Framework sets out the government's strategic approach to flood planning and response, covering various sources of flooding. It includes civil contingency support, risk assessment at multiple levels, and specialized services to government departments.

The Environment Agency operates flood and wider environment services through local and national forecasting centers staffed with monitoring and forecasting duty officers. The National Flood Risk Forecasting, a partnership between the Met Office and Environment Agency, delivers forecasts for all natural sources of flooding. Impact-Based Forecasting and Warning aims to enhance communication and enable timely action by translating hazardous information into narratives of possible consequences.

Hazard Impact Modelling identifies vulnerable areas/assets and helps prioritize response efforts. Surface Water Flooding Hazard Impact Modelling focuses on building resilience against surface water flooding. Overall, collaboration, communication, and coordination are emphasized as key to addressing the collective challenge of flood risk.

Dr. Ponnambalam Rameshwaran, Senior Research Scientist UK Centre for Ecology & Hydrology, shared a UK-Malaysia collaboration on Exploring the future risk across Peninsular Malaysia. The initiative is supported by the Newton-Ungku Omar Fund, jointly awarded by the Natural Environment Research Council (NERC) and the Ministry of Higher Education Malaysia. A great entry point for assessing flood risks and climate adaptation, the focus is on long-term forecasting and the development of detailed hydrological modeling and time-series data for effective flood management and preparedness.

The Hydrological Modeling Framework (HMF) with its 15-minute routing time step and 1-km model resolution, incorporating factors such as elevation, flow directions, soils, and land cover, allowing for a more accurate assessment of flood risks. The incorporation of artificial influences, such as current and future water transfers and diversions within the Klang River basin, into the HMF-Malaysia model enhances its applicability to real-world scenarios. Examining river flows under projected future scenarios, particularly using the CORDEX-SEAdatasets, provides valuable insights into potential changes in monthly mean and peak river flows. While the absence of bias correction in RCM data may introduce some uncertainties, the focus on the *change* between present day and future can give a good indication of the direction of travel, and the use of multiple climate models helps to capture a range of possible outcomes.

Analyzing changes in RCM rainfall under different emissions scenarios, e.g. RCP 8.5, allows for the exploration of various climate change impacts on precipitation patterns, which is critical for flood risk assessment. The identification of an increase in peak flows on the west coast of peninsula Malaysia based on median changes in annual maximum river flows across multiple RCMs for the 2030s highlights the importance of understanding regional variations in flood risks under future climate scenarios. The incorporation of these findings into future flood risk assessments, such as CCRA3 (2022), demonstrates a commitment to using global scientific knowledge to inform regional planning and adaptation strategies. This approach ensures that flood management efforts are based on the best available evidence and tailored to the specific challenges faced in Malaysia.
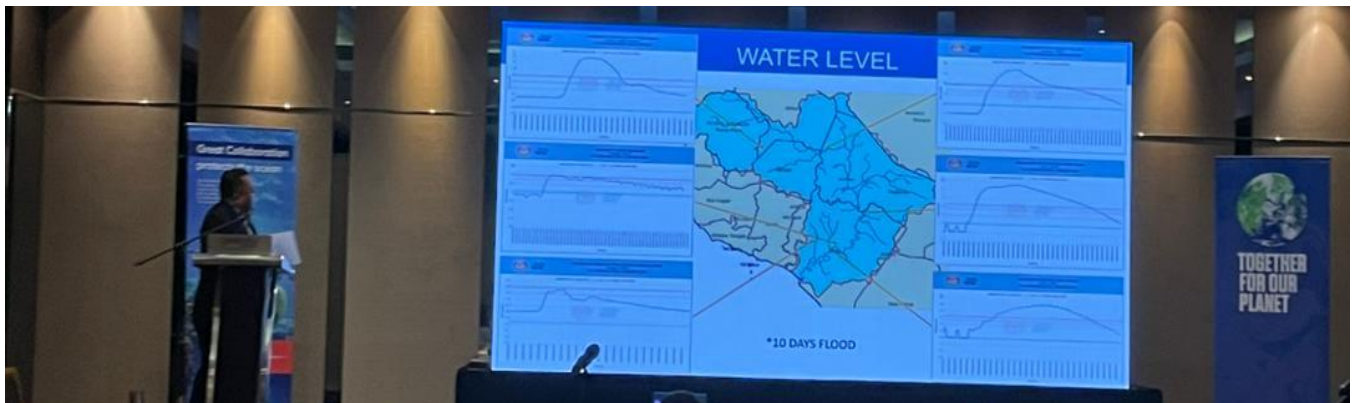
Mr. Wan Marhafidz Shah bin Wan Mohd Omar, Director of Mitigation at the National Disaster Management Agency (NADMA) and **Dr. Rebecca Beckett, International Expert Meteorologist, Met Office, UK** provided and overview of the "Weather and Climate Science for Service Partnership Programme (WCSSP). Mr. Wan Marhafidz introduced the programme that focuses on impact-based forecasting. The project was initially supported by the Newton Fund and is currently continuing with funding from the International Science Partnership Fund (ISPF). Dr. Rebecca Beckett, International Expert Meteorologist, Met Office, UK was also present virtually to provide an overview of the expanded initiative.

The WCSSP Programme, particularly in Southeast Asia, highlights a commitment to building resilient economies and societies in the face of climate and weather challenges. The program's focus on weather timescales and high-impact weather, along with the development of impact-based forecasting, underscores the importance of translating scientific advancements into practical forecasts that can directly benefit communities. Collaboration with Malaysian partners, including NADMA, demonstrates a holistic approach to capacity building and knowledge sharing. Through activities such as workshops, training sessions, and the development of technical resources, the WCSSP Programme contributes to enhancing forecasting capabilities and improving disaster preparedness in Malaysia.

Currently, the flood management in Malaysia relies on the PRAB system. The system coupled with hydrodynamic modeling, provides a sophisticated approach to flood forecasting and risk assessment. The integration of machine learning in RISK assessments demonstrates a commitment to leveraging cutting-edge technology for more accurate and efficient risk evaluation. However, challenges in disseminating models, as noted for the Kelantan state, indicate the complexities involved in implementing new systems and technologies, particularly in diverse geographical and institutional contexts.

NADMA's perspective on impact-based forecasting underscores its recognition of the importance of this approach in enhancing flood preparedness and response. The emphasis on balanced content and guided statements suggests a nuanced understanding of the communication challenges inherent in conveying complex weather information to the public. It was emphasised that efforts to improve flood forecasting and risk management in Malaysia, requires collaboration, innovation, and effective communication in building resilience to climate-related hazards.
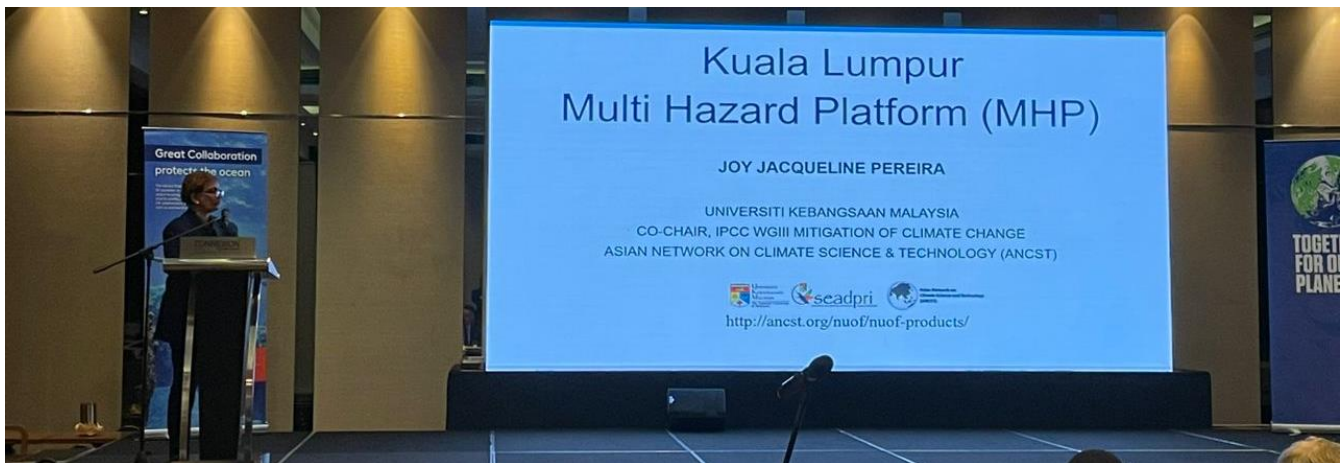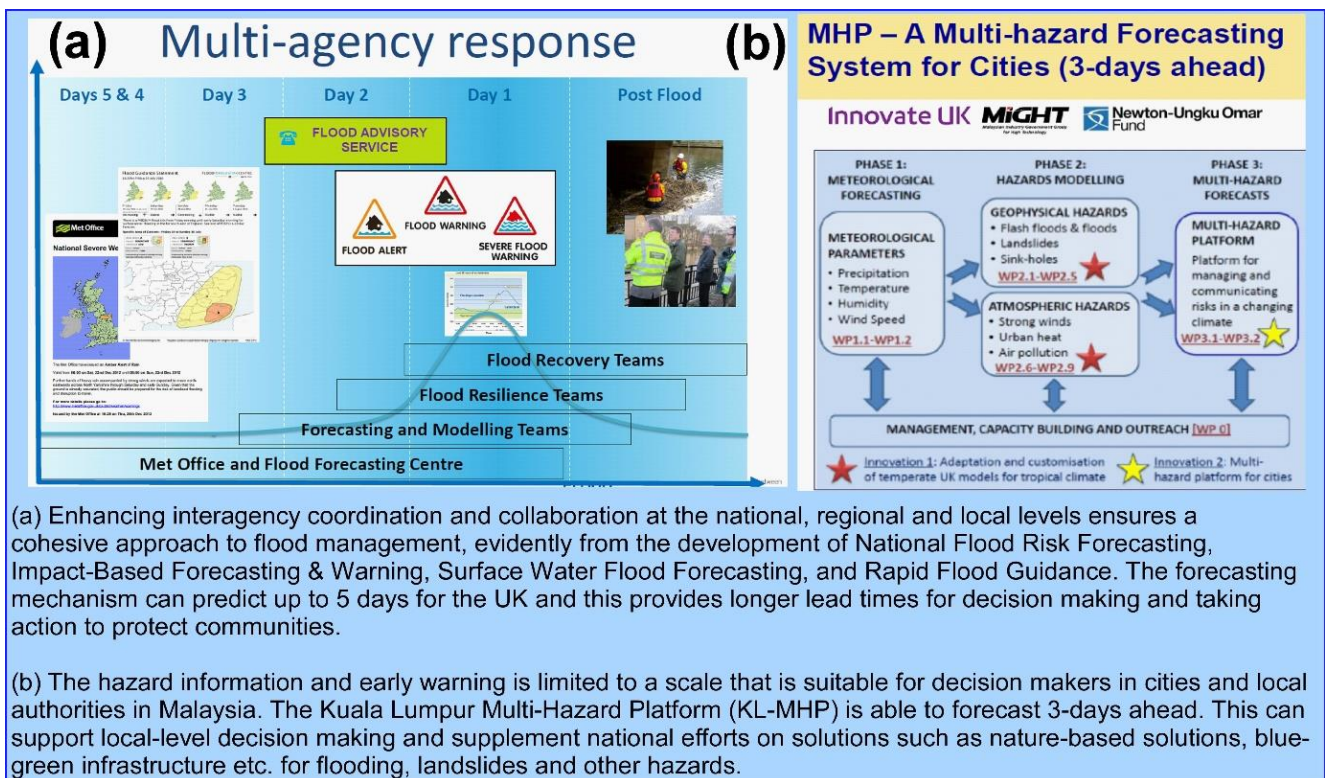
Professor Dr. Joy Jacqueline Pereira, Principal Research Fellow of SEADPRI-UKM, introduced the Kuala Lumpur Multi Hazard Platform (KL-MHP) a local level forecasting system for the city of Kuala Lumpur. The system was developed in collaboration with the Meteorology Department of Malaysia as well as partners from the UK and Malaysia, supported by the Newton Ungku Omar Fund. The system is currently customized for Kuala Lumpur City to forecast pluvial floods, landslides, sinkholes, strong winds, urban heat and air pollution at the city and neighborhood scales. Currently located in the City Hall of Kuala Lumpur (DBKL), the multi-hazard platform has been made operational to support DBKL in land use planning and disaster alerts.

The current trajectory of global warming, already at 1.1°C, underscores the urgent need for action to limit it to 1.5°C. This increase in temperature is projected to amplify extreme weather events and introduce new hazards, leading to heightened losses and constraining options for resilient development. To achieve the goal of limiting warming to 1.5°C, significant reductions in global greenhouse gas emissions are imperative. This includes peaking emissions before 2025 and subsequent reductions by 43% by 2030, alongside substantial methane reductions. Solutions span across all sectors, offering opportunities for impactful interventions in energy, industry, urban development, transportation, and beyond. The atmospheric component of the Kuala Lumpur Multi Hazard Platform (KL-MHP) could be further expanded to forecast city level emissions based on land-use planning and development scenarios.

It's crucial to recognize that climate change has evolved into an economic and social development challenge, no longer confined solely to environmental concerns. Delaying action will only diminish the range of viable options available to address its multifaceted impacts. Effectively managing the physical risks, transitional risks, and liabilities associated with climate change demands transformative governance at all levels. This transformation necessitates innovative financial mechanisms, genuine partnerships, capacity building, multidisciplinary knowledge integration, and robust international collaboration.

Cities emerge as key arenas for integrated approaches to climate change mitigation, adaptation, and disaster risk reduction. City-scale systems such as the KL-Multi-hazard Platform, offers opportunities to support localized decision-making and supplement national efforts with tailored solutions for addressing various hazards like flooding, landslides, and more. In essence, addressing climate change requires concerted action across sectors and levels of governance, emphasizing the need for proactive measures to mitigate its impacts and build resilience in communities worldwide.

(a) Enhancing interagency coordination and collaboration at the national, regional and local levels ensures a cohesive approach to flood management, evidently from the development of National Flood Risk Forecasting, Impact-Based Forecasting & Warning, Surface Water Flood Forecasting, and Rapid Flood Guidance. The forecasting mechanism can predict up to 5 days for the UK and this provides longer lead times for decision making and taking action to protect communities.

(b) The hazard information and early warning is limited to a scale that is suitable for decision makers in cities and local authorities in Malaysia. The Kuala Lumpur Multi-Hazard Platform (KL-MHP) is able to forecast 3-days ahead. This can support local-level decision making and supplement national efforts on solutions such as nature-based solutions, blue-green infrastructure etc. for flooding, landslides and other hazards.

Flood Responses in Malaysia

YBrs. Tuan Rusli bin Ibrahim, Director of Policy Section , National Disaster Management Agency (NADMA), provided statistics that painted a concerning picture of Malaysia's vulnerability to various natural disasters, with significant risks posed by floods, cyclones, and droughts. Despite ranking relatively lower for cyclone risk, the country faces considerable challenges, particularly concerning flood and drought risks.

Malaysia ranks 42nd globally for flood risk, with 10.1% of the country's total area considered flood prone. This affects a significant portion of the population, with 5.67 million people living in flood-prone areas. The recent flood data for 2023/2024 highlight the severity of the issue, with over 91,000 victims, 4 deaths, and substantial economic losses totaling 755.4 million. Malaysia ranks 50th globally for cyclone risk, which suggests a relatively lower level of vulnerability compared to floods. However, cyclones still pose a significant threat to affected regions. Malaysia ranks last, at 191 out of 191, for drought risk. While this may seem less immediate compared to floods and cyclones, droughts can have severe implications for agriculture, water resources, and livelihoods.

NADMA plays a crucial role as the principal policy-making body in Malaysia for disaster management, covering the entire disaster management cycle. However, several challenges persist, including the community's role as initial responders, misinformation, coordination among stakeholders, leadership, and crisis communication. To address these challenges, eight strategic steps have been outlined:

1. Enhancement of Policies and strengthening existing policies to better address disaster risk reduction (DRR) and disaster risk management (DRM).
2. Emphasis on DRR and prioritizing DRR initiatives to mitigate the impact of disasters.
3. Specific Allocation for DRM and DRR ensures dedicated funding for disaster management and risk reduction efforts.
4. Strengthening Coordination Mechanisms and Improving coordination among multiple stakeholders involved in disaster response and recovery.
5. Upgrading Systems and Delivery of Information: Enhancing technological systems and information dissemination channels to improve early warning systems and response capabilities.
6. Improving Communication by enhancing communication strategies to ensure accurate and timely information reaches affected communities.

7. Increasing Capacity of Local Communities by empowering local communities with the knowledge and skills to effectively respond to disasters and participate in mitigation efforts.

Addressing these issues will require a coordinated effort involving government agencies, civil society organizations, the private sector, and local communities. By implementing these strategic steps, Malaysia can improve its resilience to disasters and mitigate the impact on its population and economy.

The Panel Session on Malaysia: Strengthening Communities' responses to urban flooding: framing the practical challenges and realizing the opportunities, was moderated by Mr. Muru Loganathan, Deputy Head - Climate Change, Energy and Environment, British High Commission Kuala Lumpur. The panelists were Jonathan Moxon (Executive Manager, Flood Risk & Climate Resilience, UK), Mr. Hafiz Amirrol (Deputy Executive Director, Mercy Malaysia), Rose Afrina Mansor (Senior Associate, Climate Resilience, Think City), and Jagedeswari Mariappan (Senior River Care Programme Officer, Global Environment Centre, GEC), who collectively provide valuable perspectives on the challenges and opportunities surrounding community understanding and response to climate change.

Mr. Loganathan's personal experience underscores the critical role of community response and resilient infrastructure in mitigating the impacts of flooding. He emphasized the importance of urban planning measures such as permeable surfaces and effective drainage systems, as well as the integration of nature-based solutions like coastal vegetation to reduce flood risks. Similarly, Jonathan Moxon highlights the need for community willingness to adapt and accept climate change, drawing parallels between the UK and Malaysia. He emphasized the significance of nature-based solutions in complementing traditional engineering approaches and fostering public acceptance.

Mr. Hafiz Amirrol's reflections on the increasing complexity and costs associated with climate change adaptation over the past few decades highlight the pressing need for practical solutions and improved community preparedness. Rose Afrina Mansor emphasized the importance of localized language and visualizations in effectively communicating climate change impacts, particularly in secondary cities. She advocates for enhanced post-flood recovery efforts and underscores the potential of nature-based solutions like sponge cities in flood mitigation. Lastly, Jagedeswari Mariappan stressed the necessity of targeted awareness programs and community-based hazard mapping to enhance community

understanding and response to climate change. She highlights the challenges faced by vulnerable communities, emphasizing the importance of prioritizing climate resilience amid day-to-day struggles. Overall, these insights underscore the critical role of community engagement, localized communication strategies, and the integration of nature-based solutions in climate change adaptation efforts. Collaboration between stakeholders at all levels is essential to address the multifaceted challenges posed by climate change effectively and build resilient communities for the future.

The Panel Session on Malaysia: Refining early warning systems and raising the bar on flood response mechanisms and support systems, was moderated by Ts. Norliza Binti Hashim, Chief Executive Officer, Urbanice. The panelists were Dr Charlie Pilling (Chief Hydrometeorologist National Flood Forecasting Centre, UK), Ir. Dr. Norlida binti Mohd. Dom (Director National Flood Forecasting and Warning Centre, Department of Irrigation and Drainage Malaysia), Ir Dr Salmah Zakaria (former Chair of ASM Water Committee, and Chair of the ASM-EPU Study on Water Sector Transformation by 2040), and Mr. Muhammad Firdaus Ammar bin Abdullah (Subject Matter Expert, Numerical Weather Prediction, Malaysian Meteorological Department).

Ts. Norliza Binti Hashim shed light on the intricacies of flood management and climate change adaptation efforts in Malaysia. She emphasizes the critical importance of refining early warning systems and enhancing flood response mechanisms to mitigate the impacts of increasingly frequent and severe flood events. Community preparedness emerges as a key factor in minimizing flood-related casualties and damages, underscoring the need for effective communication strategies and public awareness campaigns. Ts. Norliza also underscored the significance of governance and leadership in coordinating and implementing comprehensive flood management strategies at various levels of government.

Dr. Charlie Pilling's observations on flood risks in the UK offer valuable comparative insights. He draws attention to the pressing need to prioritize measures aimed at saving lives amidst the growing threat of flooding. Dr. Pilling highlighted the alarming number of properties at risk of surface water flooding in

England, emphasizing the urgent need for updated national risk registers and enhanced emergency alert systems to improve flood preparedness and response capabilities.

Ir. Dr. Norlida binti Mohd. Dom's inputs on the PRAB system in Malaysia delved into the technical aspects of flood modeling and prediction. She elaborates on the collaborative efforts between government agencies such as the Department of Irrigation and Drainage (DID), the National Disaster Management Agency (NADMA), and the Malaysian Meteorological Department (MetMalaysia) in developing hydrodynamic flood modeling datasets. This collaboration enables timely warnings and informs community-based alert systems, essential components of effective flood management strategies.

Ir. Dr. Salmah Zakaria's comprehensive approach to climate change adaptation underscores the interconnectedness of scientific, engineering, and socio-economic strategies. She highlighted governance challenges in river and flood management, advocating a holistic approach that encompasses both water security and economic opportunities. The Water Sector Transformation 2040 initiative reflects Malaysia's commitment to bridging public-private partnerships and leveraging smart technologies to enhance resilience against climate change impacts.

Muhammad Firdaus Ammar bin Abdullah's insights into rainfall predictions and flood forecasting highlight the technical challenges associated with predicting and managing flood risks. He emphasizes the need for improved predictability, reliability, and uncertainty reduction in forecasting models to enhance preparedness and response capabilities. MetMalaysia's efforts in developing probabilistic models and climate simulations represent promising steps towards improving forecasting accuracy and informing proactive flood management strategies.

The collective insights from these experts underscore the multifaceted nature of flood management and climate change adaptation efforts. By prioritizing community preparedness, enhancing early warning systems, and leveraging technological advancements, stakeholders can work towards building resilience and reducing the impacts of floods and other climate-related hazards on communities and economies.

Leveraging Finance for Business Resilience to Floods in Malaysia
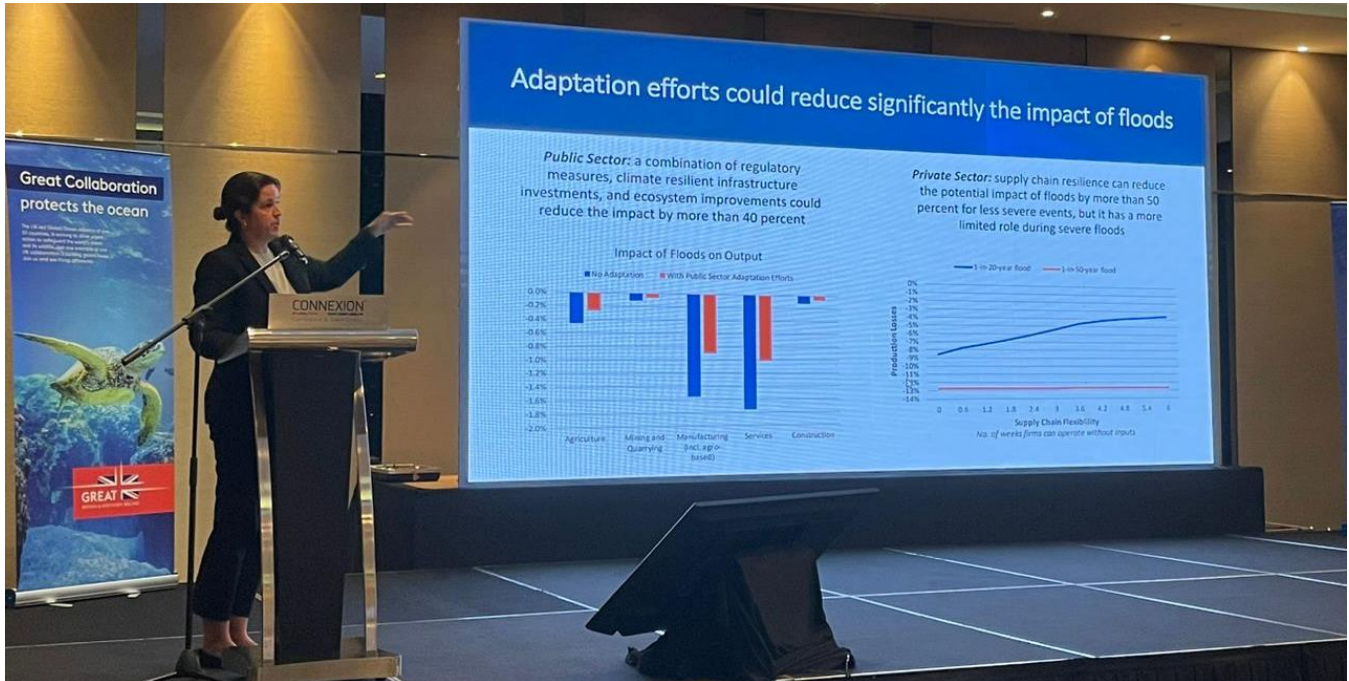
Dr. Tatiana Didier, Senior Economist, World Bank Malaysia, set the scene for Leveraging Finance for Business Resilience to Floods in Malaysia. She shared key findings from the newly published report by Bank Negara and World Bank. The report outlines a comprehensive approach to address financial challenges associated with flood resilience in Malaysia. Despite being ranked 12th globally in terms of flood frequency, Malaysia's annual flood damage only places it 78th globally. However, projections indicate an increase in precipitation, which could significantly impact various sectors by 2030, especially services and manufacturing, resulting in a potential 4.1% GDP impact and 2.2% employment loss.

One of the key findings is the potential reduction of bank loans associated with sectors like agriculture, mining, and quarrying by an estimated 10% due to floods. However, investments in climate-resilient infrastructure, ecosystem improvements, and supply chain resilience could mitigate these impacts by over 40% and 50%, respectively. Despite this, the private sector, particularly SMEs, faces significant challenges, including limited capacity to adapt, financial resilience, and vulnerability to vehicle and property damage. Additionally, SMEs often lack insurance coverage and flood risk awareness, further exacerbating their vulnerability. Financial institutions also face constraints, including data gaps on flood hazards, limited access to relevant data, and challenges in pricing flood risks into financial products. These constraints hinder their ability to accurately quantify, monitor, and manage flood risks, as well as to develop effective risk transfer mechanisms.

To address these challenges, the report proposes an integrated and proactive approach involving public, private, and financial sectors to build a flood-resilient economy. Policy actions recommended include enhancing data availability, affordability, and accessibility, developing long-term adaptation strategies, strengthening the enabling environment for the financial sector, expanding access to finance, deepening the insurance market, enhancing flood risk awareness, and building capacity. Addressing financial

challenges related to flood resilience requires concerted efforts from multiple stakeholders and targeted policy interventions to build a resilient economy that can withstand the growing impact of floods in Malaysia.

The Panel Session on Financing sustainable, resilient infrastructure in cities for effective flood management and climate adaptation, was moderated by Datin Seri Sunita Rajakumar, Chair, Climate Governance Malaysia. The panelists were Katie Lee Sheah Tsan (Climate Policy Strategist, Bank Negara Malaysia), Teresa Wong (Chief Risk Officer/Head of Sustainability Risk, Zurich Malaysia), Nurul Diana Intan Zarifah (Head, Risk and Sustainability, Cyberview), Dwi Rahardiani (Country Manager/ Senior Consultant Climate, Resilience, and Sustainability, Oxford Policy Management, Indonesia), and Ms. Anita Ahmad (Chief Executive Officer, Yayasan MySDG).

Datin Seri Sunita Rajakumar commended the Climate DASH Malaysia platform, developed with support from agencies like NAHRIM, which underscores Malaysia's proactive stance in enhancing climate governance and resilience. This platform likely serves as a crucial tool for gathering and analyzing climate data, aiding decision-makers in crafting effective policies and strategies to mitigate climate-related risks. Katie Lee Sheah Tsan's discussion on the role of Bank Negara Malaysia in flood management highlights the financial sector's responsibility in addressing climate-related challenges. With a focus on preparedness and detailed data for granular observation, Bank Negara plays a pivotal role in ensuring financial stability while channeling funds towards climate change initiatives and resilience-building efforts. This dual mandate reflects the recognition of the financial sector's influence in shaping climate-resilient economies.
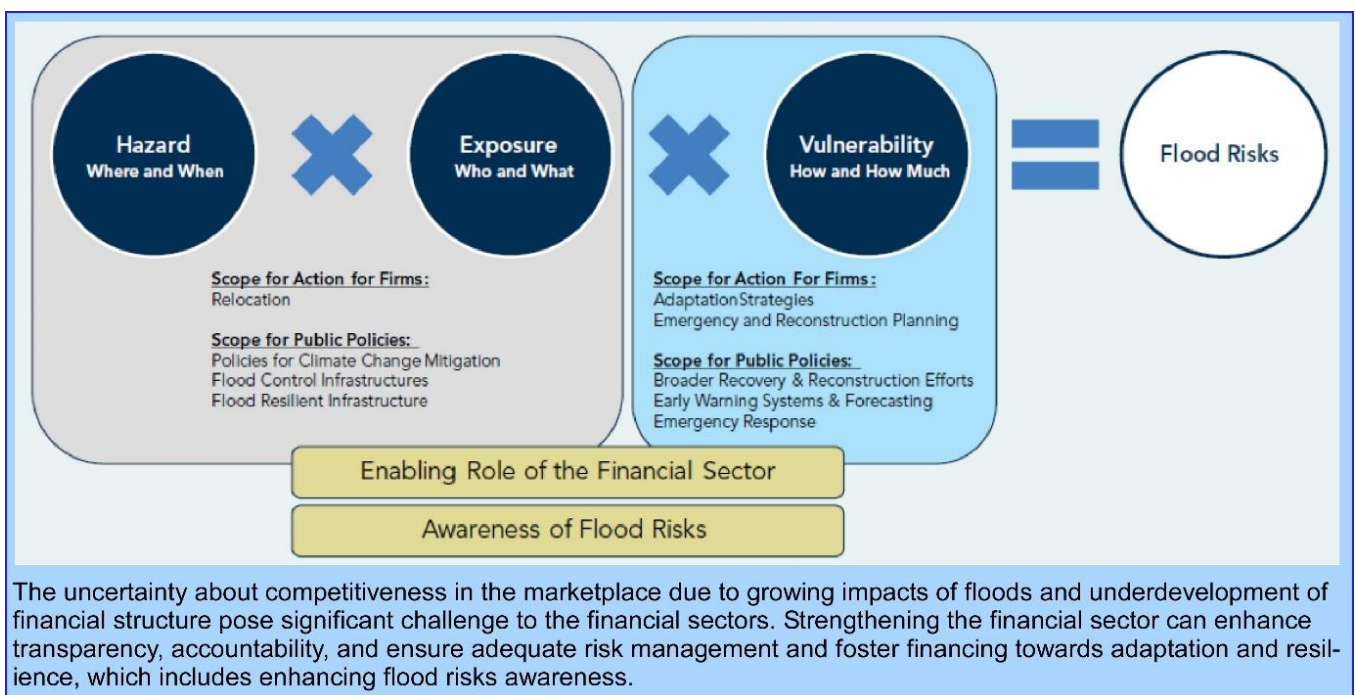
Teresa Wong's insights into Zurich's role in financing climate change and flood management shed light on the importance of insurance coverage in mitigating the economic impacts of floods. Zurich's Urban Climate Resilience Program exemplifies a community-centric approach, emphasizing community engagement and collaboration with local authorities to enhance flood resilience and support livelihoods. This approach underscores the need for inclusive and participatory strategies in building climate resilience at the grassroots level.

Nurul Diana Intan Zarifah's delineation of initiatives in Southern Cyberjaya underscores Malaysia's commitment to urban resilience through diversified strategies. By integrating smart mobility, healthcare, digital creative industries, and green infrastructure development, Malaysia aims to create sustainable and resilient urban environments. The emphasis on risk reduction strategies, collaboration with local partners, and the integration of green spaces reflects a holistic approach to urban planning that prioritizes climate adaptation and sustainability.

Dwi Rahardiani's insights into private sector investments and mitigation strategies in Indonesia shed light on the diverse array of financing mechanisms available for climate adaptation. From blended financing facilities to microfinance institutions, Indonesia demonstrates a commitment to leveraging private sector resources to address climate-related challenges. The emphasis on policy clarity, governance frameworks, and attracting private financing underscores the importance of creating an enabling environment for climate-resilient investments.

Anita Ahmad's discussion on mobilizing resources to accelerate the Sendai Framework underscores the importance of international collaboration in addressing climate-related challenges. By aligning actions with the Sustainable Development Goals (SDGs) and supporting community-based solutions, Malaysia aims to strengthen its resilience to floods and other climate hazards. The challenges of data gaps and the need for community engagement highlight the complexities of climate governance and the importance of holistic and inclusive approaches.

These insights highlight the diverse range of stakeholders, strategies, and challenges involved in climate governance, flood management, and financing climate change initiatives. By fostering collaboration, innovation, and inclusivity, Malaysia and other countries can build resilient societies capable of addressing the complex challenges posed by climate change.

Hazard
Where and When
✕
Exposure
Who and What
✕
Vulnerability
How and How Much
=
Flood Risks

Scope for Action for Firms:
Relocation

Scope for Public Policies:
Policies for Climate Change Mitigation
Flood Control Infrastructures
Flood Resilient Infrastructure

Scope for Action For Firms:
Adaptation Strategies
Emergency and Reconstruction Planning

Scope for Public Policies:
Broader Recovery & Reconstruction Efforts
Early Warning Systems & Forecasting
Emergency Response

Enabling Role of the Financial Sector

Awareness of Flood Risks

The uncertainty about competitiveness in the marketplace due to growing impacts of floods and underdevelopment of financial structure pose significant challenge to the financial sectors. Strengthening the financial sector can enhance transparency, accountability, and ensure adequate risk management and foster financing towards adaptation and resilience, which includes enhancing flood risks awareness.

Sustainable Infrastructure for Climate Proofing the Future

Dr. Andrew Eden, UK Environment Agency, Adaptation & Resilience Team Manager, shared his experience on sustainable construction for flood and coastal defenses, which highlights a crucial aspect of climate adaptation and resilience-building efforts. By drawing on experiences with low carbon concrete and embracing nature-based solutions, such as sustainable drainage systems, countries like the UK can enhance the effectiveness and environmental sustainability of their infrastructure. In framing innovation programs, it's essential to define sustainable infrastructure for climate-proofing the future. With the climate changing at an alarming rate, innovative approaches are needed to address the growing risks posed by flooding and sea level rise. With approximately 2.8 million properties at risk of flood and sea level rise by 2100, proactive measures are imperative to safeguard communities and ecosystems.

The National Flood and Coastal Erosion Risk Management Strategy (FCERM Strategy) underscores the UK's commitment to enhancing resilience and preparedness. By improving place making, facilitating quick recovery, better protecting vulnerable areas, and ensuring readiness to respond to emergencies, the strategy aims to mitigate the impacts of climate change on communities and infrastructure. Place making emerges as a crucial aspect of the strategy, focusing on sustainable development practices that prioritize flood resilience. Through innovative approaches in development planning, such as avoidance, mitigation, and reduction strategies, new developments can be designed to withstand flooding, with sustainable drainage systems playing a pivotal role in managing surface water runoff.

Better protection efforts, targeting areas with the greatest risk and benefits, are essential for safeguarding infrastructure and communities. Significant investments in improving facilities nationwide demonstrate a commitment to enhancing flood defenses and reducing vulnerability to climate impacts. Readiness to respond is another key pillar, emphasizing the importance of flood risk awareness, insurance access, property flood resilience measures, and community engagement in building resilience and recovery capabilities. Adaptation strategies, informed by dynamic adaptive policy approaches and climate projections, are crucial for long-term resilience. Case studies, such as the Thames Estuary 2100 project, highlight the importance of adaptive pathways in responding to evolving climate risks and uncertainties. Innovation plays a central role in enhancing flood and coastal resilience, with substantial investments in innovation programs aimed at developing new technologies, strategies, and adaptation measures.

Decarbonizing efforts, including initiatives to reduce carbon emissions from infrastructure, demonstrate a commitment to building climate-proof assets that mitigate the impacts of climate change while promoting sustainability and environmental stewardship. Through these integrated approaches, countries like the UK can build resilient and sustainable infrastructure that withstands the challenges of a changing climate while fostering economic and social prosperity.

Mr. Jonathan Moxon, Executive Manager, Flood Risk & Climate Resilience Programme Manager, Leeds City Council, introduced a successful city level flood innovation program in the UK. The West Yorkshire Flood Innovation Programme (WYFLIP) board represents a collaborative partnership focused on fostering innovation in addressing flood and climate risks in the West Yorkshire region. With academia playing a key role in the project, the board identifies five key themes: integrated water management solutions, nature-based solutions, property flood resilience, community and voluntary sector engagement, and enhanced flood warning systems.

The need for such a program stem from the urgency of climate adaptation, particularly highlighted by the declaration of a climate emergency by the city council in March 2019. This declaration, prompted by protests from young people advocating for environmental action, underscores the pressing need for proactive measures to address climate risks, including flooding. The program originated from the flood and coastal resilience innovation program initiated by the Yorkshire Regional Flood & Coastal Committee, which serves as a flagship program to reduce flood risk across the region. The collaborative foundation of the roadmap involves a governance structure comprising catchment partnerships, the WY flood risk partnership, the Yorkshire RFCC, program boards, steering groups, and program management and coordination bodies across districts such as Leeds, Calderdale, Bradford, Kirklees, and Wakefield.

The governance model of the program emphasizes a sustainable approach, with the West Yorkshire Flood Innovation Program taking the lead in project development and execution, supported by a steering group overseeing project management activities. Currently, the program is engaged in scoping opportunities, developing projects, fostering relationships, and overcoming initial challenges. Recent developments include projects such as the Early Flood Warning System (EFWS) using LoRaWAN technology, property flood resilience (PFR) surveys through the PFR Assured initiative, and initiatives focused on integrated water management solutions and nature-based solutions led by local councils.

Each project within the program involves academic leadership and collaboration with practitioners, ensuring a research-driven and practical approach to addressing flood and climate risks. For example, the WYFLIP Accelerator program incorporates academic work packages to facilitate project implementation effectively. Key initiatives within the program include developing a GIS database of PFR installations, implementing LoRaWAN technology for early flood warning systems, and engaging with communities to promote mental health resilience and nature-based solutions. These efforts aim to enhance community resilience, improve flood preparedness, and mitigate the impacts of climate change in the West Yorkshire region.

Planning Sustainable Infrastructure

The Panel Session on Planning Sustainable Infrastructure, was moderated by Professor Dr. Joy Jacqueline Pereira, Principal Research Fellow of SEADPRI-UKM. The panelists were Mr. Jonathan Moxon (Programme Manager, West Yorkshire Flood Innovation Programme), Mr. Murali Ram (Malaysia Lead, Cities & Advisory, Arup), Mr. Fairuz Reza Razali (Senior Lecturer, Centre of Studies Architecture, Universiti Teknologi MARA, UiTM), and Ms. Yogi Chellappan (Senior Manager, Climate Resilient, Think City).

Prof. Joy Jacqueline Pereira brought attention to the critical factors of economic feasibility and governance in flood management and infrastructure development. This calls for solutions that not only address the immediate challenges of flooding but also ensure long-term sustainability and financial viability. By considering economic feasibility, decision-makers can prioritize investments that offer the most significant benefits in terms of flood adaptation and mitigation while optimizing the use of available resources. Additionally, effective governance is essential to ensure that flood management initiatives are implemented efficiently and transparently, with clear accountability and oversight mechanisms in place.

Jonathan Moxon's focus on establishing a sustainable drainage system approving body underscores the importance of integrating sustainable water management practices into urban planning and development processes. By formalizing the approval process for sustainable drainage systems, cities can incentivize the adoption of nature-based solutions and green infrastructure, which offer multiple benefits, including flood risk reduction, improved water quality, and enhanced urban biodiversity. This approach aligns with the principles of integrated water management, which emphasize the interconnectedness of water resources and the importance of holistic solutions to water-related challenges.

The development of blue-green flood infrastructure, as highlighted by Jonathan Moxon's example of proposed development sites in Killingbeck, represents a promising approach to flood risk reduction. By combining traditional hard engineering approaches with nature-based solutions, such as green spaces, wetlands, and permeable surfaces, cities can enhance their resilience to flooding while also creating more

sustainable and livable urban environments. This integrated approach to flood management recognizes the value of natural ecosystems in regulating water flow and reducing flood risks, complementing traditional infrastructure such as levees and stormwater drains.

Murali Ram's emphasis on water scarcity, stormwater management, and public education underscores the multifaceted nature of flood risk reduction. In addition to implementing physical infrastructure solutions, such as drainage systems and flood barriers, it is essential to promote water conservation practices and raise public awareness about flood preparedness and response. Educating communities about the importance of proper waste disposal and maintaining drainage systems can help prevent littering and reduce the risk of drain blockages during heavy rainfall events.

Mr. Fairuz Reza Razali's views on blue-green infrastructure in Penang Island highlights the importance of local government support and community engagement in implementing flood resilience initiatives. By involving stakeholders in the design and planning process, cities can ensure that flood management strategies align with local needs and priorities. Moreover, differentiating between green and blue-green infrastructure and introducing innovative solutions, such as pocket parks and water features, can enhance urban resilience while also providing social and recreational benefits to residents.

Yogi Chellappan's focus on resilience and mangrove conservation in Seberang Perai underscores the importance of preserving natural ecosystems for flood risk reduction and coastal protection. Mangroves act as natural buffers against storm surges and erosion, helping to stabilize coastlines and mitigate the impacts of sea level rise. However, the conservation of mangrove forests requires coordinated efforts between government agencies, local communities, and conservation organizations to address threats such as deforestation, land conversion, and pollution. By prioritizing mangrove conservation and restoration, cities can enhance their resilience to climate change while also safeguarding valuable ecosystems and biodiversity.
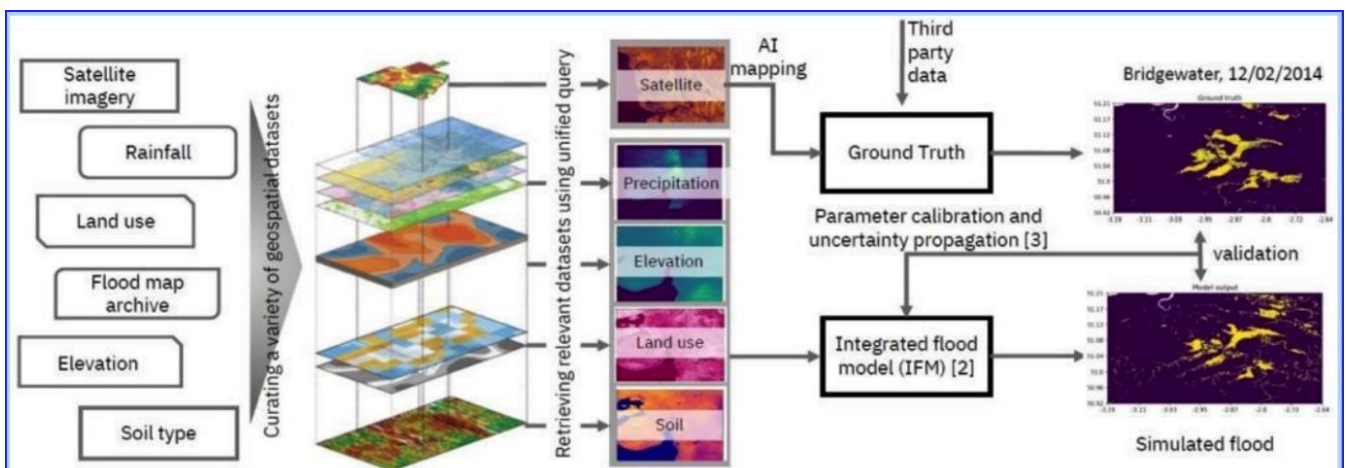
The use of Ai to assess climate impacts includes validation, calibration and uncertainty quantification for flood risks, can improve the accuracy of flood risk modelling. The expansion and modernization of flood monitoring networks such as rainfall gauges, river gauges and weather radar systems can help to overcome technical difficulties associated with forecasting. Collaborative efforts through south-south and north-north partnerships can facilitate technology transfer and knowledge exchange.

Nature Based Solutions

The Panel Session on Nature Based Solutions was moderated by Ms. Ivy Wong, Chief Executive Officer, Permian Global Malaysia. The panelists were Andrew Eden (UK Environment Agency, Adaptation & Resilience Team Manager), Dr Ponnambalam Rameshwaran (Senior Research Scientist, UK Centre for Ecology & Hydrology), and Ms. Lakshmi Lavanya Rama Iyer (Director of Policy and Climate Change, WWF Malaysia).

Andrew Eden provided insight into Natural Flood Management (NFM), which involves utilizing natural resources to mitigate flooding. With 40 projects set to benefit from a substantial funding of 25 million pounds, the aim is to double NFM implementation to meet national targets. Practical guidance is offered to plan, deliver, and maintain these assets, alongside economic methods to justify investment by valuing the full societal benefits of nature-based solutions. The CIRIA best practice provides a platform for practitioners to learn about sustainable drainage systems. Three critical factors for NFM success are identified: state intervention to provide hard engineering solutions, securing funding, and scaling up NFM efforts. Additionally, the NFM benefits calculator is introduced as a tool to assess flood, environmental, and carbon benefits.

Dr. Ponnambalam Rameshwaran outlined two projects, the Littlestock Brook NFM Scheme and the LANDWISE project. The Littlestock Brook NFM Scheme involves the creation of storage ponds, leaky dams, and tree planting to mitigate flooding. Analysis indicates significant potential for flood storage in extreme events, with multiple benefits including sediment yield reduction and habitat enhancement. The LANDWISE project focuses on innovative arable management practices to improve soil health and water retention. Nature-based solutions are emphasized for their cost-effectiveness, positive impact on water quality and biodiversity, and soil management benefits. The effectiveness of NBS or NFM is a topic of ongoing research within UKCEH.

Lakshmi Lavanya Rama Iyer introduced the launch of the IFRC/WWF first joint report, aiming to advocate for the urgent implementation of nature-based solutions (NBS) in climate change adaptation and disaster risk reduction strategies. The SEACAR Alliance, a collaboration between Thinkcity, WWF, and BCG, focuses on observing climate adaptation and resilience in Southeast Asia. Their approach includes nature-based solutions, climate analytics & AI, and assessing the resilience of cities and communities across various sectors such as health, natural ecosystems, infrastructure, trade, agriculture, and water. Community-based initiatives like Friends of Bukit Kiara demonstrate the importance of cross-cutting work in policy, climate change, sustainable market programs, and education for sustainable development in promoting environmental conservation and resilience at the local level.

Fostering community participation in flood management decision-making process through outreach programs, meetings, advisory committees and participatory planning exercises. This includes empowering local leaders and stakeholders to take ownerships of flood resilience initiatiaves. By strengthening the coordination among government agencies, local authorities, NGOs, community groups and other stakeholders enhanced their ability to plan, implement and evaluate flood resilience strategies.

Wrap Up

Professor Dr. Joy Jacqueline Pereira, Principal Research Fellow of SEADPRI-UKM provided the wrap-up to the event. The Roundtable on "Effective Flood Management and Responses in Cities" has clearly shown that the impact of flooding has an immediate impact, as well as a cascading effect to health including mental health, which is invisible and prevails long after the event. Key issues from all the sessions could be synthesized around five clusters. These are science and technology, capacity building, governance, finance and stakeholder engagement.

Science and technology have clearly advanced but scaling-up is required to support effective flood management and responses in cities. Current rainfall trends are different from historical projections, and early warning systems need to cover both the temporal and spatial dimensions, with more granular information required for the city-scale. It was noted that the expertise for projecting pluvial flooding due to direct rainfall in cities is clearly lagging behind the existing experience in fluvial or river flooding. The impact-based forecasting helmed by the Drainage and Irrigation Department of Malaysia, which focuses on predicting the impacts of weather events such as river flooding is very useful for relatively large river basins in the country, especially during the monsoon season.

A different approach is required for early warning in cities. This is demonstrated by the Kuala Lumpur Multi Hazard Platform (KL-MHP), a local level forecasting system developed for Kuala Lumpur, with support from the Newton Ungku Omar Fund. The KL-MHP is now anchored by the Meteorology Department of Malaysia for the City Hall of Kuala Lumpur. The scaling-up of such a system to other cities in the country would help Local Authorities to manage increasing hazards due to climate change such as increased intensity and frequency of rainfall and intense heatwaves. The KL-MHP is a robust and effective tool for local-level decision-making and disaster response.

Nature-based solutions and blue-green infrastructure require context-specific and area-based approaches, including assessing the severity of flooding. A range of blue-green infrastructure solutions are available for flood management, focusing along rivers and in catchment areas. Natural flood management requires state intervention to provide a hybrid approach to hard engineering solutions, allocate funding, and scaling up successful pilots. In the UK, practical guidance is offered to plan, deliver, and maintain such assets in an economical way including drawing on the full societal benefits of nature-based solutions. Tools that assess flood, environmental and carbon benefits could also benefit nature-based solutions, opening up opportunities to integrate climate change mitigation (emission reduction) and climate change adaptation (physical risk reduction).

Capacity building is critical to enhance evidence-based decision-making for effective flood management and responses in cities. Currently, the capacity for flood management is higher among practitioners in Federal

agencies and researchers in universities, compared to Local Authorities. Capacity has to be strengthened risk-informed decision-making in Local Authorities, as well as among other local stakeholders including the private sector and communities, to build resilience to floods and other disasters, which are expected to worsen in cities due to climate change.

In addition, there is also need to develop metrics to assess the effectiveness of flood-management schemes. This could then be used to assess the effectiveness of current flood management schemes to be compared to nature-based solutions. In the UK, there is a platform for practitioners to learn about sustainable drainage systems, specifically natural flood management. A similar platform could be considered in Malaysia to accelerate capacity building at the local level in Malaysia.

Governance is fundamental for effective flood management and responses in cities. Local Authorities in Malaysia need to take a holistic approach to understand the connectivity of issues. An example is the use of integrated river basin management via land-use planning and development control, as advocated in the Water Sector Transformation Plan 2040. This calls for strengthening administrative bodies within catchment areas, and taking into account river boundaries when planning land-use within administrative boundaries. Institutional arrangements and legislative measures that mainstream and accelerate nature-based solutions for flood management need to be identified and implemented.

It was noted that the mandate of the Drainage and Irrigation Department of Malaysia is confined to major rivers, while Local Authorities have jurisdiction over small river channels and drainage systems within cities. Pluvial flooding that occurs due to direct rainfall over cities is projected to worsen in cities due to climate change, increased exposure and vulnerability of infrastructure, assets and communities. Early warning systems for pluvial flooding depend on granular down-scaled rainfall projection. This calls for closer institutional arrangements between Local Authorities and the Meteorology Department of Malaysia, to facilitate the transmission of scale-appropriate weather forecasts for cities to strengthen early warning and disaster response. Early warning systems, blue-green infrastructure and nature-based solutions represent the building blocks of an adaptation industry in Malaysia, as mentioned in the National Industrial Plan.

Finance is fundamental for effective flood management and responses in cities. Overall, the financial infrastructure for floods need to be strengthened. It appears that that large multinationals have better financial protection from floods compared to smaller companies. There is need to enhance the penetration of flood risk insurance among small and medium enterprises in the country. The disclosure and reporting of flood risks also needs improvement. This calls for more granular scale information to be accessible in the country. In addition, the financial feasibility of technology implementation is an important aspect that requires evidence-based information. Funding mechanisms to support nature-based solutions and ensure their multiple benefits are realized was identified as a priority.

Stakeholder engagement is most evident in emergency responses to urban flooding, highlighting the contributions of non-government organisations, civil society organisations, academia and the private sector at the ground level. Increased knowledge sharing and exchange of experience through stakeholder engagement at the local level could help to accelerate capacity building of Local Authorities. The engagement of stakeholders needs to be further strengthened in the use of science for early warning systems, improving financing resilience, exploring sustainable infrastructures, and in capacity building initiatives to strengthen flood management. Partnerships are crucial for mainstreaming nature-based solutions. Community involvement can facilitate the maintenance natural flood infrastructure, as shown in the UK. Commitment to ongoing open data sharing was also emphasized to facilitate stakeholder engagement by improving transparency, innovation and community action for effective flood management.

25 March 2024 (1st day)

Time	Activity	Speaker
0745	Registration	
0830	Scene setting	**Poorani Krishnan** Science and Innovation (SIN) Advisor British High Commission Kuala Lumpur
0840	Welcome note:	**H.E. Ailsa Terry** High Commissioner British High Commission Kuala Lumpur
0845	Launching remarks:	**YB Tuan Nga Kor Ming** Minister Ministry of Housing and Local Government (KPKT)
UK INVESTMENT IN FLOOD RESEARCH		
0850 - 0920 *(30 minutes)*	**Session 1** Keynote: *Overview of UK's National Flood Forecasting Framework*	**Dr Charlie Pilling (UK)** Chief Hydrometeorologist National Flood Forecasting Centre, UK
0920 - 0950	**Setting the scene:** *Project 1:* *"Exploring future flood risk across Peninsular Malaysia"– A UK MY Collaboration.* *This project was an international consortium led by Malaysian and UK researchers funded by the Newton-Ungku Omar Fund. The grant was jointly awarded by the Natural Environment Research Council (NERC) and the Ministry of Higher Education Malaysia.*	**Dr Ponnambalam Rameshwaran (UK)** Senior Research Scientist UK Centre for Ecology & Hydrology

	Project 2: *Theme 3: Supporting Climate Change Adaptation* *B: Climate change adaptation for Southeast Asia* *"Explore how water and land-management affect floods, drought and water quality, in particular the move to more intensive agriculture, for current and future climate".*	
0950 - 1010	Introduction to Weather and Climate Science for Service Partnership Programme (WCSSP) with the focus on impact-based forecasting WCSSP Southeast Asia - Met Office *This project was under Newton Fund and currently continued being funded by International Science Partnership Fund (ISPF)*	**Mr. Wan Marhafidz Shah bin Wan Mohd Omar** National Disaster Management Agency (NADMA) **Rebecca Beckett** (*virtual)* International Expert Meteorologist Met Office, UK
1010 - 1030	Kuala Lumpur Multi Hazard Platform (MHP): development history and its impact; and developing the next phase *This project was funded by Newton-Ungku Omar Fund.*	**Prof Joy Jacqueline Pereira** Lead PI (MY) for MHP Professor and Principal Research Fellow Southeast Asia Disaster Prevention Research Initiative (SEADPRI UKM) Co-Chair, IPCC Working Group III on Mitigation of Climate Change
1030 - 1045	Tea break /break	
MALAYSIAN FLOOD RESPONSES		
1045- 1100	Session 2 Keynote: **Flood responses in Malaysia**	YBrs. Tuan Rusli bin Ibrahim Director of Policy Section National Disaster Management Agency (NADMA) Prime Minister's Department

1100 – 1230 *(90 minutes)*	Panel session: **Malaysia: Strengthening communities' responses to urban flooding: framing the practical challenges and realising the opportunities.** Listening to real experiences Format: 3 slides max (*optional*) / 5 minutes **slides in advance***	Moderator: **Mr Muru Loganathan** Deputy Head - Climate Change, Energy and Environment, British High Commission Kuala Lumpur 1. **Jonathan Moxon (UK)** Executive Manager - Flood Risk & Climate Resilience 2. **Mr. Hafiz Amirrol,** Deputy Executive Director Mercy Malaysia 3. **Rose Afrina Mansor** Senior Associate Climate Resilience, Think City 4. **Jagedeswari Mariappan** Senior River Care Programme Officer Global Environment Centre (GEC)
1230 – 1330	Lunch /break	
1330 - 1500	Roundtable **Malaysia: Refining early warning systems and raising the bar on flood response mechanisms and support systems.** Format: 3 slides max (*optional*) / 5 minutes **slides in advance***	Moderator: **TPr. Ts. Norliza Binti Hashim** Chief Executive Officer Urbanice 1. **Dr Charlie Pilling (UK)** Chief Hydrometeorologist National Flood Forecasting Centre, UK 2. **Ir. Dr. Norlida binti Mohd. Dom** Director National Flood Forecasting and Warning Centre Department of Irrigation and Drainage Malaysia. 3. **Ir Dr Salmah Zakaria** former Chair of ASM Water committee Chair of ASM-EPU Study on WST 2040 (Water Sector Transformation by 2040). 4. **Muhammad Firdaus Ammar bin Abdullah** SME Numerical Weather Prediction Malaysian Meteorological Department
1500	Networking/ coffee & tea	

26 March 2024 (2nd day)

Time	Activity	Speaker
0730	Registration	
CLIMATE PROOFING INFRASTRUCTURE		
0750 - 0800	Welcome briefing and recap of day one	**Poorani Krishnan** Science and Innovation (SIN) Advisor British High Commission Kuala Lumpur
0800 - 0820	**Setting the scene:** **Leveraging Finance for Business Resilience to Floods in Malaysia** *A joint study by Bank Negara and World Bank, this presentation will showcase key findings from the new report launched in March 2024.*	**Dr. Tatiana Didier** Senior Economist World Bank Malaysia
0820 -0950 (90 minutes)	**Panel session** Financing sustainable, resilient infrastructure in cities for effective flood management and climate adaptation Format: 3 slides max (optional) / 5 minutes **slides in advance***	**Moderator: Datin Seri Sunita Rajakumar,** Chair, Climate Governance Malaysia 1. **Katie Lee Sheah Tsan** Climate Policy Strategist Bank Negara Malaysia 2. **Teresa Wong** Chief Risk Officer/Head of Sustainability Risk, Zurich General Insurance Malaysia/Zurich General Takaful Malaysia/ Zurich Malaysia 3. **Nurul Diana Intan Zarifah** Head, Risk and Sustainability Cyberview 4. **Dwi Rahardiani (IND)** Country Manager/ Senior Consultant Climate, Resilience, and Sustainability Oxford Policy Management (OPM) Indonesia 5. **Anita Ahmad** Chief Executive Officer Yayasan MySDG

0950- 1010	**Defining Sustainable Infrastructure for climate proofing the future** *Sustainable construction of our flood and coastal defences – we can draw on our experiences of using low carbon concrete in flood defences and our mechanisms for sequestering/ offsetting carbon, as well as embracing nature-based solutions as part of conventional flood and coastal defences.* *Approach to innovation (framing the innovation programmes)*	Andrew Eden (UK) UK Environment Agency Adaptation & Resilience Team Manager Flood & Coastal Innovation Programmes Executive FCERM Strategy & National Adaptation
1010 – 1030	**Success stories:** *West Yorkshire Flood Innovation Programme board. We are a West Yorkshire collaborative partnership with a focus on innovation around flood and climate risks.* iCASP: About us – Yorkshire Integrated Catchment Solutions Programme (iCASP)	**Jonathan Moxon (UK)** Executive Manager - Flood Risk & Climate Resilience Programme Manager – West Yorkshire Flood Innovation Programme Flood Risk Management Highways and Transportation Leeds City Council
1030-1045	Tea Break /break	
1045-1200	**Panel session:** **PLANNING SUSTAINABLE INFRASTRUCTURE:** City planning: are we ready for climate proofing infrastructure in our urban development plans? Show me the evidence. Format: 3 slides max (*optional*) / 5 minutes **slides in advance***	**Moderator: Prof Joy Jacqueline Pereira** Professor and Principal Research Fellow Southeast Asia Disaster Prevention Research Initiative (SEADPRI UKM) Co-Chair, IPCC Working Group III on Mitigation of Climate Change 1. **Jonathan Moxon (UK)** Executive Manager - Flood Risk & Climate Resilience Programme Manager – West Yorkshire Flood Innovation Programme 2. **Murali Ram** Malaysia Lead, Cities & Advisory Arup 3. **Mr. Fairuz Reza Razali** Senior Lecturer, Centre of Studies Architecture, Universiti Teknologi MARA (UiTM)

		4. **Dr Yogi Chellappan** Senior Manager- Climate Resilient Think City
1200-1300	Lunch / break	
1300-1430	**Panel session: NATURE BASED SOLUTIONS** Where are we exactly in this niche solution pathway - share us your foresight. Format: 3 slides max (*optional*) / 5 minutes **slides in advance***	**Moderator:** **Ivy Wong** Chief Executive Officer Permian Global Malaysia 1. **Andrew Eden (UK)** UK Environment Agency Adaptation & Resilience Team Manager 2. **Dr Ponnambalam Rameshwaran (UK)** Senior Research Scientist UK Centre for Ecology & Hydrology 3. **Lakshmi Lavanya Rama Iyer** Director of Policy and Climate Change WWF Malaysia
1430 – 1500	*Wrap up session*	**Prof Joy Jacqueline Pereira** Professor and Principal Research Fellow Southeast Asia Disaster Prevention Research Initiative (SEADPRI UKM) Co-Chair, IPCC Working Group III on Mitigation of Climate Change
1500	Networking/ coffee & tea	

Annex B – List of Participants

No	Full Name	Institution Name
1	Dr. Zed Diyana Zulkafli	Universiti Putra Malaysia
2	Datin Seri Sunita Mei Lin Rajakumar	Climate Governance Malaysia
3	Ms Jacqueline Chang	Global Covenant of Mayors for Climate and Energy Asia (GCoM Asia)
4	Ms Rose Afrina Mansor	Think City
5	Dr. Balqis Mohamed Rehan	Universiti Putra Malaysia
6	Ms Lim Sui Lian	CIMB
7	Dr. Nurfashareena Muhamad	Southeast Asia Disaster Prevention Research Intiative (SEADPRI-UKM)
8	Ms Emily Oi Yen Tse	Excelsa Consulting
9	Dr. Mohd Rizal bin osman	URBANICE MALAYSIA
10	Mr Abdul Rauf Bin Mohd Hadzri	URBANICE MALAYSIA
11	Ms Nur Cempaka Edlin Binti Rosli	URBANICE MALAYSIA
12	Mr Saufi Aiman Mohd Jamil	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
13	Ir. Noor Iziddin Abdullah Bin Haji Ghazali	GIZ
14	Ms Lavanya Rama Iyer	WWF-Malaysia
15	Prof. Dr. Mazrura Sahani	University Kebangsaan Malaysia
16	Mr Teh Bor Tsong	Universiti Malaya
17	Ms Shobana Selvaraju	GIZ
18	Ms Kiranjeet Kaur Ambra Singh	MGTC
19	Ms Rozita binti Hod	Universiti Kebangsaan Malaysia
20	Mr Stephen Page	Talkin' Technical Geospatial
21	Mr Donovan Casimir Louis	Malaysian Nature Society
22	Mr Tommy Cheo Seng Kong	WWF-Malaysia
23	Ms Shantini Guna Rajan	WWF-Malaysia
24	Ms Thayanithi Kulenthran	Dayanidhi Earth
25	Ms Zayana Zaikariah	Institute of Strategic International Studies (ISIS) Malaysia
26	Ms Ambika Devi A/P Daran	Penang State Secretariat
27	Dr. Muganti Rajah Kumar	Malaysian Biotechnology Information Centre (MABIC)
28	Ms Raja Kuppuswamy	KPH Synergy Sdn Bhd
29	Dato' Ir. Lim Chow Hock	University of Nottingham Malaysia
30	Dr. Maniyammai Kumaresen	University of Nottingham Malaysia
31	Ms Anjulie Razak	Yayasan MySDG
32	Ms Kieran Li Nair	Institute of Strategic & International Studies (ISIS) Malaysia
33	Mr Navakanesh M Batmanathan	Southeast Asia Disaster Prevention Research Initiative
34	Dr. Elanni Md Affandi	Universiti Malaya
35	Mr Sebastien Goethals	Citilinks
36	Ms Elanni Md Affandi	Universiti Malaya
37	Dr. Yoong Sao Chin	CREST Malaysia
38	Dr. Yogi Chellappan	ThinkCity
39	Mr Ng Sean Fong	MNS
40	Mr Ahmad Fariz Shah	KPKT
41	Mr Muhammad Ikmal Nizam	GEC
42	Ms Soon Vivian	MNS