Science Technology Status for Disaster Risk Reduction Malaysian Standing Issued at the AMCDRR New Delhi, 2-4 Nov 2016

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The Asia Science Technology Academia Advisory Group (ASTAAG) conducted a survey in 11 countries in Asia to get an insight of the status of science and technology for disaster risk reduction. The survey was essentially a qualitative judgement of the current status of (1) science technology in decision making, (2) investment in science and technology, and (3) science link to people based on 21 different indicators, where a scale of 1 to 5 was used, with 1 being lowest and 5 being the highest. In addition to the survey, ASTAAG also made a call for submission of case studies on application of science and technology for disaster risk reduction. A total of 28 case studies were received from 13 countries in response to the call.

In Malaysia, the survey was anchored by Universiti Kebangsaan Malaysia's Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM). Findings of the survey were presented and reviewed by stakeholders comprising scientists, researchers, practitioners and government officials. The final endorsement was sought during the National Workshop on Sendai Framework on DRR convened by the National Disaster Management Agency (NADMA) and SEADPRI-UKM on 15 June 2016 in Bangi, Malaysia. In addition to establishing the current status of science and technology for disaster risk reduction, several short and long term actions were identified for advancing the field in the country. One such goal was on institutionalisation of a Scientific Expert Panel for Disaster Risk Reduction to harness science and technology for preventing climate-induced disasters and to support NADMA. The Director-General of NADMA, YBhg. Dato' Zaitun Ab Samad, presented the proposal to establish the Scientific Expert Panel to the National Science Council chaired by the Prime Minister of Malaysia on 4 August 2016. The Council has approved the establishment of the Panel, which will be chaired by the Science Advisor to the Prime Minister. Two case studies from Malaysia were also submitted directly to ASTAAG. The case studies were on "Eco Transit Homes for Disaster Relief" and "Classification of Tropical Peat Soils as the Foundation for Preventing Widespread Fires".


Photo by Rajib Shaw

*Dr. Rajib Shaw, Co-Chair of ASTAAG **(left)** presenting the Asia Science Technology Status Report for DRR to Professor Zakri Abdul Hamid, the Hon. Science Advisor to the Prime Minister of Malaysia and Chair of the Scientific Expert Panel on DRR **(right)** on 29th of September 2016 at the International Network for Government Science Advice (INGSA) Conference co-organised with the European Commission, Brussels.*

The findings of the survey and the case studies have been documented in "Asia Science Technology Status for Disaster Risk Reduction", published by Integrated Research on Disaster Risk (IRDR), Future Earth and ASTAAG. The document was released at the Asian Ministerial Conference on Disaster Risk Reduction (AMCDRR) in New Delhi, India on 2-5 November 2016.

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Disaster Risk Reduction and Informed Governance
Pengurangan Risiko Bencana dan Governans Bermaklum

Dokumen Rangka Kerja Sendai bagi Pengurangan Risiko Bencana (2015-2030) yang telah dilancarkan di Persidangan Ketiga Pertubuhan Bangsa-Bangsa Bersatu (PBB) berkaitan Pengurangan Risiko Bencana pada bulan Mac 2015, walaupun bukan dokumen yang tidak mengikat mana-mana Negara ahli PBB, telah melakarkan pendekatan pengurangan risiko bencana ("DRR") yang berpaksikan kepentingan manusia. Rangka Kerja Sendai berhubungkait rapat dengan Agenda Pembangunan Mampan 2030, yang telah digunapakai pada September 2015, yang memberi penekanan terhadap aspek-aspek berkaitan DRR, yang terkandung di dalam sekurang-kurangnya 10 daripada 17 Matlamat Pembangunan Lestari (SDG). Perkaitan antara DRR dan SDG, memberi penekanan yang lebih kepada keperluan untuk memahami risiko dan keterdedahan, serta pembentukan sistem governans DRR yang bermaklum. Ini akan membantu di dalam memastikan kelestarian hala tuju pembangunan semasa dan yang sedang dirancang.


Photo by SEADPRI-UKM

*Ms. Michelle Gyles-McDonnough **(centre)**, Resident Coordinator of the United Nations System's Operational Activities for Development in Malaysia (UNDP), with SEADPRI-UKM researchers during her research visit on 15 September 2016.*

Mandat yang jelas untuk governans DRR adalah penting. Ini memerlukan pengumpulan maklumat serta analisis yang strategik berkaitan jenis, skala dan impak dari pelbagai risiko berpunca dari pelbagai jenis bencana. Sehubungan itu, mandat yang memanfaatkan dan memajukan sains dan teknologi, serta amalan baik DRR, mengambilkira amalan tempatan, merupakan antara faktor utama dalam pembentukan governans DRR yang bermaklum. Governans DRR perlu berlandaskan penggemblengan kekuatan pelbagai pihak berkepentingan yang berkerjasama dan berusaha ke arah matlamat membina daya tahan. Ianya juga akan memberi fokus kepada pengurusan risiko pelbagai bencana, untuk mengelak dan seterusnya mengurangkan keterdedahan, disamping mengukuhkan kesiapsiagaan, respon dan pemulihan.

SEADPRI-UKM kini memberi tumpuan kepada pemahaman governans risiko bencana, disamping memberi sokongan kepada pihak kerajaan di dalam merangka arah governans dan tadbir urus bagi DRR. Fokus semasa adalah tertumpu kepada governans DRR di Malaysia, dan pada masa hadapan ianya akan diperluaskan termasuk memahami governans DRR di Asia Tenggara.

ASSOC. PROF. DR. SARAH AZIZ ABDUL GHANI AZIZ
Pengerusi SEADPRI-UKM
Chair of SEADPRI-UKM

The Sendai Framework for Disaster Risk Reduction (2015-2030) adopted at the Third UN World Conference on Disaster Risk Reduction in March 2015 has put forward a non-binding document that is people centred in its approach to disaster risk reduction (DRR). The Sendai Framework echoes through the 2030 Agenda for Sustainable Development, adopted in September 2015, with specific DRR aspects appearing in at least 10 of the 17 Sustainable Development Goals (SDG). The link between DRR and SDG places a greater emphasis on the need to understand risks and vulnerability, as well as frame a system of governance that is DRR informed. This will ensure that present and planned national development directions remain sustainable.

A clear mandate for DRR governance is necessary. This requires strategic intelligence gathering and analysis to better understand the type, scale and impact of different risks posed by multi-hazards. A mandate to capitalise on, and advance science and technology, plus good practices that include indigenous or local practices, is another key factor for informed DRR governance. DRR governance will hinge on multiple stakeholders working towards a common goal to build resilience. It will also focus on managing risks associated with multiple hazards to reduce exposure and vulnerability, as well as increase preparedness, response and recovery.

Understanding disaster risk governance is one of the primary tasks that SEADPRI-UKM has undertaken, to provide support to the government in framing the governance direction for DRR. The current focus is on DRR governance in Malaysia. Future work will include understanding DRR governance in the Southeast Asia.

Article

Enhancing Local Level Climate Change Adaptation in Southeast Asia – A Perspective on Needs and Priorities

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Abstract: *The ASEAN-India Project on Enhancing Local Level Climate Change Adaptation in Southeast Asia (Phase 1), jointly implemented by SEADPRI-UKM and the Indian Institute of Science (IISc.), Bangalore has mobilised research teams in ten ASEAN Member States (AMS). The effort has delineated adaptation needs and priorities in each AMS and the region. This was done through a series of workshops at national and regional levels, and augmented with peer reviewed literature and national reports. National needs and priorities vary across the AMS. Notwithstanding this, short and long term risks can be handled using the context and area-specific approach, integrating disaster risk reduction where feasible, to take into account variations in local conditions. Regional needs would best be handled by research consortiums comprising experts from the AMS working in conjunction with policy makers in the region. The web-based ASEANadapt Network [www.aseanadapt.org] serves as a starting point for mobilizing such expertise.*

Keywords: *climate change adaptation, slow onset hazards, disaster risk reduction, Southeast Asia.*

INTRODUCTION

The majority of disasters that affect cities in Southeast Asia are climate driven. Examples include floods, landslides, storms and drought, among others. Earthquakes and volcanic eruptions are also prevalent primarily in Indonesia and The Philippines. Climate related threats account for 30% of the total GDP damage across cities in the region, where total GDP at risk can be as high as 5% (Coburn, 2015). With the advent of climate change losses can be expected to be much higher (Barros et al., 2014). It is also anticipated that with time more people will be exposed to slow onset hazards such as sea level rise, ocean acidification, groundwater salinization and land degradation, among others. The consequences of slow onset events include for example, threats to food security, loss of livelihood options, loss of territory; leading to migration, forced or voluntary displacement and planned relocation, which may in turn give rise to security issues. Socially relevant science and technology have a critical contribution to make to address these challenges (Pereira et al., 2014). However, needs and priorities have to be identified first for science and technology to be deployed effectively.

The ASEAN-India Green Fund approved funding support to Universiti Kebangsaan Malaysia's Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM) to implement the first phase of the ASEAN-India Project on Enhancing Local Level Climate Change Adaptation in Southeast Asia (Phase 1). The project is jointly implemented by SEADPRI-UKM and the Indian Institute of Science (IISc.) Bangalore covering ten ASEAN Member States (AMS). The objectives of the project are to conduct a scoping study to identify the needs of AMS in terms of climate change adaptation and develop a regional climate change adaptation work programme and network. A major activity of the project was to solicit the inputs of stakeholders from AMS and regional institutions to get their insights on adaptation needs and priorities in the region. This was done through a series of workshops at national and regional levels, and augmented with peer reviewed literature and national reports (Pereira et al., 2015). This article provides a perspective on needs and priorities at national and regional levels.

PERSPECTIVE ON NATIONAL NEEDS AND PRIORITIES

There is a broad range of national needs and priorities across ASEAN Member States. Generally, climate change is mainstreamed at the national level but the trickle down to the local level is very limited. Stakeholder consultations in many countries highlighted the need for area-based pilots focusing on selected priorities. Among the aspects highlighted include the following:

- Forests in Southeast Asia are expected to be impacted by climate change. Hence, the aspect of carbon stock is of importance as carbon sinks could be impacted. Coping strategies and adaptation practices for addressing climate change impacts on biodiversity and forests should be investigated drawing on simulation or modelling studies;
- There is much discussion on the issue of carbon credit mechanisms among some AMS. It has identified this as a priority project but local experts are limited. There is need to build capacity in this area, particularly on aspects of securing income or incentives out of carbon credits;
- Health is identified as a priority issue, particularly health problems in the aftermath of extreme events such as flood and droughts. For example, water borne diseases, dengue fever and malaria is common and has been projected to become worse in the National Adaptation Programme of Action. Several key health risks have been identified for the region in IPCC's Fifth Assessment Report (Hijioka et al. 2014). The capacity to model health impacts needs to be enhanced in AMS;
- There was emphasis on the need to differentiate vulnerability to current climate and vulnerability to long term climate, where both approaches are equally important. There are methods available for both approaches. Inherent vulnerability index may be suitable for short term adaptation of development projects to current climate (i.e. water resource management, ecosystem based adaptation approaches, etc.). However, for long term resilience, the use of vulnerability index based climate change scenario is more relevant.
- The participation of local governments in climate change adaptation is important and necessary to effectively tackle the impacts of climate as they are the ultimate implementers. However, coordination at the national level is critical to make this happen. They are many challenges including mainstreaming of adaptation in local development planning, allocation of resources, provision of -

Activities


Photo by SEADPRI-UKM

The 3rd UNISDR Asia Science Technology Academia Advisory Group (ASTAAG) Meeting, was held on 23 May 2016 at Shangri-La Putrajaya. The meeting was hosted by SEADPRI-UKM and Asian Network on Climate Science and Technology (ANCST).

SEADPRI-UKM presented the Final Report of the ASEAN-India Green Fund Project at the 7th Meeting of the ASEAN Working Group on Climate Change (AWGCC) on 20-21 July 2016 in Kuala Lumpur. The Meeting was hosted by the Ministry of Natural Resources and Environment Malaysia.

Photo by NRE Malaysia


Photo by SEADPRI-UKM

SEADPRI-UKM Fellow, Mr. Lim Choun Sian and Honorary Fellow Dato' Yunus Abdul Razak at the Workshop on "Disasters and Climate Change Adaptation: The Role of Geoscience", held on 12 October 2016 at the Trans Luxury Hotel Bandung, West Java, Indonesia. The event was a collaboration between Ikatan Ahli Geologi Indonesia, GIC, GEOSEA, University of Cambridge, Geological Society of Malaysia, and Asian Network on Climate Science and Technology (ANCST).

Activities

SEADPRI–UKM Events and Involvement in Key Meetings

- **Conference on "Flood Catastrophes in a Changing Environment"**, 15-16 November 2016, Universiti Teknologi Malaysia (UTM), Kuala Lumpur. *Collaborators:* Universiti Teknologi Malaysia (UTM) and Asian Network on Climate Science and Technology (ANCST).
- **Asian Ministerial Conference on Disaster Risk Reduction (AMCDRR 2016)**, 2-5 November 2016, New Delhi, India. *Organisers:* Ministry of Home Affairs, Government of India, the United Nations Office for Disaster Risk Reduction (UNISDR), and International and National Development Partners
- **CCOP-VIETADAPT-SEADPRI Workshop on "Geoscience Supporting Risk Management, Water and Food Security"**, 30 October 2016, The Berkeley Hotel Pratunam, Bangkok, Thailand. *Collaborators:* Geological Survey of Finland (GTK), Sub-Institute of Hydro-Meteorology and Climate Change, Vietnam (SIHYMECC), Centre for Water Resources Warning and Forecasting, Vietnam (CEWAFO), Asian Network on Climate Science and Technology (ANCST) and CCOP Technical Secretariat.
- **Technology and Applications for Disaster Management International Conference 2016 (TADMIC16)**, 19-20 October 2016, Kuala Lumpur. *Collaborators:* Ministry of Science, Technology and Innovation Malaysia (MOSTI), Astronautic Technology (M) Sdn. Bhd., Malaysian Meteorological Department of Malaysia, Universiti Putra Malaysia (UPM), Royal Malaysia Police (PDRM) and Civil Defence Force (APM).
- **Workshop on "Disasters and Climate Change Adaptation: The Role of Geoscience"**, 12 October 2016, The Trans Luxury Hotel Bandung, West Java, Indonesia. *Collaborators:* Ikatan Ahli Geologi Indonesia, GIC, GEOSEA, University of Cambridge, Geological Society of Malaysia, and Asian Network on Climate Science and Technology (ANCST).
- **Forum SEADPRI-UKM 2016 on "Insurance for Disaster Risk Reduction and Climate Adaptation - Opportunities and Challenges"**, 6 October 2016, Puri Pujangga, UKM Bangi. *Collaborators:* National Disaster Management Agency, Prime Minister's Department of Malaysia (NADMA), Malaysian Association of Risk and Insurance Management (MARIM), Asian Network on Climate Science and Technology (ANCST), Asia-Pacific Network for Global Change Research (APN), and Institute for Global Environmental Strategies (IGES), Japan.
- **ASEAN Youth Volunteer Programme (AYVP): The Development of ASEAN Youth DRR Leaders through Volunteerism & Community Engagement,** 1-26 August 2016, Manila, Philippines. *Organisers:* Universiti Kebangsaan Malaysia (UKM), University of the Philippines, Ateneo de Manila University (ADMU), De La Salle University (DLSU), Ministry of Youth and Sports Malaysia, US Agency for International Development (USAID), ASEAN Secretariat, National Youth Commission (NYC) Philippines and Commission on Higher Education (CHED), and Office of the President of the Philippines.
- **Workshop on "Drafting the Disaster Management Council Bill",** 10-11 August 2016, Danau Golf Club UKM Bangi. *Organisers:* National Disaster Management Agency, Prime Minister's Department of Malaysia (NADMA).
- **7th Meeting of ASEAN Working Group on Climate Change (AWGCC),** 20-21 July 2016, Seri Pacific Hotel, Kuala Lumpur. *Organisers:* ASEAN and Ministry of Natural Resources and Environment (NRE) Malaysia.
- **National Workshop on "Terminology and Indicator for Sendai Framework for Disaster Risk Reduction, 2015-2030"**, 15 June 2016, Puri Pujangga, UKM Bangi. *Collaborators:* National Disaster Management Agency, Prime Minister's Department of Malaysia (NADMA).
- **Workshop on "Science & Technology for Disaster Risk Reduction"**, 24 May 2016, Shangri-La Putrajaya. *Collaborators:* National Disaster Management Agency, Prime Minister's Department of Malaysia (NADMA), Malaysian Industry-Government Group for High Technology (MIGHT), Asian Network on Climate Science and Technology (ANCST), and UN-ISDR Asia Science, Technology and Academia Advisory Group (ASTAAG).
- **3rd UNISDR Asia Science Technology Academia Advisory Group (ASTAAG) Meeting**, 23 May 2016, Shangri-La Putrajaya. *Collaborators:* UN-ISDR Asia Science, Technology and Academia Advisory Group (ASTAAG), and Asian Network on Climate Science and Technology (ANCST).
- **Workshop on "Science for Managing Disaster Risks",** 9 March 2016, PJ Hilton, Petaling Jaya. *Collaborators:* National Disaster Management Agency, Prime Minister's Department of Malaysia (NADMA), National Council of Professors (MPN), University of Cambridge, Universiti Malaya, University College of London (UCL), International Union of Geological Sciences, Commission on Geoscience for Environmental Management (IUGS-GEM), Geological Society of Malaysia, Asian Network on Climate Science and Technology (ANCST), Malaysian Association of Risk and Insurance Management (MARIM), and Risk Management Research Unit, and Universiti Utara Malaysia (UUM).
- **Workshop on "Monsoons and Weather Extremes",** 9 March 2016, Meteorological Department of Malaysia. *Collaborators:* Meteorological Department of Malaysia, Asian Network on Climate Science and Technology (ANCST), City University of Hong Kong, and Indian Institute of Sciences (IISc).
- **Mahathir Science Award Foundation (MSAF) Lecture Series: Post COP21 – Translating the Paris Agreement through Strategic Investment in Science and Technology**, 8 March 2016, Malaysian Investment Development Authority (MIDA) Sentral, Kuala Lumpur. *Collaborators:* Mahathir Science Award Foundation (MSAF), Ministry of Science, Technology and Innovation Malaysia (MOSTI), Malaysian Investment Development Authority (MIDA) , Academy of Sciences Malaysia (ASM), AmBank Group, British High Commission Kuala Lumpur, Yayasan Al-Bukhary Foundation, and Asian Network on Climate Science and Technology (ANCST).

Article

legal mandate etc. Emphasis should be given to build capacity and knowledge management skills of local government units.

PERSPECTIVE ON REGIONAL NEEDS AND PRIORITIES

The requirements for climate change adaptation for Southeast Asia are based on the perspectives of stakeholders that operate in the region. Their perspectives were solicited through focused discussions at workshops. Individual expert opinions were solicited from personnel serving the Asian Development Bank (ADB), World Agroforestry Centre and Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), Integrated Research on Disaster Risk (IRDR), UNISDR Asia Science Technology Academia Advisory Group (ASTAAG), among others. The following aspects were highlighted:

• Regional requirements in the future include both conventional research and action oriented projects, capacity building, advocacy of policy and decision-makers, public awareness about the climate change impacts, climate risk communication, early warning for climate extremes and best practice case studies, and promotion of public-private participation in climate adaptation, among others. Emphasis was placed on platforms for sharing and exchange of information relevant to climate change would advance the adaptation agenda in the region. Such platforms can serve to enhance knowledge and promote capacity development. AMS researchers and practitioners have a lot of experience and success stories to be shared;

• Also proposed was a flagship regional initiative on climate change assessment (similar to that conducted by the Intergovernmental Panel on Climate Change, IPCC) conducted by ASEAN researchers for the governments of AMS and the international community. Such assessments are already being conducted at the national level in some AMS (e.g. Vietnam Panel on Climate Change). An ASEAN Panel on Climate Change could be considered in the future. Support could be sought from the Government of India or other funding bodies for this initiative;

• There was also a suggestion on expanding the ongoing Asian Development Bank initiative called the Climate Data Consortium, which currently involves 3 pilot countries, Philippines, Thailand and Indonesia to cover more AMS. Researchers in AMS can benefit from participating in the data consortium as it is now in the early stages. Another initiative to be considered is Climate Services for Resilient Development, which is ongoing in the Indian Sub-continent, with plans for expansion to Southeast Asia;

• Stakeholders also emphasized that funding should give priority to the development of local adaptation plans as communities are the most vulnerable. Researchers in ASEAN should be mobilized to support the development of local adaptation action plans, via selected pilots so that they can then be replicated by the stakeholders. The researchers should interface with policy makers and convince progressive local policy makers to allocate funds so that research tools to evaluate and implement adaptation options can be developed to facilitate budget allocation for the long term.

CONCLUDING REMARKS

Within a national boundary, there are variations in local conditions and this is where the problems need to be tackled. In this regard, the need should be to select a specific area of high priority, for example, a landscape or an ecosystem with a cluster of villages, or a sub-basin within a watershed that may have a small landscape with communities, forests, farms, plantations, water resources, etc. Within this specific area, both the aspects of adaptation and mitigation can be considered. Short-term risks can be handled via immediate adaptation programmes and policies (that could integrate disaster risk reduction), where climate modeling outputs are optional. There is need to identify climate extremes and hotspots that constitute pockets of highly vulnerable communities in various landscapes (i.e. coastal, forests, watersheds, etc.) so that adequate adaptation measures can be given priority. Long-term planning and long term resilience programmes will require climate modelling. This can be handled using the same context and area-specific approach. The benefits of the projects in facilitating learning and capacity building was highlighted. A call was made for a platform comprising academia and researchers to exchange information on good practices and communicate on a continuous basis beyond the life of a project. This could serve as the starting point for mobilizing expertise from within AMS on a consortium basis to address regional needs and priorities. SEADPRI-UKM now hosts the web-based ASEANadapt Network [www.aseanadapt.org], which was formally recognised by the ASEAN Working Group on Climate Change (AWGCC) at its 7th Meeting on 21 July 2016 in Kuala Lumpur. The network, which is also linked to the Asian Network on Climate Science and Technology (ANCST) will facilitate continuous exchange of information on good practices and communication on climate change adaptation among universities and other affiliated organisations in the region.

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Article

Measuring Loss and Damage: Approaches and Challenges

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Abstract: *The evaluation of loss and damage (L&D) is becoming increasingly important. There are many challenges in L&D assessment and these include attribution of disasters to climate change as well as methodological limitations. Ongoing estimations are largely about the tangible damages while the assessment of intangible L&D has not been standardized. Based on a review of various approaches, a hybrid conceptual framework is proposed for measuring L&D at the city level to fulfill strategic national needs and contribute to the current climate change negotiations.*

Keywords: *loss and damage, climate change, disaster risk reduction, evaluation of natural disasters*

INTRODUCTION

Loss and damage (L&D) is a concept of increasing importance in natural hazard and climate change studies (Huq, Roberts, & Fenton, 2013). It refers to the enduring impact that remains even after adaptation and mitigation measures have been performed. In real essence, this residual loss is permanent and irreversible. The impacts of climate change and natural disaster are adverse in most cases. However, negative consequences cannot be avoided by taking mitigation and adaptation efforts alone. When such efforts become insufficient, in fact, they do (Mathew & Akter, 2015), L&D may fill the gap. Most of the current assessments are focusing on addressing the risk of L&D. Attribution of L&D to climate change requires physical science inputs and this is a major challenge due to limited information. Furthermore, ongoing estimations are largely about the tangible damages. There is no standard method for assessment of intangible L&D (Estrada, Botzen, & Tol, 2015). This article provides a very brief overview of the limitations of L&D methodologies. A way forward is proposed to address L&D at the city level to fulfill strategic national needs and contribute to the current climate change negotiations.

CURRENT APPROACHES

The assessment of L&D has to take into account economic, humanitarian and ecological dimensions (Mechler, 2003). Therefore, a multi-faceted model needs to be developed incorporating all these elements. Viewing L&D from direct vs. indirect or tangible vs. intangible points of view is misleading concerning ripple effect counting that incorporates the physical and consequential impacts (Rose, 2004). Many economic models can measure both. However, the humanitarian and ecological aspects are largely untouched by these models thus comprehensiveness of evaluations remains incomplete. Most of the models are complex and specialised for different applications (Table 1). Catastrophe risk models depend on historical data extensively and are good at assessing potential loss, but need a high level of expertise. Among them, the CATastropheSIMulation (CATSIM) and Probabilistic Risk Assessment (CAPRA) are even more comprehensive that they include several sectors and hazards at a time. However, CAPRA is unable to work in the context of bushfires and does not cover the broader section of the economy (Rajabifard et al., 2014). Integrated Assessment Models (IAMs) are specially designed for calculating consequences of different assumptions and explaining interrelations between various factors (Bergh & Botzen, 2014). They are rather simple and unable to account for the interaction between various sectors.

WorldRiskIndex is based on an index that incorporates social, economic, and environmental vulnerability but it is a shallow tool which is unable to explain the different nature of different climatic events.

UKCCRA is a model that consists of 100 relevant risk factors but cannot account for socio-economic and demographic changes in a broader sense (Surminski et al., 2012). HAZUS's economic evaluations are inaccurate because it takes into consideration only linear growth, ACM though more advanced than HAZUS however excludes indirect loss estimations (Rajabifard et al., 2014). DaLA methodology though assesses sector by sector estimates does not explain the complex nature of the economy; that is why the inter-sector relationships remain unexplained. Input-Output (I/O) models can reflect the interdependencies of a regional economy for evaluating higher order impact, but its linearity, simplicity, rigid structure lack in responding to price change are limitations. Computable general equilibrium (CGE) as an alternative to I/O model covers some of the limitations of I/O. However, it underestimates the economic impacts, and their assumption of optimising behaviour is questionable. Social Accounting Aatrixes (SAMs) are very sound about interdependency among various factors, activities, and institutions.

No	Assessment methods	Advantage	Disadvantages
1	Catastrophe Risk Models	• Able to forecast the future loss and incorporate several sectors	• Lacks in including broader economic range, additional data of multiple sectors, intangible and non-economic L&D
2	Integrated Assessment Models	• Able to integrate many sectors • Good in calculating consequences of different assumptions • Adjustable for new information	• Doesn't explain how different sectors' interaction. • Assumptions of L&D may not be explained perfectly
3	World Risk Index	• The indexes represent social, economic, and environmental vulnerability	• Shallow tool of assessing • Unable to explain the difference nature of different climatic events
4	UKCCRA	• Covers vast area by including 100 risk factors.	• The interrelation and cause and effect of risk sectors cannot be explained
5	DaLA Methodology	• A comprehensive approach and includes sector by sector evaluation	• The nature of sectoral interdependency and intangible impacts are not covered
7	Computable General Equilibrium (CGE)	• Able to examine the impact of a policy change • A non-linear in structure and capable to response to price change	• Very complex • Too flexible to deal with changes • The models underestimates the impacts
8	Input-Output (I/O) Models	• Can explain the economic interdependencies	• Restricted in terms of assumptions about technological and production factor change
9	Social Accounting Matrixes (SAMs)	• More detailed about interdependency among various factors	• In linear structure and have inflexible coefficient

Table 1: A brief glimpse of the advantages and disadvantages of existing models

Activities

SEADPRI FORUM 2016
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Siti Amira Sariyathul Rusly
SEADPRI-Universiti Kebangsaan Malaysia

*The Forum was officiated by Deputy Director General of Planning and Preparedness Sector, NADMA Malaysia, Mr. Mohd Ariff Baharom **(centre)**. He is flanked by the speaker of the Forum, Dr. S.V.R.K. Prabhakar **(left)** and the moderator Mr. Anuar Abd. Shukur **(right)** from MARIM.*

The annual SEADPRI Forum was held at Puri Pujangga Hotel, UKM on 6 October 2016. It was co-organised with the National Disaster Management Agency, Prime Minister's Department of Malaysia (NADMA Malaysia), Malaysian Association of Risk and Insurance Management (MARIM), Asian Network on Climate Science and Technology (ANCST), Asia-Pacific Network for Global Change Research (APN) and the Institute for Global Environmental Strategies (IGES), Hayama, Japan. The Forum was attended by about 50 representatives from government, academia, non-government organisations and the private sector. SEADPRI Forum 2016 featured Dr. S.V.R.K Prabhakar of IGES, who spoke on "Insurance for Disaster Risk Reduction and Climate Adaptation: Challenges and Opportunities". Dr. Prabhakar has more than 15 years of experience in participatory research and development working with various organizations such as ICRISAT, IARI, CIMMYT-RWC, UNDPT, NIDM and Kyoto University. Dr. Prabhakar elaborated on insurance as a tool for managing the risk of climate change in the agricultural sector.

He described risks associated with agriculture and outlined approaches for evaluating the effectiveness of insurance as a risk management tool. A comparative case study of crop insurance application for risk reduction in Japan and India was also highlighted. The presentation concluded with a reflection of issues that needed to be addressed for insurance to be widely applied for disaster and climate risk reduction. The discussion session saw a lively exchange of viewpoints regarding the status of insurance for disaster risk reduction in Malaysia. It was acknowledged that there is much to improve in the insurance sector as disasters such as floods have only become critical in the country over the past few years. Calls were made to make insurance mandatory through legislation. The need for scientific inputs to delineate hazardous zones at the local level was also highlighted. A community scale scheme with the involvement of farmers' cooperatives was suggested for the agriculture sector as an initial step to promote insurance as a climate change adaptation tool in the country.

Activities

ASEAN Youth Volunteer Programme (AYVP): The Development of ASEAN Youth DRR Leaders through Volunteerism & Community Engagement

1-26 August, Manila, Philippines

Mohd Khairul Zain Ismail
SEADPRI-Universiti Kebangsaan Malaysia

*The Forum on The Roles of Multi-Stakeholder Partnership for DRR Implementation in ASEAN was held on 25 August 2016 during the ASEAN Youth Volunteer Programme (AYVP): The Development of ASEAN Youth DRR Leaders through Volunteerism & Community Engagement. Mr. Khairul of SEADPRI-UKM **(far right)** served as a Panelist at the Forum.*

The ASEAN Youth Volunteer Programme (AYVP) is an ASEAN youth community leaders programme, which aims to mobilise ASEAN youth in developing innovative solutions to the social, cultural, economic and environmental challenges of communities across ASEAN, while forging a sense of regional identity and cross-cultural understanding among ASEAN youth in the region. This year, the theme of AYVP Philippines 2016 was "The Development of ASEAN Youth DRR Leaders through Volunteerism & Community Engagement". The four-week programme was organised in cooperation with Universiti Kebangsaan Malaysia (UKM), University of the Philippines, Ateneo de Manila University (ADMU) and De La Salle University (DLSU), with support from Ministry of Youth and Sports Malaysia, US Agency for International Development (USAID), ASEAN Secretariat, National Youth Commission (NYC) Philippines and Commission on Higher Education (CHED), Office of the President of the Philippines. SEADPRI-UKM was involved in development of training modules and the forum session of AYVP 2016. Week 1 saw the development of training modules "Unit 1 - Introduction to Disaster Risk Reduction" and "Unit 2 – DRR and Cross Cutting Issues (Sustainable Development and Climate Change)", which were developed by Dr. Mohammad Imam Hasan Reza (Research Fellow) and Mr. Lim Choun Sian (Senior Research Officer). In the final week, for the DRR Forum Session with DRR experts and AYVP Alumni, Mr. Mohd Khairul Zain Ismail was involved as a panellist for the forum entitled "The Roles of Multi-stakeholder Partnership for DRR Implementation in ASEAN". The one-month programme successfully assembled some 50 youth volunteers from 10 ASEAN countries including 13 participants from Malaysia. The closing ceremony speech was delivered by Prof. Dato' Dr. Imran Ho bin Abdullah, UKM Deputy Vice-Chancellor (Industry and Community Partnership). Also present at the closing ceremony were the Director of University Community Transformation Centre (UCTC), Assoc Prof Dato' Dr Rokiah Omar, President of UP, Dr Alfredo E Pascual, President of Anteneo De Manila University, Fr Jose Ramon T Villarin Sj, President of De La Salle University, Br Raymundo B Suplido FSC and representatives of the ASEAN ambassadors in the Philippines.

Article

The limitations of these models are that there is no supply capacity constraint available. These models overestimate the impacts and have no response to the price change (Okuyama, 2013). A typical gap found (Table 1) in all models is that none include stock and flow estimation while forecasting the future L&D at the same time. It should be noted that risk transferring, risk retention, risk reduction and measuring the actual amount of L&D have not been found incorporated in any methods.

THE PROPOSED APPROACH

There are two kinds of loss and damage evaluation approaches i.e. retrospective and prospective (Rose, 2004). The retrospective assessment can be further differentiated between stock and flow measures. In the stock measure, affected properties and human capitals are mainly included (Okuyama & Santos, 2014; Rose, 2004). However, in the stock loss valuation, the intangible L&D are missing. To include intangible L&D, an economic valuation should take place and then added to total direct L&D, combining tangible and intangible. In flow measure, consequential analysis takes place where losses from business interruptions due to direct L&D are evaluated. These have backward and forward linkages and result in a ripple effect in the economy (Okuyama & Santos, 2014). This impact analysis can be differentiated between short term and long term. Although the consequential analysis can be done without stock damages, they are very essential to measure prospective L&D. To see the actual L&D, this framework includes retrospective and prospective measures to achieve a comprehensive and complete approach of L&D (Figure 1).

An attempt at calculating actual L&D should incorporate stock and flow measures based on which, estimating the future L&D may provide a more precise picture. An integration of more than one existing model may bring forth good results. However, econometric models are not widely useful in this regard. A combination of econometric model and existing L&D assessment models may open a new horizon. Taking this into account, there is potential for a hybrid framework. The proposed framework for a comprehensive evaluation is to cover all ex-post, consequential and prospective L&D assessment at the city level (Figure 1).

In each junction, suitable models should be used in an integrating way. Although several economic tools have been used in evaluation processes, the application of financial tools and instruments are limited. The economic tools largely cover the impact analysis, and the financial approaches focus on the risk assessing. The gap remains in assessing the actual L&D.

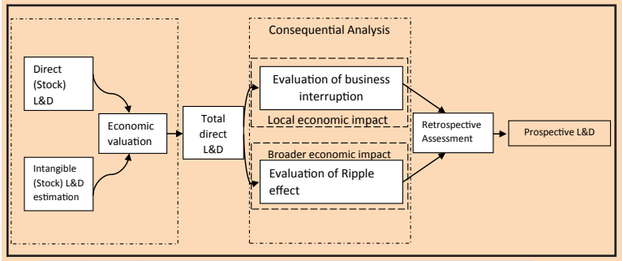

Figure 1: The proposed framework to evaluate overall loss and damage

CONCLUDING REMARKS

There are many challenges in measuring L&D. A major issue for climate change negotiation is the attribution aspect. It is also evident that measuring L&D requires several dimensions where there is no one method to account for all these aspects. A combination methods may provide sounder output for assessing L&D. In addition, any assessment of L&D will require the multi-disciplinary inputs where the physical sciences can contribute to the attribution aspect. A hybrid framework has been proposed, which is currently being tested in Kuala Lumpur, Malaysia.

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Article

Strengthening Resilience of Rural Cultural Landscapes in the Pahang River Basin, Malaysia

Mohammad Imam Hasan Reza[1], Anizan Isahak[2] and Mohd Raihan Taha[1]

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Abstract: *Subsequent to the unprecedented floods of December 2014 – January 2015, a multi-disciplinary study was conducted in the Pahang River Basin, Malaysia. Flood risk zones as well as the housing and evacuation centres therein were delineated based on remotely sensed images, field mapping, interviews and expert judgment. Erosion of traditional knowledge and its consequences were also documented. The findings indicate that geospatial technologies are indispensable to delineate affected sites and identify the best locations for evacuation sites. Insights were also obtained on improvements that may be helpful in making the local community more resilient in coping with future disasters within their cultural landscape.*

Keywords: *disaster risk reduction, flood risk mapping, eco-disaster risk reduction, resilience*

INTRODUCTION

Human designs that are incompatible with the prevailing natural perturbation may create disastrous consequences. The unprecedented floods of December 2014 – January 2015 affected many people by destroying their houses, properties and livelihoods, particularly in the northeastern part of Peninsular Malaysia. Never before has the country encountered such serious flooding, bringing to fore the need for more risk assessments and other studies to strengthen disaster prevention, mitigation and preparedness.

A community could be both disaster-resistant and disaster-resilient. Disaster-resistance focuses on preventing disasters from happening, while disaster-resilience focuses on recovering from damages caused by disasters. Resilient communities are flexible and resourceful. They have many ways to recover from a disaster (Cooper & Block, 2006). Designing and building disaster-resilient communities is much more efficient than providing post-disaster support. An integrated approach based on the geospatial technologies has great potential to be used to delineate sites that may be exposed to disasters so that planning, including the selection of sites for evacuation centres, can be most effective (Yang et al., 2012). This article highlights two aspects of the findings of the multi-disciplinary project entitled "Disaster resilient structural design for urban and rural cultural landscapes of Pahang River Basin" (TRGS/1/2015/UKM/01/1/4) led by Professor Mohd Raihan Taha that was funded by the Ministry of Higher Education Malaysia, subsequent to the 2014-2015 floods. The first aspect relates to the flood risk mapping that was conducted after the disaster. The second aspect relates to the erosion of traditional knowledge and its consequences. The findings provide an insight on the improvements that may be helpful in making the local community more resilient in coping with future disasters within their cultural landscape.

FLOOD RISK ZONES

Using Landsat satellite images and GIS technology augmented with field mapping, interviews and expert judgement, a flood risk map was produced for the Pahang River Basin (Figure 1).

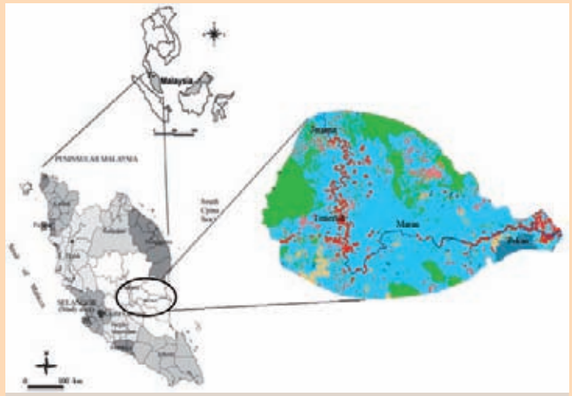

Figure 1. Distribution of population residing in flood risk zones along the Pahang River Basin. Red coloured areas represent houses located within the flood risk zones, which experienced long inundation periods during the 2014 and 2015 floods.

It was found that a considerable proportion of residents in the river basin are living in flood risk zones. The 2014 and 2015 floods affected many of these households where, in some cases, houses were inundated. This is exemplified in the towns of Pekan and Temerloh where, a significant number of houses that were found to be located within flood risk zones, were inundated over several days (Figure 2).

In Malaysia, schools are prioritized to be used as evacuation centers. During the 2014 and 2015 floods, several of the gazetted evacuation centres could not be used. The centres were either inundated by floods, damaged or could not be accessed. The study revealed that such centres are generally found to be located in high risk zones (Figure 2). Proper selection of sites for evacuation centres can guarantee citizens' safety rights, prevent loss of life and property as well as maintain the trusting relationship between citizens and the government (Yang et al., 2012). Schools and other buildings that have been identified as suitable evacuation centers should be designed to be adaptable and multifunctional. Temporary and permanent public buildings such as schools should be constructed or repaired to be disaster-resilient.

Activities

National Workshop on Terminology and Indicators for Sendai Framework for Disaster Risk Reduction (2015–2030)

15 June 2016, UKM Bangi

Mohd Khairul Zain Ismail
SEADPRI-Universiti Kebangsaan Malaysia

Participants of the National Workshop on "Terminology and Indicators for Sendai Framework for Disaster Risk Reduction, 2015-2030", 15 June 2016, Puri Pujangga, UKM Bangi. The Workshop was convened by the National Disaster Management Agency, Prime Minister's Department of Malaysia (NADMA), in collaboration with SEADPRI-UKM.

The National Agency for Disaster Management Malaysia (NADMA Malaysia), in collaboration with Universiti Kebangsaan Malaysia's Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM), successfully organised the National Workshop on Terminology and Indicators for Sendai Framework for Disaster Risk Reduction (SFDRR) on 15 June 2016, at Puri Pujangga, UKM Bangi. The Workshop was inaugurated by Mr. Mohd Arif bin Baharom, Deputy Director General (Planning and Preparedness Sector), NADMA Malaysia. Participants comprised representatives from federal government agencies who are involved directly in disaster management in the country. They were provided with an overview of the SFDRR, which was signed by the Government of Malaysia during the 3rd World Conference on Disaster Risk Reduction (WCDRR) on 14 to 18 March 2015 in Sendai Japan. The Worksop commenced with presentations covering the history and evolvement of SFDRR as a successor to Hyogo Framework for Action (2005-2015). Participants were also updated on the progress of the Open-ended Intergovernmental Expert Working Group (OIEWG) on Terminology and Indicators Relating to Disaster Risk Reduction, where NADMA has appointed Professor Joy Jacqueline Pereira of SEADPRI-UKM to represent Malaysia. The discussion focused on implementation of SFDRR in Malaysia, particularly with respect to the terminology and indicators that are now being negotiated at the global level.

The Workshop emphasized that global definitions have to be clear but flexible to take into account national circumstances. In some cases, data for the indicators come from the private sector and their collation could be very challenging. The reporting of SFDRR indicators will require the participation of all stakeholders, particularly those who are involved in disaster risk reduction. The involvement of relevant Ministries and agencies, especially the Economic Planning Unit (EPU) and Statistics Department of the Prime Minister's Department is crucial. In developing national indicators, aspects related to institutional arrangements and capacity building need careful consideration, particularly in times where resources are limited. The need to synergise with ongoing national efforts to develop Sustainable Development Indicators (SDGs) anchored by the EPU and efforts of the Ministry of Natural Resources and Environment (NRE) on the Paris Agreement on Climate Change was also articulated. The Workshop was informed that the final meeting of the OIEWG on Terminology and Indicators will be held in mid-November 2016. In preparation for this meeting, NADMA with technical support from SEADPRI-UKM, will conduct a feasibility assessment of the proposed indicators.

Technological Hazards Programme

Article

DNA Optosensor as Potential Diagnostic Tool for Dengue Virus Detection

Tan Ling Ling

SEADPRI-Universiti Kebangsaan Malaysia

Urbanization, high population density and poor environmental hygienic standards are the major factors that contribute to the dengue outbreak in tropical countries around the world. ***(Bernama Image)***

Dengue virus is endemic in Malaysia. The symptoms of dengue fever are high fever, body rashes, body pain including joint and muscle pain, headache as well as sore throat and vomiting. ***(Google Image)***

Dengue virus comprises four different subtypes, namely DENV-1, DENV-2, DENV-3 and DENV-4; and DENV-2 is mainly responsible for the severe dengue fever in Southeast Asia. Dengue haemorrhagic fever or dengue shock syndrome is the main disease caused by the arthropod-borne virus pathogen in humans, and is being taken seriously as it is fatal. In the worst case scenario, a sharp drop in the patient's blood platelets is followed by internal bleeding. Recognition of shock in its early stage with prompt fluid replacement therapy will give a good clinical outcome and prevent mortality. However, laboratory confirmation of dengue infection relies on the serological test that is time-consuming, as the patient is required to produce a detectable level of anti-dengue antibodies, which would normally take some four to five days to yield a positive reactive result. Late diagnosis often results in delayed treatment, which can be less effective in preventing or decreasing further complications. Currently, there is no specific vaccine or medication available for dengue fever. However, if an early diagnosis is made, the risk of severe complications and number of deaths can be reduced. In order to change the current practice from responsive approach to a more preventive one, SEADPRI-UKM is working on developing optical DNA biosensor for naked-eye detection of dengue virus as early as the first day of the onset of the illness.

In order to eliminate electrical interference, optical biosensors have drawn the attention of many researches because of their small size, ease of operation and freedom from electrical induced noise. The principle of optical sensing is typically based on the interaction between sample and light. The type of optical transduction element (i.e. absorption spectroscopy, fluorescence spectroscopy or reflectance spectroscopy) used is depends on the optical characteristics of the chemical reagent and physical properties of the immobilization matrix.

The proposed DNA optode can be simply transformed into a colorimetric sensor for semi-quantitative visual inspection of dengue virus DNA, based on colour change on the receptive layer of the DNA biosensor. As the DNA probe is only selective towards its complementary target DNA, visual monitoring of DNA in human bodily fluids (e.g. urine and saliva samples) would allow fast-track monitoring of dengue infection, and provide early diagnosis as early as the first day of the onset of illness. This could subsequently expedite triggering the public health system to give appropriate control and preventive action.

The proposed method also makes in-situ DNA testing more convenient compared to traditional laboratory-based serological testing. Examination of dengue virus DNA in vectors and larval samples based on naked-eye inspection technique in the field could eliminate significant optimization steps as normally conducted with the standard analytical instruments or training of qualified personnel. This is especially important as an early warning sign to the residents for prevention and control of dengue in housing areas. This is expected to be a promising tool for the monitoring and surveillance of dengue in humans, vectors and larvae, where it could serve as an early warning system for rapid and real-time visual assessment of arboviral disease. The design for optical DNA biosensing of dengue virus offers great promise for the development of a commercial kit, which will facilitate the diagnostic application for dengue disaster management.

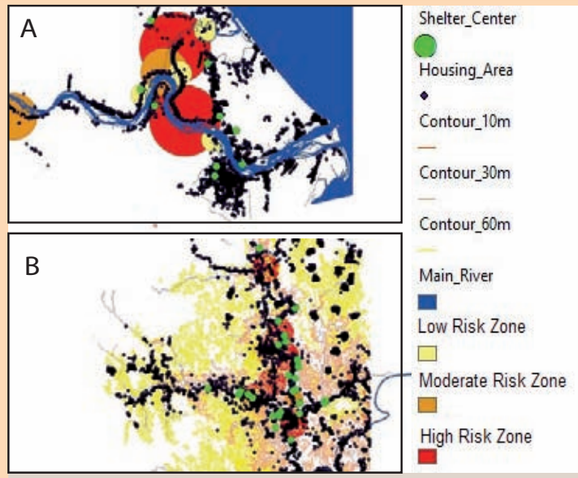

Figure 2. Distribution of housing areas *(black circles)* and evacuation centres *(green circles)* in flood risk areas in (A) Pekan and (B) Temerloh, which are located in the Pahang River Basin, Malaysia.

Accessibility for those with mobility, visual or communication problems must also be considered. It should also be considered whether it is necessary to build permanent evacuation centers instead of relying on public buildings. If not, more public buildings and public spaces should also be designed to serve as evacuation centers to eliminate the sole dependency on schools.

The evacuation centers in the vicinity of Temerloh were assessed using the Sphere Project guidelines (The Sphere Project, 2011). The assessment concluded that not much development is needed in terms of structural strength for the area. However, the design, management strategies and logistics that are involved in using evacuation centres, have to be improved. Recommendations for further improvement of flood evacuation centres include stakeholder engagement and action encompassing the local community, city council, academicians and the private sector. The use of geospatial technologies is also indispensable to delineate affected sites and identify the best locations to relocate evacuation sites.

TRADITIONAL KNOWLEDGE

Rural and urban settings and infrastructure vary a great deal as do their types of vulnerabilities. Traditional disaster mitigation measures that do not take into account these differences have been found to be ineffective, and fail to serve their purpose in the long run. The design of structures and mitigating measures for disasters such as floods have to be innovative to be effective over a long period.

The culture of farming and slope protection management by planting indigenous crops and plants, which are a part of flood resilience, could erode over time in rural areas.

Local communities in Peninsular Malaysia including Pekan, which is located in the Pahang River Basin, appear to have limited skill in exploiting the vast benefits of plants such as bamboo that are now known to be useful in flood mitigation and adaptation.

The design of post-disaster temporary shelter based on sustainable and renewable material such as the locally available bamboo could also serve to enhance livelihood options for the affected communities. In addition, bamboo is also useful for crafts (Wong, 1989), serves as a good substitute for timber in producing high value-added products (Azmy et al., 2009), and is even suitable as a source for energy (Langford, 2014). Over the years, the use of bamboo as a natural flood mitigation technique appears to be less common. It has been replaced by concrete structures and other modern facilities.

CONCLUDING REMARKS

The local level flood risk zones that have been identified in Pekan and Temerloh have potential use for overall flood risk management along the Pahang River Basin. The distribution of shelter centers and its severity of risk to floods can be used to relocate and improve the design of evacuation centres to strengthen disaster preparedness in the area. The use of bamboo as an eco-disaster mitigation measure should be re-introduced and mainstreamed in the Pahang River Basin. This will serve to enhance the socio-economic well-being of the local community in the Pahang River Basin whilst building their resilience to future flood disasters.

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Climatic Hazards Programme

ANCST Advances Local Level Disaster Prevention through Climate Science

Joy Jacqueline Pereira[1] and Julian Hunt [2]

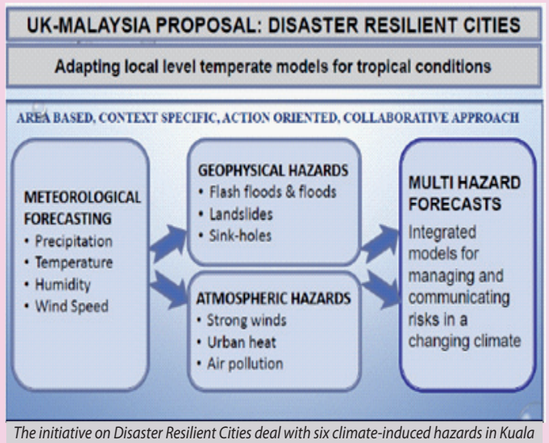
[1]SEADPRI-Universiti Kebangsaan Malaysia
[2]University of Cambridge

*Professor Zakri Abdul Hamid, Science Advisor to the Prime Minister of Malaysia **(right)** was instrumental in establishing the Newton Ungku Omar Fund in Malaysia. He delivered the keynote address at the Workshop on New Science and Business Developments for Managing Climate Risks in the Royal Society, London on 5 November 2015, convened by Prof. Lord Julian Hunt **(left)** of University of Cambridge.*

The long-standing linkage of the Malaysian Commonwealth Studies Centre (MCSC), Cambridge to the region has expedited establishment of the Asian Network on Climate Science and Technology (ANCST) coordinated by Universiti Kebangsaan Malaysia's Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM) in 2013, funded by the Cambridge Malaysian Education and Development Trust (CMEDT) and MCSC. The Network [http://ancst.org/] serves as a conduit to facilitate exchange of knowledge and expertise. Directors of ANCST, Professor Joy Jacqueline Pereira of SEADPRI-UKM and Professor Lord Julian Hunt of MCSC successfully completed their first initiative supported by the Newton Ungku Omar Fund entitled "Future Cities: Science to Action for Building Resilience of Urban Communities to Climate Induced Physical Hazards" in 2016. Professor Pereira and Professor Lord Hunt are now embarking on their second initiative supported by the Newton Ungku Omar Fund on "Disaster Resilient Cities: Forecasting Local Level Climate Extremes and Physical Hazards for Kuala Lumpur". The Newton-Ungku Omar Fund is administered by UK Partners and the Malaysian Industry-Government Group for High Technology (MIGHT) with equal contribution from the Governments of UK and Malaysia.

The initiative on Future Cities brought together scientists working on various aspects of physical hazards and risks in a changing climate, with a particular emphasis on large urban areas, to build capacity to innovate and advance practices, scientific tools and techniques relevant to Malaysia and the tropics. There are distinctive aspects of extreme natural hazards in the tropics that are not included in most hazard and climate models.

Examples include extended periods of calm weather with elevated winds aloft that affect the build-up of air pollution, and periods of very intense rainfall leading to extreme localised urban flooding, as happens in Kuala Lumpur. New approaches and technology are being developed in Malaysia and the region that could lead to new businesses and exports to other countries faced with similar challenges.



The initiative on Disaster Resilient Cities deal with six climate-induced hazards in Kuala Lumpur and adjacent areas (flash floods & floods, landslides, sinkholes, strong winds, urban heat and air pollution & haze) and involves six UK and ten Malaysian partners, exploiting the best of expertise on both sides, with ANCST facilitating regional linkages.

The initiative on Disaster Resilient Cities is designed to enhance capacity to conduct multi-hazard assessments and identify areas susceptible to multi-hazards within cities; advance modelling of climate extremes and atmospheric hazards; and promote professional development. The emphasis will be to develop effective products and services for reducing risks at the neighbourhood level, focusing on the bottom 40% income group of Malaysians. The ultimate goal is to deliver new innovative business models for disaster risk reduction, driven by consortiums with multidisciplinary and multi-sector representation. This will directly contribute to national aspirations for socio-economic well-being and climate resilient development.

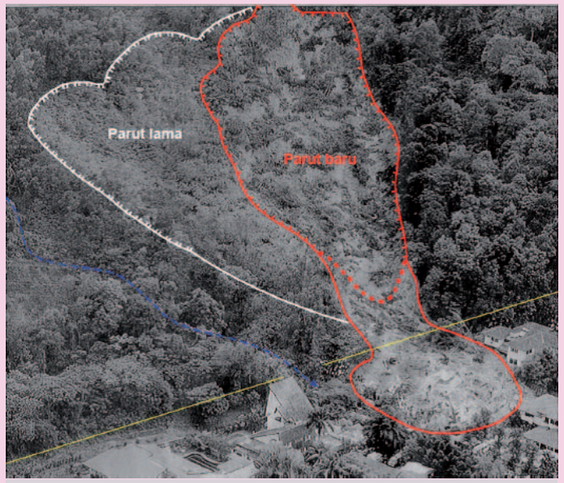
The two initiatives supported by the Newton Ungku Omar Fund have flourished linkages between UK and Malaysia. More importantly project partners in Malaysia and the UK are able to make use of the regional linkages that have already been established through ANCST, to engage with the wider research and innovation community in Asia.

Geological Hazards Programme

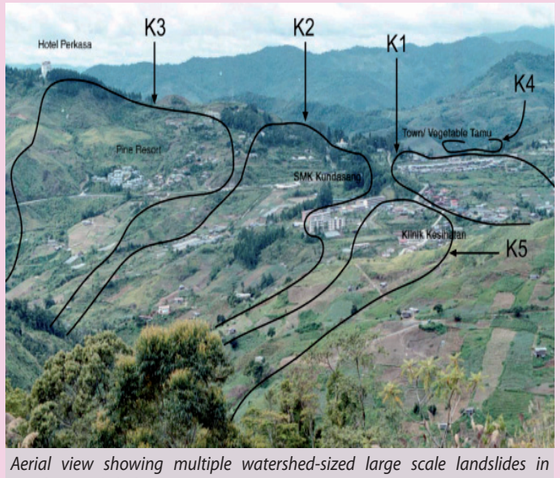
Causal Factors and Triggers of Landslides Case Studies of Bukit Antarabangsa and Kundasang, Malaysia

Lim Choun Sian

SEADPRI-Universiti Kebangsaan Malaysia



Aerial photograph showing the overlap of a new landslide on an old landslide scar in Bukit Antarabangsa, Selangor.



Aerial view showing multiple watershed-sized large scale landslides in Kundasang, Sabah

Landslides are a major disaster in Malaysia. They have resulted in the highest loss of lives and injuries as well as significant damage to property and infrastructure. Landslide occurrences have been increasing over the years. The current post-disaster response to landslides much favours structural engineering solutions. There have been cases where repeated fixes do not resolve the problem, resulting in increased costs and much frustration to the affected parties. An in-depth evaluation of causal factors and triggers could provide insights for making engineering solutions more effective and put an end to recurring landslides. A major research has recently been completed under the Geological Hazards Programme to address this issue. The research takes an engineering geology approach to examine the causal factors and triggers of landslides.

Two case-study areas of contrasting landslide origins were investigated. The first area is Bukit Antarabangsa, Selangor, which is essentially an urban housing area in a hilly region that has experienced numerous landslide incidences. The second area is Kundasang, Sabah, which is a mountain farming township located on a zone of multiple complex and large-scale landslides, each the size of a watershed. A hybrid geomorphological-based engineering geological mapping was adopted to systematically map landslides in disturbed and built-up areas as well as large scale mass movements. Multi-temporal remotely sensed imageries were analysed, and detailed ground mapping was conducted to delineate natural and man-made features including land cover, landslide morphology and surface deformations.

The findings confirm that land cover change in Bukit Antarabangsa has exacerbated the susceptibility of the area to landslides. In Kundasang, it was revealed that seven main landslide systems are controlling the still-active movements and these have now been mapped at a higher accuracy. Slope instability is influenced by underlying factors, triggering factors and external factors. Underlying factors include aspects such as geological structures, weathered geological materials, surficial deposits of tectonic or colluvial origins and other features, which make the terrain susceptible to landsliding. Triggering factors are primarily rain and soil water content. External factors are time-dependent and includes aspects such as negligence of slope maintenance, prolonged unattended bare slopes and disturbance of adjacent slopes, among others. The research has contributed to strengthen the approach of investigating landslides in tropical terrain.

Engineering geological mapping is a fundamental and indispensable component in the assessment of hazards. The delineation of causal factors and triggers of landlides can provide insights to enhance structural and non-structural solutions to prevent tragedies, and contribute significantly to disaster risk reduction.